






NATIONAL HIGHWAYS INFRA TRUST

(Registered in the Republic of India as an irrevocable trust set up under the Indian Trusts Act, 1882, on October 19, 2020, and registered as an infrastructure investment trust under the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended, on October 28, 2020, having registration number IN/InvIT/20-21/0014)

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SPONSOR	INVESTMENT MANAGER	TRUSTEE
		
NATIONAL HIGHWAYS AUTHORITY OF INDIA	NATIONAL HIGHWAYS INFRA INVESTMENT MANAGERS PRIVATE LIMITED	IDBI TRUSTEESHIP SERVICES LIMITED

INITIAL OFFER OF 499,600,000* UNITS (THE "UNITS") BY WAY OF A FRESH ISSUE, REPRESENTING AN UNDIVIDED BENEFICIAL INTEREST IN THE NATIONAL HIGHWAYS INFRA TRUST (THE "TRUST") THROUGH A PRIVATE PLACEMENT AT A PRICE OF ₹ 101 PER UNIT ("OFFER PRICE"), AGGREGATING TO ₹ 50,459.60* MILLION BY THE TRUST (THE "OFFER")

**Subject to finalization of Basis of Allotment*

THE FLOOR PRICE IS ₹ 100 PER UNIT AND THE CAP PRICE IS ₹ 101 PER UNIT. EACH BIDDER MUST MAKE A BID AT OR ABOVE THE FLOOR PRICE OR WITHIN THE PRICE BAND BUT AT OR BELOW THE CAP PRICE. BIDS BELOW THE FLOOR PRICE AND ABOVE THE CAP PRICE SPECIFIED, WERE LIABLE TO BE REJECTED.

THE OFFER, AND THE DISTRIBUTION OF THE PLACEMENT MEMORANDUM AND THIS FINAL PLACEMENT MEMORANDUM, WILL BE MADE ONLY TO ELIGIBLE INVESTORS IN RELIANCE UPON REGULATION 14(2) OF THE SECURITIES AND EXCHANGE BOARD OF INDIA (INFRASTRUCTURE INVESTMENT TRUSTS) REGULATIONS, 2014, AS AMENDED ("INVIT REGULATIONS")

The Units of the Trust are proposed to be listed on National Stock Exchange of India Limited ("NSE") and BSE Limited ("BSE") and together with NSE, the "Stock Exchanges". NSE is the Designated Stock Exchange. The Trust has received in-principle approval from NSE and BSE for listing of the Units pursuant to letters dated April 13, 2021 (read along with the extension letters dated July 12, 2021, and September 29, 2021, issued by NSE) and August 25, 2021, respectively. Applications shall be made to the Stock Exchanges for obtaining the final listing and trading approvals for the Units to be Allotted pursuant to the Offer. The Stock Exchanges assume no responsibility for the correctness of any statements made, opinions expressed or reports contained herein. Admission of the Units to be Allotted pursuant to the Offer for trading on the Stock Exchanges should not be taken as an indication of the merits of the Trust or of the Units. A copy of the Draft Placement Memorandum and the Placement Memorandum have been, and a copy of the Final Placement Memorandum will be delivered to NSE and BSE.

This being an initial offer by the Trust, there has been no formal market for the Units. The Offer Price, should not be taken to be indicative of the market price of the Units after the Units are listed. No assurance can be given regarding an active or sustained market for trading in the Units or regarding the price at which the Units will be traded after listing. This Final Placement Memorandum has not been, and will not be, registered as a prospectus, will not be circulated or distributed to the public at large in India or any other jurisdiction, and will not constitute a public offer in India or any other jurisdiction.

The Units have not been and will not be registered under the United States Securities Act of 1933, as amended (the "Securities Act") and may not be offered or sold within the United States except pursuant to an exemption from, or in a transaction not subject to, the registration requirements of the Securities Act and applicable U.S. state securities laws. Accordingly, the Units are being offered and sold (a) in the United States only to "qualified institutional buyers" (as defined in Rule 144A under the Securities Act ("Rule 144A") and referred to in this Final Placement Memorandum as a "U.S. QIB") in transactions exempt from the registration requirements of the Securities Act, and (b) outside the United States in "offshore transactions" as defined in, and in reliance on, Regulation S under the Securities Act ("Regulation S") and the applicable law of the jurisdictions where such offers and sales occur. The Units are transferable only in accordance with the restrictions described under the section entitled "Selling and Transfer Restrictions" on page 277 of this Final Placement Memorandum. For the avoidance of doubt, the term U.S. QIBs does not refer to a category of institutional investors defined under applicable Indian regulations and referred to in this Final Placement Memorandum as "QIBs".

THIS FINAL PLACEMENT MEMORANDUM WILL BE PERSONAL TO EACH ELIGIBLE INVESTOR. THIS FINAL PLACEMENT MEMORANDUM HAS BEEN PREPARED BY THE TRUST SOLELY FOR PROVIDING INFORMATION IN CONNECTION WITH THE OFFER AND FOR FILING WITH THE SECURITIES AND EXCHANGE BOARD OF INDIA PURSUANT TO THE INVIT REGULATIONS AND THE CIRCULAR NO. SEBI/HO/DDHS/DDHS/CIR/P/2019/161 DATED DECEMBER 24, 2019. YOU MAY NOT, AND ARE NOT AUTHORIZED TO, (1) DELIVER THIS FINAL PLACEMENT MEMORANDUM TO ANY OTHER PERSON; OR (2) REPRODUCE THIS FINAL PLACEMENT MEMORANDUM IN ANY MANNER WHATSOEVER. ANY DISTRIBUTION OR REPRODUCTION OF THIS FINAL PLACEMENT MEMORANDUM, IN WHOLE OR IN PART, IS UNAUTHORIZED. FAILURE TO COMPLY WITH THIS INSTRUCTION MAY RESULT IN A VIOLATION OF THE SECURITIES AND EXCHANGE BOARD OF INDIA (INFRASTRUCTURE INVESTMENT TRUSTS) REGULATIONS, 2014, AS AMENDED OR OTHER APPLICABLE LAWS OF INDIA AND OF OTHER JURISDICTIONS.

INVESTMENTS IN UNITS INVOLVE RISKS AND INVESTORS SHOULD NOT INVEST ANY FUNDS IN THE OFFER UNLESS THEY CAN AFFORD TO TAKE THE RISK OF LOSING THEIR ENTIRE INVESTMENT. IN MAKING AN INVESTMENT DECISION, INVESTORS MUST RELY ON THEIR OWN EXAMINATION OF THE TRUST, THE UNITS, THE OFFER, AND THE PLACEMENT MEMORANDUM, INCLUDING THE RISKS INVOLVED. INVESTORS ARE ADVISED TO CAREFULLY READ THIS FINAL PLACEMENT MEMORANDUM, INCLUDING THE SECTION ENTITLED "RISK FACTORS" ON PAGE 61 BEFORE MAKING AN INVESTMENT DECISION. EACH ELIGIBLE INVESTOR IS ADVISED TO CONSULT ITS OWN ADVISORS, ABOUT THE CONSEQUENCES OF AN INVESTMENT IN THE UNITS BEING ISSUED PURSUANT TO THE PLACEMENT MEMORANDUM.

Unless a serially numbered Placement Memorandum along with an Application Form is addressed to a particular Eligible Investor, no invitation to offer shall be deemed to have been made to such Eligible Investor to make an offer to subscribe to Units pursuant to the Offer. For further details, please see the section entitled "Offer Information" on page 289. The distribution of the Draft Placement Memorandum or the Placement Memorandum or this Final Placement Memorandum or the disclosure of its contents without the Trustee's or Investment Manager's prior consent, to any person, is unauthorized and prohibited.

Each addressee, by accepting delivery of this Final Placement Memorandum, agrees to observe the foregoing restrictions and shall make no copies of this Final Placement Memorandum or any documents referred to in this Final Placement Memorandum.

LEAD MANAGERS			REGISTRAR AND UNIT TRANSFER AGENT
			
SBI CAPITAL MARKETS LIMITED 202, Maker Tower 'E', Cuffe Parade, Mumbai 400 005, Maharashtra, India Tel: +91 22 2217 8300 Fax: +91 22 2218 8332 E-mail: nhaiinvit@sbicaps.com Investor Grievance E-mail: investor.relations@sbicaps.com Contact Person: Mandeep Singh Website: www.sbicaps.com SEBI Registration Number: INM000003531	ICICI SECURITIES LIMITED ICICI Venture House, Appasaheb Marathe Marg, Prabhadevi, Mumbai - 400 025 Maharashtra, India Tel: +91 22 6807 7100 Fax: +91 22 6807 7801 E-mail: nhaiinvit@icicisecurities.com Investor Grievance E-mail: customercare@icicisecurities.com Contact Person: Rupesh Khant Website: www.icicisecurities.com SEBI Registration Number: INM000011179	KOTAK MAHINDRA CAPITAL COMPANY LIMITED 1 st Floor, 27 BKC, Plot No. C-27, 'G' Block, Bandra Kurla Complex, Bandra (East), Mumbai 400 051, Maharashtra, India Tel: +91 22 4336 0000 Fax: +91 22 67132445 E-mail: nhai.invit@kotak.com Investor Grievance E-mail: kmccredressal@kotak.com Contact Person: Ganesh Rane Website: www.investmentbank.kotak.com SEBI Registration Number: INM000008704	KFIN TECHNOLOGIES PRIVATE LIMITED (Formerly known as "Karvy Fintech Private Limited") Selenium, Tower B, Plot No. 31 & 32, Financial District, Nanakramguda, Serilingampally, Hyderabad, Rangareddi 500 032, Telangana, India Tel: +91 40 6716 2222 Fax: +91 40 2343 1551 E-mail: nhai.invit@kfintech.com Investor grievance e-mail: einward.ris@kfintech.com Website: www.kfintech.com Contact Person: M Murali Krishna SEBI Registration No.: INR000000221

This Final Placement Memorandum is dated November 3, 2021

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NOTICE TO INVESTORS

The statements contained in this Final Placement Memorandum relating to the Trust and the Units are, in all material respects, true and accurate and not misleading, and the opinions and intentions expressed in this Final Placement Memorandum with regard to the Trust and the Units are honestly held, have been reached after considering all relevant circumstances and are based on reasonable assumptions and information presently available to the Sponsor or both, the Sponsor and the Investment Manager. There are no material facts in relation to the Trust and the Units, the omission of which would, in the context of the Offer, make any statement in this Final Placement Memorandum misleading in any material respect. Further, each of the Investment Manager and Sponsor has made all reasonable enquiries to ascertain such facts and to verify the accuracy of all such information and statements.

The Lead Managers have not separately verified any information (financial, legal or otherwise) contained in this Final Placement Memorandum. Accordingly, none of the Lead Managers or any of their respective shareholders, employees, counsel, officers, directors, representatives, agents, associates or affiliates make any express or implied representation, warranty or undertaking, and accept no responsibility or liability as to the accuracy or completeness of the information contained in this Final Placement Memorandum or any other information supplied in connection with the Offer or the distribution of the Units, other than in relation to themselves.

Each Bidder acknowledges that such person has neither relied on the Lead Managers nor any of their respective shareholders, employees, counsel, officers, directors, representatives, agents, associates or affiliates in connection with such person's investigation of the accuracy of such information or such person's investment decision, and each such person must rely on his/her own examination of the Trust and the merits and risks involved in investing in the Units. Bidders should not construe the contents of this Final Placement Memorandum as legal, business, tax, accounting or investment advice.

No person is authorized to give any information or to make any representation not contained in this Final Placement Memorandum and any information or representation not so contained must not be relied upon as having been authorized by or on behalf of the Trust or by or on behalf of the Lead Managers. The delivery of this Final Placement Memorandum, at any time, does not imply that the information contained in it is correct as of any time subsequent to its date.

Certain U.S. Matters

The Units to be issued pursuant to the Offer have not been approved, disapproved or recommended by any regulatory authority in any jurisdiction, including the United States Securities and Exchange Commission ("SEC"), any other federal or state authorities in the United States, the securities authorities of any non-United States jurisdiction or any other United States or non-United States regulatory authority. No authority has passed on or endorsed the merits of the Offer or the accuracy or adequacy of this Final Placement Memorandum. Any representation to the contrary is a criminal offence in the United States and may be a criminal offence in other jurisdictions.

The Units have not been and will not be registered under the Securities Act and may not be offered or sold within the United States except pursuant to an exemption from, or in a transaction not subject to, the registration requirements of the Securities Act and applicable state securities laws. Accordingly, the Units are being offered and sold (a) in the United States only to U.S. QIBs in transactions exempt from the registration requirements of the Securities Act, and (b) outside the United States in "offshore transactions" as defined in, and in reliance on, Regulation S and the applicable laws of the jurisdictions where those offers and sales occur. The Units are transferable only in accordance with the restrictions described under the section "*Selling and Transfer Restrictions*" on page 277 of this Final Placement Memorandum. For the avoidance of doubt, the term U.S. QIBs does not refer to a category of institutional investors defined under applicable Indian regulations and referred to in this Final Placement Memorandum as "QIBs".

Each purchaser of the Units offered by the Placement Memorandum will be deemed to have made the representations, agreements and acknowledgments as described in this section entitled "Notice to Investors – Representations by Eligible Investors" on page 2 and in the section entitled "Selling and Transfer Restrictions" on page 277.

Notice to Investors in certain other jurisdictions

The distribution of this Final Placement Memorandum and the issue of the Units in certain jurisdictions may be restricted by law. As such, this Final Placement Memorandum does not constitute, and may not be used for, or in connection with, an offer or solicitation by anyone in any jurisdiction in which such offer or solicitation is not authorized or to any person to whom it is unlawful to make such offer or solicitation. In particular, no action has been taken by the Investment Manager or the Lead Managers which would permit an Offer of the Units or distribution of this Final Placement Memorandum in any jurisdiction, other than India. Accordingly, the Units may not be offered or sold, directly or indirectly, and neither this Final Placement Memorandum nor any Offer materials in connection with the Units be distributed or published in or from any country or jurisdiction that would require registration of the Units in such country or jurisdiction. Please see the section entitled “*Selling and Transfer Restrictions*” on page 277.

Representations by Eligible Investors

References herein to “you” or “your” is to each Eligible Investor in the Offer.

By purchasing, or subscribing to, Units pursuant to the Offer, you are deemed to have represented to the Trustee, the Investment Manager, the Sponsor and the Lead Managers, and acknowledge and agree as follows:

- (1) You are entitled to acquire the Units under the laws of all relevant jurisdictions and that you have all necessary capacity and have obtained all necessary consents, governmental or otherwise and authorisations to enable you to commit to this participation in the Offer and to perform your obligations in relation thereto (including, without limitation, in the case of any person on whose behalf you are acting, all necessary consents and authorisations to agree to the terms set out or referred to in this Final Placement Memorandum) and will honour such obligations;
- (2) You undertake to (i) hold, manage or dispose of any Units that are Allotted to you in accordance with the InvIT Regulations and all other applicable laws; and (ii) to comply with all requirements under applicable law in relation to reporting obligations, if any, in this relation;
- (3) You will make all necessary filings, in relation to the Offer and your investment in Units, with appropriate governmental, statutory or regulatory authorities, including the RBI, as may be required, in accordance with applicable law, including in your respective jurisdiction;
- (4) You agree to provide on request in a timely manner, and consent to the use and disclosure (including to any taxation or other regulatory authorities) of, any information or documentation in relation to yourself and, if and to the extent required, the direct or indirect beneficial ownership of your Units (if any), as may be necessary for the Trust (or the Trustee and its agents) and the Investment Manager to comply with any regulatory obligations and/or prevent the withholding of tax or other penalties under FATCA, the CRS or other similar exchange of tax information regimes. You acknowledge and agree that you shall have no claim against the Trust (or the Trustee and its agents) and the Investment Manager for any losses suffered by you (including in relation to the direct or indirect beneficial ownership of your Units (if any)) as a result of such use or disclosure of such information or documentation to, any relevant regulatory, governmental or statutory authority;
- (5) You are aware that the Units have not been, and will not be, registered through a prospectus under the InvIT Regulations, or under any other law in force in India. This Final Placement Memorandum will be submitted to SEBI and the Stock Exchanges;
- (6) You confirm that, either: (i) you have not participated in or attended any investor meetings or presentations by the Trust, the Sponsor or its agents (“**Presentations**”) with regard to the Trust, the Units or the Offer; or (ii) if you have participated in or attended any Presentations, you understand and acknowledge that the Lead Managers or the Trustee may not have knowledge of the statements that the Trust, Sponsor or its agents may have made at such Presentations and are therefore unable to determine whether the information provided to you at such Presentations may have included any material misstatements or omissions, and, accordingly you acknowledge that the Lead Managers, the Trustee (or its agents), the Investment Manager or the Sponsor have advised you not to rely in any way on any information that was provided to you at such Presentations;
- (7) None of the Sponsor, the Investment Manager, the Trustee or any of the Lead Managers or any of their respective shareholders, members, directors, officers, employees, counsel, representatives, agents or

affiliates is making any recommendations to you or advising you regarding the suitability of any transactions it may enter into in connection with the Offer and that participation in the Offer is on the basis that you are not and will not, up to the Allotment, be a client of the Lead Managers. None of the Sponsor, the Trustee, the Investment Manager, the Lead Managers or any of their respective shareholders, members, employees, counsel, officers, directors, representatives, agents or affiliates have any duties or responsibilities to you for providing the protection afforded to their clients, or for providing advice in relation to the Offer and are in no way acting in a fiduciary capacity towards you;

- (8) All statements, other than statements of historical fact included in this Final Placement Memorandum, including, without limitation, those regarding the Trust's financial position, business strategy, plans and objectives for future operations, the Investment Objectives, and the Projections of Revenue from Operations and Cash Flow from Operating Activities, are forward-looking statements. Such forward-looking statements involve known and unknown risks, uncertainties and other important factors that could cause actual results to be materially different from future results, performance or achievements expressed or implied by such forward-looking statements. Such forward-looking statements are based on numerous assumptions regarding the Trust's present and future business strategies and the environment in which the Trust will operate in the future. You should not place undue reliance on forward-looking statements, which speak only as of the date of this Final Placement Memorandum. The Trust, the Trustee, the Sponsors, the Investment Manager and the Lead Managers or any of their respective shareholders, members, directors, officers, employees, counsel, representatives, agents, associates or affiliates assume no responsibility to update any of the forward-looking statements contained in this Final Placement Memorandum;
- (9) You have been provided a serially numbered copy of the Placement Memorandum and this Final Placement Memorandum and will be deemed to have read the Placement Memorandum in its entirety, including, in particular, the section entitled "*Risk Factors*" on page 61;
- (10) You are aware and understand that the Units are being offered only to Eligible Investors and are not being offered to the general public and the Allotment shall be on a discretionary basis;
- (11) You have made, or are deemed to have made, as applicable, the representations provided in the section entitled "*Selling and Transfer Restrictions*" on page 277;
- (12) If you are in the United States, you (i) are not acquiring or subscribing for the Units as a result of any "general solicitation or general advertising" (within the meaning of Regulation D under the Securities Act) and (ii) understand and agree that x) offers and sales in the United States of the Units are being made in reliance on an exemption to the registration requirements of the Securities Act and y) the Units are "restricted securities" within the meaning of Rule 144(a)(3) under the Securities Act and may be eligible for resale or transfer under Rule 144 of the Securities Act, and z) the Units may not be deposited into an unrestricted depository receipt facility established or maintained by a depository bank unless and until such time as such Units are no longer "restricted securities" within the meaning of Rule 144(a)(3) under the Securities Act;
- (13) If you are outside the United States, you (i) are not acquiring or subscribing for the Units as a result of any "directed selling efforts" (as defined in Regulation S) and (ii) are acquiring or subscribing for the Units in an "offshore transaction" as defined in, and in reliance on, Regulation S;
- (14) If you are within the United States, you are a U.S. QIB, who is acquiring the Units for your own account or for the account of an institutional investor who also meets the definition of a U.S. QIB, for investment purposes only, and not with a view to, or for reoffer or resale in connection with, the distribution (within the meaning of any United States securities laws) thereof, in whole or in part, and are not an affiliate of the Trust or a person acting on behalf of such an affiliate;
- (15) If you are outside the United States, you are subscribing for the Units in an "offshore transaction" as defined in Regulation S, and are not an affiliate of the Trust or the Lead Managers or a person acting on behalf of such an affiliate;
- (16) You understand and agree that the Units are transferable only in accordance with the restrictions described in the section entitled "*Selling and Transfer Restrictions*" on page 277, and you warrant that you will comply with such restrictions;

- (17) In making your investment decision, you have (i) relied on your own examination of the Trust, the Units and the terms of the Offer, including the merits and risks involved, (ii) made and will continue to make your own assessment of the Trust, the Units and the terms of the Offer based solely on the information contained in the Placement Memorandum, (iii) consulted your own independent advisors or otherwise have satisfied yourself concerning, without limitation, the effects of local laws, (iv) relied solely on the information contained in the Placement Memorandum and no other disclosure or representation by the Sponsor or the Investment Manager or the Lead Managers or any other party; (v) received all information in the Placement Memorandum that you believe is necessary or appropriate in order to make an investment decision in respect of the Trust and the Units, and (vi) relied upon your own investigation in deciding to invest in the Offer;
- (18) You have such knowledge and experience in financial, business and investment matters as to be capable of evaluating the merits and risks of an investment in the Units. You and any accounts for which you are subscribing to the Units, (i) are each able to bear the economic risk of the investment in the Units; (ii) will not, subject to the terms of this Final Placement Memorandum, look to any of the Investment Manager, the Trustee, the Sponsor or the Lead Managers or any of their respective shareholders, members, employees, counsel, officers, directors, representatives, agents or affiliates for all, or part, of any such loss or losses that may be suffered due to your investment in the Units; and (iii) are able to sustain a complete loss on the investment in the Units; (iv) have no need for immediate liquidity with respect to the investment in the Units, and (v) have no reason to anticipate any change in your or their circumstances, financial or otherwise, which may cause or require any sale or distribution by you or them of all or any part of the Units. You acknowledge that an investment in the Units involves a high degree of risk and that the Units are, therefore, a speculative investment. You are seeking to subscribe to the Units in the Offer for your own investment and not with a view to resell or distribute in any manner that could characterise you as an underwriter or similar party in any jurisdiction;
- (19) The Trustee, the Sponsor, the Investment Manager, the Lead Managers or any of their respective shareholders, members, directors, officers, employees, counsel, representatives, agents or affiliates have not provided you with any legal, financial or tax advice or otherwise made any representations regarding the tax consequences of the Units (including but not limited to, the Offer and the use of the proceeds of the Offer). You will obtain your own independent legal, financial or tax advice and will not rely on the Investment Manager, the Sponsor, the Trustee, the Lead Managers or any of their respective shareholders, members, employees, counsel, officers, directors, representatives, agents or affiliates or the Investment Manager when evaluating the tax consequences in relation to the Units (including but not limited to the Offer and the use of the proceeds of the Offer). You waive and agree not to assert any claim against the Lead Managers, the Sponsor, the Trustee or the Investment Manager with respect to the tax aspects of the Units or the Offer or as a result of any tax audits by tax authorities, in relation to the Units and the Offer, wherever situated;
- (20) You are not the Trustee, or the Valuer or an employee of the Valuer involved in the valuation of the Project SPV;
- (21) You are aware that (i) we have received the in-principle approval from NSE dated April 13, 2021 (read along with the extension letters dated July 12, 2021, and September 29, 2021, issued by NSE), and the in-principle approval from BSE dated August 25, 2021, respectively, and (ii) the application for the final listing and trading approvals will be made only after Allotment. There can be no assurance that the final approvals for listing and trading of the Units will be obtained in a timely manner, or at all. The Trust, the Trustee, the Investment Manager or the Sponsor shall not be responsible for any delay or non-receipt of such final approvals (except to the extent prescribed under the InvIT Regulations) or any loss arising from such delay or non-receipt;
- (22) You shall not undertake any trade in the Units credited to your demat account until such time that the final listing and trading approvals for the Units have been issued by the Stock Exchanges, subject to compliance with applicable law;
- (23) The only information you are entitled to rely on, and on which you have relied, in committing yourself to acquire the Units, is contained in the Placement Memorandum, such information being all that you deem necessary to make an investment decision in respect of the Units and that you have neither received nor relied on any other information given or representations, warranties or statements made by the Trustee, the Lead Managers, the Investment Manager or the Sponsor, and neither the Trustee, the Lead Managers, the

Investment Manager nor the Sponsor will be liable for your decision to accept an invitation to participate in the Offer based on any other information, representation, warranty or statement that you have obtained or received;

- (24) You understand that the Units to be Allotted in this Offer will, when issued, be credited as fully paid and will rank *pari passu* in all respects with all other Units, including in respect of the right to receive all distributions declared, made or paid in respect of the Units after the Allotment. For details, please see the section entitled “*Distribution*” on page 248;
- (25) You are eligible to Bid for, and hold, Units, so Allotted. Your unitholding after the Allotment of the Units shall not exceed the investment level permissible as per any applicable law and regulation;
- (26) You agree to indemnify and hold the Trustee, Investment Manager, the Sponsor and the Lead Managers harmless from any and all costs, claims, liabilities and expenses (including legal fees and expenses) arising out of or in connection with any breach of the representations and warranties in this section;
- (27) The Trustee, the Investment Manager, the Sponsor, the Lead Managers, their respective shareholders, members, employees, counsel, offices, directors, representatives, agents or affiliates, will rely on the truth and accuracy of the foregoing representations, warranties, acknowledgements and undertakings which are given to the Lead Managers on their own behalf and on behalf of the Trust, the Sponsor, the Investment Manager, the Trustee, and the same are irrevocable;
- (28) You are eligible to invest in India and in the Units under applicable law, including the FEMA Rules, and have not been prohibited by SEBI or any other statutory, regulatory or judicial authority from buying, selling or dealing in securities;
- (29) You understand that, subject to the terms of this Final Placement Memorandum, neither the Lead Managers, the Investment Manager, the Sponsor nor the Trustee has any obligation to purchase or subscribe to all, or any part, of the Units purchased by you in the Offer, or to support any losses directly or indirectly sustained or incurred by you for any reason whatsoever in connection with the Offer;
- (30) Any dispute arising in connection with the Offer will be governed by, and construed in accordance with, the laws of the Republic of India and the courts at New Delhi shall have exclusive jurisdiction to settle any disputes which may arise out of or in connection with the Placement Memorandum or this Final Placement Memorandum; and
- (31) You have made, or are deemed to have made, as applicable, the representations provided in this section and each of the representations, warranties, acknowledgements and agreements set out above shall continue to be true and accurate at all times, up to, and including, the Allotment, listing and trading of the Units in the Offer.

Available Information

The Investment Manager agrees to comply with any undertakings given by it from time to time in connection with the Units to the Stock Exchanges and, without prejudice to the generality of foregoing, shall furnish to the Stock Exchanges all such information as the rules of the Stock Exchanges may require in connection with the listing of the Units on such Stock Exchanges.

The Investment Manager agrees that, for so long as any Units are “restricted securities” within the meaning of Rule 144(a)(3) under the Securities Act, the Trust will, during any period in which it is neither subject to Section 13 or 15(d) of the U.S. Securities Exchange Act of 1934, as amended, nor exempt from reporting pursuant to Rule 12g3-2(b) thereunder, provide to any holder or beneficial owner of such restricted securities or to any prospective purchaser of such restricted securities designated by such holder or beneficial owner, upon the request of such holder, beneficial owner or prospective purchaser, the information required to be provided by Rule 144A(d)(4) under the Securities Act, subject to compliance with applicable provisions of Indian law.

IMPORTANT NOTICE

THE VALUE OF UNITS AND THE INCOME DERIVED FROM THEM MAY FALL AS WELL AS RISE. UNITS ARE NOT OBLIGATIONS OF, DEPOSITS IN, OR GUARANTEED BY, THE TRUST, THE TRUSTEE, THE SPONSOR, THE INVESTMENT MANAGER, THE LEAD MANAGERS OR ANY OF THEIR RESPECTIVE SHAREHOLDERS, MEMBERS, EMPLOYEES, COUNSEL, OFFICERS, DIRECTORS, MEMBERS, REPRESENTATIVES, AGENTS, ASSOCIATES OR AFFILIATES. AN INVESTMENT IN UNITS IS SUBJECT TO INVESTMENT RISKS, INCLUDING THE POSSIBLE LOSS OF THE PRINCIPAL AMOUNT INVESTED. FURTHER, LISTING OF THE UNITS ON THE STOCK EXCHANGE DOES NOT GUARANTEE A LIQUID MARKET FOR THE UNITS. INVESTORS HAVE NO RIGHT TO REQUEST THE TRUST, THE TRUSTEE, THE SPONSOR OR THE INVESTMENT MANAGER OR ANY OF ITS SHAREHOLDERS, MEMBERS, EMPLOYEES, COUNSEL, OFFICERS, DIRECTORS, MEMBERS, REPRESENTATIVES, AGENTS, ASSOCIATES OR AFFILIATES TO REDEEM THEIR UNITS WHILE THE UNITS ARE LISTED, UNLESS OTHERWISE PERMITTED BY APPLICABLE LAW. THE PERFORMANCE OF ANY OF THE LISTED UNITS OF THE TRUST IS NOT NECESSARILY INDICATIVE OF THE FUTURE PERFORMANCE OF UNITS OF THE TRUST.

DISCLAIMER CLAUSE OF THE STOCK EXCHANGES

As required, a copy of the Draft Placement Memorandum and the Placement Memorandum have been and this Final Placement Memorandum will be submitted to the Stock Exchanges.

The Stock Exchanges do not in any manner:

1. warrant, certify or endorse the correctness or completeness of the contents of this Final Placement Memorandum;
2. warrant that the Units will be listed or will continue to be listed on the Stock Exchanges; and
3. take any responsibility for the financial or other soundness of the Trust, the Sponsor, the Investment Manager, the Project Manager or any other party to the Trust;

and it should not, for any reason be deemed or construed to mean that this Final Placement Memorandum has been cleared or approved by the Stock Exchanges. Every person who desires to apply for or otherwise acquire the Units may do so pursuant to an independent inquiry, investigation and analysis and shall not have any claim against the Stock Exchanges whatsoever, by reason of any loss which may be suffered by such person consequent to or in connection with, such subscription/acquisition, whether by reason of anything stated or omitted to be stated herein, or for any other reason whatsoever.

DEFINITIONS AND ABBREVIATIONS

This Final Placement Memorandum uses the definitions and abbreviations set forth below which you should consider when reading the information contained herein.

References to any legislation, act, regulations, rules, guidelines, circulars, notifications, clarifications or policies shall be to such legislation, act, regulations, rules, guidelines, circulars, notifications, clarifications or policies as amended, supplemented, or re-enacted from time to time and any reference to a statutory provision shall include any subordinate legislation made under that provision.

The words and expressions used in this Final Placement Memorandum, but not defined herein shall have the meaning ascribed to such terms under the InvIT Regulations, the SEBI Act, the Depositories Act, and the rules and regulations made thereunder.

Notwithstanding the foregoing, the terms not defined but used in the sections entitled “Audited Financial Information”, “Projections of Revenue from Operations and Cash Flow from Operating Activities”, “Taxation” and “Legal and other Information” on pages 323, 349, 298 and 264, respectively, shall have the meanings ascribed to such terms in those respective sections.

In this Final Placement Memorandum, unless the context otherwise requires, a reference to “we”, “us” and “our” refers to the Trust and the Project SPV on a consolidated basis.

Trust Related Terms

Term	Description
A&F Policy	The Asset acquisition and unit funding policy adopted by the Investment Manager pursuant to the resolution of the IM Board dated September 30, 2021
Abu Road Swaroopganj Project Highway	The Abu Road – Swaroopganj section of NH 27 with a total length of 31 kms, in the state of Rajasthan
Asset Revenue Information	Revenue data of the InvIT Assets as has been historically collected through toll collection and maintenance contracts, for the period between April 1, 2018, to August 31, 2021
Associate	Associate shall have the meaning set forth in Regulation 2(1)(b) of the InvIT Regulations. Since (i) the Sponsor is a body corporate whose capital is funded by the Central Government and members are appointed and executive decisions taken by the President of India (acting through the Department of Personnel and Training and MoRTH), and (ii) the President of India is the Promoter of the Investment Manager, persons or entities that may be classified as “associates” of the Sponsor and Investment Manager in terms of Regulation 2(1)(b)(ii) and Regulation 2(1)(b)(iii) of the InvIT Regulations, have not been identified as ‘associates’ of the Sponsor and the Investment Manager.
Audited Financial Information	The audited standalone financial information of the Trust, for the period from the date of its settlement, that is October 19, 2020, till March 31, 2021, and for the three months period ending June 30, 2021
Auditors	A.R. & Co., Chartered Accountants, statutory auditors of the Trust
Audit Committee	The audit committee of the Investment Manager constituted in accordance with the Companies Act
Borrowing Policy	The borrowing policy of the Trust adopted by the Investment Manager pursuant to a resolution of the IM Board dated February 3, 2021, as amended pursuant to the resolution of the IM Board dated September 27, 2021
Compliance Officer	The compliance officer of the Trust
Chittorgarh Kota Project Highway	Chittorgarh – Kota section of NH 27 with a total length of 160.50 kms, in the state of Rajasthan
Distribution Policy	The distribution policy adopted by the Investment Manager pursuant to a resolution of its board of directors dated February 3, 2021, as amended pursuant to the resolution of the IM Board dated September 27, 2021
IM Board	The board of directors of the Investment Manager

Term	Description
Investment Management Agreement	Investment management agreement dated October 21, 2020, entered into between the Trustee (on behalf of the Trust) and the Investment Manager
Investment Manager or NHIIMPL	National Highways Infra Investment Managers Private Limited
Investment Objectives	The investment objectives of the Trust, as provided under the section entitled “ <i>Overview of the Trust</i> ” on page 24
InvIT Assets	InvIT assets as defined in Regulation 2(1)(zb) of the InvIT Regulations, in this case being the concessions granted under the Concession Agreements, in respect of the (i) Kotha Kota Kurnool Project Highway, (ii) Chittorgarh Kota Project Highway, (iii) Maharashtra Belgaum Project Highway, (iv) Abu Road Swaroopganj Project Highway and (v) Palanpur Abu Road Project Highway
InvIT Documents	(i) The Trust Deed; (ii) the Investment Management Agreement; (iii) the Project Implementation and Management Agreement; and (iv) such other policies, documents, agreements and letters executed in connection with the Trust, as originally executed and amended, modified, supplemented or restated from time to time, together with the respective annexures, schedules and exhibits, if any
Kotha Kota Kurnool Project Highway	The Kothakota bypass – Kurnool section of NH 44 with a total length of 74.6 kms, connecting the states of Telangana to Andhra Pradesh.
Maharashtra Belgaum Project Highway	The Belgaum – Kagal section of NH 48 with a total length of 77.7 kms, connecting the states of Karnataka and Maharashtra
NHIPPL	National Highways Infra Projects Private Limited
Palanpur Abu Road Project Highway	The Palanpur/Khemana – Abu Road section of NH 27 with a total length of 45 kms, connecting the states of Gujarat and Rajasthan
Parties to the Trust	The Sponsor, the Trustee, the Investment Manager and the Project Manager
Project Implementation and Management Agreement	Project implementation and management agreement dated March 30, 2021, entered into amongst the Trustee (on behalf of the Trust), the Project Manager, the Investment Manager and the Project SPV, as amended by way of an amendment agreement to the project implementation and management agreement dated September 29, 2021.
Project Manager or NHIPMPL	National Highways InvIT Project Managers Private Limited
Project SPV Facilities	The loans aggregating up to ₹ 65,760.00 million approximately, to be provided by the Trust to the Project SPV in accordance with the Project SPV Facility Agreements
Project SPV Facility Agreements	The facility agreements each dated September 30, 2021, entered into between the Trust (acting through the Trustee), the Trustee, the Investment Manager and the Project SPV.
Projections of Revenue from Operations and Cash Flow from Operating Activities	Projections of revenue from operations and cash flow from operating activities of the Trust (consisting of the Trust and the Project SPV) individually, for the years ending March 31, 2022, March 31, 2023 and March 31, 2024, along with the basis of preparation and other explanatory information and significant assumptions
Project SPV	NHIPPL
Related Parties	Related parties, as defined under Regulation 2(1)(zv) of the InvIT Regulations
Share Purchase Agreement	The share purchase agreement dated September 30, 2021, entered into among the Sponsor, the Trustee (on behalf of the Trust), the Investment Manager and the Project SPV, in respect of the acquisition by the Trust of the equity shareholding of the Project SPV. For further details, please see the section entitled “ <i>Formation Transactions in Relation to the Trust - Acquisition of the Project SPV by the Trust and acquisition of the Units by the Sponsor</i> ” on page 26.
Sponsor	National Highways Authority of India
SPV(s)	Special purpose vehicles, as defined in Regulation 2(1)(zy) of the InvIT Regulations
Technical Consultant	Técnica Y Proyectos, S.A. (TYPESA) in JV with Avanza Engineering Private Limited
Technical Reports	Technical consultant reports each dated March 2021, issued by the Technical Consultant, concerning the Kotha Kota Kurnool Project Highway, the Chittorgarh Kota Project Highway, the Maharashtra Belgaum Project Highway, the Abu Road

Term	Description
	– Swaroopganj Project Highway and the Palanpur Abu Road Project Highway, which forms part of this Final Placement Memorandum, as set out in Annexure B
Traffic Consultants	Ramboll India Private Limited and Steer Davies Gleave India Private Limited
Traffic Reports	The traffic reports prepared by the Traffic Consultants in respect of the InvIT Assets, which forms part of this Final Placement Memorandum, as set out in Annexure C.
Transitional Support Agreement	The transitional support agreement dated March 30, 2021, entered into amongst the Sponsor, Project Manager and the Project SPV, read along with the (i) letter dated September 24, 2021, from the Project SPV to the Sponsor, and (ii) letter dated September 28, 2021, from the Sponsor to the Project SPV. For further details, please see the section entitled “ <i>Related Party Transactions – Transitional Support Agreement</i> ” on page 251.
Trust	National Highways Infra Trust
Trust Deed	Trust deed dated October 19, 2020, entered into between the Sponsor and the Trustee
Trustee	IDBI Trusteeship Services Limited
Unexpired Cash Flow	The amount calculated by multiplying the concession fee with the percentages provided in the relevant Concession Agreements
Unitholder(s)	Any Person who holds Units (as hereinafter defined) upon making a defined contribution as determined by the Trustee
Unit	An undivided beneficial interest in the Trust, and such Units together represent the entire beneficial interest in the Trust
UPSI Policy	The unpublished price sensitive information policy adopted by the Investment Manager pursuant to a resolution of its board of directors dated February 3, 2021, as amended pursuant to the resolution of the IM Board dated September 27, 2021
Valuation Report	The valuation report dated March 31, 2021, issued by the Valuer, which sets out their opinion as to the fair enterprise value of the Project SPV as on March 30, 2021, which is set out in Annexure A to the Final Placement Memorandum
Valuer	RBSA Valuation Advisors LLP

Offer Related Terms

Term	Description
Allocated/ Allocation	The allocation of Units, to successful Bidders on the basis of the Application Form submitted by them, by the Investment Manager, in consultation with the Lead Managers and the Sponsor
Allot/ Allotment/ Allotted	Unless the context otherwise requires, the issue and allotment of Units to successful Bidders, pursuant to the Offer
Allottees	Bidders to whom Units are issued and Allotted pursuant to the Offer
Application Form	The serially numbered form pursuant to which Eligible Investors submitted a Bid for the Units in the Offer
Bid(s)	Indication of interest of an Eligible Investor, as provided in the Application Form, to subscribe for the Units at a price being at or above the floor price specified in the Placement Memorandum and at or below the cap price specified in the Placement Memorandum, in terms of the Placement Memorandum and the Application Form
Bid Amount	The Bid Price multiplied by the total number of Units Bid for by a Bidder as indicated in the Application Form
Bid/Offer Closing Date	November 2, 2021
Bid/Offer Opening Date	October 29, 2021
Bid/Offer Period	Period between the Bid/Offer Opening Date and the Bid/Offer Closing Date, inclusive of both days, during which Eligible Investors submitted their Bids
Bid Lot/ Minimum Bid Size	A minimum of 2,600,000 Units and in multiples of 200,000 Units thereafter
Bid Price	An amount per Unit, within the Price Band as indicated by a Bidder in the Application Form

Bidder	Any Eligible Investor, who made a Bid pursuant to the terms of the Placement Memorandum and the Application Form
Bodies Corporate	Bodies corporate as defined in Regulation 2(1)(d) of the InvIT Regulations, whether Indian or foreign
Business Day	Any day from Monday to Friday, excluding any public holiday
Cap Price	The higher end of the Price Band, being ₹ 101 per Unit, above which the Offer Price will not be finalised and above which no Bids were accepted
Cash Escrow Account	‘No-lien’ and ‘non-interest bearing’ account opened with the Escrow Collection Bank and in whose favour Bidders transferred money through direct credit/NEFT/NECS/RTGS in respect of the Bid Amount when submitting a Bid
Cash Escrow Agreement	The cash escrow agreement dated September 24, 2021, entered into amongst the Trust (acting through the Trustee), the Investment Manager, the Lead Managers, the Sponsor and the Escrow Collection Bank for, among others, collection of the Bid Amounts and for remitting refunds, if any, of the amounts collected, to the Bidders
Client ID	Client identification number maintained with one of the Depositories in relation to a demat account
Closing Date	The date on which Allotment of Units pursuant to the Offer shall be made, i.e. on or about November 3, 2021
Demographic Details	Details of the Bidders, including the Bidder’s address, name of the Bidder’s father/husband, investor status, occupation and bank account details, PAN, DP ID and Client ID
Designated Date	The date of credit of Units to the Eligible Investors’ demat accounts
Designated Stock Exchange	NSE
Draft Placement Memorandum	The draft placement memorandum dated March 31, 2021, issued in accordance with the InvIT Regulations and the SEBI circular dated December 24, 2019 (Circular No: SEBI/HO/DDHS/DDHS/CIR/P/2019/161)
Eligible Investors	Institutional Investors and Bodies Corporate, whether Indian or foreign
Escrow Collection Bank	Axis Bank Limited
Final Placement Memorandum	This final placement memorandum dated November 3, 2021, to be issued in relation to this Offer in accordance with the InvIT Regulations and SEBI circular dated December 24, 2019 (Circular No.: SEBI/HO/DDHS/DDHS/CIR/P/2019/161)
Floor Price	The lower end of the Price Band, in this case being ₹ 100 at or above which the Offer Price was finalised and below which no Bids were accepted
Offer	Initial offer of 499,600,000* Units by way of a fresh issue, through a private placement to Eligible Investors aggregating to ₹ 50,459.60* million by the Trust <i>*Subject to finalization of Basis of Allotment</i>
Institutional Investors	Institutional investors as defined in Regulation 2(1)(ya) of the InvIT Regulations
I-Sec	ICICI Securities Limited
Kotak	Kotak Mahindra Capital Company Limited
Listing Agreements	The listing agreements to be entered into with the Stock Exchanges by the Trust, in line with the format as specified under the Securities and Exchange Board of India circular number CIR/CFD/CMD/6/2015 dated October 13, 2015 on “Format of uniform Listing Agreement”
Listing Date	The date on which the Units will be listed on the Stock Exchanges
Lead Managers	SBICAP, I-Sec and Kotak
Mutual Funds	Mutual funds registered with SEBI under the Securities and Exchange Board of India (Mutual Funds) Regulations, 1996
Net Proceeds	Proceeds of the Offer that will be available to the Trust, i.e., Offer Proceeds, less Offer expenses apportioned to the Trust
Offer Expenses	Expenses in relation to the Offer
Offer Price	₹ 101 per Unit
Offer Proceeds	The proceeds of the Offer that are available to the Trust. For further details about the use of the Offer Proceeds, please see the section entitled “ <i>Use of Proceeds</i> ” on page 224
Offer Size	The offer of 499,600,000* Units aggregating to ₹ 50,459.60* million

	<i>*Subject to finalization of Basis of Allotment</i>
Placement Agreement	The placement agreement dated March 31, 2021, entered into among the Trust (acting through its Trustee), the Trustee, the Investment Manager, the Sponsor, the Project Manager and the Lead Managers
Placement Memorandum	The placement memorandum dated October 26, 2021, in relation to this Offer, filed with SEBI and the Stock Exchanges, issued in accordance with the InvIT Regulations, containing the complete particulars of the Offer
Price Band	Price band between the minimum price of ₹ 100 per Unit (Floor Price) and the maximum price of ₹ 101 per Unit (Cap Price) (as decided by the Investment Manager, in consultation with the Lead Managers).
Qualified Institutional Buyers or QIB(s)	Qualified institutional buyers, as defined under Regulation 2(1)(ss) of the SEBI ICDR Regulations, which currently includes (i) a mutual fund, a VCF, an AIF and an FVCI registered with SEBI, (ii) an FPI, other than individuals, corporate bodies and family offices, (iii) a public financial institution as defined in section 2(72) of the Companies Act, 2013, (iv) a scheduled commercial bank as included in the second schedule to the Reserve Bank of India Act, 1934, (v) a multilateral and bilateral development financial institution, (vi) a state industrial development corporation, (vii) an insurance company registered with the IRDAI, (viii) a provident fund with minimum corpus of ₹ 250 million, (ix) a pension fund with minimum corpus of ₹ 250 million, (x) National Investment Fund set up by resolution no. F. No. 2/3/2005-DDII dated November 23, 2005 of the GoI published in the Gazette of India, (xi) insurance funds set up and managed by army, navy or air force of the Union of India, (xii) insurance funds set up and managed by the Department of Posts, India, and (xiii) systemically important non-banking financial companies.
Registrar and Unit Transfer Agent or Registrar	KFin Technologies Private Limited
SBICAP	SBI Capital Markets Limited
Working Day	Working Day, with reference to (a) Bid/Offer Period, shall mean all days, excluding Saturdays, Sundays and public holidays, on which commercial banks in Mumbai are open for business; and (b) the time period between the Bid/ Offer Closing Date and the listing of the Units on the Stock Exchanges, shall mean all trading days of Stock Exchanges, excluding Sundays and bank holidays

Technical and Industry Related Terms

Term	Description
%	Percentage
2A	2 Axle truck
3A	3 Axle truck
AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
AR	Alternate Route
BIA	Broad Influence Area
BOT	Build Operate Transfer
BRO	Border Roads Organisation
CAGR	Compounded Annual Growth Rate
CJV	Cars / Jeeps / Vans
CK	Chittorgarh-Kota
COD	Commercial Operations Date
DBFOT	Design, Build, Finance, Operate and Transfer
DEA	Department of Economic Affairs
DME	Delhi Mumbai Expressway
DPR	Detailed Project Report
ETC	Electronic Toll Collection
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product

Term	Description
HAM	Hybrid Annuity Model
HCV	Heavy Commercial Vehicles
HME	Heavy Machinery and Equipment
IDC	Interest during construction
IHMCL	Indian Highways Management Company Limited
IIA	Immediate Influence Area
IRC	Indian Road Congress
InvIT	Infrastructure Investment Trust
JEPL	Jadcherla Expressways Private Limited
KK	Kotha Kota-Kurnool
Km	Kilometre
LCV	Light Commercial Vehicle
M Bus	Minibus
MAV	Multi Axle Vehicle
MLCV	Mini LCV
MoRTH	Ministry of Road Transport and Highways
NCT	National Capital Territory
NH	National Highway
NHAI	National Highways Authority of India
NHDP	National Highways Development Program
NHIIMPL or NHIMPL	National Highways Infra Investment Managers Private Limited
NHTIS	National Highway Toll Information System
NIP	National Infrastructure Pipeline
NPV	Net Present Value
NRRDA	National Rural Road Department Agency
NSDP	National State Domestic Production
O&M	Operation and Maintenance
OD	Origin Destination
OD	Origin-Destination survey
OECD	Organisation for Economic Cooperation and Development
OECD	Organisation for Economic Cooperation and Development
PCU	Passenger Car Unit
PIA	Project Influence Area
PR	Project Road
PWD	Public Works Departments
RNP	Registered Number Plate
RUCS	Road User Cost Study
SCF	Seasonality Correction Factors
SCOD	Scheduled commercial operations date
SEZ	Special Economic Zone
SH	State Highway
SPV	Special Purpose Vehicle
T&R	Traffic and Revenue
TMS	Traffic Management System
TOT	Toll-Operate-Transfer
TP	Toll Plaza
TVC	Traffic Volume Count
VOC	Vehicle Operating Cost
VOT	Value of Time
WATL	Western Andhra Expressways Limited
WPI	Wholesale Price Index
YOY	Year on Year
YTD	Year to Date

Abbreviations

Term	Description
AIF	Alternative Investment Fund as defined in and registered with SEBI under the SEBI AIF Regulations
BSE	BSE Limited
CCEA	Cabinet Committee on Economic Affairs
CCI	Competition Commission of India
CDSL	Central Depository Services (India) Limited
CIN	Corporate Identity Number
Companies Act	Companies Act, 1956 and/or the Companies Act, 2013, as applicable
Companies Act, 1956	Companies Act, 1956
Companies Act, 2013	Companies Act, 2013
Competition Act	Competition Act, 2002
Depository	A depository registered with SEBI under the Securities and Exchange Board of India (Depositories and Participants) Regulations, 2018
Depositories Act	Depositories Act, 1996
DIN	Director Identification Number
FEMA	Foreign Exchange Management Act, 1999, read with rules and regulations thereunder
FEMA Rules	Foreign Exchange Management (Non-debt Instruments) Rules, 2019
Financial Year or Fiscal Year or Fiscal	Period of 12 months ended March 31 of that particular year, unless otherwise stated
FPI	Foreign portfolio investors
FVCI	Foreign venture capital investors, as defined under the SEBI FVCI Regulations
GAAR	General Anti-Avoidance Rules
GoI or Government	Government of India
GST	Goods and Services Tax
ICAI	Institute of Chartered Accountants of India
Income Tax Act or IT Act	The Income-tax Act, 1961
Ind AS	Companies (Indian Accounting Standards) Rules, 2015, notified on February 19, 2015 by the MCA, including any amendments or modifications thereto
Indian GAAP	Generally Accepted Accounting Principles in India
Indian GAAS	Generally Accepted Auditing Standards in India
InvIT	Infrastructure investment trust
InvIT Regulations	Securities and Exchange Board of India (Infrastructure Investment Trust) Regulations, 2014
IRDAI	Insurance Regulatory and Development Authority of India
MCA	Ministry of Corporate Affairs, Government of India
MoEF	Ministry of Environment, Forest and Climate Change
NACH	National Automated Clearing House
NEFT	National Electronic Funds Transfer
NHAI	National Highways Authority of India
NHAI Act	National Highways Authority of India Act, 1988, as amended
NSDL	National Securities Depository Limited
NSE	The National Stock Exchange of India Limited
PAN	Permanent account number
RBI	Reserve Bank of India
Regulation S	Regulation S under the Securities Act
RoC	Registrar of Companies, Delhi and Haryana at New Delhi
Rs./Rupees/INR/₹	Indian Rupees
RTGS	Real Time Gross Settlement
Rule 144A	Rule 144A under the Securities Act
SCRA	Securities Contracts (Regulation) Act, 1956
SCRR	Securities Contracts (Regulation) Rules, 1957
SEBI	Securities and Exchange Board of India constituted under the SEBI Act
SEBI Act	The Securities and Exchange Board of India Act, 1992
SEBI AIF Regulations	Securities and Exchange Board of India (Alternative Investments Funds) Regulations, 2012

Term	Description
SEBI Circular on Financial Disclosures	SEBI Circular (CIR/IMD/DF/114/2016) dated October 20, 2016 on ‘Disclosure of Financial Information in Offer Document/Placement Memorandum for InvITs’
SEBI Debenture Trustees Regulations	Securities and Exchange Board of India (Debenture Trustees) Regulations, 1993
SEBI FPI Regulations	Securities and Exchange Board of India (Foreign Portfolio Investors) Regulations, 2019
SEBI FVCI Regulations	Securities and Exchange Board of India (Foreign Venture Capital Investors) Regulations, 2000
SEBI ICDR Regulations	Securities and Exchange Board of India (Issue of Capital and Disclosure Requirements) Regulations, 2018
Securities Act	U.S. Securities Act of 1933
Stock Exchange	NSE
U.S./U.S.A/United States	United States of America
USD/US\$	United States Dollars

PRESENTATION OF FINANCIAL DATA AND OTHER INFORMATION

Certain Conventions

All references in this Final Placement Memorandum to “India” are to the Republic of India.

Unless stated otherwise, all references to page numbers in this Final Placement Memorandum are to the page numbers of this Final Placement Memorandum.

Financial Data

The Trust was settled on October 19, 2020, and has acquired ownership of the Project SPV. The audited standalone financial information of the Trust for the period from its date of settlement, i.e. October 19, 2020, up to March 31, 2021, and for the three months period ended June 30, 2021, is included in this Final Placement Memorandum.

As the Project SPV was incorporated on July 23, 2020, the summary financial information of the Project SPV for Fiscals 2019 and 2020, are not available for disclosure in this Final Placement Memorandum. However, the summary financial information of the Project SPV for Fiscal 2021 has been included in this Final Placement Memorandum on page 51. Further, no separate financial information, including actual revenue data for the InvIT Assets, are currently available, which could be used to clearly ascertain financial information including revenue and expenses in respect of each of the InvIT Assets. Accordingly, in lieu of the combined financial statements of the Trust along with the InvIT Assets and/or SPV, the revenue data that NHAI has historically been collecting through toll collection and maintenance contracts, has been included in the section entitled “*Asset Revenue Information*” on page 313. This revenue data has been provided from April 1, 2018 till August 31, 2021, separately for each InvIT Asset, to the extent that such data is available for such InvIT Asset. The said amounts being collected are at times intermittent on account of gaps in tolling contract periods and would not be a true reflection of the revenue that these InvIT Assets are actually generating. Please refer to “*Risk Factors - We have no operating history and limited historical financial information and, as such, there are limited financial statements presented in this Final Placement Memorandum.*” on page 61 in this regard.

Further, this Final Placement Memorandum includes projections of revenue from operations and cash flow from operating activities of the Trust (consisting of the Trust and the Project SPV), individually, for the financial years ended March 31, 2022, 2023 and 2024, prepared in accordance with the basis of preparation as set out in the projections of revenue from operations and cash flow from operating activities (the “**Projections of Revenue from Operations and Cash Flow from Operating Activities**”). For further details, please see the section entitled “*Projections of Revenue from Operations and Cash Flow from Operating Activities*” on page 349.

Further, this Final Placement Memorandum includes summary financial information of the Sponsor, as of and for the financial years ended March 31, 2019, March 31, 2018 and March 31, 2017, derived from the audited standalone financial statements of the Sponsor for the respective years. Further, the unaudited limited review standalone financial results of the Sponsor for the financial year ended March 31, 2020, the unaudited limited review standalone financial results of the Sponsor for the six months ended September 30, 2020, the unaudited limited review standalone financial results of the Sponsor for the financial year ended March 31, 2021, and the unaudited limited review standalone financial results of the Sponsor for the three months ended June 30, 2021, have been included. For further details, please see the sections entitled “*Summary Financial Information of the Sponsor*” on page 29.

Further, as highlighted in the section entitled “*Parties to the Trust*” on page 94, the Investment Manager was incorporated on July 25, 2020. Accordingly, the summary financial information of the Investment Manager for Fiscals 2019 and 2020, are not available for disclosure in this Final Placement Memorandum. However, the summary financial information of the Investment Manager for Fiscal 2021 has been included in this Final Placement Memorandum on page 46. However, please note that while the financial information of the Investment Manager for Fiscal 2021, has been audited by the statutory auditor appointed by the Comptroller and Auditor General of India (“**CAG**”), the same may be subject to supplementary audit of the CAG, in accordance with the Companies Act, 2013, as amended.

The degree to which the financial information included in this Final Placement Memorandum will provide meaningful information is entirely dependent on the reader’s level of familiarity with Indian accounting policies and practices, the Companies Act, Ind AS, Indian GAAP and the InvIT Regulations. Any reliance by persons not

familiar with Indian accounting policies and practices on the financial disclosures presented in this Final Placement Memorandum should accordingly be limited.

The financial year for the Trust and Parties to the Trust commences on April 1 and ends on March 31 of the next year; accordingly, all references to a particular financial year, unless stated otherwise, are to the 12 month period ended on March 31 of that year.

In this Final Placement Memorandum, any discrepancies in any table between the total and the sums of the amounts listed are due to rounding off. All figures in decimals and all percentage figures have been rounded off to two decimal places.

Currency and Units of Presentation

All references to:

- “Rupees” or “₹” or “INR” or “Rs.” are to Indian Rupee, the official currency of the Republic of India; and
- “USD” or “US\$” are to United States Dollar, the official currency of the United States.

Except otherwise specified, certain numerical information in this Final Placement Memorandum have been presented in “million” units. One million represents 1,000,000 and one billion represents 1,000,000,000. One lakh represents 1,00,000 and one crore represents 1,00,00,000.

Unless the context requires otherwise, any percentage amounts, as set forth in this Final Placement Memorandum, have been calculated on the basis of the Audited Financial Information, Asset Revenue Information and the summary financial statements of the Sponsor.

Exchange Rates

This Final Placement Memorandum contains conversion of certain other currency amounts into Indian Rupees. These conversions should not be construed as a representation that these currency amounts could have been, or can be converted into Indian Rupees, at any particular rate.

The following table sets forth, for the dates indicated, information with respect to the exchange rate between the Rupee and the US\$ (in Rupees per US\$):

Currency	June 30, 2021	March 31, 2021	March 31, 2020	March 31, 2019*	March 31, 2018**
1 US\$	74.35	73.50	75.39	69.17	65.04

Source: <https://fbil.org.in>

*Exchange rate as on March 29, 2019, as RBI Reference Rate is not available for March 30, 2019, being Saturday and March 31, 2019, being a Sunday.

** Exchange rate as on March 28, 2018, as RBI Reference Rate is not available for March 29, 2018 and March 30, 2018, being public holidays and March 31, 2018, being a Saturday

Industry and Market Data

Unless stated otherwise, industry and market data used in this Final Placement Memorandum has been obtained or derived from publicly available information, as well as from the Report titled “*Report on Road Infrastructure Industry*” dated March 2021, prepared by CARE Advisory Research and Training Limited (“**CARE Report**”). The CARE Report is subject to the following disclaimer:

“This report is prepared by CARE Advisory Research and Training Limited (CART). CART has taken utmost care to ensure accuracy and objectivity while developing this report based on information available in public domain. However, neither the accuracy nor completeness of information contained in this report is guaranteed. CART operates independently of ratings division and this report does not contain any confidential information obtained by ratings division, which they may have obtained in the regular course of operations. The opinion expressed in this report cannot be compared to the rating assigned to the company within this industry by the ratings division. The opinion expressed is also not a recommendation to buy, sell or hold an instrument.

CART is not responsible for any errors or omissions in analysis/inferences/views or for results obtained from the use of information contained in this report and especially states that CARE (including all divisions) has no financial liability whatsoever to the user of this product. This report is for the information of the intended recipients only and no part of this report may be published or reproduced in any form or manner without prior written permission of CART.”

Although the Investment Manager believes that the industry and market data used in this Final Placement Memorandum is reliable, it has not been independently verified by the Investment Manager, the Sponsor, the Trustee or the Lead Managers, or any of their affiliates or advisors and their accuracy and completeness are not guaranteed and their reliability cannot be assured. The data used in these sources may have been re-classified by us for the purposes of presentation. Data from these sources may also not be comparable. Such data involves risks, uncertainties and numerous assumptions and is subject to change based on various factors, including those disclosed in the section entitled “*Risk Factors*” on page 61. Accordingly, no investment decisions should be based on such information.

The extent to which the market and industry data used in this Final Placement Memorandum is meaningful depends on the reader’s familiarity with and understanding of the methodologies used in compiling such data. There are no standard data gathering methodologies in the industry in which business of the Trust is conducted, and methodologies and assumptions may vary widely among different industry sources.

Traffic Consultants

The traffic reports in Annexure C, as well as the data used in this Final Placement Memorandum from those reports, have been prepared by the Traffic Consultants. In addition, in August 2021, the Traffic Consultants were engaged to prepare additional reports on the impact of COVID-19 on the Toll Roads, portions of which are summarized in this Final Placement Memorandum. These additional reports have also been included in Annexure C.

Disclaimers from the Traffic Consultants

Disclaimer from Steer Davies Gleave India Private Limited

*“This Final Placement Memorandum includes selected provisions of or a summary of the traffic and revenue due diligence report (the “**Report**”) prepared by Steer, Davies & Gleave India Private Limited, solely in its capacity as the Traffic Consultant (the “**Traffic Consultant**”), on behalf of NHIIMPL (the “**Client**”) for the Offer and is not a full statement of the terms of the Report. Accordingly, such summary or excerpt is qualified in its entirety by reference to and is subject to the full text of the Report, which are attached to the Final Placement Memorandum as Annexure C. Investors must view the summaries in the context of the full Report, which is subject to the limitations and disclaimers in such Report. Without limiting the generality of the foregoing, the Report is expressly subject to the qualifications, assumptions made, procedures followed, matters considered and any limitations on the scope of work contained therein.*

Investors should note that these summaries, and the Report, are provided only as of the date set forth therein and do not contemplate any event, circumstances or changes with respect to Offer or otherwise after such date. The foregoing summaries of the Report may include projected information and data (financial and otherwise), and other forward-looking information, that may or may not occur or prove to be accurate. Such projected and forward-looking information is based on current expectations and projections about future events which are beyond the control of the Traffic Consultant, the Client or any other participant in the Offer, and such projections and information can be affected by inaccurate assumptions. While these projections and information were prepared in good faith, no assurance can be given as to the accuracy or adequacy of such projections and information, or the assumptions underlying such projections and information.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE PROJECT IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN CONNECTION WITH THE PROJECT.”

Disclaimer from Ramboll India Private Limited

This Report is intended for the National Highways Infra Investment Managers Private Limited's sole and exclusive use and is not for the benefit of any third party and may not be distributed to, disclosed in any form to, used by, or relied upon by, any third party, except as agreed between the Parties, without prior written consent of Ramboll, which consent may be withheld in its sole discretion.

Use of this Report or any information contained herein, if by any party other than the Client, shall be at the sole risk of such party and shall constitute an agreement by such party to defend and indemnify Ramboll and its officers, employees from and against any liability for direct, indirect, incidental, consequential or special loss or damage or other liability of any nature arising from its use of the Report or reliance upon any of its content. To the maximum extent permitted by law, such release from and indemnification against liability shall apply in contract, tort (including negligence), strict liability, or any other theory of liability.

In preparing this report, Ramboll India Private Limited relied, in whole or in part, on data and information provided by National Highways Infra Investment Managers Private Limited, which information has not been independently verified by Ramboll and which Ramboll has assumed to be accurate, complete, reliable, and current. Therefore, while Ramboll has utilized its best efforts in preparing this Report, Ramboll does not warrant or guarantee the conclusions set forth in this Report which are dependent or based upon data, information, or statements supplied by third parties or the client.

FORWARD-LOOKING STATEMENTS

Certain statements contained in this Final Placement Memorandum that are not statements of historical fact constitute “forward-looking statements”. Bidders can generally identify forward-looking statements by terminology such as “aim”, “anticipate”, “believe”, “continue”, “can”, “could”, “estimate”, “expect”, “intend”, “may”, “objective”, “plan”, “potential”, “project”, “pursue”, “seek to”, “shall”, “should”, “will”, “would”, or other words or phrases of similar import. Similarly, statements that describe the strategies, objectives, plans or goals of the Trust and the Projections of Revenue from Operations and Cash Flow from Operating Activities are also forward-looking statements. However, these are not the exclusive means of identifying forward-looking statements.

All statements regarding the Trust’s expected financial conditions, results of operations and cash flows, business plans and prospects including the Projections of Revenue from Operations and Cash Flow from Operating Activities are forward-looking statements. These forward-looking statements include statements as to the Trust’s business strategy, planned projects, revenue and profitability (including, without limitation, any financial or operating projections or forecasts), new business and other matters discussed in this Final Placement Memorandum that are not historical facts. Further, please note that the Projections of Revenue from Operations and Cash Flow from Operating Activities included in this Final Placement Memorandum are based on a number of assumptions. For further details, please see the section entitled “*Projections of Revenue from Operations and Cash Flow from Operating Activities*” on page 349.

The Valuation Report included in this Final Placement Memorandum, is based on certain projections and accordingly, should be read together with assumptions and notes thereto. For further details, please see the “*Valuation Report*” attached as Annexure A. The Technical Reports include projections and estimates in relation to traffic growth and operation and maintenance expenses respectively, and accordingly, should be read in conjunction with the relevant notes and assumptions thereto.

Actual results may differ materially from those suggested by the forward-looking statements or financial projections due to certain known or unknown risks or uncertainties associated with the Investment Manager’s expectations with respect to, but not limited to, the actual growth in the infrastructure sector, the Investment Manager’s ability to successfully implement the strategy, growth and expansion plans, cash flow projections, exposure to market risks, the outcome of any legal or regulatory proceedings, the future impact of new accounting standards, regulatory changes pertaining to the infrastructure sector in India and our ability to respond to them, general economic and political conditions in India which have an impact on our business activities or investments, changes in competition, and the Project Manager’s ability to operate and maintain the Project SPV and successfully implement any technological changes. By their nature, certain of the market risk disclosures are only estimates and could be materially different from what actually occurs in the future. As a result, actual future gains, losses or impact on net interest income and net income could materially differ from those that have been estimated.

Factors that could cause actual results, performance or achievements of the Trust to differ materially include, but are not limited to, those discussed in the sections entitled “*Risk Factors*”, “*Industry Overview*”, “*Our Business*” and “*Management’s Discussion and Analysis of Factors by the Directors of the Investment Manager affecting the Financial Condition, Results of Operations and Cash Flows*”, on pages 61, 146, 155 and 242, respectively. Some of the factors that could cause the Trust’s actual results, performance or achievements to differ materially from those in the forward-looking statements and financial information include, but are not limited to, the following:

- Restrictions in flexibility to utilise the available funds from any payment by the Project SPV, including in the event of the termination of the Concession Agreements as a result of a mandatory escrow arrangement;
- cost of implementing new technologies for collection of tolls and monitoring our projects;
- limitations and risks associated with debt financing and refinancing;
- inability to obtain the prior approval of NHAI for certain actions of the Project SPV;
- premature termination of the Project SPV’s toll-road concessions under certain circumstances;
- competing roads and bridges and other modes of transportation, and any improvements to, or construction of, such roads, bridges and other modes of transportation affecting toll collections and Toll Road traffic volumes; and
- changes in the policies adopted by governmental entities or in the relationships of any member of the Trust with the Government or State Governments.

Forward-looking statements and Projections of Revenue from Operations and Cash Flow from Operating Activities, Valuation Report and Technical Reports reflect current views as of the date of this Final Placement Memorandum and are not a guarantee of future performance or returns to Bidders. These statements and projections are based on certain beliefs and assumptions, which in turn are based on currently available information. Although each of the Investment Manager and the Sponsor believes that the expectations and the assumptions upon which such forward-looking statements are based are reasonable at this time, neither the Investment Manager nor the Sponsor can assure Bidders that such expectations will prove to be correct or accurate. In accordance with the InvIT Regulations, the assumptions underlying the Projections of Revenue from Operations and Cash Flow from Operating Activities have been examined by the Auditors. The Projections of Revenue from Operations and Cash Flow from Operating Activities have been prepared for inclusion in the Final Placement Memorandum for the purposes of this Offer, using a set of assumptions that include hypothetical assumptions about future events and management's actions that are not necessarily expected to occur, and have been approved by the IM Board. Consequently, Bidders are cautioned that the Projections of Revenue from Operations and Cash Flow from Operating Activities may not be appropriate for purposes other than that described above. Given these uncertainties, Bidders are cautioned not to place undue reliance on such forward-looking statements and Projections of Revenue from Operations and Cash Flow from Operating Activities. In any event, these statements speak only as of the date of this Final Placement Memorandum or the respective dates indicated in this Final Placement Memorandum, and the Trust, the Investment Manager and the Lead Managers or any of their affiliates or advisors, undertake no obligation to update or revise any of the statements reflecting circumstances arising after the date hereof or to reflect the occurrence of underlying events, whether as a result of new information, future events or otherwise after the date of this Final Placement Memorandum. If any of these risks and uncertainties materialize, or if any of the Investment Manager's underlying assumptions prove to be incorrect, the actual results of operations or financial condition or cash flow of the Trust could differ materially from that described herein as anticipated, believed, estimated or expected. All subsequent forward-looking statements attributable to the Trust are expressly qualified in their entirety by reference to these cautionary statements.

THE OFFER

The following is a general summary of the terms of this Offer. This summary should be read in conjunction with, and is qualified in its entirety by, the detailed information appearing elsewhere in this Final Placement Memorandum:

Trust	National Highways Infra Trust is a contributory irrevocable trust set up under the Indian Trusts Act, 1882, and registered as an infrastructure investment trust under the InvIT Regulations on October 28, 2020, having registration number IN/InvIT/20-21/0014
Offer	Initial offer of 499,600,000* Units by way of a fresh issue, through a private placement to Eligible Investors aggregating to ₹ 50,459.60* million by the Trust
Floor Price	₹ 100 per Unit
Cap Price	₹ 101 per Unit
Offer Price	₹ 101 per Unit
Bid Lot/ Minimum Bid Size	A minimum of 2,600,000 Units and in multiples of 200,000 Units thereafter
Bid/Offer Opening Date	October 29, 2021
Bid/Offer Closing Date	November 2, 2021
Sponsor	National Highways Authority of India
Trustee	IDBI Trusteeship Services Limited
Investment Manager	National Highways Infra Investment Managers Private Limited
Project Manager	National Highways InvIT Project Managers Private Limited
Eligible Investors	Institutional Investors and Bodies Corporate, subject to applicable law
Authority for this Offer	This Offer was authorised and approved by the IM Board on March 22, 2021.
Tenure of the Trust	The Trust shall remain in force perpetually until it is dissolved or terminated in accordance with the Trust Deed. For details, please see the section entitled “Parties to the Trust” on page 94.
Units issued and outstanding immediately prior to this Offer	-
Units issued and outstanding immediately after this Offer	595,200,000*
Sponsor Units	95,600,000 Units. The Units to be held by the Sponsor will rank <i>pari passu</i> with, and have the same rights as the Units to be Allotted to other Bidders pursuant to the Offer. The Units to be held by the Sponsor will be allotted to the Sponsor, simultaneously with the Allotment pursuant to this Offer.
Distribution	Please see the section entitled “Distribution” on page 248.
Indian Taxation	Please see the section entitled “Taxation” on page 298.
Use of Proceeds	Please see the section entitled “Use of Proceeds” on page 224.
Listing	Prior to this Offer, there was no market for the Units. The Units are proposed to be listed on NSE and BSE. The Trust has received the in-principle approvals of NSE and BSE pursuant to letters dated April 13, 2021 (read along with the extension letters dated July 12, 2021, and September 29, 2021, issued by NSE) and August 25, 2021, respectively, for the listing of the Units. The Investment Manager shall apply to NSE and BSE for the final listing and trading approvals, after the Allotment and after the credit of the Units to the beneficiary accounts with the Depository Participants.
Designated Stock Exchange	National Stock Exchange of India Limited
Closing Date	The date on which Allotment of the Units pursuant to this Offer shall be made, i.e. on or about November 3, 2021
Ranking	The Units being issued will rank <i>pari passu</i> in all respects, including rights in respect of distribution. The Unitholders will be entitled to participate in distribution, if any, declared by the Trust after the date of Allotment. Please see the section entitled “Rights of Unitholders” on page 284.
Lock-in and Rights of Unitholders	For details, please see the sections entitled “Information concerning the Units” and “Rights of Unitholders” on pages 223 and 284, respectively.

Risk Factors	Prior to making an investment decision, Bidders should consider carefully the matters discussed in the section entitled “ <i>Risk Factors</i> ” on page 61.
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**Subject to finalization of Basis of Allotment*

The Units, on Allotment, shall be traded only in the dematerialized segment of the Stock Exchanges.

In accordance with the InvIT Regulations, no Unitholder shall enjoy superior voting or any other rights over another Unitholder. Further, there shall not be multiple classes of Units.

For further details in relation to this Offer, including the method of application, please see the section entitled “*Offer Information*” on page 289.

OVERVIEW OF THE TRUST

The following overview is qualified in its entirety by, and is subject to, the more detailed information contained in or referred to elsewhere in this Final Placement Memorandum. Statements contained in this summary that are not historical facts may be forward-looking statements. Such statements are based on certain assumptions and are subject to certain risks, uncertainties and assumptions that could cause actual results of the Trust to differ materially from those forecasted or projected in this Final Placement Memorandum. Under no circumstances should the inclusion of such information herein be regarded as a representation, warranty or prediction of the accuracy of the underlying assumptions by the Trust, the Parties to the Trust or the Lead Managers or any other person or that these results will be achieved or are likely to be achieved. Investment in Units involves risks. Bidders are advised not to rely solely on this overview, and, should read this Final Placement Memorandum in its entirety and, in particular, the sections entitled “Risk Factors” and “Forward Looking Statements” on pages 61 and 20, respectively.

Structure and description of the Trust

The Sponsor settled the Trust on October 19, 2020, as a contributory irrevocable trust, pursuant to the Trust Deed, under the provisions of the Indian Trusts Act, 1882. The Trust was registered with SEBI on October 28, 2020, as an infrastructure investment trust under Regulation 3(1) of the InvIT Regulations having registration number IN/InvIT/20-21/0014. The Sponsor has settled the Trust for an initial sum of ₹ 10,000.

For details of the registered office and contact person of the Sponsor, please see the section entitled “General Information” on page 89. For the contact details of the Trust, please see the cover page.

Further, NHIIMPL has been appointed as the investment manager, and NHIPMPL has been appointed as the project manager to the Trust. For further details please see the section entitled “Parties to the Trust” on page 94.

Investment Objectives

The investment objectives of the Trust are to carry on the activity of and to make investments as an infrastructure investment trust as permissible in terms of the InvIT Regulations. The investment of the Trust shall only be in any manner permissible under, and in accordance with, the InvIT Regulations and applicable law, including in such holding companies and/or special purpose vehicles and/or infrastructure projects and/or securities in India as permitted under the InvIT Regulations. Whilst making such investments, the Trust shall adhere to the investment strategy as set out in the section entitled “Our Business” on page 155. The investment by the Trust shall be in compliance with the provisions of the InvIT Regulations.

As on the date of this Final Placement Memorandum, the Trust is not permitted to carry out any other principal activity unless specifically provided under applicable law.

Fee and expenses

Annual Expenses

The expenses in relation to the Trust, other than such expenses incurred in relation to operations of Project SPV, would broadly include fees and expenses payable to (i) Trustee; (ii) Investment Manager; (iii) Project Manager; (iv) Auditor; (v) Valuer; and (vi) other intermediaries and consultants.

The estimated recurring expenses on an annual basis are as follows:

(₹ in million)	
Particulars	Estimated Expenses
Trustee fee	0.96
Investment Manager fee	110.00 [^]
Project Manager fee	84.00 [#]
Fee payable to the credit rating agencies	0.06
Auditor fee, Valuer fee, other intermediaries and consultants and others	0.25 ^{**}
Total	195.27

[#] Payable by the Project SPV at ₹ 84.00 million per annum for one and a half years and the fee thereafter is to be mutually agreed in terms of Project Implementation and Management Agreement.

[^] Effective from Oct 21, 2020 with annual escalation as per the terms of the Investment Manager Agreement

*** Fee for the first Fiscal Year after the listing of Units.*

Offer Expenses

The total expenses of this Offer are estimated to be approximately ₹ 185.04 million which will be incurred by the Trust. For details in relation to the expenses for this Offer, please see the section entitled “*Use of Proceeds*” on page 224.

Set-up expenses

The expenses in relation to setting up the Trust, being an aggregate of ₹ 1.22 million, has been borne by the Sponsor on behalf of the Trust.

Details of credit ratings

With respect to our proposed long term bank facilities, we have been given a credit rating of Provisional CARE AAA; Stable and Provisional IND AAA/Stable by CARE Ratings Limited and India Ratings and Research Private Limited, respectively. Further, we have been given an issuer rating of Provisional CARE AAA (Is); Stable and Provisional IND AAA/Stable by CARE Ratings Limited and India Ratings and Research Private Limited, respectively. For details, please see the section entitled “*Material Contracts and Documents for Inspection*” on page 357.

FORMATION TRANSACTIONS IN RELATION TO THE TRUST

Details of arrangement pertaining to the Trust

The Trust's portfolio comprises our Project SPV namely National Highways Infra Projects Private Limited. The details of the Project SPV are as provided below:

National Highways Infra Projects Private Limited ("NHIPPL")

NHIPPL is a private limited company incorporated on July 23, 2020, at New Delhi, under the Companies Act, 2013, having obtained a certificate of incorporation, from the Registrar of Companies, Delhi and Haryana on July 23, 2020. The CIN of the Project SPV is U45201DL2020GOI366737.

Capital structure of NHIPPL

Particulars	Number of equity shares of ₹ 10 each on a pre-Offer basis	Number of equity shares of ₹ 10 each on a post-Offer basis
Authorised capital	1,000,000	1,000,000
Issued, subscribed and paid-up capital	1,000,000	1,000,000

The Trust (jointly with its nominee) holds 100% of the issued, subscribed and paid-up share capital of NHIPPL as on the date of this Final Placement Memorandum.

In terms of the letter dated March 17, 2021, bearing reference number SEBI/HO/DDHS/DDHS3/OW/MA/P/2021/6250/1 from SEBI, the Investment Manager undertakes to obtain adequate insurance for the Project SPV within 30 days of the closure of the Offer.

In light of the fact that the Initial Assets will constitute tolling rights and not underlying land, the requirement for conducting land diligence in respect of the InvIT Assets does not arise.

The Investment Manager confirms that not less than 80% of the InvIT Assets are 'eligible infrastructure projects' (as defined in the InvIT Regulations) in terms of Regulation 18(4) of the InvIT Regulations.

For further details in relation to the Project SPV, please see the section entitled "*Our Business*" on page 155.

Acquisition of the Project SPV by the Trust and acquisition of the Units by the Sponsor

The Trust, acting through the Trustee, has acquired from the Sponsor, and the Sponsor has transferred to the Trust in exchange for Units and/or cash, the equity shareholding in the Project SPV, pursuant to the Share Purchase Agreement (the "**Proposed Transfer**"). The Proposed Transfer is as set out below:

Sr. No.	Name of the Project SPV	Pre-Offer shareholding of the Sponsor (jointly with its nominee) (%)	Proposed post-Offer shareholding (%)	
			The Sponsor (jointly with its nominee)	The Trust*
1.	NHIPPL	100.00%	Nil	100.00%

**including through its nominee*

For further details (including in relation to the key terms of the Share Purchase Agreement), please see the section entitled "*Related Party Transactions*" on page 251.

Accordingly, the Sponsor will receive Units pursuant to the acquisition of the Project SPV by the Trust. The aggregate unitholding of the Sponsor (including Units received as consideration for acquisition of the Project SPV) shall amount to at least 15% of the post-Offer Units, subject to the conditions specified in the InvIT Regulations.

Borrowings of the Trust

The Trust has also entered into a loan agreement dated September 29, 2021, with certain lenders for availing loans amounting to approximately ₹ 20,000.00 million ("**Trust Loans**"). However, as on date of this Final Placement Memorandum, the Trust has not drawn down any amounts pursuant to the Trust Loans. For details in relation to

the terms of the Trust Loans, and the proposed utilisation of the funds to be raised through Trust Loans, please see the sections entitled “*Financial Indebtedness and Deferred Payments*” and “*Use of Proceeds*” respectively on pages 226 and 224.

Utilisation of Net Proceeds

Further, upon the listing of the Units, the Trust shall utilize the Net Proceeds for (i) infusion of debt/equity into the Project SPV; and (ii) general purposes. The Trust proposes to utilise an estimated aggregate amount of ₹ 50,059.60 million from the Net Proceeds and part proceeds from the Trust Loans to provide loans to the Project SPV (“**Project SPV Facilities**”) in terms of the Project SPV Facility Agreements.

The Project SPV will utilize the funds raised through the Project SPV Facilities and/or equity from the Trust towards: (a) payment of (i) initial estimated concession value to the Sponsor, in terms of the Concession Agreements; (ii) initial improvement cost; (iii) major maintenance cost; (iv) upfront fees to various agencies, as applicable; (b) creation and maintenance of debt service reserve account, if any; and/or (c) creation and maintenance of major maintenance reserve, if any, and/or (d) any general corporate purposes. For further details, please see the section entitled “*Use of Proceeds*” on page 224.

Some of the key terms of the Project SPV Facility Agreements include:

Interest: The Project SPV Facilities shall carry interest at such rate as may be communicated by the Trust to the Project SPVs from time to time which may be reset on a date as may be mutually agreed to between the Project SPV and the Trust.

Repayment: Repayment of the principal amount of the Project SPV Facilities shall be due and payable by the Project SPV to the Trust as per the repayment schedule set out in the Project SPV Facility Agreements.

Premature Repayment: The Project SPV shall with the prior written consent of the Trust, at any time, during subsistence of the Project SPV Facility Agreements, prepay all or a portion of the outstanding Project SPV Facilities in the manner and subject to the conditions more particularly set out under the Project SPV Facility Agreements.

Security: In consideration of the Trust making available the Project SPV Facilities to the Project SPV, repayment of the principal amounts, interest and/or other payments due and payable with respect to the Project SPV Facilities shall be secured by: (a) a first ranking exclusive charge on the receivables of the Project, both present and future; and (b) a first ranking exclusive charge over the escrow account (or any accounts in substitution thereof) of the Project SPV opened in relation to the Project and all receivables deposited therein from time to time; in each case subject to the terms of the Concession Agreements.

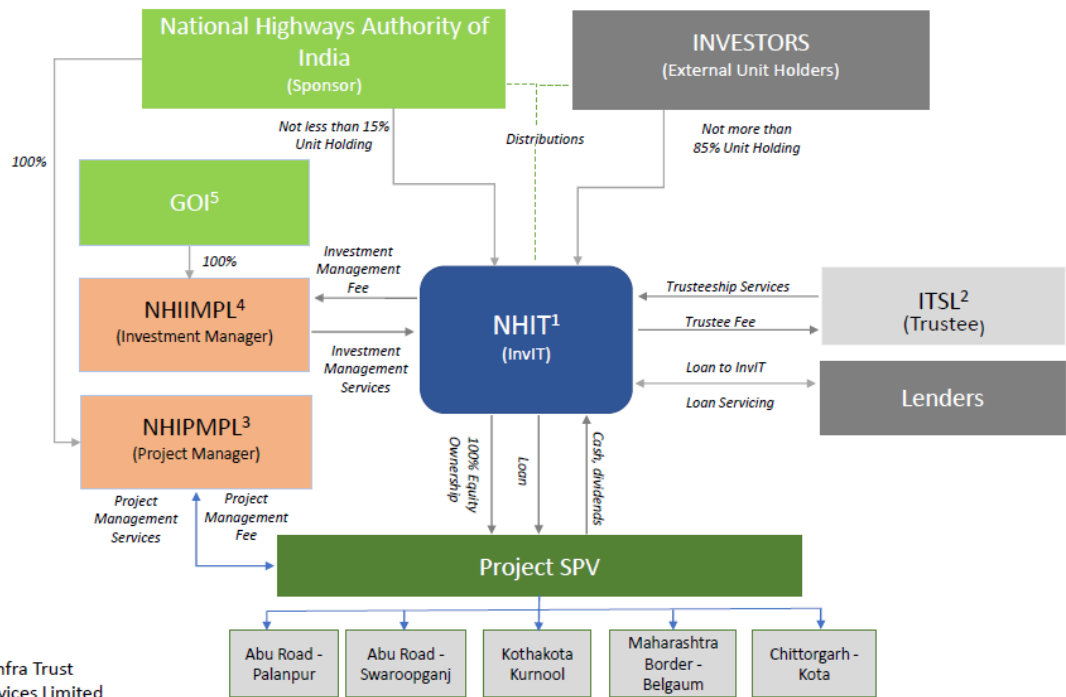
Mandatory Prepayment: If there is a difference of 30% or more between the estimated or projected Project cash flows with respect to the Project (as per the business plan) and the actual Project cash flows realised (“**Cashflow Shortfall**”), the Trust shall be entitled to require the Project SPV to repay the outstanding amounts proportionate to the Cashflow Shortfall within 30 (Thirty) days of such notice.

Term: The Project SPV Facility Agreements shall remain in force until the final settlement date, i.e. the date on which all outstanding amounts owed / payable to the Trust by the Project SPV have been irrevocably paid and discharged in full to the satisfaction of the Trust. The termination or expiry of the Project SPV Facility Agreements shall be without prejudice to any obligations of the Project SPV which are intended to or customarily survive such termination or expiry.

Proposed post-listing structure

For details of the pre-Offer and post-Offer unitholding structure of the Trust, please see the section entitled “*Information concerning the Units*” on page 223.

The following structure illustrates the relationship between the Trust, the Trustee, the Sponsor, the Investment Manager, the Project Manager and the Unitholders that is proposed at the Listing Date:



¹National Highways Infra Trust

²IDBI Trusteeship Services Limited

³National Highways InvIT Project Managers Private Limited

⁴National Highways Infra Investment Managers Private Limited

⁵Shareholding held by the President of India acting through Ministry of Road Transport and Highways

SUMMARY FINANCIAL INFORMATION OF THE SPONSOR

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Annexure A

SUMMARY BALANCE SHEET

S. No.	Particulars	As on 31.03.2019 (Rs. In Lakhs)	As on 31.03.2018 (Rs. In Lakhs)
I.	Sources of Funds		
1.	Shareholders' Fund		
	a) Capital	1,92,85,401.29	1,63,77,926.38
	b) Reserves & Surplus	-	-
2.	Grants		
	a) Capital	13,82,510.33	13,83,229.45
3.	Borrowings	1,79,43,786.63	1,22,52,415.96
	TOTAL	3,86,11,698.26	3,00,13,571.79
II.	Application of Funds		
1.	Fixed Assets		
	a) Gross Block	17,652.59	16,163.18
	b) Less:- Assets Created Out of Grant	758.11	612.58
	c) Assets out of own fund	16,894.48	15,550.60
	d) Less:- Depreciation	10,061.76	8,804.24
	e) Net Block	6,832.73	6,746.36
	f) Assets held on behalf of GOI (completed & ongoing)	3,71,31,458.01	2,85,64,371.53
	Total	3,71,38,290.73	2,85,71,117.89
2.	Investment	93,617.34	93,617.34
3.	Current Assets, Loans and Advances		
	a) Inventories	-	-
	b) Deposits, Loans & Advances	63,15,984.74	50,73,832.44
	c) Interest accrued but not due on deposits	2,421.71	4,326.74
	d) Interest accrued and due on CALA Deposits	5,549.75	8,069.98
	e) Cash & Bank Balances	6,55,725.06	4,03,795.66
	f) Inter Unit Account	-	-
	Sub total	69,79,681.25	54,90,024.83
	Less:- Current Liabilities and Provisions		
	a) Liabilities	55,92,789.67	41,36,257.50
	b) Reserves & Provisions	7,101.39	4,930.77
	Sub Total	55,99,891.07	41,41,188.27
	Net Current Assets	13,79,790.18	13,48,836.56
4	Misc. Expenditure (to the extent not written off)		
5	Profit & Loss Account (Debit Balance, if any)		
	TOTAL	3,86,11,698.26	3,00,13,571.79

SUMMARY PROFIT & LOSS ACCOUNT

S. No.	Particulars	For the year ended on 31.03.2019 (Rs. In Lakhs)	For the year ended on 31.03.2018 (Rs. In Lakhs)
I.	Income		
	a) Value of Work Done		
	b) Other Income	1,143.66	1,381.89
	c) Interest (Gross)	0.30	0.41
	d) Net Increase/ Decrease in Work-in-progress (+)/(-)		
	Total Income	1,143.96	1,382.30
II.	Expenditure		
	a) Construction Stores/Material Consumed		
	Other stores, spares & tools etc. consumed		
	Work Expenses	-	-
	Personnel & Administrative Expenses	45,460.82	38,230.45
	Finance Charges	9.85	8.36
	Depreciation	1,382.99	1,027.75
	Assets of Small Value Charged off	43.84	36.96
	<u>Exceptional Item</u>		
	Provision for diminution in the value of Investment	-	-
	Less:- Provision transferred to Capital	-	-
	Total Expenditure	46,897.50	39,303.52
	Profit/ (Loss) for the period	(45,753.54)	(37,921.22)
	Add:- Prior Period Items net (+/-)	(1,419.95)	(1,305.05)
	Transfer of Net Establishment Expenses for the year	47,173.48	39,226.27
	Less/Add : Provision for Taxation	-	-
	Net Profit		
	Less:- Transfer to Capital Reserve		
	Less:- Transfer to other specific Reserve/fund		
	Less/Add:- Transfer to/ Transfer from General Reserve (+/-)		
	Less/Add:- Surplus brought forward from previous year		
	Surplus carried to Balance Sheet		

SUMMARY CASH FLOW STATEMENT

S. No.	Particulars	For the year ended on 31.03.2019 (Rs. In Lakhs)	For the year ended on 31.03.2018 (Rs. In Lakhs)
A.	Cash Flow from Operating Activities:-		
	Net Profit before tax	(45,753.54)	(37,921.22)
	Adjustments for:-		
	Depreciation	1,382.99	1,027.75
	Profit/Loss on Sale of assets	(4.45)	(3.20)
	Interest Income	(0.30)	(0.41)
	Operating profit before working capital changes	(44,375.30)	(36,897.08)
	Adjustments for		
	(Increase)/Decrease in Deposits, Loans & Advances	(12,42,152.30)	(17,78,512.25)
	Increase/(Decrease) in liabilities	14,56,532.17	9,49,158.62
	(Increase)/Decrease in Provision for gratuity and Leave encashment	2,170.63	810.61
	Cash flow before extraordinary Item & prior period items	1,72,175.20	(8,65,440.09)
	Prior period item	(1,419.95)	(1,305.05)
	Net Cash generated from operating activities	1,70,755.26	(8,66,745.14)
B.	Cash Flow from Investing Activities		
	Purchase of fixed assets	(1,480.11)	(3,713.53)
	Realisation from sale of assets	15.21	6.00
	(Increase)/Decrease in Capital Work in Progress	(76,42,832.35)	(62,79,050.43)
	(Increase)/Decrease in Investment	-	(2,658.34)
	Interest Income	2,40,122.79	2,24,294.28
	Capital Reserve(Receipts)	20,591.80	32,922.86
	Net cash used in Investing activities	(73,83,582.67)	(60,28,199.16)
C.	Cash Flow from financing Activities		
	Cess funds received from Govt of India	11,56,900.00	12,42,945.00
	Capital additional budgetary receipts	-	4,15,000.00
	EAP Grant utilized towards Revenue Expenditure	(719.11)	17,586.44
	Adjusted plough back of Toll Remittance, etc	17,50,574.91	7,60,600.92
	Net decrease in loan from ADB due to Exchange Loss after Adjustment of Repayments	(2,186.92)	(4,949.65)
	Proceeds from issue of 54EC Capital Gains Tax-Free Bonds	4,70,634.60	6,65,741.30
	Proceeds from issue of Tax-able Bonds, Masala Bonds & NSSF Loan	17,51,040.00	43,87,500.00

	Proceeds From NSSF Loan & SBI Term Loan	39,00,000.00	-
	Redemption of Capital Gains Tax-Free Bonds	(4,28,117.00)	(3,34,340.40)
	Interest and Other expenditure on Bond	(11,33,369.66)	(6,89,023.91)
	Net cash generated from financing activities	74,64,756.81	64,61,059.69
	Net increase(decrease) in cash and cash equivalents (A+B+C)	2,51,929.40	(4,33,884.60)
	Operating cash and cash equivalents	4,03,795.66	8,37,680.26
	Closing cash and cash equivalents	6,55,725.06	4,03,795.66
	Notes:		
	Cash and cash equivalents Include:		
	Cash and cheques in hand/ in transit	-	1.10
	Balance with banks-Current Account	61,641.24	90,400.98
	Balance with banks-Saving Bank Account	5,64,947.91	2,78,858.78
	Balance with banks-Fixed Deposit Account	29,135.90	34,534.80
	Balance as per books of account	6,55,725.06	4,03,795.66

SUMMARY BALANCE SHEET

S. No.	Particulars	As on 31.03.2018 (Rs. In Lakhs)	As on 31.03.2017 (Rs. In Lakhs)
I.	Sources of Funds		
1.	Shareholders' Fund		
	a) Capital	1,63,77,926.38	1,39,59,380.47
	b) Reserves & Surplus	-	-
2.	Grants		
	a) Capital	13,83,229.45	13,65,643.01
3.	Borrowings	1,22,52,415.96	75,38,464.71
	TOTAL	3,00,13,571.79	2,28,63,488.18
II.	Application of Funds		
1.	Fixed Assets		
	a) Gross Block	16,163.18	12,533.36
	b) Less:- Assets Created Out of Grant	612.58	612.58
	c) Assets out of own fund	15,550.60	11,920.77
	d) Less:- Depreciation	8,804.24	7,857.39
	e) Net Block	6,746.36	4,063.38
	f) Assets held on behalf of GOI (completed & ongoing)	2,85,64,371.53	2,17,72,656.62
	Total	2,85,71,117.89	2,17,76,720.00
2.	Investment	93,617.34	90,959.00
3.	Current Assets, Loans and Advances		
	a) Inventories	-	-
	b) Deposits, Loans & Advances	50,73,832.44	32,95,320.19
	c) Interest accrued but not due on deposits	4,326.74	1,399.71
	d) Interest accrued and due on CALA Deposits	8,069.98	52,628.05
	e) Cash & Bank Balances	4,03,795.66	8,37,680.26
	f) Inter Unit Account	-	-
	Sub total	54,90,024.83	41,87,028.21
	Less:- Current Liabilities and Provisions		
	a) Liabilities	41,36,257.50	31,87,098.88
	b) Reserves & Provisions	4,930.77	4,120.15
	Sub Total	41,41,188.27	31,91,219.03
	Net Current Assets	13,48,836.56	9,95,809.18
4	Misc. Expenditure (to the extent not written off)		
5	Profit & Loss Account (Debit Balance, if any)		
	TOTAL	3,00,13,571.79	2,28,63,488.18

SUMMARY PROFIT & LOSS ACCOUNT

S. No.	Particulars	For the year ended on 31.03.2018 (Rs. In Lakhs)	For the year ended on 31.03.2017 (Rs. In Lakhs)
I.	Income		
	a) Value of Work Done		
	b) Other Income	1,381.89	1,353.35
	c) Interest (Gross)	0.41	1.06
	d) Net Increase/ Decrease in Work-in-progress (+)/(-)		
	Total Income	1,382.30	1,354.40
II.	Expenditure		
	a) Construction Stores/Material Consumed		
	Other stores, spares & tools etc. consumed		
	Work Expenses	-	-
	Personnel & Administrative Expenses	38,230.45	27,282.06
	Finance Charges	8.36	14.71
	Depreciation	1,027.75	771.52
	Assets of Small Value Charged off	36.96	22.01
	<u>Exceptional Item</u>		
	Provision for diminution in the value of Investment	-	40,310.88
	Less:- Provision transferred to Capital	-	(40,310.88)
	Total Expenditure	39,303.52	28,090.30
	Profit/ (Loss) for the period	(37,921.22)	(26,735.89)
	Add:- Prior Period Items net (+/-)	(1,305.05)	(1,135.83)
	Transfer of Net Establishment Expenses for the year	39,226.27	27,871.73
	Less/Add : Provision for Taxation		
	Net Profit		
	Less:- Transfer to Capital Reserve		
	Less:- Transfer to other specific Reserve/fund		
	Less/Add:- Transfer to/ Transfer from General Reserve (+/-)		
	Less/Add:- Surplus brought forward from previous year		
	Surplus carried to Balance Sheet		

SUMMARY CASH FLOW STATEMENT

S. No.	Particulars	For the year ended on 31.03.2018 (Rs. In Lakhs)	For the year ended on 31.03.2017 (Rs. In Lakhs)
A.	Cash Flow from Operating Activities:-		
	Net Profit before tax	(37,921.22)	(26,735.89)
	Adjustments for:-		
	Depreciation	1,027.75	771.52
	Profit/Loss on Sale of assets	(3.20)	(2.77)
	Interest Income	(0.41)	(1.06)
	Operating profit before working capital changes	(36,897.08)	(25,968.20)
	Adjustments for		
	(Increase)/Decrease in Deposits, Loans & Advances	(17,78,512.25)	(7,17,489.15)
	Increase/(Decrease) in liabilities	9,49,158.62	5,50,900.39
	(Increase)/Decrease in Provision for gratuity and Leave encashment	810.61	438.95
	Cash flow before extraordinary Item & prior period items	(8,65,440.09)	(1,92,118.01)
	Prior period item	(1,305.05)	(1,135.83)
	Net Cash generated from operating activities	(8,66,745.14)	(1,93,253.85)
B.	Cash Flow from Investing Activities		
	Purchase of fixed assets	(3,713.53)	(803.66)
	Realisation from sale of assets	6.00	12.16
	(Increase)/Decrease in Capital Work in Progress	(62,79,050.43)	(38,66,631.06)
	(Increase)/Decrease in Investment	(2,658.34)	(9,617.00)
	Interest Income	2,24,294.28	1,62,085.61
	Capital Reserve(Receipts)	32,922.86	20,349.00
	Net cash used in Investing activities	(60,28,199.16)	(36,94,604.95)
C.	Cash Flow from financing Activities		
	Cess funds received from Govt of India	12,42,945.00	2,32,650.00
	Capital additional budgetary receipts	4,15,000.00	5,64,902.00
	EAP Grant utilized towards Revenue Expenditure	17,586.44	(637.31)
	Transfer of "Premium on Bonds" to "Capital Reserve"	-	(748.68)
	Adjusted plough back of Toll Remittance, etc	7,60,600.92	6,50,681.46
	Net decrease in loan from ADB due to Exchange Loss after Adjustment of Repayments	(4,949.65)	(6,133.29)
	Proceeds from issue of 54EC Capital Gains Tax-Free Bonds	6,65,741.30	5,57,274.20
	Proceeds from issue of Taxable Bonds, Masala Bonds & NSSF Loan 2017-18	43,87,500.00	27,54,500.00
	Redemption of Capital Gains Tax-Free Bonds	(3,34,340.40)	(2,94,212.90)

	Interest and Other expenditure on Bond	(6,89,023.91)	(4,06,816.15)
	Net cash generated from financing activities	64,61,059.69	40,51,459.33
	Net increase(decrease) in cash and cash equivalents (A+B+C)	(4,33,884.60)	1,63,600.54
	Operating cash and cash equivalents	8,37,680.26	6,74,079.72
	Closing cash and cash equivalents	4,03,795.66	8,37,680.26
	Notes:		
	Cash and cash equivalents Include:		
	Cash and cheques in hand/ in transit	1.10	114.81
	Balance with banks-Current Account	90,400.98	6,08,310.77
	Balance with banks-Saving Bank Account	2,78,858.78	2,03,371.82
	Balance with banks-Fixed Deposit Account	34,534.80	25,882.86
	Balance as per books of account	4,03,795.66	8,37,680.26

NATIONAL HIGHWAYS AUTHORITY OF INDIA G-5 & 6, Sector-10, Dwarka, New Delhi-110075				
Unaudited Financial Results for Half year ended 31st March 2020 (as per annexure 1 of SEBI circular CIR/IMD/DF1/69/2016 dated Aug. 10,2016)				
Rs. in Lakhs				
S. No.	Particulars	Half year ended		Year ended 31 st March, 2019
		31 st March, 2020	31 st March, 2019	
		Unaudited	Unaudited	Audited
1.	Total income from Operations	NA	NA	NA
2.	Net Profit/(Loss) for the period (before Tax, Exceptional and or Extraordinary Items)	(26,645.41)	(29,118.67)	(45,753.54)
3.	Net Profit/(Loss) for the period before Tax(after Exceptional and or Extraordinary Items)	(28,733.60)	(29,406.92)	(47,173.48)
4.	Net Profit/(Loss) for the period after tax (after Exceptional and or Extraordinary Items)	(28,733.60)	(29,406.92)	(47,173.48)
5.	Total Comprehensive Income for the period (comprising Profit/Loss for the period (after tax) and Other Comprehensive Income (after tax)*	(28,733.60)	(29,406.92)	(47,173.48)
6.	Paid up Equity Share Capital	2,19,05,844.32	1,92,85,401.29	1,92,85,401.29
7.	Reserves (excluding Revaluation Reserve)	-	-	-
8.	Net worth	2,19,05,844.32	1,92,85,401.29	1,92,85,401.29
9.	Paid up Debt Capital/Outstanding Debt	2,48,83,166.07	1,79,43,786.63	1,79,43,786.63
10.	Outstanding Redeemable Preference Shares	-	-	-
11.	Debt Equity Ratio **	1.14	0.93	0.93
12.	Earnings per share (of Rs. /- each) (for continuing and discontinued operations)- 1. Basic 2. Diluted	NA	NA	NA
13.	Capital Redemption Reserve	-	-	-
14.	Debenture Redemption Reserve	-	-	-
15.	Debt Service Coverage Ratio	NA	NA	NA
16.	Interest Service Coverage Ratio	NA	NA	NA

*Based on Accounting Policy net expenses are capitalized.

Debt Equity Ratio= Debt Outstanding / Shareholders' Fund*

***Shareholder's Fund= Capital Base, Cess Fund, Additional Budgetary Support, Net of Plough Back of Toll Remittance after deducting maintenance expenses of Toll Plazas and Reserve & Surplus.
Capital and Net worth for the half year ended 31st March 2019 have been rearranged to make it comparable with audited results.

- a) Entire capital of the Authority is provided by Government of India and the capital is not divided into shares.
- b) Figures for 31st March, 2020 have been subjected to "Limited Review" by a Chartered Accountant Firm and approved by Board of Authority through circulation on 25.06.2020.
- c) The figures for the previous period have been regrouped/ rearranged wherever necessary to make them comparative.
- d) The audit of the accounts of the Authority is carried out by the C&AG on annual basis.
- e) As on 31st March, 2020, no investor complaint is pending. The credit rating of NHAI assigned at the time of issue has not been downgraded. NHAI has not defaulted in payment of interest for non-convertible debt securities and loans etc. Also, the properties charged are adequate in discharging the due repayment to debenture holders i.e. interest and redemption amount.
- f) Annual Report 2018-19 along with Audited Annual Financial Statements is ready and expected to be laid in the coming session of Parliament.
- g) During this period NHAI has collected Rs.5,192.86 crore as toll revenue (including Rs. NIL from TOT) and deposited Rs.5,186.48 crore to CFI. MoRTH, during the period, has ploughed back Rs.5,000.00 crore to NHAI.
- h) NHAI does not have its own source of income; however during the 2nd half year 2019-20, NHAI has generated an income of Rs.9.59 crore, mainly through sale of tender documents.
- i) As on 31st March 2019, there is a contingent liability of Rs.65,320.03 crore and USD 5,79,937.08 in Arbitration and Rs. 4,715.93 crore & Euro 2,62,180.71 in Court Cases. NHAI on the other hand has claimed 28,693.24 crore in Arbitration and 8,457.70 crore in Court Cases. Figures for 31.03.2020 is under compilation.
- j) NHAI is constituted by an Act of Parliament for development, maintenance & management of National Highways. NHAI is an "Executing Agency" of Government of India and therefore does not have its own income or expenses. Excess of revenue expenses over income, as shown at sl. No. 5, is transferred to Project Development cost i.e. Assets held on behalf of Government of India.
- k) Highway projects are shown as Assets held on behalf of Government of India (Completed and Ongoing). C&AG has opined that National Highways (NH) assets can be depicted in the accounts of NHAI subject to providing depreciation on such assets. Accordingly, Authority intends to capitalize and depreciate all completed projects in the annual financials 2019-20. This will impact the net worth of the Authority.

NATIONAL HIGHWAYS AUTHORITY OF INDIA G-5 & 6, Sector-10, Dwarka, New Delhi-110075				
Unaudited Financial Results for half year ended 30th Sept 2020 (as per annexure 1 of SEBI circular CIR/IMD/DF1/69/2016 dated Aug. 10,2016)				
Rs. in Lakhs				
S. No.	Particulars	Half year ended		Year ended
		30 th Sept, 2020	30th Sept, 2019	31 st March, 2020
		Unaudited	Unaudited	Unaudited
1.	Total income from Operations	NA	NA	NA
2.	Net Profit/(Loss) for the period (before prior period, Tax, Exceptional and or Extraordinary Items)	(15,847.93)	(17,466.13)	(7,04,569.15)
3.	Net Profit/(Loss) for the period before Tax(after Exceptional and or Extraordinary Items)	(17,499.38)	(19,635.38)	(49,23,127.11)
4.	Net Profit/(Loss) for the period after tax (after Exceptional and or Extraordinary Items)	(17,499.38)	(19,635.38)	(49,23,127.11)
5.	Total Comprehensive Income for the period (comprising Profit/Loss for the period (after tax) and Other Comprehensive Income (after tax)*	(17,499.38)	(19,635.38)	(49,23,127.11)
6.	Paid up Equity Share Capital	2,40,51,934.54	2,09,52,184.89	2,18,23,450.89
7.	Reserves excluding Revaluation Reserve / (Debit Balance of Profit & Loss A/C)	(50,89,627.38)	-	(50,72,128.00)
8.	Net worth (6-7)	1,89,62,307.16	2,09,52,184.89	1,67,51,322.89
9.	Paid up Debt Capital/Outstanding Debt	2,63,27,851.93	2,02,58,266.79	2,48,83,166.07
10.	Outstanding Redeemable Preference Shares	-	-	-
11.	Debt Equity Ratio **	1.39	0.97	1.49
12.	Earnings per share (of Rs. /- each) (for continuing and discontinued operations)- 1. Basic 2. Diluted	NA	NA	NA
13.	Capital Redemption Reserve	-	-	-
14.	Debenture Redemption Reserve	-	-	-
15.	Debt Service Coverage Ratio	-	-	-
16.	Interest Service Coverage Ratio	-	-	-

*Expenses are capitalized as per accounting policy of the Authority.

Debt Equity Ratio= Debt Outstanding / Shareholders' Fund*

***Shareholder's Fund= Capital Base, Cess Fund, Additional Budgetary Support, Net of Plough Back of Toll Remittance after deducting maintenance expenses of Toll Plazas and Reserve & Surplus/ Debit Balance of Profit & Loss A/C.

During FY 2019-20, Authority has capitalized its road assets and charged depreciation on completed projects.

- a) NHAI is constituted by an Act of Parliament for development, maintenance & management of National Highways. NHAI is an “Executing Agency” of Government of India and therefore does not have its own income or expenses.
- b) Entire capital of the Authority is provided by Government of India and the capital is not divided into shares. Highway projects are shown as Assets held on behalf of Government of India (Completed and Ongoing).
- c) Audit of the accounts of the Authority is carried out by the C&AG on annual basis. Annual financials 2019-20 are under audit.
- d) On the basis of observation of C&AG, completed National Highways (NH) have been capitalized and depreciated in 2019-20 as per the policy of the Authority approved in 2019-20.
- e) The figures for the previous period have been regrouped/ rearranged wherever necessary to make them comparative.
- f) Net worth as on 30th Sept 2019 is not comparable with that of 31st March 2020 and 30th Sept, 2020.
- g) NHAI does not have its own source of income; however during the 1st half year 2020-21, NHAI has generated an income of Rs.7.48 crores, mainly through sale of tender documents.
- h) Depreciation on Fixed Assets (except in case of disposal of asset) and provisions are year-end exercise, therefore, have not been considered during the six month period.
- i) Figures for the half year ended 30th Sept, 2020 have been subjected to “Limited Review” by a Chartered Accountant Firm and approved by Board of Authority through circulation on 12.11.2020.
- j) As on 30th Sept, 2020, no investor complaint is pending. The credit rating of NHAI assigned at the time of issue has not been downgraded. NHAI has not defaulted in payment of interest for non-convertible debt securities and loans etc. Also, the properties charged are adequate in discharging the due repayment to bond holders i.e. interest and redemption amount.
- k) During the half year ended 30th Sept, 2020 NHAI has collected Rs.8,801.94 crore as toll revenue (including Rs. 5011.00 from TOT) and deposited Rs.8751.81 crore to CFI.
- l) As on 31st March 2020, there is a contingent liability of Rs.71,764.54 crore and USD 3,39,185.03 in Arbitration and Rs. 5,991.97 crore in Court Cases. NHAI on the other hand has claimed 42,945.90 crore in Arbitration and 13,561.51 crore in Court Cases. Figures for the first half year 2020-21 has not been compiled.

NATIONAL HIGHWAYS AUTHORITY OF INDIA G-5 & 6, Sector-10, Dwarka, New Delhi-110075				
Unaudited Financial Results for half year ended 31st March 2021 (as per annexure 1 of SEBI circular CIR/IMD/DF1/69/2016 dated Aug. 10, 2016)				
Rs. in Lakhs				
S. No.	Particulars	Half year ended		Year ended
		31 st March, 2021	31 st March, 2020	31 st March, 2020
		Unaudited	Unaudited	Unaudited
1.	Total income from Operations	NA	NA	NA
2.	Net Profit/(Loss) for the period (before prior period, Tax, Exceptional and or Extraordinary Items)	(6,79,110.48)	(26,645.41)	(7,04,569.15)
3.	Net Profit/(Loss) for the period before Tax (after Exceptional and or Extraordinary Items)	(2,37,164.47)	(28,733.60)	(49,23,127.11)
4.	Net Profit/(Loss) for the period after tax (after Exceptional and or Extraordinary Items)	(2,37,164.47)	(28,733.60)	(49,23,127.11)
5.	Total Comprehensive Income for the period (comprising Profit/Loss for the period (after tax) and Other Comprehensive Income (after tax)*	(2,37,164.47)	(28,733.60)	(49,23,127.11)
6.	Paid up Equity Share Capital	2,60,39,420.92	2,18,23,450.89	2,18,23,450.89
7.	Reserves excluding Revaluation Reserve / (Debit Balance of Profit & Loss A/C)	(53,26,791.85)	(50,72,128.00)	(50,72,128.00)
8.	Net worth (6-7)	2,07,12,629.07	1,67,51,322.89	1,67,51,322.89
9.	Paid up Debt Capital/Outstanding Debt	3,07,16,261.17	2,48,83,166.07	2,48,83,166.07
10.	Outstanding Redeemable Preference Shares	-	-	-
11.	Debt Equity Ratio **	1.48	1.14	1.14
12.	Earnings per share (of Rs. /- each) (for continuing and discontinued operations)- 1. Basic 2. Diluted	NA	NA	NA
13.	Capital Redemption Reserve	-	-	-
14.	Debenture Redemption Reserve	-	-	-
15.	Debt Service Coverage Ratio	NA	NA	NA
16.	Interest Service Coverage Ratio	NA	NA	NA

*Expenses are capitalized as per accounting policy of the Authority.

Debt Equity Ratio= Debt Outstanding / Shareholders' Fund*

***Shareholder's Fund = Capital Base, Cess Fund, Additional Budgetary Support, Net of Plough Back of Toll Remittance after deducting maintenance expenses of Toll Plazas and Reserve & Surplus/ Debit Balance of Profit & Loss A/C.

- a) NHAI is constituted by an Act of Parliament for development, maintenance & management of National Highways. NHAI is an "Executing Agency" of Government of India and therefore does not have its own income or expenses.
- b) Entire capital of the Authority is provided by Government of India and the capital is not divided into shares. Highway projects are shown as Assets held on behalf of Government of India (Completed and Ongoing).
- c) Audit of the accounts of the Authority is carried out by the C&AG on annual basis. Annual financials 2019-20 are under audit.
- d) On the basis of observation of C&AG, completed National Highways (NH) have been capitalized and depreciated in 2019-20 and onwards, as per the policy approved in 2019-20.
- e) The figures for the previous period have been regrouped/ rearranged wherever necessary to make them comparative.
- f) NHAI does not have its own source of income; however, during the 2nd half year 2020-21, NHAI has generated an income of Rs.21.21 crores, mainly through sale of tender documents.
- g) Depreciation for 2020-21 on the national highways completed till 31.03.2020 have been charged on actual basis. Depreciation on highways completed during 2020-21, due to non-availability of cost allocation data immediately, have been calculated and charged on the basis of moving average of actual depreciation of past twenty-one year subject to final depreciation in the annual financials for 2020-21.
- h) Depreciation on Fixed Assets (except in case of disposal of asset) and provisions are year-end exercise, therefore, has been charged for the full year in the half year ended on 31st March 2021.
- i) Prior period adjustment in depreciation has been adjusted through exceptional items.
- j) Figures for the half year ended 31st March, 2021 have been subjected to "Limited Review" by a Chartered Accountant Firm and approved by Board of Authority through circulation on 11.05.2021.
- k) As on 31st March, 2021, no investor complaint is pending. The credit rating of NHAI assigned at the time of issue has not been downgraded. NHAI has not defaulted in payment of interest for non-convertible debt securities and loans etc. Also, the properties charged are adequate in discharging the due repayment to bond holders i.e. interest and redemption amount.
- l) During the half year ended 31st March, 2021 NHAI has collected Rs.6,415.48 crore as toll revenue and deposited Rs.6404.67 crore to CFI.
- m) As on 31st March 2020, there is a contingent liability of Rs.71,764.54 crore and USD 3,39,185.03 in Arbitration and Rs. 5,991.97 crore in Court Cases. NHAI on the other hand has claimed 42,945.90 crore in Arbitration and 13,561.51 crore in Court Cases. Figures for 31st March, 2021 is under compilation.

For and on behalf of the Board of the Authority

Member (Finance)

Chairman

Date: 12.05.2021

Place: New Delhi

**S.K. Mehta & Co.
Chartered Accountants
Firm's Registration Number 00478N**

**(CA Jyoti Bagga)
Partner
Membership No. 087002**

NATIONAL HIGHWAYS AUTHORITY OF INDIA G-5 & 6, Sector-10, Dwarka, New Delhi-110075				
Unaudited Financial Results for quarter ended 30th June 2021 (as per annexure 1 of SEBI circular CIR/IMD/DF1/69/2016 dated Aug. 10,2016)				
Rs. in Lakhs				
S. No.	Particulars	Quarter ended		Year ended
		30 th June, 2021	30 th June, 2020 (Revised)	31 st March, 2021
		Unaudited	Unaudited	Unaudited
1.	Total income from Operations	NA	NA	NA
2.	Net Profit/(Loss) for the period (before prior period, Tax, Exceptional and or Extraordinary Items)	(4,148.31)	(5,237.95)	(46,726.31)
3.	Net Profit/(Loss) for the period before Tax (after Exceptional and or Extraordinary Items)	(5,098.13)	(6,073.97)	(49,790.21)
4.	Net Profit/(Loss) for the period after tax (after Exceptional and or Extraordinary Items)	(5,098.13)	(6,073.97)	(49,790.21)
5.	Total Comprehensive Income for the period (comprising Profit/Loss for the period (after tax) and Other Comprehensive Income (after tax)*)	(5,098.13)	(6,073.97)	(49,790.21)
6.	Paid up Equity Share Capital (Shareholders' Fund)***	2,81,89,587.44	2,26,45,906.66	2,61,11,353.19
7.	Reserves (excluding Revaluation Reserve)	-	-	-
8.	Net worth (6-7)	2,81,89,587.44	2,26,45,906.66	2,61,11,353.19
9.	Paid up Debt Capital/Outstanding Debt	3,16,65,124.10	2,53,61,489.63	3,07,16,261.17
10.	Outstanding Redeemable Preference Shares	-	-	-
11.	Debt Equity Ratio **	1.12	1.12	1.17
12.	Earnings per share (of Rs. /- each) (for continuing and discontinued operations)- 1. Basic 2. Diluted	NA	NA	NA
13.	Capital Redemption Reserve	-	-	-
14.	Debenture Redemption Reserve	-	-	-
15.	Debt Service Coverage Ratio	NA	NA	NA
16.	Interest Service Coverage Ratio	NA	NA	NA

*Based on Accounting Policy net expenses are capitalized.

Debt Equity Ratio= Debt Outstanding / Shareholders' Fund*

***Shareholder's Fund= Capital Base, Cess Fund, Additional Budgetary Support, Net of Plough Back of Toll Remittance after deducting maintenance expenses of Toll Plazas and Reserve & Surplus.

- a) NHAI is constituted by an Act of Parliament for development, maintenance & management of National Highways. NHAI is an "Executing Agency" of Government of India and therefore does not have its own income or expenses.

- b) Entire capital of the Authority is provided by Government of India and the capital is not divided into shares. Highway projects are shown as Assets held on behalf of Government of India (Completed and Ongoing).
- c) Audit of the accounts of the Authority is carried out by the C&AG on annual basis. Annual financials 2020-21 are under audit.
- d) The figures for the previous period have been regrouped/ rearranged wherever necessary to make them comparative.
- e) NHAI does not have its own source of income; however during the 1st Quarter 2021-22, NHAI has generated an income of Rs.4.95 crores, mainly through sale of tender documents.
- f) Depreciation (except in case of disposal of asset) and provisions are year-end exercise, therefore, have not been considered during the quarter.
- g) Inter unit balances and transfer of fixed assets from one unit to other is a continuous process and is under reconciliation.
- h) Corresponding figures of previous period i.e. June 2020 have been taken from unaudited financial statements which have been revised due to change in depreciation policy and revision of Annual Financials 2019-20 as per the decision taken in the meeting with Statutory Auditor.
- i) Figures for 30th June, 2021 have been subjected to "Limited Review" by a Chartered Accountant Firm and approved by Board of Authority through circulation.
- j) As on 30th June, 2021, no investor complaint is pending. The credit rating of NHAI assigned at the time of issue has not been downgraded. NHAI has not defaulted in payment of interest for non-convertible debt securities and loans etc. Also, the properties charged are adequate in discharging the due repayment to debenture holders i.e. interest and redemption amount.
- k) During this period NHAI has collected Rs.2823.48 crore as toll revenue (including Rs. NIL from TOT) and deposited Rs.2900.26 crore to CFI.
- l) As on 31st March 2021, there is a contingent liability of Rs.92,143.79 crore and USD 71,205.00 in Arbitration and Rs. 6,102.36 crore in Court Cases. NHAI on the other hand has claimed Rs. 40,828.11 crore in Arbitration and Rs. 14,491.83 crore in Court Cases. Figures as on 30.06.2021 has not been compiled.

For and on behalf of the Board of the Authority

Member (Finance)

Chairman

Date: 21.09.2021

Place: New Delhi

**S.K. Mehta & Co.
Chartered Accountants
Firm's Registration Number 00478N**

**(CA Jyoti Bagga)
Partner
Membership No. 087002**

SUMMARY FINANCIAL INFORMATION OF THE INVESTMENT MANAGER

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NATIONAL HIGHWAYS INFRA INVESTMENT MANAGERS PRIVATE LIMITED
REGD. OFFICE- G-5&6, SECTOR-10, DWARKA, NEW DELHI -110075
CIN:- U65929DL2020GOI366835

SUMMARY BALANCE SHEET

Particulars	As on 31.03.2021 (Amount in Rs.)
ASSETS	
Non-current assets	
(a) Property, Plant & Equipment	-
(b) Capital work-in-progress	-
(c) Investment Property	-
(d) Other Intangible Assets	-
(e) Financial Assets :-	-
(i) Investments	-
(ii) Trade Receivables	-
(iii) Loans	-
(iv) Other Financial Assets	-
(f) Deferred Tax Assets (net)	-
(g) Other non-current Assets	-
Sub-total	-
Current Assets	
(a) Investments	-
(b) Financial Assets :-	
(i) Trade Receivables	-
(ii) Cash & Cash equivalents	14,18,22,773.00
(iii) Bank Balances other than (ii) above	-
(iv) Loans	-
(v) Other Financial Assets	-
c) Tax Assets (net)	-
d) Other Current Assets	13,87,878.00
Sub-total	14,32,10,651.00
Total Assets	14,32,10,651.00
EQUITY AND LIABILITIES	
Equity	
(a) Equity Share Capital	11,00,00,000.00
(b) Other Equity	2,76,89,540.00
Sub-total	13,76,89,540.00
Liabilities	
Non-current Liabilities	
(a) Financial Liabilities	
(i) Borrowings	-
(ii) Trade Payables – MSME	-
(iii) Trade Payables – Others	-
(iv) Other Financial Liabilities	-
(b) Provisions	-
(c) Other non-Current Liabilities	-
Sub-total	-
Current Liabilities	
(a) Financial Liabilities	

(i) Borrowings	-
(ii) Trade Payables – MSME	-
(iii) Trade Payables – Others	33,078.00
(iv) Other Financial Liabilities	48,81,823.00
(b) Provisions	-
(c) Other Current Liabilities	6,06,210.00
Sub-total	55,21,111.00
Total Equity and Liabilities	14,32,10,651.00

NATIONAL HIGHWAYS INFRA INVESTMENT MANAGERS PRIVATE LIMITED
REGD. OFFICE- G-5&6, SECTOR-10, DWARKA, NEW DELHI -110075
CIN:- U65929DL2020GOI366835

SUMMARY STATEMENT OF PROFIT AND LOSS

Particulars	For the year ended on 31.03.2021 (Amount in Rs.)
Income	
(i) Revenue from Operations	-
(ii) Other Income	-
Total Income	-
Expenses	
(i) Cost of Material Consumed	-
(ii) Purchase of Stock in Trade	-
(iii) Changes in Inventory	-
(iv) Employees Benefit Expenses	49,54,997.00
(v) Finance Costs	1,984.00
(vi) Depreciation & Amortization Expenses	-
(vii) Other Expenses	1,73,53,479.00
Total Expenses	2,23,10,460.00
Profit before exceptional items and tax	(2,23,10,460.00)
Exceptional Items – Expense/(Income)	-
Profit Before Tax	(2,23,10,460.00)
Tax Expense	
(i) Current Tax	-
(ii) Tax related to earlier years	-
Profit for the year from continuing operations	(2,23,10,460.00)
Profit from discontinued operations after tax	-
I Profit for the Year	(2,23,10,460.00)
II Other Comprehensive income	
(i) Items that will not be reclassified to profit or loss (after tax)	-
(ii) Items that will be reclassified to profit or loss (after tax)	-
Other Comprehensive income	-
Total Comprehensive income for the year (I+II)	(2,23,10,460.00)

NATIONAL HIGHWAYS INFRA INVESTMENT MANAGERS PRIVATE LIMITED
REGD. OFFICE- G-5&6, SECTOR-10, DWARKA, NEW DELHI -110075
CIN:- U65929DL2020GOI366835

SUMMARY CASH FLOW STATEMENT

S. No.	Particulars	For the year ended on 31.03.2021 (Amount in Rs.)
A.	Cash Flows from Operating Activities:-	
	Net Profit/(Loss) before tax	(2,23,10,460.00)
	Adjustments for:-	
	Depreciation	-
	Profit/Loss on Sale of assets	-
	Interest Income	-
	Operating profit before working capital changes	(2,23,10,460.00)
	Adjustments for	
	(Increase)/Decrease in Deposits, Loans & Advances and other current Assets	(13,87,878.00)
	Increase/(Decrease) in liabilities	55,21,111.00
	(Increase)/Decrease in Provision for gratuity and Leave encashment	-
	Cash Generated from Operations	(1,81,77,227.00)
	Direct taxes Paid	-
	Net Cash generated from operating activities (A)	(1,81,77,227.00)
B.	Cash Flows from Investing Activities	
	Sale/(Purchase) of fixed assets	-
	(Increase)/Decrease in Investments	-
	Interest Income	-
	Net cash generated from Investing activities (B)	-
C.	Cash Flows from financing Activities	
	Receipts from issue of Share Capital	11,00,00,000.00
	Net Proceeds from /(repayment) of long/short term borrowings/other Equity	5,00,00,000.00
	Interest Paid	-
	Net cash generated from financing activities (C)	16,00,00,000.00
	Net increase/(decrease) in cash and cash equivalents (A+B+C)	14,18,22,773.00
	Operating cash and cash equivalents	-
	Closing cash and cash equivalents	14,18,22,773.00

SUMMARY FINANCIAL INFORMATION OF THE PROJECT SPV

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NATIONAL HIGHWAYS INFRA PROJECTS PRIVATE LIMITED
REGD. OFFICE- G-5&6, SECTOR-10, DWARKA, NEW DELHI -110075
CIN:- U45201DL2020GOI366737

SUMMARY BALANCE SHEET

Particulars	As at 31.03.2021 (Amount in Rs.)
ASSETS	
Non-current assets	
(a) Property, Plant & Equipment	-
(b) Capital work-in-progress	-
(c) Investment Property	-
(d) Other Intangible Assets	73,50,40,00,000.00
(e) Financial Assets :-	-
(i) Investments	-
(ii) Trade Receivables	-
(iii) Loans	-
(iv) Other Financial Assets	-
(f) Deferred Tax Assets (net)	20,823.00
(g) Other non-current Assets	-
Sub-total	73,50,40,20,823.00
Current Assets	
(a) Investments	-
(b) Financial Assets :-	
(i) Trade Receivables	-
(ii) Cash & Cash equivalents	9,99,910.00
(iii) Bank Balances other than (ii) above	-
(iv) Loans	-
(v) Other Financial Assets	-
(c) Tax Assets (net)	-
(d) Other Current Assets	-
Sub-total	9,99,910.00
Total Assets	73,50,50,20,733.00
EQUITY AND LIABILITIES	
Equity	
(a) Equity Share Capital	10,00,000.00
(b) Other Equity	(93,348.00)
Sub-total	9,06,652.00
Liabilities	
Non-current Liabilities	
(a) Financial Liabilities	
(i) Borrowings	-
(ii) Trade Payables – MSME	-
(iii) Trade Payables – Others	-
(iv) Other Financial Liabilities	-
(b) Provisions	-
(c) Other non-Current Liabilities	-
Sub-total	-
Current Liabilities	
(a) Financial Liabilities	

(i) Borrowings	-
(ii) Trade Payables – MSME	-
(iii) Trade Payables – Others	-
(iv) Other Financial Liabilities	73,50,41,11,831.00
(b) Provisions	-
(c) Other Current Liabilities	2,250.00
Sub-total	73,50,41,14,081.00
Total Equity and Liabilities	73,50,50,20,733.00

NATIONAL HIGHWAYS INFRA PROJECTS PRIVATE LIMITED
REGD. OFFICE- G-5&6, SECTOR-10, DWARKA, NEW DELHI -110075
CIN:- U45201DL2020GOI366737

SUMMARY STATEMENT OF PROFIT AND LOSS

Particulars	For the year ended on 31.03.2021 (Amount in Rs.)
Income	
(i) Revenue from Operations	-
(ii) Other Income	-
Total Income	-
Expenses	
(i) Cost of Material Consumed	-
(ii) Purchase of Stock in Trade	-
(iii) Changes in Inventory	-
(iv) Employees Benefit Expenses	-
(v) Finance Costs	-
(vi) Depreciation & Amortization Expenses	-
(vii) Other Expenses	1,14,171.00
Total Expenses	1,14,171.00
Profit before exceptional items and tax	(1,14,171.00)
Exceptional Items – Expense/(Income)	-
Profit Before Tax	(1,14,171.00)
Tax Expense	
(i) Current Tax	-
(ii) Deferred Tax Expense	(20,823.00)
Profit for the year from continuing operations	(93,348.00)
Profit from discontinued operations after tax	-
I Profit for the Year	(93,348.00)
II Other Comprehensive income	
(i) Items that will not be reclassified to profit or loss (after tax)	-
(ii) Items that will be reclassified to profit or loss (after tax)	-
Other Comprehensive income	-
Total Comprehensive income for the year (I+II)	(93,348.00)

NATIONAL HIGHWAYS INFRA PROJECTS PRIVATE LIMITED
REGD. OFFICE- G-5&6, SECTOR-10, DWARKA, NEW DELHI -110075
CIN:- U45201DL2020GOI366737

SUMMARY CASH FLOW STATEMENT

S. No.	Particulars	For the year ended on 31.03.2021 (Amount in Rs.)
A.	Cash Flows from Operating Activities:-	
	Net Profit/(Loss) before tax	(1,14,171.00)
	Adjustments for:-	
	Depreciation	-
	Profit/Loss on Sale of assets	-
	Interest Income	-
	Operating profit before working capital changes	(1,14,171.00)
	Adjustments for	
	(Increase)/Decrease in Deposits, Loans & Advances and other current Assets	-
	Increase/(Decrease) in liabilities	73,50,41,14,081.00
	(Increase)/Decrease in Provision for gratuity and Leave encashment	-
	Cash Generated from Operations	73,50,39,99,910.00
	Direct taxes Paid	-
	Net Cash generated from operating activities (A)	73,50,39,99,910.00
B.	Cash Flows from Investing Activities	
	Sale/(Purchase) of Intangible Assets	(73,50,40,00,000.00)
	(Increase)/Decrease in Investments	-
	Interest Income	-
	Net cash generated from Investing activities (B)	(73,50,40,00,000.00)
C.	Cash Flows from financing Activities	
	Receipts from issue of Share Capital	10,00,000.00
	Net Proceeds from /(repayment) of long/short term borrowings/other Equity	-
	Interest Paid	-
	Net cash generated from financing activities (C)	10,00,000.00
	Net increase/(decrease) in cash and cash equivalents (A+B+C)	9,99,910.00
	Operating cash and cash equivalents	-
	Closing cash and cash equivalents	9,99,910.00

SUMMARY OF BUSINESS

Overview

We are a registered infrastructure investment trust under the InvIT Regulations. We primarily own, operate and maintain a portfolio of five Toll Roads (*defined below*) in the Indian states of Gujarat, Rajasthan, Telangana, and Karnataka under the Toll Operate Transfer (“**TOT**”) model conceived by NHAI. These Toll Roads are operated and maintained pursuant to concessions granted by the National Highways Authority of India (“**Authority**”). The Toll Roads comprise of five stretches spanning a total length of 389 kms.

Our Sponsor is NHAI, an autonomous authority of the GoI under the MoRTH constituted on June 15, 1989 by an Act of the Indian Parliament titled - The National Highways Authority of India Act, 1988 (the “**NHAI Act**”). NHAI was operationalised in February 1995 with the appointment of a full-time Chairman and other members of the board. The functioning of NHAI is governed by the NHAI Act and the rules, and regulations framed thereunder.

The Project SPV has entered into five (5) independent Concession Agreements with NHAI for concessions of each of the Toll Roads. We expect to satisfy all conditions precedent and commence our Concessions in accordance with the terms of the Concession Agreements. For further details, see “*Summary of the Concession Agreements*”, “*Management’s Discussion and Analysis of Financial Position and Results of Operations*” and “*Use of Proceeds*” on pages 194, 242 and 224.

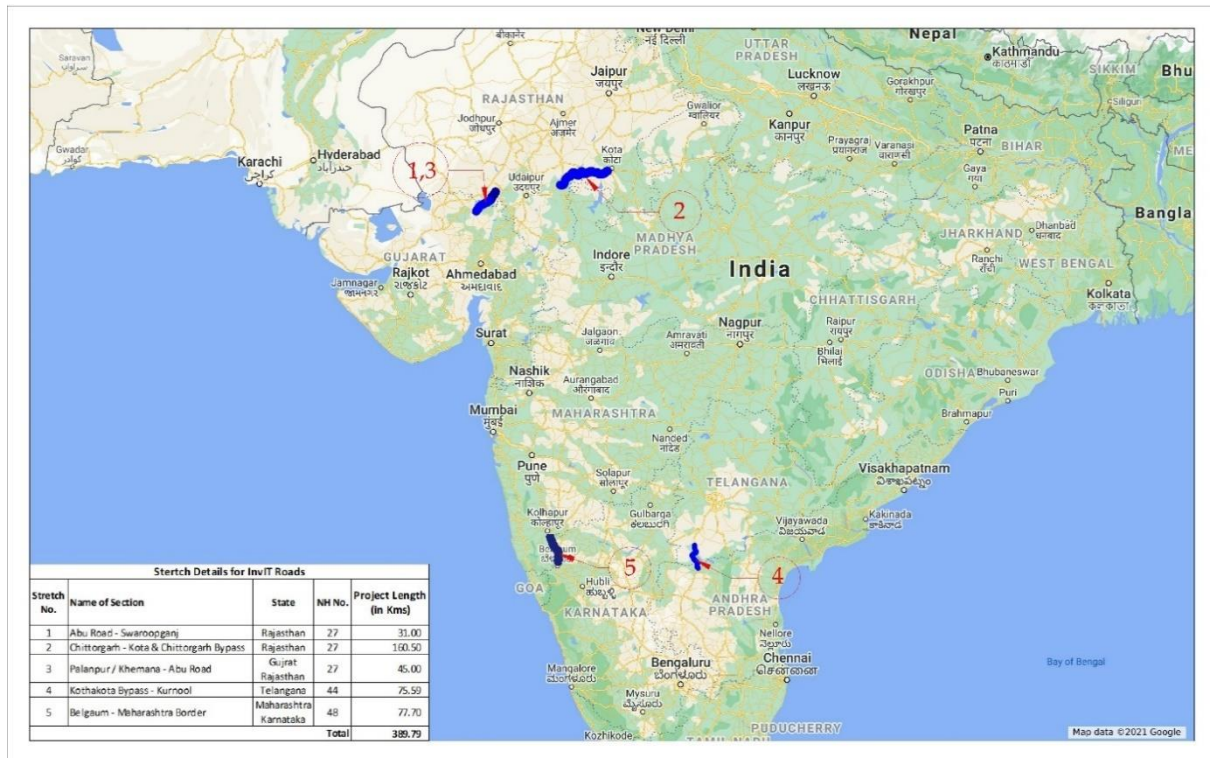
The Concession Agreements provide the Project SPV the right to collect tolls for a period of 30 years from users of each Toll Road, with certain overlay activities and the construction of additional toll lanes in respect of certain of the Toll Roads (the “**Initial Improvement Works**”) to be completed by the Project SPV within 24 months from the Appointed Date (as defined in “*Summary of the Concession Agreements*”). Responsibility for the supervision of the operation and maintenance of the Toll Roads also vests with us. In return, the Project SPV is required to pay the concession fee to the NHAI prior to the commencement of the Concession, as set out in the respective Concession Agreements. For further information on the provisions of the Concession Agreements, see “*Summary of the Concession Agreements*”.

Pursuant to the Formation Transactions and the Proposed Transfer, the Trust has acquired 100% of the equity shares of the Project SPV from the Sponsor. For additional information about the Proposed Transfer, please see the section headed “*Formation Transactions in Relation to the Trust*”.

From the Appointed Date, the Project SPV will own, operate and maintain the following toll road assets (the “**Toll Roads**”):

- Palanpur/Khemana – Abu Road Project (“**Asset 1**”): Abu Road section of NH 27 with a total length of 45 kms, connecting the states of Gujarat and Rajasthan; and
- Abu Road – Swaroopganj Project (“**Asset 2**”): Swaroopganj section of NH 27 with a total length of 31 kms, in the state of Rajasthan;
- Maharashtra/Karnataka Border (Kagal) – Belgaum Project (“**Asset 3**”): Belgaum – Kagal section of NH 48 with a total length of 77.7 kms, connecting the states of Karnataka and Maharashtra;
- Chittorgarh – Kota & Chittorgarh Bypass Project (“**Asset 4**”): Chittorgarh – Kota section of NH 27 with a total length of 160.5 kms, in the state of Rajasthan; and
- Kothakota Bypass – Kurnool Highway Project (“**Asset 5**”): Kothakota bypass – Kurnool of NH 44 with a total length of 74.6 kms, connecting the states of Telangana to Andhra Pradesh.

The following map depicts the location of the Toll Roads that comprise our concession:



(1) This map is for illustrative purposes only, is not to scale and is subject to change at any time.

Strengths of the Trust

The strengths of the Trust are:

- Experienced Sponsor with consistent track record in operating and maintaining projects in the roads and highways sector in India;
- Sizeable portfolio of diversified long-term revenue generating Toll Road assets;
- Presence in strategic regions/ Strategic geographic location of portfolio assets;
- Experienced management team with industry experience;
- Growth opportunities and access to Sponsor's portfolio; and
- Favourable Concession Agreement terms with Low Counterparty Risk.

Strategies of Our Trust

The strategies of our Trust are:

- Organic growth through proactive management;
- Acquisition of toll road projects;
- Optimization of capital structure;
- Seamlessly transition all aspects of the Toll Roads upon acquisition; and
- Improve toll collection efficiencies across the Toll Roads

SUMMARY OF INDUSTRY

The information contained in this section is derived from various government, other industry sources and reports including report by CARE Advisory Research and Training Limited on Update on Road Infrastructure Industry, dated March 18, 2021 (“**CARE Report**”). Neither we nor any other person connected with the Offer has independently verified this information. Industry sources and publications generally state that the information contained therein has been obtained from sources generally believed to be reliable, but that their accuracy, completeness and underlying assumptions are not guaranteed, and their reliability cannot be assured. Industry publications are also prepared based on information available as of specific dates and may no longer be current or reflect current trends. Accordingly, investment decisions should take these limitations into account. All references to years refer to calendar years except as otherwise stated. References to Indian financial years (“**FY**”) are to the one-year period ending March 31 of the named year.

Overview of the Indian Economy

In April 2021, the International Monetary Fund (“**IMF**”), projected that India would reclaim the status of the world's fastest-growing economy with projected growth at 12.5% in FY2021. In July 2021, the IMF lowered India's gross domestic product (“**GDP**”) forecast in FY2021 to 9.5%. This was on account of the severe setback caused by the COVID-19 second wave. Further, in July 2021, the IMF revised their growth forecast for FY2022 to 8.5% from their earlier prediction of 6.9% in April 2021. (Source: *International Monetary Fund - World Economic Outlook - Managing Divergent Recoveries, April 2021 and World Economic Outlook Update, July 2021*). According to the Reserve Bank of India (“**RBI**”), the Indian economy stopped shrinking in the October-December quarter of FY2021, projecting a nominal GDP growth rate of 0.1% in the third quarter of FY 2021 for the period October-December 2020 and 0.7% growth in the final quarter of FY2021 for the period January-March of FY2021. According to central bank, India's economy will shrink 7.5% in FY21, lower from its earlier assessment on 9.5%. While, the Government intensified its effort to cushion the Indian economy from the impact of the COVID-19 pandemic and announced economic stimulus packages, Government Final Consumption Expenditure (GFCE) was 10.9% of GDP in the July-September quarter of FY2021 compared to 18.1% in the April-June quarter of FY2021. On the assumption that the COVID-19 vaccine is distributed on a large-scale basis in the calendar year 2021 and there is no widespread resurgence of further infections, the Indian economy is poised to grow (real GDP) by 11% in 2021-22. (Source: *CARE Report*). Further, in July 2021, the Asian Development Bank lowered India's economic growth forecast for the FY2022 to 10% from its projection of 11% released in April 2021. (Source: *Asian Development Outlook (ADO) 2021 Supplement: Renewed Outbreaks and Divergent Recoveries, July 2021*).

India has been one of the world's fastest growing economies with GDP growth in the last 10 years reaching a high of almost 8.5 per cent as reported by the World Bank. According to the World Bank's Ease of Doing Business 2020 report, India moved up 14 places to rank 63, due to positive developments in the areas of starting a business, dealing with construction permits, trading across borders and resolving insolvency. (Source: *Doing Business 2020 – Comparing Business Regulation in 190 Economies prepared by the World Bank*)

The table below sets forth a comparison between India's real GDP growth rate in 2019 and 2020, and its expected real GDP growth rate in 2021, as compared to advanced economies in Asia, emerging markets and developing economies in Asia, and the world generally on a calendar year basis:

	<u>Real GDP growth rate</u> <u>2019</u>	<u>2020</u>	<u>Projected GDP growth rate</u> <u>2021</u>
		(in percentage)	
India.....	4.2	-10.3	8.8
Advanced Economies	1.2	-4.2	2.9
Asia.....			
Japan	0.7	-5.3	2.3
Korea	2.0	-1.9	2.9
Australia	1.8	-4.2	3.0
Taiwan province of China	2.7	0.0	3.2
Singapore	0.7	-6.0	5.0
Hong Kong SAR	-1.2	-7.5	3.7
New Zealand	2.2	-6.1	4.4
Macao SAR	-4.7	-52.3	23.9
Emerging Markets and Developing Economies	5.5	-1.7	8.0
Asia			
Global.....	2.8	-4.4	5.2

(Source: International Monetary Fund, World Economic Outlook Database, October 2020 (the “IMF Report October 2020”))

As shown in the table above, India’s pace of growth has outperformed global growth. The Indian economy began to regain momentum with clear signs of increase in consumption and investment towards the end of the third quarter of Fiscal 2019 according to OECD Economic Survey of India, only to be slowed by COVID-19, which resulted in the Government of India (“GoI”) enforcing a country-wide lockdown in late March 2020. (Source: *OECD Economic Survey of India 2019 prepared by OECD available at Étude économique 2019 de l’Inde (oecd.org)*). Due to the COVID-19 pandemic, the IMF reports that global growth has dipped -4.4% in 2020. Similarly, in India, economic growth was projected to decline by -10.3% by the IMF in 2020. Manufacturing and construction sectors have been severely affected by the pandemic, with growth down by 39.3% and 50.3% respectively. (Source: CARE Report).

Nevertheless, according to the IMF, global recovery with 5.2 per cent growth is projected for 2021. Similarly, the World Bank projects that despite a resurgence of COVID-19 cases in early 2021, the global economy will strengthen gradually over time as consumption, trade and general sentiment improve along with ongoing vaccination. However, the impact of the pandemic on investment and human capital is expected to negatively affect growth prospects and key development goals in emerging market and developing economies (“EMDEs”). (Source: Chapter 1, World Bank Global Economic Prospects dated January 2021)

In order to propel recovery of the Indian economy, in November 2020, the GoI announced a third stimulus package of approximately U.S.\$16.1 billion, bringing total stimulus plans so to around 15% of GDP. The Reserve Bank of India’s (“RBI”) decision to withhold interest rate increases and expand the money supply policy has stimulated consumption growth. Increasing demand has in turn restored price growth.

Limiting the spread of the virus, providing relief for vulnerable populations, and overcoming vaccine-related challenges are expected to be key immediate policy priorities in India. As the pandemic abates, policymakers are expected to balance the risks from large and growing debt loads with those from slowing the economy through fiscal tightening. To confront the adverse consequences of the pandemic, it will be critical to foster resilience by safeguarding health and education, prioritizing investments in digital technologies and green infrastructure, improving governance, and enhancing debt transparency. Global cooperation will be crucial in addressing many of these challenges. The widespread deployment of effective vaccines is also expected to play a key role in halting the pandemic’s progression, and to strengthen economic activity by improving confidence and financial market conditions.

This baseline scenario assumes that voluntary and mandatory pandemic control measures will be diligently maintained over the next several quarters until after widespread vaccination becomes available. From its recent increases in several major economies, the daily number of infections is assumed to decline in the first half of 2021 in most countries. In advanced economies and major EMDEs, vaccination campaigns initiated in early 2021 are expected to reach widespread coverage in the second half of 2021 but would be expected to be delayed by two to four quarters in other EMDEs and LICs, partly due to logistical impediments. Activity is expected to improve as the pandemic abates, vaccines are rolled out, and financial conditions remain benign, supported by accommodative monetary policy (Source: World Bank Global Economic Prospects dated January 2021).

Overview of the Infrastructure Sector in India

India has the second largest road network in the world, spanning a total of 5.89 million kilometres (kms). This road network transports 64.5% of all goods in the country and 90% of India’s total passenger traffic uses road network to commute. This road network comprises mainly of national highways, expressways, state highways, major district roads, other district roads and village roads. Out of this, around 0.1 million kms were national highways as on FY2020. More than 8,000 km of national highways were built from 1 April 2020 to 15 January 2021, an increase of 8% over the same period in the last financial year. The GoI is hopeful that this pace of work should allow it to surpass the FY target of 11,000 kms by March 31, 2021, despite the ongoing COVID-19 related challenges (Source: CARE Report). Many reforms have been initiated in the infrastructure sector to minimize the effect of the unprecedented crisis from COVID-19 observed in this FY. In May 2020, the Government, adding to its past measures and that of RBI, announced a consolidated stimulus package of Rs 20 lakh crore (US\$ 283.73 billion). The stimulus package was pivoted on “Atma Nirbhar Bharat”, where Micro, Small and Medium Enterprises (“MSMEs”) received a huge financial package in terms of collateral free debt, guarantee for subordinate debt through Funds-of-Funds, and interest subvention scheme. The GoI also introduced Pradhan Mantri Garib Kalyan Rojgar Abhiyaan, a rural infrastructure and employment generation scheme, for the benefit of returnee migrants.

In financial year 2020, the GoI focused on enhancing expenditure on infrastructure and has planned to invest

around 100 lakh crores in infrastructure in the next 5 years as part of the National Infrastructure Pipeline (“NIP”) announced in December 2019 (*Source: www.pib.gov.in*). As part of the NIP, roads projects are expected to receive 19 per cent of the project capital expenditure for the period from Fiscal 2020 to 2025, which together with energy, urban and railways, accounted for over 70 per cent of projected capital expenditure during the period from Fiscal 2020-2025. According to the Union Budget 2020-21 the total outlay for the transportation sector in financial year 2020-21 is ₹1,69,637 crore. Since 2015 and 2016, the GoI has been increasing its capital expenditure significantly. In the Union Budget 2021-2022, the GoI proposes to sharply increase capital expenditure further by 34.5% against the Union Budget 2020-2021, bringing capital expenditure to ₹5.54 lakh crore, of which ₹44,000 crore will be provided for projects, programmes/departments that are in need of further funds. In addition to government funding, in its Union Budget 2020-2021, the GoI recognized importance of a “National Monetization Pipeline” under its Asset Monetization Programme which includes NHAI Operational Toll Roads. As part of that, the InvIT sponsored by NHAI was named in the Union Budget 2020-2021 specifically. The GoI also set out additional economic corridors that are being planned and under construction, including section of the Mumbai-Kanyakumari corridor, the Madurai-Kollam Corridor, the Chittoor-Thatchur Corridor and additional works in the State of Assam. (*Source: Government of India, Ministry of Finance, Union Budget Speech 2021 – 2022*).

Overview of the Road Sector in India

India has one of the largest road networks in the world, with approximately 59 lakh kilometers of roads comprising expressways, national highways, state highways, major district roads and rural roads (which include other district roads and village roads). India’s national highways carry 40% of the total road-based traffic despite constituting only 2.2% of the total road network. State highways and the major district roads together constitute a secondary system of road transportation and contribute significantly to the development of India’s rural economy and industrial growth. The secondary system also carries about 40% of the total road traffic, although it constitutes only 13% of the total road network. At the tertiary level are the other district roads and the rural roads. (*Source: Twelfth Five Year Plan (2012- 2017), Economic Sectors, Volume II (“Twelfth Five Year Plan”) and the NHAI website at www.nhai.org/roadnetwork.htm*)

The Ministry of Road Transport and Highways (“MoRTH”) set a target of constructing roads worth Rs. 15 lakh crores by FY 2022 – 2023. In the GoI’s Union Budget for 2021-2022, a total of ₹1,18,101 crores have been budgeted for the MoRTH on schemes and projects, including ₹1,08,230 crores of capital expenditure, increasing from ₹91,823 crores budgeted in the 2020-2021 Union Budget and ₹78,248 crores spent in 2019-2020. This reflects an increase at CAGR of 13.10% in the budget outlay for road transport and highways. (*Source: Government of India, Ministry of Finance, Union Budget 2020 – 2021; Government of India, Ministry of Finance, Union Budget Speech 2021 – 2022; https://www.ibef.org/download/Roads-November-2020.pdf, Press Release, Ministry of Road Transport & Highways dated May 7, 2020 available at: https://pib.gov.in/PressReleasePage.aspx?PRID=1621779*) According to the Technical Consultant, social distancing protocols as a result of COVID-19 will have a major impact on the travel habits of people and impact upon road traffic. The population in lesser income group groups will continue to travel on mass public transportation. The population in higher income category groups will use private transportation more. However, the burden on roads is bound to increase with the increase in GDP and purchasing power of the people. While COVID-19 has impacted the auto industry and sales have reduced, according to the Technical Consultant, all major auto brands are developing promotional schemes such as more discounts and EMI schemes. These schemes could potentially lead to more affordability and access to modes of private transport, consequently increasing passenger traffic on the road.

RISK FACTORS

An investment in the Units involves a high degree of risk. Before investing in the Units, prospective investors should pay particular attention to the fact that the Trust, the Parties to the Trust, the Project SPV and each of their activities are governed by the legal, regulatory and business environment in India, which differs from that which prevails in other countries. Prospective investors should carefully consider the risks and uncertainties described below and the information contained elsewhere in this Final Placement Memorandum before making an investment in the Units. In making an investment decision, each investor must rely on its own examination of us and the terms of the offering of the Units. The risks and uncertainties described in this section may not be the only risks and uncertainties the Trust currently faces. Additional risks and uncertainties not presently known to the Trustee or the Investment Manager, or that the Trustee or the Investment Manager currently deem immaterial, may arise or may adversely affect our business, financial condition, cash flows and results of operations. If any of the following risks, or other risks that are not currently known or are now deemed immaterial, actually occur, our business prospects, results of operations, cash flows and financial condition could suffer, the price of the Units could decline and prospective investors may lose all or part of their investments. Unless otherwise stated in the relevant risk factors set forth below, the Trustee and the Investment Manager are not in a position to specify or quantify the financial or other risks mentioned herein.

The financial and other related implications of the risk factors, wherever quantifiable, have been disclosed in the risk factors mentioned below. However, there are certain risk factors where the financial impact is not quantifiable and, therefore, cannot be disclosed in such risk factors. Unless specified or quantified in the relevant risk factors below, we are not in a position to quantify the financial or other implication of any of the risks described in this section.

Investors should be aware that the price of the Units, and the income from them, may be subject to volatility. If any of the risks described below occurs, our business and prospects could be materially and adversely affected, the trading price of the Units could decrease, and investors could lose all or part of their original investment.

This Final Placement Memorandum also contains forward-looking statements (including Projections of Revenue from Operations and Cash Flow from Operating Activities) that involve risks, assumptions, estimates and uncertainties. Our actual results could differ materially from those anticipated in such forward-looking statements as a result of certain factors including the considerations described below and elsewhere in this Final Placement Memorandum.

In making an investment decision, prospective investors must rely upon your own examination and the terms of the Offer, including the merits and the risks involved. You should consult your tax, financial and legal advisors about the particular consequences of investing in the Offer.

In this section, unless specified otherwise, a reference to “we”, “us” and “our” refers to the Trust and the Project SPV on a consolidated basis.

Risks Related to the Structure of the Trust

- 1. We have no operating history and limited historical financial information and, as such, there are limited financial statements presented in this Final Placement Memorandum.***

The Project SPV was incorporated on July 23, 2020 for the purpose of entering into the Concession Agreements to acquire tolling rights from the Sponsor for undertaking tolling, operation, and maintenance of national highways in India. We do not currently have any operations, and have not had any operations since the date of incorporation of the Project SPV, and we are not expected to take over the operation of certain of the Toll Roads until 2024 at the earliest and for other Toll Roads in a staggered manner. See “—*The Concession Agreements may be terminated prematurely under certain circumstances.*” Furthermore, the Sponsor requested SEBI for an exemption dated January 13, 2021 to allow for the relaxation of strict application of financial disclosure rules per the InvIT Regulations for the Sponsor and the Investment Manager (“**SEBI Exemption Request**”). Our Sponsor also requested for an exemption from SEBI dated March 4, 2021 (the “**March 4 SEBI Exemption Request**”) related to the disclosure of project operating cash flows and revenue on a monthly basis for each asset proposed to be transferred to the Project SPV, the disclosure of specified line items for financial statements and disclosures, and for the discussion and analysis of historical financial information pertaining to assets transferred to the Project SPV in this Final Placement Memorandum. Both the SEBI Exemption Request and the March 4 SEBI Exemption Request were made on the basis that (i) the Sponsor was incorporated under the NHAI Act and no historical

consolidated financials are available for presentation in the Final Placement Memorandum and (ii) the Investment Manager has only recently been incorporated by the Sponsor and hence limited historical financial information is available in respect of the Investment Manager. SEBI has acceded to the request and granted exemption through its letters dated February 12, 2021 in respect of the SEBI Exemption Request and March 17, 2021 in respect of the March 4 SEBI Exemption Request. Accordingly, limited financial information with respect to the Sponsor and the Investment Manager will be disclosed in the Final Placement Memorandum. As a result, limited historical financial statements are presented in this Final Placement Memorandum. The absence of meaningful historical operating data or financial statements may make it difficult for investors to evaluate our ability to operate, manage and maintain the Toll Roads and assess our financial position or future prospects or results of operations.

Furthermore, the Auditors have included an emphasis of matter relating to the Audited Financial Information. We cannot assure that this or other emphases of matter will not arise in the future, and investors should consider this in evaluating the Trust's financial position, cash flows and results of operations.

Our inability to successfully operate and manage the Toll Roads or to operate and manage the Toll Roads in an efficient and cost-effective manner could have an adverse effect on our results of operations and our ability to meet our payment obligations under the Units.

2. *We must maintain certain investment ratios, which may present additional risks to us.*

Pursuant to the InvIT Regulations, we are required to invest not less than 80% of the value of our assets in eligible infrastructure projects as defined under the InvIT Regulations, such as the Project SPV. In addition, we must not invest more than 20% of the value of our assets in certain financial instruments prescribed under the InvIT Regulations. If these conditions are breached on account of market movements of the price of the underlying assets or securities, the Investment Manager must inform the Trustee and ensure that these conditions are satisfied within six months of such breach (or within one year with Unitholder approval). Failure to comply with these conditions may present additional risks to us, including divestment of certain assets, delisting and other penalties, which could have a material, adverse effect on our business, financial condition and results of operations.

3. *We may not be able to make distributions to Unitholders or the level of distributions may fall.*

The Trust's distributions will be based on the cash flows generated from the operations to be undertaken by the underlying Project SPV held by the Trust and not on whether the Trust makes an accounting profit or loss. The InvIT Regulations provide that not less than 90% of net distributable cash flows of the Project SPV are required to be distributed to the Trust in proportion of its holding in the Project SPV subject to applicable provisions of the Companies Act. Not less than 90% of distributable cash flows of the Trust shall be distributed to the Unitholders. Such distributions are required to be declared and made not less than once in every year and shall be made not later than fifteen days from the date of such declaration. For more details, see the section headed "*Distribution*" on page 248 of this Final Placement Memorandum.

The Trust will substantially rely on the receipt of interest, dividends, and principal repayments (net of applicable taxes and expenses) from the Project SPV in order to make distributions to Unitholders. The distributions to Unitholders will be in the form of dividends, interest and any other means permitted by law. There can be no assurance or guarantee that the Trust will have sufficient distributable or realised profits or surplus in any future period to make distributions every year in any amount or at all. The ability of the Project SPV to pay dividends, make interest payments and repay shareholder loans may be affected by a number of factors including, among other things:

- The business and financial position of the Project SPV;
- insufficient cash flows received from the Project SPV;
- applicable laws and regulations, which may restrict the payment of dividends by the Project SPV;
- ability of the Project SPV to borrow funds and access capital markets;
- operating losses incurred by the Project SPV in any financial year;
- fluctuations in the working capital needs of the Project SPV;
- changes in accounting standards, taxation laws and regulations, laws and regulations in respect of foreign exchange repatriation of funds, corporation laws and regulations relating thereto; and
- the terms of agreements, including the Concession Agreements or financing agreements, to which the Project SPV is, or may become, a party.

Further, the method of calculation of the net distributable cash flows may change subsequently due to regulatory changes. Any change in applicable laws in India or elsewhere (including, for example, tax laws and foreign exchange controls) may limit our ability to pay or maintain distributions to our Unitholders. Furthermore, no assurance can be given that we will be able to pay or maintain the levels of distributions at all, or that the level of distributions will increase over time, or that future acquisitions will increase our distributable cash flow to our Unitholders. Any reduction in, or delay/default in payments of distributions could materially and adversely affect the market price of our Units.

In addition, the financing agreements as may be entered into by Project SPV with banks and/or financial institutions typically may contain certain restrictive covenants, including, but not limited to, requirements that they obtain consent from the lenders prior to making any dividend payments to the Trust. Any failure to obtain such consents in a timely manner or at all would impede our ability to make distributions to Unitholders on a regular basis or at all, which could materially and adversely affect the market price of the Units. Additionally, following a default under our financing agreements if and when entered into, lenders may take coercive actions as per the rights available to them under applicable law, which may restrict our ability to conduct business and operations.

4. *The completion of the transactions contemplated by the debt financing documentation entered into may be subject to certain closing and other conditions that may prevent us from providing debt financing to the Project SPV*

The Trust has entered into an agreement with lenders for availing ₹ 20,000.00 million, it has not drawn down any amounts as on date. In the event the Project SPV avails debt in the future and intends to refinance a certain portion of their outstanding indebtedness with the Trust, such refinancing would require prior consent of the Authority under the relevant Concession Agreements. The approval of the Authority has to be in conformity with any regulations or guidelines that may be notified by the Government or the Reserve Bank of India, as the case may be.

Furthermore, the Concession Agreements require the submission to the Sponsor, in its capacity as the Authority for its review and comments, all project agreements (including financing arrangements) to which the Project SPV is a party prior to entry, amendment or replacement of such agreements. The Project SPV shall submit such drafts to the NHAI. Further, the utilisation of the Net Proceeds by the Trust is not subject to monitoring by any independent agency.

Furthermore, any inability of the Trust to complete the debt financing transactions in the manner described in this Final Placement Memorandum may adversely impact the ability of the Trust to make distributions to Unitholders in the manner described in this Final Placement Memorandum or at all. In the event the Trust is unable to complete the debt financing transactions in the manner described in this Final Placement Memorandum, you will be unable to rely on the Projections of Revenue from Operations and Cash Flow from Operating Activities or evaluate the manner in which we propose to invest the Net Proceeds on the economic merits of such investments. Such event may materially and adversely affect the ability of the Trust to make distributions to the Unitholders.

5. *The regulatory framework governing infrastructure investment trusts in India is untested and the interpretation and enforcement thereof involve uncertainties, which may have a material, adverse effect on the ability of certain categories of investors to invest in the Units, our business, financial condition and results of operations and our ability to make distributions to Unitholders.*

The SEBI issued the InvIT Regulations with effect from September 26, 2014. The regulations have been amended and supplemented with additional guidelines and circulars.

As the regulatory framework governing infrastructure investment trusts in India comprises a separate set of regulations, interpretation and enforcement by regulators and courts involves uncertainties. Furthermore, regulations and processes with respect to certain aspects of infrastructure investment trusts, including, but not limited to, follow-on public offers and bonus issues, the liabilities of the Unitholders, and the procedure for dissolution and delisting of infrastructure investment trusts have not yet been issued. For example, infrastructure investment trusts are not “companies” or “bodies corporate” within the meaning of the Companies Act, 2013 and various SEBI regulations, including the Securities and Exchange Board of India (Buy-back of Securities) Regulations, 2018 and the Securities and Exchange Board of India (Substantial Acquisition of Shares and Takeovers) Regulations, 2011.

In addition, new costs may arise from audit, certification and/or self-assessment standards required to maintain compliance with new and existing InvIT Regulations. Such changes in regulation, interpretation and enforcement may have a material, adverse effect on our business, financial condition and results of operations.

As we will be operating in a new and relatively unclear regulatory environment, it is difficult to forecast how any new laws, regulations or standards or future amendments to the InvIT Regulations will affect infrastructure investment trusts and this could have any consequential impact on the infrastructure sector in India, and no assurance can be given that the regulatory system will not change in a way that will impair our ability to comply with the regulations, conduct our business, compete effectively or make distributions.

Further, the Government of India has notified the Finance Act, 2021 (“**Finance Act**”) which has introduced various amendments to taxation laws in India. The Finance Act has included definition of ‘pooled investment vehicle’ under the Securities Contracts (Regulation) Act, 1956, which shall comprise business trusts as defined under the IT Act. The IT Act defines business trusts to include trusts registered with SEBI as an InvIT under the InvIT Regulations. The Finance Act and the amendments in the Securities Contracts (Regulation) Act, 1956 which have come into effect from April 1, 2021 have also recognised units, debentures and other instruments issued by InvITs as ‘securities’ which may have further implications under various regulations issued by SEBI governing securities, including under the Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015, as amended and the Securities and Exchange Board of India (Prohibition of Insider Trading) Regulations, 2015, as amended.

Further, as announced in the previous budget, the dividend distribution tax regime was abolished and replaced with dividend withholding tax regime. However, the procedural provisions regarding exemption of withholding tax in relation to dividend distribution by Special Purpose Vehicles (SPVs, as defined under IT Act) to InvIT were absent. In this regard, the Finance Act has exempted withholding of taxes on dividend distributions by SPVs to InvITs. Please note that such amendment is proposed to take effect retrospectively from April 1, 2020.

As such, there is no certainty on the impact that the Finance Act, 2021, may have on our business and operations or on the industry in which we operate. We cannot predict whether any tax laws or other regulations impacting it will be enacted or predict the nature and impact of any such laws or regulations or whether, if at all, any laws or regulations would have a material adverse effect on our business, financial condition and results of operations.

Failure to comply with changes in laws, regulations and standards may have a material, adverse effect on our business, financial condition, results of operations and prospects.

Risks Relating to Our Business and the Concession Agreements

6. *Any payment by the Project SPV, including in the event of the termination of the Concession Agreements, is subject to a mandatory escrow arrangement which restricts its flexibility to utilise the available funds.*

The escrow arrangement mandated under the Concession Agreements requires all monies that are received by the Project SPV, including funds constituting the financial package, the fees and any other revenues collected from or in respect of the Project Highway (including the proceeds of any rentals, deposits, capital receipts or insurance claims) and all payments by the Sponsor (including, if any, in relation to the change of scope), to be deposited in an escrow account and utilised only in accordance with the order prescribed under the escrow agreement. The consent of NHAI, in its capacity as the concessioning authority (the “**Authority**”), and lenders, is required to amend the order of outflow of payments from such escrow account.

The escrow arrangements prioritise the payment of all taxes due, followed by payment of the concession fee to the Authority, expenses in connection with the construction of the project, operation and maintenance expenses, other costs and expenses incurred by the Sponsor, debt service payments, any payments and damages due and payable to the Sponsor, and balance, if any, in accordance with the instructions of the concessionaire. For details of the escrow arrangement, please see the section headed “*Summary of the Concession Agreements*” on page 194 of this Final Placement Memorandum.

The debt financing proposed to be provided by the Trust to the Project SPV comprises of certain secured or unsecured interest-bearing loans (collectively, the “**Trust Financing**”) which will be classified as senior debt under the Concession Agreements. In accordance with the escrow arrangement, the amounts payable to the Trust in respect of the Trust Financing, will be subordinated to the amounts payable in respect of taxes due, concession fees, construction expenses, operation, maintenance and other costs and expenses. Further, any reduction in the

cash flows of the Project SPV and/or an unanticipated increase in any of the abovementioned payments to be made by the Project SPV from the escrow accounts may result in decreased and/or delayed payment to the Trust, materially and adversely impacting the ability of the Project SPV to meet their payment obligations to the Trust. Any inability on the part of the Project SPV to meet their payment obligations to the Trust may adversely impact the ability of the Trust to make distributions to the Unitholders in the manner described in this Final Placement Memorandum or at all.

In case of withdrawals from the escrow account on termination, the escrow arrangement prioritises the payment of all taxes due and payable, followed by the payment due to senior lenders (which includes the Trust), any payments and damages due and payable to the Sponsor, retentions and payments arising out of liability for any defects and deficiencies, incurred or accrued operation and maintenance expenses and any other payments under the Concession Agreements, after which the balance may be withdrawn by the Project SPV for its own purposes. Therefore, in case of termination, the amounts payable to the Trust in respect of the Trust Financing may be recovered only after payment of all taxes.

7. *The Sponsor, whose interests may be different from the other Unitholders, will be able to exercise significant influence over certain activities of the Trust, and under the InvIT Regulations, it has the ability to divest its holdings in the Units three years following the Offer.*

After the completion of the Offer, i.e. on a post-Offer basis, the Sponsor will own an aggregate of not less than 15% of the issued and outstanding Units and will be entitled to vote as a Unitholder on all matters other than matters where it is a related party and not permitted to vote under the InvIT Regulations. Although the Investment Manager has and will continue to have the requisite number of independent directors on its board of directors, the Sponsor may nonetheless be in a position to exercise significant influence in matters which require the approval of Unitholders by virtue of its ownership of Units in the Trust. The interests of the Sponsor may conflict with the interests of our other Unitholders and the Sponsor may, for business considerations or otherwise, seek to benefit itself instead of the Trust or the interests of the other Unitholders. The Sponsor will also exercise significant influence over the Project Manager, which is a wholly owned subsidiary of the Sponsor. Accordingly, the Project Manager may also be subject to conflicts of interest with respect to the Trust.

In addition, under the InvIT Regulations, the Sponsor will be able to divest its holding in the Units at any time three years subsequent to the Offer after completion of the lock-in period prescribed under the InvIT Regulations. Given the influence that the Sponsor exerts on the Investment Manager, and consequently the operations and credibility of the Trust, any material divestiture by the Sponsor in the Units, or any conflict of interest that it has compared to that of other Unitholders, could have a material adverse impact on our business, financial condition and results of operations.

8. *The cost of implementing new technologies for collection of tolls and monitoring our projects could materially and adversely affect our business, financial condition and results of operations.*

Our future success will depend in part on our ability to respond to technological advances and emerging standards and practices on a cost-effective and timely basis. In addition, rapid and frequent technology and market-demand changes can often render existing technologies and equipment obsolete, requiring substantial new capital expenditures or write-downs of assets. Any failure by us to successfully adopt such technologies in a cost-effective and timely manner could increase our costs. Additionally, governmental authorities may require adherence with certain technologies in the execution of projects and there can be no assurance that we would be able to implement the same in a timely manner, or at all.

9. *We may face limitations and risks associated with debt financing and refinancing.*

We are subject to regulatory restrictions in relation to our debt financing and refinancing. We may from time to time require debt financing and refinancing to carry out the Investment Manager's investment strategy and to cover maintenance costs. In the event that we undertake debt financing or refinancing, we may be limited by Indian law as to the form of financing or refinancing that we may undertake. As a trust, we may be unable to access certain debt capital available to companies.

In the event that we undertake debt financing or refinancing, we may also be subject to risks associated with debt financing and refinancing, including the risk that our cash flow may be insufficient to meet required payments of principal and interest under such financing and to make distributions to Unitholders. Our ability to generate sufficient cash to satisfy our debt obligations will depend on our future operating performance, which may be

affected by prevailing economic conditions and financial, business and other factors beyond our control. There is no assurance that we will be able to generate sufficient cash flow to meet all of our debt obligations. If we are unable to make payments due under our debt facilities, the lenders may be able to declare an event of default and initiate enforcement proceedings relating to any security provided in respect of the loan facilities, and/or call upon any guarantees, and this may materially and adversely affect our ability to make distributions to Unitholders. Such default may also result in the termination of the Concession Agreements by the Sponsor.

10. *Certain actions of the Project SPV require the prior approval of NHAI, and no assurance can be given that NHAI will approve such actions in a timely manner or at all.*

Certain terms and conditions in the Project SPV's Concession Agreements, financing agreements, and our other approvals require the Authority's prior written approval to be obtained for one or more of the following actions, among others, such as:

- assignment of the Concession Agreements to any persons, the creation of any encumbrance over, or transfer or disposal of rights and benefits of the Project SPV under the Concession Agreements or any project agreements;
- the selection or replacement of any operation and maintenance contractor and execution of the operation and maintenance agreements;
- securing refinancing;
- any change in ownership of the Project SPV.

Furthermore, the Concession Agreements with NHAI typically require the submission to NHAI, for its review and comments, all project agreements to which the Project SPV is a party prior to entry, amendment or replacement of such agreements.

The restrictions described above may impose constraints on our flexibility to conduct our business. Furthermore, if as a result of these restrictions, we are unable to pursue a favourable course of action or to respond to an unfavourable event, condition or circumstance, then our business, financial condition and results of operations may be materially and adversely affected. For further details on the terms of the Concession Agreements, section headed "*Summary of the Concession Agreements*" on page 194 of this Final Placement Memorandum.

11. *The Project SPV's toll-road concessions may be terminated prematurely under certain circumstances.*

The Toll Roads concessions of the Project SPV are our principal assets. We will be unable to continue the operation of a particular road concession without a continuing concession right from the Sponsor, in its capacity as Authority. A concession may be terminated by the Sponsor for certain reasons set forth in the Concession Agreements, including, but not limited to, one or more of the following:

- any failure by the Project SPV to comply with the change of ownership requirements;
- any failure by the Project SPV to make any payments, including negative grants, to the Sponsor in a timely manner;
- any failure by the Project SPV to comply with maintenance requirements;
- the Concessionaire abandons or manifests intention to abandon the operation and maintenance of the Project Highway;
- any occurrence of an event of default under any financing document;
- any continuation of a force majeure event, such as an act of God, act of war, expropriation or compulsory acquisition of any project assets by the government, strikes, civil commotions, boycotts and political agitations, beyond a specified time; and
- any failure by the Project SPV to comply with the Concession Agreements if such default causes a material adverse effect on the Sponsor.

If the Concession Agreements are terminated by the NHAI due to a default by the Project SPV, or by the Project SPV due to a default by the NHAI, the Project SPV is entitled to termination payments or otherwise from the NHAI in accordance with the terms of the relevant Concession Agreements. If the Concession Agreements are terminated prematurely, our business, financial condition and results of operations may be materially and adversely affected. For further details on the termination of the relevant Concession Agreements, the termination payments, and the definition of "default" as contemplated under the Concession Agreements, see the section headed "*Summary of the Concession Agreements*" on page 194, of this Final Placement Memorandum.

12. Toll collections and Toll Road traffic volumes may be affected by existing or new competing roads and bridges and other modes of transportation, and any improvements to, or construction of, such roads, bridges and other modes of transportation.

Upon commencement of the concessions, our principal source of revenue will be the collection of toll fees from users of the Toll Roads. The level of toll collections may be affected by existing or new competing routes and alternative modes of transportation, such as adjacent free roads, new or existing toll roads including national highways or state toll roads, railways or air transport. Although the Concession Agreements contain certain restrictions on the ability of the Sponsor to construct or cause to be constructed any competing roads within 15 kilometers of the Toll Roads, the Sponsor is not prohibited from constructing such competing free or toll roads if the average traffic on the Toll Road exceeds 90 per cent. of its stipulated designed capacity for three consecutive years. Furthermore, the Sponsor is not restricted under the Concession Agreements from constructing alternative modes of travel which service the same areas as are serviced by the Toll Roads.

In particular, the Sponsor has entrusted the Project SPV with the role of development, operation, maintenance and management of the Toll Roads mentioned hereinbelow.

Toll Road	Length of Toll Road (in kms)	Connecting States
Abu road - Swaroopganj	31.0	Rajasthan to Gujarat
Chittorgarh – Kota & Chittorgarh Bypass	160.5	Madhya Pradesh - Rajasthan
Kothakota Bypass – Kurnool Highway	74.6	Telangana – Andhra Pradesh
Palanpur/Khemana – Abu Road	45	Gujarat - Rajasthan
Maharashtra Border – Belgaum	77.7	Maharashtra - Karnataka

Additionally, given the renewed focus of the GoI, at the national, state and local levels, on the development and strengthening of the highway network across India, subject to the aforementioned restriction, there can be no assurance that there will not be any construction, widening or improvement of any free or toll roads, or construction of other modes of transportation, in the proximity of the Toll Roads or which provide an alternative or more direct routing to locations served by the Toll Roads. Any such construction, widening or improvement may divert traffic away from the Toll Roads, which may adversely affect toll collections and, therefore, our ability to meet our payment obligations under the Units.

13. Our business will be subject to seasonal fluctuations that may affect our cash flows.

Our cash flows will be affected by seasonal factors, which may materially and adversely affect traffic volumes. Traffic volumes tend to decrease during the monsoon season and conversely tend to increase during holiday seasons. The monsoon season may also restrict our ability to carry on activities related to our operation and maintenance of the Toll Roads. This may result in delays in periodic maintenance and reduce productivity, thereby materially and adversely affecting our business, financial condition and results of operations.

14. Toll rates and collections and Toll Road traffic volumes are dependent on factors beyond our control and are subject to significant fluctuations.

Revenue from toll receipts is affected by traffic volume and toll rates, both of which are beyond our control. The toll rate structure is laid down under National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended from time to time (the “**Fee Rules**”). The Fee Rules specify that the applicable toll rates specified thereunder shall be increased by three per cent. each year along with an adjustment based on an increase in the wholesale price index (the “**WPI**”). We are not provided with any flexibility to adjust the toll rates as the rates are explicitly changed by the GOI in accordance with the Fee Rules. See “—Toll collections are affected by applicable toll rates and revisions to such rates and the number of road users subject to such rates.”

Traffic volumes on the Toll Roads and toll collections are directly and indirectly affected by a number of other factors beyond our control, including but not limited to:

- the growth of the Indian economy and the economic development of the states in which the Toll Roads are located as well as neighbouring states (the “Project Influence Area”);
- restrictions on mining, or a decline in manufacturing or exports of commodities plying on the Toll Roads due to regulatory clampdowns or other reasons;
- the number and type of motor vehicles in operation and the cost of purchasing and operating motor vehicles, including financing costs, environmental law compliance costs, exchange rate fluctuations and fuel prices, in the Project Influence Areas;
- weather conditions, such as floods or torrential rain, acts of God, strikes or any other force majeure event, including epidemics, such as COVID-19 (defined below), that could impair the safe operation of, restrict traffic access to, or prevent use of the Toll Roads;
- traffic on the roads providing access to and from the Toll Roads, or the physical condition of such roads, which hampers the ability of road users to gain access to and from the Toll Roads;
- the capacity and physical condition of the Toll Roads, or any structure forming part of the Toll Roads, such as bridges, bypasses or tunnels, and the need for maintenance and repair of parts or all of the Toll Roads, or any structure forming part of the Toll Roads, which may result in restricted or no access to the Toll Roads for material periods of time;
- overall security of the Toll Roads as managed by the relevant security contractors, including the possible threat of terrorist attacks on the Toll Roads or any of their free-standing structures;
- a change in the applicable toll policies or other applicable laws which affects any category of vehicle or fuel;
- changes to axle load norms in order to further increase the permissible axle load limits in India, which may adversely impact traffic growth along Indian national and state highways and cause accelerated deterioration of the condition of the pavement of the Toll Roads;
- the reactions of the public or other national or state government institutions to toll rate increases; and
- seasonal holidays.

In the event there is a significant decrease in traffic volume or change in toll rates on the Toll Roads, there may be a corresponding decrease in toll collections which could have a material adverse effect on our ability to meet our payment obligations under the Units.

15. *We are subject to risks associated with outbreaks of diseases or similar pandemics or public health threats, such as the novel coronavirus (“COVID-19”), which could have a material adverse impact on our business and our results of operations and financial condition.*

In the past, various contagious diseases have spread throughout the world, including India where the entire operations of Sponsor or the Toll Roads are located. Most recently, beginning in late 2019 and continuing in 2020 and 2021, the global spread of COVID-19 has created significant economic and political volatility and uncertainty and business disruption. The spread of COVID-19 has led to governments around the world to take various measures such as the implementation of incoming and outgoing travel restrictions, voluntary and mandatory cessations of business operations, mandatory quarantines and work-from-home and other alternative working arrangements, curfews, limitations on social and public gatherings and partial lockdowns of cities or regions in order to limit the virus’ spread. The spread of COVID-19 and governmental responses have resulted in worker absences, reduced business productivity, other business disruptions, reduced demand and stagnated economic activity in India and around the world. The ultimate extent of COVID-19 on our business, financial condition and results of operations will depend on future developments, which are highly uncertain and cannot be predicted. More generally, any epidemic, pandemic or other health crisis, whether similar to COVID-19, SARS, H1N1, MERS or other past global diseases, could materially and adversely affect our business, financial condition and results of our operations.

16. *Leakage of the tolls collected on the Toll Roads may adversely affect toll collections.*

Toll collections are dependent on the integrity of our toll collection system. Upon commencement of the concessions, the Toll Roads will be operated on an “open” toll collection system with different toll rates applicable to certain classes of vehicles; each motorist using a particular class of vehicle is charged a flat rate at the point of entry to the toll road regardless of the actual distance travelled.

The level of toll collections may be reduced by leakage through toll evasion, fraudulent acts on the part of road users or our toll collection operators, theft, technical faults in our toll collection systems, or unlawful roadway entries or exits by road users to avoid paying the required toll. To the extent we become aware of any routes available to road users to bypass the toll plazas, we may face delays in obtaining approval from the Sponsor to

implement additional toll plazas to prevent such unauthorized entry or exit to the Toll Roads, which may adversely affect our revenue and our ability to meet our payment obligations under the Units. If toll collection is not adequately monitored, leakage may reduce toll collections. Although we expect to put in place systems and software, as well as deploy a number of toll plaza supervisors and security manpower, to minimize leakage through fraud and theft, if there is any significant failure in the efficiency or effectiveness of our collection practices or of the installed system software or any significant failure by us or our contractors to control leakage in toll collection, there could be a material adverse effect on our toll collections.

Furthermore, there may be situations where toll collection is disrupted or stopped, for example, due to public disturbances, or strikes or work stoppages as a result of disputes with local labor unions. See “—*Our operations could be adversely affected by strikes, work stoppages or wage increase demands by, or any other kind of disputes involving, our workforce or our contractors’ work force or any labor unions.*” Any such disruption or other stoppage of toll collection may interfere with our collection practices, resulting in increased leakage and reduced toll collections by us, which may adversely affect our revenue and our ability to meet our payment obligations under the Units.

17. *The termination payment due to us upon termination of the Concession Agreements may not adequately compensate us for the actual costs and investments associated with the Toll Roads in a timely manner or at all and thus may not provide us with sufficient funds to repay the Units.*

The Concession Agreements may be terminated by us or the NHAI prior to their expiration for a number of reasons. See “—*The Concession Agreements may be terminated prematurely under certain circumstances.*” In the event that the early termination of the Concession Agreements is due to a breach by us, we are entitled to receive a termination payment equal to 70 per cent. of the Unexpired Cash Flow in addition to remaining liable for costs and liabilities in relation to the Toll Roads. In the event that the early termination of the Concession Agreements is due to a breach by the NHAI, we are entitled to receive a contractually agreed termination amount, as set out in “*Summary of the Concession Agreements.*” As the termination payment payable to us in the event of a breach by us would be lower than what we would have otherwise been entitled to receive in the event that the Concession Agreements had not been terminated, we may not be adequately compensated for the actual costs and investments associated with the Toll Roads and, therefore, may not be able to repay the Units.

There is no assurance that any termination payment due to us will be paid in a timely manner or at all. Further, there are no precedents of termination payments being triggered in respect any other TOT projects in India. In the event of a delay in the disbursement of a termination payment by the Sponsor, in particular, if any dispute arises in respect of such payment, or in the event the Sponsor fails to make the termination payment at all, there may be insufficient funds available for us to meet our payment obligations under the Units.

18. *Toll collections are affected by applicable toll rates and revisions to such rates and the number of road users subject to such rates.*

Under the terms of the Concession Agreements, the toll rates applicable to the Toll Roads are determined in accordance with the Fee Rules. The applicable toll rates shall be increased by 3 per cent. each year and are subject to an adjustment in accordance with the Fee Rules on April 1 of each year based on the difference in the WPI between the week ending on January 6, 2007 and the week ending on or immediately after January 1 of such year of adjustment (the “**WPI Adjustment**”). The WPI Adjustment shall be restricted to 40 per cent. of the increase in the WPI. In recent years, there has been little correlation between changes in the consumer price index (the “**CPI**”) and the WPI, or between increases in the minimum wage and the WPI. As such, in the event of high CPI inflation or increased minimum wages, we may experience significantly higher operating costs, but there may be little variation in the WPI resulting in a muted increase in the applicable toll rate. As the determination of the applicable toll rates does not take account of changes in our operating, financing or other costs, there can be no assurance that the toll rates will be sufficient to cover any increase in such costs or that we will be able to implement any changes in the toll rates at the time or in the manner which we believe is in our best interest. Furthermore, an increase in the applicable toll rates may result in a reduction in overall toll collections if the higher toll rates cause a reduction in the traffic flow on the Toll Roads.

Our toll collections may also be affected by the level of exemptions, i.e. the number of road users required to pay the applicable toll rates when using the Toll Roads. The Concession Agreements provide that certain users of the Toll Roads are exempt from paying user fees for non-commercial use of the roads, while frequent users are entitled to discounted fees to use the Toll Roads.

Any inability to introduce or any delay in introducing adjusted toll rates to address, among other things, changes to the economic environment, higher operating and maintenance costs, decreased revenue due to a decrease in traffic volume, or changes in exchange rates or consumer preferences, any increase in the toll rates causing a reduction in traffic volume, or any increase in the number of road users who are exempt from payment of user fees or entitled to discounted fees in respect of the Toll Roads, would have a material adverse effect on our toll collections and, therefore, our ability to meet our payment obligations under the Units.

19. *Our revenues under the Transitional Support Agreement are dependent on successful continuation of underlying tolling contracts.*

The Sponsor, Project Manager and the Project SPV have entered into a transitional support agreement for the purpose of the Sponsor providing transitional support to (i) the Project Manager in respect of its obligations under the Project Implementation and Management Agreement, and (ii) the Project SPV in respect of its O&M obligations and tolling obligations (as provided under the Concession Agreements). As a result, the Sponsor is obligated, during the term of the Transitional Support Agreement, to undertake the tolling obligations/ tolling related responsibilities under and in compliance with the Concession Agreement(s) on behalf of the Concessionaire. In furtherance of this, the Sponsor has entered into tolling contracts with certain third-party contractors in respect of the project highways under which these contractors pay the Sponsor a fixed contracted fee on a regular basis irrespective of the actual quantum of fee collected in respect of the project highway.

The Sponsor shall continue to operate tolling contracts on “as is basis” during the transition period from appointed date. Further, the remittance (which would be due to the Sponsor) under such tolling contracts would be credited directly to the Project SPV on consummation of the transaction. All these tolling contracts have a defined period and have set expiry dates. Furthermore, some of these tolling contracts may expire during the period of transition. Additionally, the tolling contracts have a clause related to pre-mature termination in case of default by the third-party contractors. In either of these scenarios, the Sponsor could be required to enter into new contracts or extend such contracts, and the remittance amount from those renewed tolling contracts might be lesser than the current contracted amount. This could have a material adverse effect to our business, financial condition and prospects.

20. *The operation of the Toll Roads and the revenues generated from them may be impacted as a result of any capacity augmentation or other works required to be carried out in accordance with the terms of the Concession Agreements or any RFPs floated by the Sponsor.*

The Sponsor has the right under the terms of the Concession Agreements to undertake, through a contractor, at its own cost, capacity augmentation of the Toll Roads. In connection with any capacity augmentation work in respect of the Toll Roads, the toll fees shall be reduced to 75% during the period of construction in terms of the applicable fee rules. There can be no assurance that construction work will be completed in the expected time frames, and if they are not, this would adversely impact the revenue of the relevant Project SPV. While we are contractually entitled under the Concession Agreements to collect additional revenue from the augmented stretch upon completion of the construction, there can be no assurance that we would be able to do so in a timely manner.

In exercise of its rights relating to capacity augmentation under the Concession Agreements, the Sponsor may from time to time release Request for Proposals (“RFPs”) for construction activities on the Toll Roads. For example, in August 2021, the Sponsor had released RFPs inviting bids for construction works on certain sections of the Belgaum Kagal Project. The RFPs contain the timeframe within which the construction must be completed and details of works to be completed during augmentation including the proposed structures like flyovers and bridges. There can be no assurance that the capacity augmentation or construction under these RFPs would be completed within the expected time frames. Further, the length of these structures would determine the permitted increase in Toll Fees that the concerned Project SPV would be entitled to charge upon successful completion of the construction. The actual increase in length of the structures and in turn, permitted increase in Toll Fees is dependent on several factors beyond our control, such as, the final length of the structures constructed under the RFPs.

21. *Changes in the policies adopted by governmental entities or in the relationships of any member of the Trust with the Government or State Governments could materially and adversely affect our business, financial performance and results of operations.*

The Project SPV would be deriving almost all of its revenue from the Concession Agreements with the NHAI and must maintain good relationships and strategic alliances with the Sponsor, the Government and State Governments. We expect that we will continue to depend on, and benefit from, policies relating to the terms of

the concessions in respect of the Project SPV's existing projects and any future projects. In addition, we expect to benefit from, and depend on, the Sponsor and various Government and State Government entities in terms of policies, incentives, budgetary allocations and other resources provided by these entities for the road industry in general. Any adverse change in any existing governmental policies, incentives, allocations or resources, or any change in our relationships with governmental entities, could materially and adversely affect our business, financial condition and results of operations.

Additionally, the Toll Roads may be subject to delays, extensive internal processes, policy changes, changes due to local, national and internal political pressures and changes in governmental or external budgetary allocation and insufficiency of funds. Since governmental entities are responsible for awarding concessions and are a party to the development and operation of the awarded projects, our business will be directly and significantly dependent on their support. Any withdrawal of support or adverse changes in their policies, even if not quantifiable monetarily, may lead to the Project SPV's agreements being restructured or renegotiated or the concession period being decreased, which could materially and adversely affect the Project SPV's financing, capital expenditure, revenues, development or operations.

22. *The Valuation Report, and any underlying reports, are not opinions on the commercial merits of the Trust or the Project SPV, nor are they opinions, expressed or implied, as to the future trading price of the Units or the financial condition of the Trust upon listing, and the valuation contained therein may not be indicative of the true value of the Project SPV's assets.*

RBSA Valuation Advisors LLP has been appointed as the independent valuers (the "Valuers") to undertake independent appraisals of the Project SPV. The Valuers have issued the Valuation Report, included in **Annexure A** to this Final Placement Memorandum, which sets out their opinion as to the fair enterprise value of the Project SPV as on March 30, 2021. In order to issue their Valuation Report, the Valuers based their assumptions regarding the traffic volume, toll rates, operation and maintenance costs, amortization, debt repayments and non-cash net working capital projections amongst other things, on information provided by and discussions with or on behalf of us, the Sponsor and the Investment Manager, and which reflects current expectations and views regarding future events and, therefore, necessarily involves known and unknown risks and uncertainties. Please see the Valuation Report included in Annexure A to this Final Placement Memorandum for a more detailed description of all assumptions relied upon in the preparation thereof. The Valuation Report contains forecasts, projections and other "forward-looking" statements that relate to future events, which are, by their nature, subject to significant risks and uncertainties. The future events referred to in these forward-looking statements involve risks, uncertainties and other factors which may cause the actual results or performance to be materially different from any future results or performance expressed or implied by the forward-looking statements.

The Valuation Report is not an opinion on the commercial merits and structure of the Trust or the Project SPV, nor is it an opinion, expressed or implied, as to the future trading price of the Units in or the financial condition of the Trust upon listing. The Valuation Report does not purport to contain all the information that may be necessary or desirable to fully evaluate the Trust or the Project SPV or an investment in the Trust or the Units. The Valuation Report is not based on a comprehensive review of the business, operational or financial condition of the Project SPV and, accordingly, makes no representation or warranty, expressed or implied, in this regard. The Valuation Report does not confer rights or remedies upon investors or any other person, and does not constitute and should not be construed as any form of assurance as to the financial condition or future performance of the Trust or as to any other forward-looking statements included therein, including those relating to certain macro-economic factors, by or on behalf of the Sponsor, the Investment Manager, the Project Manager, the Trust, or the Lead Managers. Further, we cannot assure you that the valuation prepared by the Valuers reflects the true value of the net future revenues of the Project SPV or that other valuers would arrive at the same valuation. Accordingly, the valuation contained therein may not be indicative of the true value of the Project SPV's assets. The Valuation Report has been issued on March 31, 2021, but does not take into account any subsequent developments and should not be considered as a recommendation by the Sponsor, the Investment Manager, the Project Manager, the Trust or the Lead Managers or any other party that any person should take any action based on the Valuation Report. Accordingly, investors should not completely place on reliance on the Valuation Report in making an investment decision to purchase Units in the Trust.

23. *We have referred to the data derived from (i) Technical Consultant Report commissioned from the Technical Consultant, (ii) Traffic Reports commissioned from the Traffic Consultants and (ii) CARE Report which are based on certain bases, estimates and assumptions that are subjective in nature and may not be accurate.*

We have appointed Técnica Y Proyectos, S.A. (TYPISA) in a joint venture with Avanza Engineering Pvt. Ltd. (“TYPISA-AVANZA JV”), an independent third-party research agency, as our technical consultant (the “**Technical Consultant**”) to forecast the traffic volumes and operations and maintenance expenses for the Project SPV’s projects and to prepare traffic reports on the InvIT Assets, which are set out in **Annexure B** to this Final Placement Memorandum (the “**Technical Consultant Reports**”). We have also appointed Ramboll India Private Limited and Steer Davies Gleave India Private Limited as our traffic consultants (“**Traffic Consultants**”) to peer review the Technical Consultant Report and provide their analysis and forecast of traffic volumes for the Project SPV’s projects which are set out in **Annexure C** to this Final Placement Memorandum (the “**Traffic Consultants Reports**”). Furthermore, we have also commissioned a report titled “*Report on Road Infrastructure Industry*” dated March 2021, prepared by CARE Advisory Research and Training Limited (“**CARE Report**”). All of the Technical Consultant Reports, the Traffic Reports and the CARE Report (together referred to as “**Industry Expert Reports**”) are subject to various limitations and are based upon certain bases, estimates and assumptions that are subjective in nature and that are based, in part, on information provided by and discussions with or on behalf of us, the Sponsor and the Investment Manager. In particular, certain of the information we have provided the Traffic Consultants for the purposes of the Traffic Reports has been aggregated from data collected by third-party service providers. Although we believe such data to be accurate, we have not verified the information and cannot assure you that it is free from error. The Industry Expert Reports reflect current expectations and views regarding future events, and therefore, necessarily involve known and unknown risks and uncertainties. The Industry Expert Reports contain forecasts, projections and other “forward-looking” statements that relate to future events, which are, by their nature, subject to significant risks and uncertainties, including population growth, gross domestic product growth, vehicle ownership rates, per capita income, agricultural output and fuel consumption. The future events referred to in the Industry Expert Reports involve risks, uncertainties and other factors which may cause the actual traffic volumes to be materially different from any future traffic volumes expressed or implied by the Industry Expert Reports. There can be no assurance that the bases, estimates and assumptions adopted by the Technical Consultant, CARE or the Traffic Consultants for the purposes of preparing their respective reports will prove to be accurate. If any of these bases traffic assumptions is incorrect, future traffic volumes for the InvIT Assets could be materially different from those that are set forth in these reports and this Final Placement Memorandum.

24. *Certain provisions of the standard form of Concession Agreements may be untested, and the Concession Agreements may contain certain restrictive terms and conditions which may be subject to varying interpretations.*

The Concession Agreements that we have entered into is substantially based on a model concession agreement prescribed by the Sponsor. For example, the toll fees under the Concession Agreements is fixed, subject to annual adjustments to account for inflation as specified in the Concession Agreements. In addition, the operation and maintenance standards and specifications require the Project SPV to incur operation and maintenance costs on a regular and periodic basis. The Concession Agreements also provide for a fixed term concession and, although our Concession Agreements provide for an extension or reduction of the concession period based on certain factors, including actual traffic volumes on specified target dates, the Concession Agreements do not provide for renewal of the Concession Agreements after the expiry of the term.

The form of the Concession Agreements has evolved within the last decade and there is limited guidance available on the interpretation of a number of terms and conditions of the Concession Agreements. In addition, certain terms of the Concession Agreements, such as those related to an augmentation in the capacity of the toll roads, substitution of the Sponsor in any or all of the project agreements, termination payments by the Sponsor, construction of additional competing roads by the Sponsor, the Government or State Governments and payment of compensation by the Sponsor for changes in law are untested. Accordingly, the interpretation of certain terms and conditions in the Concession Agreements of the Project SPV by the Sponsor, the courts or regulators may be different from our interpretation of such terms and conditions.

The terms and conditions of the Concession Agreements contain restrictive terms and conditions. For example, the Concession Agreements contain provisions that mandate substitution clauses in the project agreements. Such substitution clauses allow the Sponsor to step into project agreements in place of the Project SPV in the event of suspension of the Project SPV or termination of the Concession Agreements due to a breach or default by the Project SPV. The Concession Agreements also provides that the lenders to a Project SPV may substitute the Project SPV with new entities approved by the Sponsor in the event of a default by the Project SPV under the relevant Concession Agreements or financing agreements. The terms of the Project SPV’s Concession Agreements requires

the Project SPV to indemnify the Sponsor for losses arising out of breach of the obligations of the Project SPV under the Concession Agreements.

In the event the Sponsor or a lender invokes any restrictive term or condition in the Concession Agreements, or the Sponsor, a court, or regulator interprets any term or condition in an adverse manner, such invocation or interpretation may materially and adversely affect our business, financial condition and results of operations.

25. *We may be subject to increases in costs, including operation and maintenance costs, which we cannot recover by increasing toll fees under the Concession Agreements.*

The terms and conditions of the Concession Agreements are fixed and are not negotiable during the concession period. The costs of operating and maintaining the InvIT Assets may increase due to factors beyond the Project SPV's control, including, among other things:

- increase in the cost of labour, materials and insurance;
- the Project SPV being required to install intelligent toll-collection systems at their own costs;
- the Project SPV being required to restore their project roads in the event of any landslides, floods, road subsidence, other natural disasters, accidents or other events causing structural damage or compromising safety;
- increase in electricity tariff rates or other fuel costs resulting in an increase in the cost of energy;
- adverse weather conditions;
- unforeseen legal, tax and accounting liabilities relating to acquired assets; and
- other unforeseen operational and maintenance costs.

In the event that our costs increase, we may be unable to offset such increases with higher revenues by increasing toll fees due to the restrictions of the Concession Agreements. Any significant increase in operation and maintenance costs beyond the amounts budgeted for by us, or any failure to meet quality standards, may reduce our profits, could expose us to penalties imposed by the concessioning authorities and could have a material, adverse effect on our business, financial condition and results of operations. Such events may also impact the ability of the Project SPV to service the debt obtained from the Trust and our ability to make distributions to Unitholders. As such, the inability to change the terms and conditions, including the toll fees of the concession during the concession period, may materially and adversely affect our operational and financial flexibility.

26. *Leakage of the toll fees on the Project SPV's roads may materially and adversely affect our revenues and financial condition.*

The Project SPV's toll receipts are primarily dependent on the integrity of toll-collection systems and the willingness of road users to pay toll fees. While the Project SPV has an integrated toll-collection system in place, the level of revenues derived from collection of tolls may be reduced by leakage through toll evasion, theft, fraud or technical defaults in the Project SPV's toll systems or forced violations by users of the Toll Roads. Furthermore, the Project SPV may also, at times, need to allow users of the Toll Roads to pass through without paying applicable tolls due to heavy traffic build-up, or may be unable to collect tolls due to political protests or other agitations relating to tolling. In addition, in certain circumstances, the governmental authorities or Indian courts could seek to suspend toll-collection for or during certain periods, in full or in part, on the Toll Roads, which suspension would result in a reduction in our revenues. For example, in November 2016, the Government ordered the suspension of toll collection at all national highways for a particular period of time on account of the demonetization of certain high-value currency denominations. Further, toll-collection errors may amount to a loss of revenue as there is an inherent risk of under-collection of toll fees given that most users of toll roads pay in cash. Any significant failure by us to monitor and control leakage in toll-collection systems could have a material, adverse effect on our business, prospects, financial condition and results of operations and our ability to make distributions.

27. *We will depend on certain directors, executive officers and key employees of the Investment Manager, the Project Manager and the Project SPV, and such entities may be unable to appoint, retain such personnel or to replace them with similarly qualified personnel, which could have a material, adverse effect on the business, financial condition, results of operations and prospects of the Trust.*

Our performance will depend, in part, upon the continued service and performance of certain directors, executive officers and key personnel of the Investment Manager, the Project Manager and the Project SPV. The continued operations and growth of our business will be dependent upon the Investment Manager, the Project Manager and

the Project SPV being able to attract and retain personnel who have the necessary and required experience and expertise. Competition for qualified personnel with relevant industry expertise in India is intense due to the scarcity of qualified individuals in the toll-road business, and the aforesaid entities may not be able to retain their executive officers and key employees or attract and retain fresh talent in the future. Any inability by the Investment Manager, the Project Manager and the Project SPV to retain their directors, executive officers and key employees, or the inability to replace such individuals with similarly qualified personnel, could have a material, adverse effect on the business, financial condition, results of operations and prospects of the Trust.

28. *There can be no assurance that we will be able to successfully undertake future acquisitions of road assets or efficiently manage the infrastructure road assets we have acquired or may acquire in the future.*

Our growth strategy in the future may involve strategic acquisitions of toll roads and other road assets. We may not be able to identify or conclude appropriate or viable acquisitions in a timely manner. The success of our past acquisitions and any future acquisitions will depend upon several factors, including:

- our ability to identify, finance and acquire operational toll roads and other road assets on a cost-effective basis;
- our ability to integrate acquired personnel, operations, products and technologies into our organisation effectively;
- unanticipated problems or legal liabilities of the acquired businesses; and
- tax or accounting issues relating to the acquired businesses.

There can be no assurance that we will be able to achieve the strategic purpose of such acquisitions or operational integration or an acceptable return on such investments, which may materially and adversely affect our profits, financial condition and distributions.

Furthermore, Concession Agreements for future toll-road projects may also contain terms and conditions that are more restrictive than those under the current Project SPV's Concession Agreements for the Toll Roads. These restrictions may restrict our flexibility in managing our business or projects and could in turn materially and adversely affect our business prospects, financial condition and results of operations.

29. *The Project SPV may not be able to comply with its maintenance obligations under the Concession Agreements, which may result in the termination of the Concession Agreements, the suspension of the Project SPV's rights to collect tolls or the requirement that the Project SPV pay compensation or damages to the Sponsor.*

The Project SPV is required to undertake operation and maintenance of the Toll Roads within periods and in the manner as specified in the Concession Agreements. There can be no assurance that the Project SPV will not breach the maintenance obligations under the Concession Agreements on account of the Project Manager's failure to undertake the stipulated maintenance work in a timely manner, or at all.

If the Project SPV is in breach or default of its obligations, then the NHAI has the right to (a) suspend the right of the Project SPV, including the right to collect tolls and other fees, (b) claim compensation for all direct, additional costs suffered or incurred by the Sponsor arising out of such default, or (c) terminate the Concession Agreements.

If the Concession Agreements are terminated, the right to collect tolls is suspended or the Project SPV is required to pay compensation or damages, our business, financial condition and results of operations may be materially and adversely affected. For further details of the maintenance obligations, suspension and termination events under the Concession Agreements, see the section headed "*Summary of the Concession Agreements*" on page 194 of this Final Placement Memorandum.

30. *The insurance policies for the InvIT Assets are not currently in place for any protection against various risks associated with our Operations and any future insurance coverage obtained may be inadequate.*

Our Sponsor had requested for an exemption for obtaining adequate insurance in respect of the InvIT Assets after the appointed date under the Concession Agreements, *vide* the March 4 SEBI Exemption Request, which was which was acceded to. Under the terms of the Concession Agreements entered into for the tolling rights for the InvIT Assets, such tolling rights would be granted as on and with effect from the appointed date which shall occur upon the conditions specified in the Concession Agreements which would be subsequent to the allotment of the Units pursuant to the proposed issue of Units. As such, obtaining adequate insurance would only be undertaken

on or after the appointed date under the Concession Agreements and we have currently not obtained insurance for the InvIT Assets.

While the Investment Manager has undertaken to obtain insurance within 30 days of the Offer, there can be no assurance that all risks are adequately insured against or that we will be able to procure adequate insurance coverage at commercially reasonable rates in the future.

Further the Toll Roads/InvIT Assets are subject to various risks that we may not be insured against, adequately or at all, including:

- changes in governmental and regulatory policies;
- shortages of, or adverse price movement for, construction materials;
- design and engineering defects;
- breakdown, failure or substandard performance of the road assets and other equipment;
- improper installation or operation of the road assets and other equipment;
- labour disturbances;
- terrorism and acts of war;
- inclement weather and natural disasters;
- environmental hazards, including earthquakes, flooding, tsunamis and landslides; and
- adverse developments in the overall economic environment in India.

Further, we are subject to various risks in the operation of the Toll Roads, including on account of accidents on the Toll Roads. Any insurance obtained may not provide adequate coverage in certain circumstances and is subject to certain deductibles, exclusions and limits on coverage. To the extent we suffer damage or loss which is not covered by insurance, or exceed our insurance coverage, such damage or loss would have to be borne by us. We can make no assurance that material losses in excess of insurance proceeds (if any at all) will not occur in the future, which could materially and adversely affect our financial condition, business and results of operations.

31. *The Sponsor and the Trustee are involved in certain legal and other proceedings, which may not be decided in their favour.*

The Sponsor, certain of its Associates and the Trustee are involved in legal proceedings or claims which are pending at different levels of adjudication before various courts, tribunals and regulatory authorities. For details of certain material outstanding legal proceedings, see the section headed “*Legal and other Information*” on page 264 of this Final Placement Memorandum. There is no assurance that these legal proceedings and regulatory matters will be decided in favour of the respective entities. Decisions in any of the aforesaid proceedings adverse to our interests may have a material adverse effect on our or their business, future financial performance and results of operations. If the courts or tribunals rule against the Sponsor or its Associates or the Trustee, we or the Sponsor may face monetary and/or reputational losses and may have to make provisions in our financial statements, which could increase expenses and liabilities. Pursuant to the acquisition of the shareholding of the Project SPV by the Trust pursuant to the Share Purchase Agreement, the Project SPV owned by the Trust will be responsible for legal proceedings against itself. While the Sponsor has provided certain indemnities under the Share Purchase Agreement, there can be no assurance that the relevant Project SPV or the Trust will be able to successfully bring a claim against the Sponsor under the Share Purchase Agreement or that such indemnities will be adequate to satisfy all the losses, damages, costs and expenses suffered by the Trust arising from such proceedings or the consequences thereof.

32. *We do not own the “NHAI” trademark and logo. Our license to use the “NHAI” trademark and logo may be terminated under certain circumstances and our ability to use the trademark and logo may be impaired.*

We do not own the “NHAI” trademark and “NHAI” logo, which is a trademark currently applied for by the Sponsor and which has been accepted and advertised by the Trademark Registry, Government of India. However, pursuant to a separate trademark and tradename license, the Sponsor has granted to the Trust, the non-transferable and non-assignable right to use the name of NHAI as part of the trade name of the Trust, as well as the Sponsor’s trademarks (“**Trademarks**”) in connection with the business of the Trust, on a non-exclusive basis, for the use in the Republic of India and globally. The license granted to the Trust in terms of the Trademark License Agreement shall be for a term of 1 (one) year from the date of such agreement, or such shorter period as may be mutually agreed to between the parties. The Trust’s right to use the Trademarks shall stand terminated with immediate effect if any of the terms of the license are breached. The Trust is using the Sponsor’s logo pursuant to the terms of the aforesaid trademark license, and does not separately hold any trademarks in its name. The termination or failure

to register its logo as a trademark in a timely manner may have a material, adverse effect on the operations of the Trust and require management's time and attention.

- 33. *We will depend on NHAI and various third parties to undertake certain activities in relation to the operation and maintenance of the InvIT Assets. Any delay, default or unsatisfactory performance by these third parties could materially and adversely affect our ability to effectively operate or maintain the InvIT Assets.***

We will depend on the availability and skills of NHAI and third-party employees and contractors pertaining to the operation and maintenance of the InvIT Assets. Under the Transitional Support Agreement, NHAI will provide support pertaining to the operation and maintenance of the InvIT Assets. When the Transitional Support Agreement expires, i.e. after a period of six months commencing from the appointed date as per the respective Concession Agreements, we will need to appoint third-party entities to undertake operations and maintenance and tolling, and the terms of these future contracts may not be favourable to us. We can also make no assurance that the services of such third parties will continue to be available at reasonable rates in the areas in which we conduct our operations. We may also be exposed to risks relating to the ability of such third parties to obtain requisite approvals for the operation and maintenance activities, as well as the quality of their services, equipment and supplies. In particular, failure to ensure the reliability and sustainability of toll collectors who are required to man the toll booths continuously may materially and adversely affect our overall level of net revenue. We may also be exposed to civil and criminal liability in relation to the actions of other third parties, including our employees and contractors.

Further, if we undertake limited development, while we may sub-contract our construction work, we may still be liable for accidents on our projects due to defects in design and quality of construction of our projects during their construction and operation. In addition, we can make no assurance that such contractors or their sub-contractors will continue to hold or renew valid registrations under the relevant labour laws in India or be able to obtain the requisite approvals for undertaking such construction and operation. Any delay, default or unsatisfactory performance by these third parties could materially and adversely affect our ability to manage the operation and maintenance of the InvIT Assets under the Concession Agreements in a timely manner or at all. Any of the foregoing factors could have a material, adverse effect on our business, financial condition, reputation and results of operations.

- 34. *The completion certificate and provisional completion certificate in respect of one of the InvIT Assets are not traceable and accordingly, alternate documents have been relied upon in relation to certain disclosures made in the Final Placement Memorandum.***

We are unable to trace the completion certificate and provisional completion certificate in respect of one of the InvIT Assets. Under these circumstances, we have relied on alternative documents such as the defects liability certificate dated May 17, 2010, issued by M/s Stanley Consultants Inc. in joint venture with M/s RITES Limited, certifying completion of all works on April 27, 2010, and the Technical Reports in respect of Chittorgarh to Kota section in Rajasthan for upgrading of NH-76 of east west corridors undertaken by NHAI ("**Chittorgarh – Kota Project Highway**"). We cannot assure you that the information relating to completion of the works in connection with the Chittorgarh – Kota Project Highway included in "*Regulatory Approvals*" are true and accurate. For details, please see the section entitled "*Regulatory Approvals*" on page 262.

- 35. *The Project SPV may be held liable for the payment of wages to the contract labourers engaged indirectly in our operations.***

The Project SPV may appoint independent contractors who, in turn, engage on-site contract labour to perform certain operations. The Project SPV will need to obtain registration as a principal employer under the Contract Labour (Regulation and Abolition) Act, 1970 ("**Contract Labour Act**") for certain locations where workmen would be employed through contractors or agencies licensed under the Contract Labour Act. Although the Project SPV does not engage these labourers directly, in the event of default by any independent contractor, the Project SPV may be held responsible for any wage payments that must be made to such labourers. Any violation of the provisions of the Contract Labour Act by the Project SPV may result in penalties pursuant to the provisions of the Contract Labour Act. If the Project SPV is required to pay the wages of the contracted workmen and subjected to other penalties under the Contract Labour Act, the reputation, results of operations, cash flows and financial condition of the Trust could be adversely affected.

36. *Significant differences exist between Indian GAAS used to prepare the Sponsor's Audited Financial Information and other accounting principles, such as Ind-As and IFRS, with which investors may be more familiar.*

The Sponsor has prepared its Audited Financial Information in accordance with Indian GAAS in accordance with the NHAI Act and the rules thereunder. The Sponsor has not attempted to quantify the impact of Ind-As or International Financial Reporting Standards ("IFRS") on the Audited Financial Information, nor will the Sponsor provide a reconciliation of our financial statements to those of IFRS or Ind-As. If we were to prepare our Audited Financial Information in accordance with such other accounting principles, our results of operations, financial condition and cash flows may be substantially different. Accordingly, the degree to which the Sponsor's Audited Financial Information will provide meaningful information is entirely dependent on your level of familiarity with Indian accounting practices under Indian GAAS. Any reliance by persons not familiar with such accounting practice on our financial disclosures presented in this Final Placement Memorandum should accordingly be limited. Persons not familiar with Indian accounting practices should, accordingly, consult their own professional advisors before relying on the financial disclosures presented in this Final Placement Memorandum.

Risks Related to the Trust's Relationships with the Sponsor and the Investment Manager

37. *The Sponsor, whose interests may be different from the other Unitholders, will be able to exercise significant influence over certain activities of the Trust.*

After the completion of the Offer, the Sponsor will own an aggregate of not less than 15.00% of the issued and outstanding Units and will be entitled to vote as a Unitholder on all matters other than matters where it is a related party and not permitted to vote under the InvIT Regulations. Although the Investment Manager has and will continue to have the requisite number of independent directors on its board of directors, the Sponsor will nonetheless be in a position to exercise significant influence in matters which require the approval of Unitholders by virtue of its ownership of Units in the Trust. The interests of the Sponsor may conflict with the interests of our other Unitholders and the Sponsor may, for business considerations or otherwise, seek to benefit itself instead of the Trust or the interests of the other Unitholders. The Sponsor will also exercise significant influence over the Project Manager, which is a wholly owned subsidiary of the Sponsor. Accordingly, the Project Manager may also be subject to conflicts of interest with respect to the Trust. These conflicts may be harmful to our interests or the interests of our other Unitholders, which may impact our business, financial condition and results of operations.

38. *The Investment Manager may not be able to implement its investment or corporate strategies and the fees payable to the Project Manager are dependent on various factors.*

The Investment Manager's strategies focus on three main areas:

- managing the underlying assets of the Trust;
- managing the Trust's acquisitions and disposals; and
- managing the Trust's capital structure to maximize distributions.

The Investment Manager is a newly incorporated entity and does not have any operational history of similar investment management or other activities in the infrastructure sector. There is no assurance that the Investment Manager will be able to implement these strategies successfully or that it will be able to expand our portfolio at any specified rate or to any specified size or to maintain distributions at projected levels. The Investment Manager may not be able to make acquisitions or investments on favourable terms or within a desired time frame, and it may not be able to manage the operations of its underlying assets in a profitable manner. Factors that may affect this risk may include, but are not limited to, changes in the regulatory framework in India, competition for assets, partial award of concessions or licenses favouring local or other competitors of the Trust, changes in the Indian regulatory or legal environment or macro-economic conditions. If the Investment Manager is unable to implement these strategies successfully or expand our portfolio, we will nonetheless be required to pay the Investment Manager an annual management fee, exclusive of taxes, in accordance with the terms of appointment of the Investment Manager.

Even if the Investment Manager is able to successfully grow the operating business of the underlying assets and to acquire toll roads and other eligible infrastructure projects in India as desired, there can be no assurance that the Investment Manager will achieve its intended return on such acquisitions or capital investments. Furthermore, the Investment Manager's investment mandate involves a higher level of risk as compared to a portfolio which

has a more diverse range of investments. The Investment Manager may only be removed by a resolution of Unitholders (excluding the Sponsor) such that the votes cast in favour of the resolution are not less than one-and-a-half times the votes cast against the resolution.

Accordingly, the fees payable to the Project Manager may vary each year based upon the operating and maintenance work that is actually required to be undertaken by the Project Manager with respect to the Project SPV, and accordingly, cannot be a flat rate or decided upfront for all periods. Additionally, any such payment of fees will be in the nature of a related party transaction and the approval of Unitholders will be required prior to making such a payment to the Project Manager. For further information, please see “*Overview of the Trust*” on page 24 of this Final Placement Memorandum.

39. *While the Sponsor had communicated its intention of transferring around 1500 km of roads, the Trust may be unable to bid effectively for them.*

In accordance with the approval granted by the Chairman of NHAI, by way of communication dated March 29, 2021, the Sponsor will offer around 1,500 km of roads in three years to the Trust (the “**Future Assets**”).

There can be no assurance that the Trust will be able to accurately or effectively assess the Future Assets on the basis of the information to it or in the time available, and its bids may provide to be uncompetitive. Furthermore, the Sponsor may accept or reject any binding offer made by the Trust, based on various factors regarding which the Trust may have no influence.

Access to future toll road assets sourced by the Sponsor or its existing or future subsidiaries will be an important source of growth in the future for the Trust, and any inability to bid competitively for Future Assets or the inability to win contracts from the Sponsor for their operation for any reason could have a material adverse effect on the Trust’s operations, financial condition or prospects.

40. *Parties to the Trust are required to maintain the eligibility conditions specified under Regulation 4 of the InvIT Regulations on an ongoing basis. The Trust may not be able to ensure such ongoing compliance by the Sponsor, the Investment Manager, the Project Manager and the Trustee, which could result in the cancellation of the registration of the Trust.*

Each of the parties to the Trust are required to maintain the eligibility conditions specified under Regulation 4 of the InvIT Regulations on an ongoing basis. These eligibility conditions include, among other things, that (a) the Sponsor, Investment Manager and Trustee are separate entities, (b) the Sponsor has a net worth of not less than ₹ 1,000 million and has a sound track record in the development of infrastructure or fund management in the infrastructure sector, (c) the Investment Manager has a net worth of not less than Rs. 100 million and has not less than five years’ experience in fund management or advisory services or development in the infrastructure sector or the combined experience of the directors, partners and employees of the investment manager in fund management or advisory services or development in the infrastructure sector is not less than 30 years, (d) the Trustee is registered with the SEBI under Securities and Exchange Board of India (Debenture Trustees) Regulations, 1993 and is not an associate of the Sponsor or Investment Manager and (e) each of the Sponsor, Investment Manager, Project Manager and Trustee are “fit and proper persons” as defined under Schedule II of the Intermediaries Regulations on an ongoing basis. The Trust may not be able to ensure such ongoing compliance by the Sponsor, the Investment Manager, the Project Manager and the Trustee, which could result in the cancellation of the registration of the Trust.

41. *The Investment Manager is required to comply with certain ongoing reporting and management obligations in relation to the Trust. There can be no assurance that the Investment Manager will be able to comply with such requirements.*

The Investment Manager is required to comply with certain ongoing reporting and management obligations in relation to the Trust in accordance with the InvIT Regulations. These requirements include, among other things, (a) making investment decisions with respect to the underlying assets or projects of the Trust, (b) overseeing the activities of the Project Manager, (c) investing and declaring distributions in accordance with the InvIT Regulations, (d) submitting reports to the Trustee and (e) ensuring the audit of the Trust’s accounts. There can be no assurance that the Investment Manager will be able to comply with such requirements in a timely manner or at all, which could subject the Investment Manager, the other parties to the Trust, the Trust or any person involved in the activity of the Trust to applicable penalties under the InvIT Regulations, the Intermediaries Regulations and/or the SEBI Act. Any such failure to comply or the imposition of any penalty could have a material adverse

effect on our business, financial condition and results of operations. Under the InvIT Regulations, the SEBI also has the right to inspect documents, accounts and records relating to the activity of the Trust, Project SPV or parties to the InvIT and may issue directions in the nature of, *inter alia*, (i) requiring the Trust to delist its Units and surrender its certificate of registration; (ii) requiring the Trust to wind-up; (iii) requiring the Trust to sell its assets; (iv) requiring the Trust or parties to the Trust to take such action as may be in the interest of investors; or (v) prohibiting the Trust or parties to the Trust from operating in the capital market or from accessing the capital market for a specified period.

42. *Our Investment Manager is wholly-owned and controlled by the GoI, which makes us susceptible to changes to its policies.*

The Investment Manager is currently wholly-owned and controlled by the President of India acting through the Ministry of Road Transport and Highways. Accordingly, the GoI will be able to exercise significant influence over the Investment Manager, its policies and affairs. Further, the GoI could require the Investment Manager to take actions aimed at serving the public interest, which may not be aligned with the commercial objectives of the unitholders.

43. *The InvIT Regulations allow for sponsors of listed InvITs to be declassified from the status of sponsors subject to certain conditions. There can be no assurance that our Sponsor will not exercise its ability to be declassified as the Sponsor of the Trust.*

The InvIT Regulations, pursuant to amendments made in June 2020, permit sponsors of listed infrastructure investment trusts to be declassified from the status of sponsors subject to compliance with the following conditions:

- (i) The units of the relevant InvIT should have been listed on the stock exchanges for a period of three years;
 - (ii) The unitholding of such sponsor and its associates taken together should not exceed 10.00% of the outstanding units of the relevant InvIT;
 - (iii) The investment manager of the relevant InvIT is not an entity controlled by such sponsor or its associates; and
 - (iv) approval of unitholders has been obtained in accordance with the InvIT Regulations.
- There can be no assurance that in the future, our Sponsor, upon fulfilment of the aforementioned conditions or any other conditions that SEBI prescribes for declassifications of sponsors, will not exercise its ability to declassify itself from the status of our Sponsor.

Risks related to India

44. *Changing laws, rules and regulations and legal uncertainties may materially and adversely affect our business, financial condition and results of operations.*

Our business, financial condition and results of operations could be materially and adversely affected by any change in laws or interpretations of existing, or the promulgation of new, laws, rules and regulations applicable to us and our business. There can be no assurance that the Government or State Governments will not implement new regulations and policies which will require the Trust Group to obtain additional approvals and licenses from governmental and other regulatory bodies or impose onerous requirements and conditions on our operations. The Investment Manager cannot predict the terms of any new policy, and there can be no assurance that such policy will not be onerous.

45. *Significant increases in the price or shortages in the supply of crude oil and products derived therefrom, including petrol and diesel fuel, could materially and adversely affect the volume of traffic at the projects operated by the Project SPV and the Indian economy in general, including the infrastructure sector.*

India imports a significant majority of its requirements of crude oil. Crude oil prices are volatile and are subject to a number of factors, including the level of global production and political factors, such as war and other conflicts, particularly in the Middle East, where a substantial proportion of the world's oil reserves are located. Any significant increase in the price of or shortages in the supply of crude oil could materially and adversely affect the volume of traffic at the projects operated by the Project SPV and materially and adversely affect the Indian economy in general, including the infrastructure sector, which could have a material, adverse effect on our business, financial condition and results of operations.

46. *We may be affected by competition law in India and any adverse application or interpretation of the Competition Act could materially and adversely affect our business.*

The Competition Act, 2002, as amended (the "**Competition Act**"), regulates practices having an appreciable adverse effect on competition in the relevant market in India. Under the Competition Act, any formal or informal arrangement, understanding or action in concert, which causes or is likely to cause an appreciable adverse effect on competition is considered void and results in the imposition of substantial monetary penalties. Further, any agreement among competitors which directly or indirectly involves the determination of purchase or sale prices, limits or controls production, supply, markets, technical development, investment or provision of services, shares the market or source of production or provision of services by way of allocation of geographical area, type of goods or services or number of customers in the relevant market or directly or indirectly results in bid-rigging or collusive bidding is presumed to have an appreciable adverse effect on competition. The Competition Act also prohibits abuse of a dominant position by any enterprise.

On March 4, 2011, the Government issued and brought into force the combination regulation (merger control) provisions under the Competition Act with effect from June 1, 2011. These provisions require acquisitions of shares, voting rights, assets or control or mergers or amalgamations that cross the prescribed asset-and turnover-based thresholds to be mandatorily notified to and pre-approved by the Competition Commission of India (the "**CCI**"). Additionally, on May 11, 2011, the CCI issued the Competition Commission of India (Procedure in regard to the transaction of business relating to combinations) Regulations, 2011, as amended, which set out the mechanism for implementation of the merger control regime in India. The Competition Act aims to, among other things, prohibit all agreements and transactions which may have an appreciable adverse effect on competition in India. Further, the CCI has extra-territorial powers and can investigate any agreements, abusive conduct or combination occurring outside India if such agreement, conduct or combination has an appreciable adverse effect on competition in India.

In the event, the Project SPV or the Trust enters into any agreements or transactions that have an appreciable adverse effect on competition in the relevant market in India, the provisions of the Competition Act will be applicable. Any prohibition or substantial penalties levied under the Competition Act could materially and adversely affect our financial condition and results of operations. Any adverse impact on our financial condition or operations due to the Competition Act may have a material adverse impact on our business, financial condition, results of operations and prospects and our ability to make distributions to the Unitholders.

47. *Any downgrading of India's debt rating by rating agencies could have a negative impact on our business.*

India's sovereign rating decreased from Baa2 with a "negative" outlook to Baa3 with a "negative" outlook by Moody's and from BBB with a "stable" outlook to BBB with a "negative" outlook (Fitch) in June 2020; and from BBB "stable" to BBB "negative" by DBRS in May 2020. India's sovereign rating could be downgraded due to various factors, including changes in tax or fiscal policy or a decline in India's foreign exchange reserves, which are outside our control. Any adverse revisions to India's credit ratings by rating agencies may adversely affect our ability to raise additional financing, and the interest rates and other terms at which such additional financing is available. This could materially and adversely affect our ability to obtain financing for capital expenditure, which could in turn materially and adversely affect our business, prospects, financial condition, results of operations and cash flows. India's sovereign debt rating could be downgraded due to various factors, including changes in tax or fiscal policy or a decline in India's foreign exchange resources, which are outside our control.

48. *Compliance with the European Union Directive on Alternative Investment Fund Managers may increase administrative and regulatory burdens on the Investment Manager and the Trust.*

As used herein, the "AIFMD" refers to Directive 2011/61/EU of the European Parliament and of the Council of June 8, 2011 on Alternative Investment Fund Managers, together with EU Commission delegated Regulation (EU) No. 231/2013 of December 19, 2012, supplementary Directive 2011/61/EU of the European Parliament and of the Council, and the national laws transposing Directive 2011/61/EU in any EEA Member State in which the Trust is marketed.

Among other things, the AIFMD regulates and imposes regulatory obligations in respect of the active marketing in the EEA by AIFMs (irrespective of whether they have their registered office in an EEA Member State or elsewhere) of AIFs (whether established in an EEA Member State or elsewhere). The Investment Manager is a Non-EEA AIFM for the purposes of the AIFMD. Non-EEA AIFMs are currently not able to become authorised under the AIFMD. In order to market to investors resident, domiciled or with a registered office in the EEA, non-

EEA AIFMs must market AIFs in accordance with the applicable national private placement regimes of the EEA member states in which they wish to market and comply with a sub-set of requirements under the AIFMD (which are much more limited in scope than those applicable to AIFMs that are established in the EEA). Such limited requirements are: (i) "point-of-sale" disclosures (as disclosed elsewhere), (ii) ongoing investor disclosures required pursuant to Articles 23(4) and (5) of the AIFMD (as to which, please see below), (iv) provision of information relating to the Trust's investments and its assets under management to the regulators of any EEA Member State into which Units in the Trust are actively marketed, and (v) the "asset-stripping" rules (in the event that the Trust acquires control of an EEA based portfolio company).

The information in respect of the Trust required to be disclosed pursuant to Articles 23(4) and (5) of the AIFMD will be made available to each Unitholder, as follows: (a) the percentage of the Trust's assets which are subject to special arrangements arising from their illiquid nature will be notified to the Unitholders; (b) any new arrangements for managing the liquidity of the Trust will be provided without undue delay in a disclosure notice delivered to each Unitholder; (c) the current risk profile of the Trust and the risk management systems employed by the Investment Manager to manage those risks may be provided in each annual report of the Trust; (d) any changes to the maximum level of leverage which the Investment Manager may employ on behalf of the Trust, as well as any right of the reuse of collateral or any guarantee granted under the leveraging arrangement, will be provided without undue delay in a disclosure notice delivered to each Unitholder; and (e) the total amount of leverage employed by the Trust may be provided in each annual report of the Trust.

In addition, it is possible that some EEA member states will elect in the future to restrict or prohibit the marketing of non-EEA AIFs to investors based in those jurisdictions. Any such restrictions or prohibitions may make it more difficult for the Trust to raise its targeted amount of commitments.

In light of the foregoing, the AIFMD could have an adverse effect on the Investment Manager or the Trust by, among other things, increasing the regulatory burden and costs of doing business in the EEA member states, imposing extensive disclosure obligations on companies located in EEA member states, if any, in which the Trust invests, and potentially disadvantaging the Trust as an investor in portfolio companies located in EEA member states as compared to competitors (e.g., those not in the alternative investment space) that may not be in scope of the AIFMD. ESMA has recently also consulted on the possible extension of the passport for marketing and managing under AIFMD to non-EEA based managers (the marketing and managing passports under AIFMD are currently only available to certain types of EEA based managers).

ESMA provided advice to the European Commission in July 2015 and July 2016 on whether, amongst other things, the passporting regime should be extended to the management and/or marketing of AIFs by non-EEA AIFMs. The European Commission is currently considering whether the passport should be extended. It is currently not clear what the impact would be for the Investment Manager or the Trust of any decision by the European Commission to extend the passporting regime. If the AIFMD national private placement regimes (where implemented) continue to exist in parallel with an extension of the passporting regime, then the Investment Manager may continue to market under AIFMD national private placement regimes, or choose to "opt-in" to rely on the passporting regime (which would likely mean an increase in regulatory and compliance costs to comply with the conditions of the passporting regime). If the AIFMD national private placement regimes are removed, then the Investment Manager would likely need to "opt-in" to the passporting regime for any AIFMD marketing of the Trust (which would likely mean an increase in regulatory and compliance costs for the Trust).

49. *Unitholders may not be able to enforce a judgment of a foreign court against the Trust or the Investment Manager.*

The enforcement of civil liabilities by overseas investors in the Units, including the ability to effect service of process and to enforce judgments obtained in courts outside of India, may be adversely affected by the fact that (i) the Trust is constituted under the laws of the Republic of India, (ii) the Investment Manager is a limited liability company incorporated under the laws of the Republic of India, (iii) the directors and key personnel of the Investment Manager reside in India and (iv) all of the assets of the Trust and the Investment Manager are located in India. All of the assets of the Trust and the assets of the Directors are also located in India. As a result, it may be difficult to serve process upon the Trust, the Investment Manager or any of these persons outside of India or to enforce in India judgments obtained against such persons in courts outside of India.

India is not a party to any international treaty in relation to the recognition or enforcement of foreign judgments. Recognition and enforcement of foreign judgments are provided for under Section 13, Section 14 and Section 44A of the Civil Procedure Code. The GoI has, under Section 44A of the Civil Procedure Code, notified certain

countries as reciprocating countries. Section 13 of the Civil Procedure Code provides that a foreign judgment will be conclusive regarding any matter directly adjudicated upon, between the same parties or between the parties whom they or any of them claim are litigating under the same title, except: (i) where the judgment has not been pronounced by a court of competent jurisdiction; (ii) where the judgment has not been given on the merits of the case; (iii) where it appears on the face of the proceedings that the judgment is founded on an incorrect view of international law or a refusal to recognise the law of India in cases in which such law is applicable; (iv) where the proceedings in which the judgment was obtained were opposed to natural justice; (v) where the judgment has been obtained by fraud; or (vi) where the judgment sustains a claim founded on a breach of any law in force then in India. Section 44A of the Civil Procedure Code provides that where a foreign judgment has been rendered by a superior court in any country or territory outside India, which the GoI has, by notification, declared to be a reciprocating territory, it may be enforced in India by proceedings in execution as if the judgment had been rendered by the relevant court in India. However, Section 44A of the Civil Procedure Code is applicable only to monetary decrees not being in the nature of any amounts payable in respect of taxes or other charges of a similar nature or in respect of a fine or other penalties and does not include arbitration awards. The United Kingdom and some other countries have been declared by the GoI to be a reciprocating territory for the purposes of Section 44A. However, the United States has not been declared by the GoI to be reciprocating territories for the purposes of Section 44A. A judgment of a court in the United States may be enforced in India only by a suit upon the judgment, subject to Section 13 of the Civil Procedure Code and not by proceedings in execution.

There may be considerable delays in the disposal of suits by Indian courts. It may be unlikely that a court in India would award damages on the same basis as a foreign court if an action is brought in India. Furthermore, it may be unlikely that an Indian court would enforce foreign judgments if it viewed the amount of damages awarded as excessive or inconsistent with the public policy in India. A party seeking to enforce a foreign judgment in India is required to obtain prior approval from the RBI to repatriate any amount recovered pursuant to execution and any such amount may be subject to income tax in accordance with applicable laws. Any judgment or award in a foreign currency would be converted into Indian Rupees on the date of the judgment or award and not on the date of the payment which could be subject to foreign exchange risk. Generally, there are considerable delays in the processing of legal actions to enforce a civil liability in India, and therefore it is uncertain whether a suit brought in an Indian court will be disposed of in a timely manner or subject to considerable delays.

Risks Related to Ownership of the Units

50. *The Trust may be dissolved, and the proceeds from the dissolution thereof may be less than the amount invested by the Unitholders.*

The Trust is an irrevocable trust registered under the Registration Act and it may only be extinguished (i) if it is impossible to continue with the Trust or if the Trustee, on the advice of the Investment Manager, deems it impracticable to continue with the Trust; (ii) on the written recommendation of the Investment Manager and upon obtaining the prior written consent of such number of the Unitholders as is required under the InvIT Regulations; (iii) if the Units of the Trust are delisted from the Stock Exchanges; (iv) if the SEBI passes a direction for the winding up of the Trust or the delisting of the Units; or (v) in the event the Trust becomes illegal. Under the Trust Deed, in the event of dissolution, the net assets of the Trust, remaining after settlement of all liabilities, and the retention of any reserves which the Trustee deems to be necessary to discharge contingent or unforeseen liabilities, shall be paid to the Unitholders. Should the Trust be dissolved, depending on the circumstances and the terms upon which assets of the Trust are disposed of, there is no assurance that a Unitholder will recover all or any part of his investment.

51. *The reporting requirements and other obligations of infrastructure investment trusts post-listing are still evolving. Accordingly, the level of ongoing disclosures made to and the protection granted to Unitholders may be more limited than those made to or available to the shareholders of a company that has listed its equity shares upon a recognized stock exchange in India.*

The InvIT Regulations, along with the guidelines and circulars issued by the SEBI from time to time, govern the affairs of infrastructure investment trusts in India. However, as compared to the statutory and regulatory framework governing companies that have listed their equity shares upon a recognized stock exchanges in India, the regulatory framework applicable to infrastructure investment trusts is relatively nascent and thus, still evolving. Pursuant to a circular dated November 29, 2016, the SEBI has prescribed certain continuous disclosure requirements that will be applicable to an InvIT after listing of its units.

Accordingly, the ongoing disclosures made to Unitholders under the InvIT Regulations may differ from those made to the shareholders of a company that has listed its equity shares upon a recognized stock exchange in India in accordance with the Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015. Further, the rights of the Unitholders may not be as extensive as the rights of the shareholders of a company that has listed its equity shares upon a recognized stock exchange in India, and accordingly, the protection available to the Unitholders may be more limited than those available to such shareholders.

52. *Any additional debt financing or issuance of additional Units may have a material, adverse effect on the Trust's distributions, and your ability to participate in future rights offerings may be limited.*

The Investment Manager may require additional debt financing or the issuance of additional Units in order to support the operating business or to make acquisitions and investments. If obtained, any such additional debt financing may decrease distributable income, and any issuance of additional Units may dilute existing Unitholders' entitlement to distributions.

We are not required to offer pre-emptive rights to existing Unitholders when issuing new Units. Compliance with securities laws or other regulatory provisions in some jurisdictions may prevent certain investors from participating in any future rights issuances and thereby result in dilution of their existing holdings in Units.

53. *The Trust may be unable to dispose of its non-performing assets in a timely manner.*

Due to the nature of its structure, the Trust may be unable to dispose of its non-performing assets in a timely manner, or at all. As a result, no assurance can be given that the Trust may be able to adapt to market developments, changes in asset quality, or adverse macroeconomic factors in a way comparable to, or competitive with, its competitors or more traditional corporate entities in general. Any ability to dispose of non-performing assets may in turn adversely affect the financial condition, business and prospects of the Trust, as well as distributions that the holders of the Units may receive from the Trust.

54. *Fluctuations in the exchange rate of the Indian Rupee with respect to the U.S. Dollar or other currencies will affect the foreign currency equivalent of the value of the Units and any distributions.*

Fluctuations in the exchange rates between the Indian Rupee and other currencies will affect the foreign currency equivalent of the Indian Rupee price of the Units. Such fluctuations will also affect the amount that holders of the Units will receive in foreign currency upon conversion of any cash distributions or other distributions paid in Indian Rupees by us on the Units, and any proceeds paid in Indian Rupees from any sale of the Units in the secondary trading market.

55. *Unitholders are unable to require the redemption of their Units.*

Unitholders will not have the right to redeem Units or request or require the redemption of Units by the Investment Manager while the Units are listed on the Stock Exchanges, although the Trust Deed provides that the Investment Manager may repurchase Units at its sole discretion if it has obtained the prior approval of Unitholders in a general meeting by passing an ordinary resolution in accordance with the Trust Deed but subject to other requirements of the relevant laws, regulations and guidelines imposed by authorities in India.

56. *The Units have never been publicly traded and the listing of the Units on the Stock Exchanges may not result in an active or liquid market for the Units.*

There is no public market for the Units prior to the Offer and an active public market for the Units may not develop or be sustained after the Listing Date. Listing and quotation does not guarantee that a trading market for the Units will develop or, if a market does develop, that there will be liquidity of that market for the Units. Accordingly, prospective Unitholders should view the Units as illiquid and must be prepared to hold their Units for an indefinite length of time.

57. *Any future issuance of Units by us or sales of Units by the Sponsor or any of other significant Unitholders may materially and adversely affect the trading price of the Units.*

Any future issuance of Units by us could dilute investors' holdings of Units. Any such future issuance of Units may also materially and adversely affect the trading price of the Units, and could impact our ability to raise capital

through an offering of our securities. There can be no assurance that we will not issue further Units. In addition, any perception by investors that such issuances might occur could also affect the trading price of the Units. Units will be tradable on the Stock Exchanges. If the Sponsor (following the lapse of its lock-up arrangements or pursuant to any applicable waivers), directly or indirectly, sells or is perceived as intending to sell a substantial number of its Units, or if a secondary offering of the Units is undertaken, the market price for the Units could be materially and adversely affected. These sales may also make it more difficult for us to raise capital through the issue of new units at a time and at a price we deem appropriate.

58. *Our rights and the rights of the Unitholders to recover claims against the Investment Manager or the Trustee are limited.*

Under the Investment Management Agreement, the Investment Manager is not liable for, among other things, any action or omission, if it has carried out its duties and exercised its powers with reasonable skill and care expected of an investment manager (except in the case of fraud, negligence or wilful misconduct). Pursuant to the Trust Deed, the Trustee is not liable for anything done or omitted to be done or suffered by the Trustee in good faith. Further, the Trustee is not liable for any action or omission that results in any depletion in the value of the trust fund and consequent losses of the Unitholder, except in situations where such depletion is a result of the gross negligence or wilful default on the part of the Trustee. The Investment Management Agreement provides that the Investment Manager is entitled to be indemnified out of the Trust Fund against all taxes and other liabilities, claims, costs, losses, damages and expenses (including reasonable attorney's fees and costs) ("**Losses**") incurred in connection with the Trust, unless arising out of gross negligence, dishonest acts or commissions or omissions, wilful misfeasance, reckless disregard of duty or breach of duties under the Investment Management Agreement. As a result, the Trust's rights and the rights of the Unitholders to recover claims against the Investment Manager are limited. Furthermore, recourse to the Trustee may be limited under the Trust Deed. The Trust Deed provides for the indemnification of the Trustee and the Investment Manager for all Losses, except Losses incurred due to any gross negligence, default, breach of duty or trust, or a failure to show a requisite degree of diligence and care. Accordingly, the liability of the Investment Manager and the Trustee are limited under the terms of these agreements and the Unitholders may not be able to recover claims against the Trustee or the Investment Manager, including claims with respect to any offer documents relating to the Offer.

Further, pursuant to the Trust Deed, the Trustee is not under any obligation to institute, acknowledge the service of, appear in, prosecute or defend any action, suit, proceeding or claim, which in its opinion might involve it in expense or liability that exceeds the value of the fund. The Trust (acting through the Trustee) and the Investment Manager intend to apply the proceeds of the Offer towards the objects set out in this Final Placement Memorandum. Accordingly, the Net Proceeds may not be sufficient to recover claims, including claims with respect to any offer documents in relation to the Offer.

59. *Information and the other rights of Unitholders under Indian law may differ from such rights available to equity shareholders of an Indian company or under the laws of other jurisdictions.*

The Trust Deed and various provisions of Indian law govern our corporate affairs. Legal principles relating to these matters and the validity of corporate procedures, fiduciary duties and liabilities, and Unitholders' rights may differ from those that would apply to a company in India or a trust in another jurisdiction. Unitholders' rights and disclosure standards under Indian law may also differ from the laws of other countries or jurisdictions. See the section headed "*Rights of Unitholders*" on page 284 of this Final Placement Memorandum.

60. *The price of the Units may decline after the Listing Date.*

The Offer Price has been determined by the Investment Manager in consultation with the Lead Managers. The Offer Price may not be indicative of the market price of the Units upon completion of the Listing. The market price of the Units may also be highly volatile and could be subject to wide fluctuations. If the market price of the Units declines significantly, investors may be unable to resell their Units at or above their purchase price, if at all. There can be no assurance that the market price of the Units will not fluctuate or decline significantly in the future. The market price of the Units will depend on many factors, including, among others:

- the perceived prospects of our business and investments and the market for toll roads and other infrastructure projects;
- differences between our actual financial and operating results and those expected by investors and analysts;
- the perceived prospects of future toll roads and other infrastructure projects that may be added to our portfolio in accordance with our investment mandate;

- changes in research analysts' recommendations or projections;
- changes in general economic or market conditions;
- the market value of our assets;
- the perceived attractiveness of the Units against those of other business trusts, equity or debt securities;
- the balance of buyers and sellers of the Units;
- the size and liquidity of the Indian business trusts market;
- any changes to the regulatory system, including the tax system, both generally and specifically in relation to India business trusts;
- the ability of the Investment Manager to implement successfully its investment and growth strategies;
- foreign exchange rates;
- broad market fluctuations, including increases in interest rates and weakness of the equity and debt markets;
- variations in our quarterly operating results;
- difficulty in assessing our performance against either domestic or international benchmarks, as there are few listed comparables;
- publication of research reports about us, other road businesses, the road industry in general or other relevant sectors, or the failure of securities analysts to cover the Units after the Total Issue;
- additions or departures of key management personnel of the Trust and/or the Trust Group;
- changes in the amounts of our distributions, if any, and changes in the distribution payment policy or failure to execute the existing distribution policy;
- actions by Unitholders;
- changes in market valuations of similar business entities or companies;
- announcements by us or our competitors of significant contracts, acquisitions, disposals, strategic partnerships, joint ventures or capital commitments;
- speculation in the press or investment community; and
- changes or proposed changes in laws or regulations affecting the road industry and infrastructure development in India or enforcement of these laws and regulations, or announcements relating to these matters.

To the extent that we retain operating cash flow for investment purposes, working capital reserves or other purposes, these retained funds, while increasing the value of our underlying assets, may not correspondingly increase the market price of the Units. Our failure to meet market expectations with regard to future earnings and cash distributions may materially and adversely affect the market price of the Units.

Where new Units are issued at less than the market price of the Units, the value of an investment in the Units may be affected. In addition, Unitholders who do not, or are not able to, participate in the new issuance of Units may experience a dilution of their interest in the Trust. In addition, the Units are not capital-safe products and there is no guarantee that Unitholders can regain the amount invested, in full or in part. If the Trust is extinguished, it is possible that investors may lose a part or all of their investment in the Units.

Risks Related to Tax

61. Unitholders should consider the impact of U.S. Foreign Account Tax Compliance Act withholding.

Pursuant to certain provisions of the U.S. Internal Revenue Code of 1986, commonly known as FATCA, a “foreign financial institution” may be required to withhold on certain payments it makes (“foreign passthru payments”) to persons that fail to meet certain certification, reporting, or related requirements. A number of jurisdictions, including India, have entered into, or have agreed in substance to, intergovernmental agreements with the United States to implement FATCA (“IGAs”), which modify the way in which FATCA applies in their jurisdictions. Certain aspects of the application of the FATCA provisions and IGAs to instruments such as the Units, including whether withholding would ever be required pursuant to FATCA or an IGA with respect to payments on instruments such as the Units, are uncertain and may be subject to change. Even if withholding would be required pursuant to FATCA or an IGA with respect to payments on instruments such as the Units, proposed regulations have been issued that provide that such withholding would not apply prior to the date that is two years after the date on which final regulations defining “foreign passthru payments” are published in the U.S. Federal Register. In the preamble to the proposed regulations, the U.S. Treasury Department indicated that taxpayers may rely on these proposed regulations until the issuance of final regulations. Holders should consult their own tax advisors regarding how these rules may apply to their investment in the Units.

62. *The Trust may be classified as a passive foreign investment company for U.S. federal income tax purposes, which could subject U.S. holders of Units to significant adverse tax consequences.*

The Trust may be classified as a passive foreign investment company ("PFIC") for a particular taxable year if, after the application of certain "look-through" rules, either (i) 75% or more of its gross income is "passive income" as that term is defined in the relevant Code provisions or (ii) 50% or more of the value (determined on the basis of a quarterly average) of its assets are considered "passive assets" (generally, assets that generate "passive income" or are held for the production of "passive income"). The determination of PFIC status is an annual determination, cannot be made until the close of a taxable year, involves extensive factual investigation, including ascertaining the fair market value of all assets on a quarterly basis and the character of each item of income earned, and is subject to uncertainty in several respects. The Trust has not made, and does not expect to make, any determination as to its potential classification as a PFIC during any taxable year. If the Trust were to be treated as a PFIC, material adverse tax consequences could result for U.S. Holders (as defined below under "Tax Considerations—United States"), including with respect to any gain realized on the sale, exchange or disposition of the Units and on the receipt of certain "excess distributions" received with respect to the Units, and certain additional reporting requirements may apply. U.S. Holders should consult their own tax advisers regarding the potential application of the PFIC rules and should read the discussion below under "Tax Considerations—United States".

63. *Some of our roads assets enjoy certain benefits under Section 80-IA of the Income Tax Act and any change in these tax benefits applicable to us may materially and adversely affect our results of operations.*

Currently, surface transport infrastructure development projects, including toll-road concession projects, enjoy certain benefits under Section 80-IA of the Income Tax Act. In accordance with and subject to the condition specified in this section, the Project SPV is entitled to certain benefits for all of the operational infrastructure projects and would be entitled to a deduction of 100% of the profits derived from the development or operation and maintenance or development, operation and maintenance of the toll roads for any 10 consecutive tax assessment years out of 20 years, beginning from the year in which the Project SPV develops and begins to operate the infrastructure facility. The incentives for Section 80-IA of the Income Tax Act are available for a period of 10 consecutive tax years out of a block of 20 years from the year of commencement of operations. However, the Project SPV would be liable to pay tax on their respective book profits under the MAT Provisions at the rate of 18.5% (plus applicable surcharge and cess). When the tax incentives expire or terminate, our tax liability may increase, thereby impacting our profitability. Further, the India tax authorities may disallow the deduction availed if the conditions specified are not complied with or the computation of the profits and gains of the eligible business is not in accordance with the manner prescribed and there is no assurance that such projects will continue to enjoy the tax benefits. This may affect the overall tax liabilities of the Project SPV and result in significant additional taxes becoming payable thereby resulting in a material, adverse effect on our business, financial condition, cash flows and results of operations and consequently may have a material, adverse impact on our distributions.

64. *Tax laws are subject to changes and differing interpretations, which may materially and adversely affect our operations.*

Tax laws and regulations are subject to differing interpretations by tax authorities. Differing interpretations of tax and other fiscal laws and regulations may exist within governmental ministries, including tax administrations and appellate authorities, thus creating uncertainty and potential unexpected results. The degree of uncertainty in tax laws and regulations, combined with significant penalties for default and a risk of aggressive action by the governmental or tax authorities, may result in tax risks in the jurisdictions in which we operate being significantly higher than expected. For instance, while the Investment Manager intends to take measures to ensure that it is in compliance with all relevant tax laws, there is no assurance that the tax authorities will not take a position that differs from the position taken by us with regard to our tax treatment of various items. Any of the above events may result in a material, adverse effect on our business, financial condition, results of operations and/or prospects and our ability to make distributions to the Unitholders.

65. *Changes in legislation or the rules relating to such tax regimes and surcharges could materially and adversely affect our business, prospects and results of operations.*

The Finance Act, 2020 has been granted assent by the President of India on March 27, 2020. The Finance Act has amended the definition of 'business trusts', and also abolished the dividend distribution tax regime as applicable to companies and has shifted the incidence of taxation of dividend on the shareholder or unitholders. For further

details, please refer to the risk factor titled “*Investors may be subject to Indian taxes arising out of capital gains on the sale of Units and on any dividend or interest component of any returns from the Units*” on page 87 below. There have been two recent major reforms in Indian tax laws, namely the introduction of the Goods and Services Tax (“GST”) and provisions relating to general anti-avoidance rules (“GAAR”). The GST regime came into effect on July 1, 2017, combining taxes and levies by the Government and State Governments into a unified rate structure.

Additionally, there is limited clarity on the availability of input tax credit, and any unfavourable orders in this regard may have a material adverse impact on our financial position and cash flows. Further, any application of existing law or future amendments may affect our overall tax efficiency, and may result in significant additional taxes becoming payable.

Tax laws and regulations are subject to differing interpretations by tax authorities. Differing interpretations of tax and other fiscal laws and regulations may exist within governmental ministries, including tax administrations and appellate authorities, thus creating uncertainty and potential unexpected results. The degree of uncertainty in tax laws and regulations, combined with significant penalties for default and a risk of aggressive action by the governmental or tax authorities, may result in tax risks being significantly higher than expected.

The GAAR regime came into effect on April 1, 2017. The tax consequences of the GAAR provisions being applied to an arrangement could result in denial of tax benefit, among other consequences. In the absence of any precedents on the subject, the application of these provisions is uncertain. If the GAAR provisions are made applicable to the Trust or any member of the Trust, it may have a material adverse tax impact on the Trust.

Such transactions are declared as impermissible avoidance arrangements and the consequence in relation to tax arising from such arrangements, including denial of a tax benefit or a benefit under a tax treaty, shall be determined according to the circumstances of the case. The rules notified with respect to GAAR prescribe that these shall not be applicable to FIIs in accordance with the SEBI (Foreign Institutional Investors) Regulations, 1995 subject to the fulfilment of certain conditions. GAAR may have a material adverse tax impact on the Trust, the Sponsor and the Unitholders.

The Investment Manager has not determined the impact of such existing or proposed legislations on our business. Uncertainty in the applicability, interpretation or implementation of any amendment to, or change in, governing law, regulation or policy, including by reason of an absence, or a limited body, of administrative or judicial precedent may be time consuming as well as costly for us to resolve, and may impact the viability of our current business or restrict our ability to grow our business in the future.

66. *The Ministry of Finance, GoI, has constituted a task force to draft new direct tax legislation, the provisions of which may have an unfavourable implication for us.*

The Ministry of Finance, GoI, has set up a panel to review the Income Tax Act and to draft a new direct tax legislation (“Panel”). The Panel has been tasked with drafting appropriate direct tax legislation aimed at (i) aligning India’s domestic direct tax regime in line with international best practices; and (ii) ensuring and encouraging compliance. The impact of the report by the Panel, including findings and recommendations in their report and the provisions of the proposed direct tax legislation could have an unfavourable implication on us. Since the Panel and its report, including their recommendations and the draft of the new direct tax legislation has not been released yet, the possible impact on us is not clear.

67. *Investors may be subject to Indian taxes arising out of capital gains on the sale of Units and on any dividend or interest component of any returns from the Units.*

Under current Indian tax laws, units of a business trust held for more than 36 months are considered as long term capital assets. In case of sale of such units through a recognised stock exchange in India and payment of securities transaction tax (“STT”), any gain arising in excess of ₹ 0.10 million is subject to long term capital gains tax at a concessional rate of 10% (plus applicable surcharge and cess). However, if the said units are sold in any other manner, the same shall be subject to long term capital gains tax at the rate of 20% with indexation benefit (plus applicable surcharge and cess).

In case the units are held for less than or up to 36 months, the same shall be regarded as short term capital asset. Any gain arising in case of sale of such units through a recognised stock exchange in India and subject to payment of STT, is subject to short term capital gains tax at concessional rate of 15% (plus applicable surcharge and cess).

However, if the said units are sold in any other manner, the same shall be subject to short term capital gains tax at applicable tax rates of the holder (plus applicable surcharge and cess).

The aforesaid taxability in India is subject to tax treaty benefits in the case of a non-resident holder.

The Finance Act, 2020 amended the Income Tax Act to abolish the dividend distribution tax regime and shift the incidence of taxation of dividend (declared or distributed on or after April 1, 2020) to shareholder. Under the Finance Act, 2020, a distribution made by a business trust, being in nature dividend income received from a special purpose vehicle, will not be subject to tax in the hands of a unitholder, so long as the special purpose vehicle has not opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the Income Tax Act. Similarly, a business trust (which includes an infrastructure investment trust) will not be required to withhold tax on any distributions which are in the nature of dividend income received from a special purpose vehicle, so long as such special purpose vehicle has not opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the Income Tax Act. However, where the special purpose vehicle opts to pay tax under Section 115BAA of the Income Tax Act, dividend income distributed by the business trust would be taxed in the hands of a non-resident unitholder at 20% (plus applicable surcharge and cess) or the applicable treaty rate and at the ordinary rate for a resident unitholder. Further, the business trust would be required to withhold tax on such distributions made from dividend received from the special purpose vehicle. Thus, the taxability of dividends distributed by the Trust will depend on the taxation regime opted by the Project SPV.

Further, the Government of India has notified the Finance Act, 2021 (“**Finance Act**”) which has introduced various amendments to taxation laws in India. Further, as announced in the previous budget, the dividend distribution tax regime was abolished and replaced with dividend withholding tax regime. However, the procedural provisions regarding exemption of withholding tax in relation to dividend distribution by Special Purpose Vehicles (SPVs, as defined under IT Act) to InvIT were absent. In this regard, the Finance Act has exempted withholding of taxes on dividend distributions by SPVs to InvITs. Please note that such amendment is proposed to take effect retrospectively from April 1, 2020.

Furthermore, the Trust might not be able to pay or maintain the levels of distributions or ensure that the level of distributions will increase over time, or that future acquisitions will increase the Trust’s distributable free cash flow to the Unitholders. Any reduction in, or elimination or taxation of, payments of distributions could materially and adversely affect the market price of the Units.

GENERAL INFORMATION

National Highways Infra Trust

National Highways Infra Trust (“**Trust**”) was settled on October 19, 2020, in New Delhi pursuant to the Trust Deed as a contributory irrevocable trust in accordance with the Indian Trusts Act, 1882. The Trust was registered with SEBI on October 28, 2020, under Regulation 3(1) of the InvIT Regulations and has obtained a certificate of registration from SEBI bearing number IN/InvIT/20-21/0014. The principal place of business of the Trust is situated at G - 5 & 6, Sector 10, Dwarka, New Delhi – 110 075.

The Trust is an infrastructure investment trust established for making investments in special purpose vehicles as defined under Regulation 2(1)(zy) of the InvIT Regulations, or infrastructure projects or securities of Indian companies engaged in the infrastructure sector, as may be permitted in terms of Regulation 18(5) of the InvIT Regulations. For information on the background of the Trust and the description of the InvIT Assets, please see the sections entitled “*Overview of the Trust*” and “*Our Business*” on pages 24 and 155, respectively.

Compliance Officer of the Trust

The Compliance Officer is Smt. Gunjan Singh. Her contact details are as follows:

Smt. Gunjan Singh

Address: G-5 & 6,
Sector – 10,
Dwarka, New Delhi – 110 075
Tel: +91 11-2507 4100 Extn: 1671
Fax: +91 11 2507 6536
E-mail: cs.nhim@nhai.org

Bidders can contact the Compliance Officer or the Registrar to the Offer in case of any pre-Offer or post-Offer related problems such as non-receipt of Allotment Advice/letter of Allotment, non-credit of Allotted Units in the respective beneficiary account, non-receipt of refund orders and non-receipt of funds by electronic mode.

The Sponsor – National Highways Authority of India

Head office and address for correspondence:

G-5 & 6,
Sector – 10,
Dwarka, New Delhi – 110 075

Contact Person of the Sponsor

Shri S.Q. Ahmad, General Manager (Finance) is the contact person of the Sponsor. His contact details are as follows:

Shri S.Q. Ahmad

G-5 & 6,
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Dwarka, New Delhi – 110 075
Tel: +91 11 2507 4100 / 4200 Extn: 1306
Fax: +91 11 2509 3605
Email: sqahmad@nhai.org
Website: www.nhai.gov.in

The Investment Manager - National Highways Infra Investment Managers Private Limited

Registered office and address for correspondence:

G - 5 & 6,
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Fax: +91 11 2509 3605
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Contact Person: Shri Suresh Goyal

The Project Manager – National Highways InvIT Project Managers Private Limited

Registered office and address for correspondence

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New Delhi – 110075
Tel: +91 11 2507 4100 Ext: 1641
Contact Person: Shri Bugatha Muralidhara Rao

The Trustee – IDBI Trusteeship Services Limited

Registered Office and correspondence address

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Tel: (+91) (11) 45708885, 8097474713
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E-mail: delhiitsl@idbitrustee.com
Contact Person: Deepak Kumar
Website: [http:// www.idbitrustee.com](http://www.idbitrustee.com)

Other Parties involved in the Trust

Auditors

A.R. & Co.

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E-mail: ar_co1981@yahoo.co.in, pawankgoel1@gmail.com
Contact Person: CA. Pawan K Goel
Firm Registration No: 002744C
Peer Review No: 011988

Valuer

RBSA Valuation Advisors LLP

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E-mail: ravishu.shah@rbsa.in
Website: www.rbsa.in
Firm Registration No: IBBI/RV-E/05/2019/110
Contact Person: Ravishu Vinod Shah

Technical Consultant

Técnica Y Proyectos, S.A. (TYPESA) In JV with Avanza Engineering Private Limited

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Website: www.typsa.com
E-mail: admin@avanzaindia.com
Contact person: Akash Bhatnagar

Traffic Consultants

Ramboll India Private Limited

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Lead Managers to this Offer

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Fax: +91 22 2218 8332
Email: nhaiinvit@sbicaps.com
Website: www.sbicaps.com
Investor Grievance Email: investor.relations@sbicaps.com
Contact person: Mandeep Singh
SEBI Registration No: INM000003531

ICICI Securities Limited

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Website: www.icicisecurities.com
Investor Grievance Email: customercare@icicisecurities.com
Contact person: Rupesh Khant
SEBI Registration No: INM000011179

Kotak Mahindra Capital Company Limited

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Fax: +91 22 6713 2445
E-mail: nhai.invit@kotak.com
Investor Grievance E-mail: kmccredressal@kotak.com
Contact Person: Ganesh Rane
Website: www.investmentbank.kotak.com
SEBI Registration No.: INM000008704

Escrow Collection Bank

Axis Bank Limited

G03G04, HL Arcade, Sector-5 (MLU),

Plot No 14, Dwarka,
New Delhi – 110 075
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E-mail: dwarka.branchhead@axisbank.com
Contact Person: Prashant Kumar Sinha
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Indian legal counsel to the Lead Managers

Cyril Amarchand Mangaldas

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International Legal counsel to the Trust and the Sponsor as to United States Federal Securities law

Linklaters Singapore Pte. Ltd.

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Registrar and Transfer Agent

KFin Technologies Private Limited

(Formerly known as “Karvy Fintech Private Limited”)

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Investor Grievance E-mail: einward.ris@kfintech.com
Website: www.kfintech.com
Contact Person: M Murali Krishna
SEBI Registration No.: INR000000221

Credit Rating Agencies

CARE Ratings Limited

A Wing Kanakia Wall Street,
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E-mail: rajashree.murkute@careratings.com
Website: www.careratings.com
Contact Person: Rajashree Murkute, Director
SEBI Registration Number: IN/CRA/004/1999

India Ratings and Research Private Limited

Wockhardt Towers, 4th floor,
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Contact Person: Arunima Basu, Compliance Officer
SEBI Registration Number: IN/CRA/002/1999

PARTIES TO THE TRUST

A. The Sponsor – National Highways Authority of India

History and Certain Corporate Matters

NHAI is an autonomous body under MoRTH, and was established on June 15, 1989, by the NHAI Act, as a body corporate, having a perpetual succession and common seal. It was made operational in February, 1995, with the appointment of the Chairman and other Members. NHAI is responsible for the development, maintenance and management of the national highways in India entrusted to it by the Central Government.

NHAI has an all India presence through its different offices (regional offices/project implementation units/corridor management units) in different cities. The functioning of NHAI is governed by NHAI Act, and the rules and regulations framed thereunder.

Background of the Sponsor

NHAI is an autonomous body under MoRTH. It is established and governed by the NHAI Act. NHAI is not a company in terms of the Companies Act, 2013 (or in terms of the Companies Act, 1956), and accordingly, does not have a share capital.

Pursuant to Section 17 of the NHAI Act, NHAI may receive additional capital and grants from the Central Government to discharge its functions. Additionally, NHAI has not issued any shares against such capital or grants invested by the Central Government.

As per Section 3(3) of the NHAI Act, NHAI shall consist of: (i) a chairman; (ii) not more than six full-time members; and (iii) not more than six part-time members, and each of the above shall be appointed by the Central Government by notification in the official gazette.

In accordance with the eligibility criteria specified under the InvIT Regulations, NHAI had a shareholders' fund of not less than ₹ 1,000 million as on March 31, 2021.

Further, neither the Sponsor nor any of the members of the Sponsor: (i) are debarred from accessing the securities market by SEBI; (ii) are promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; or (iii) are in the list of wilful defaulters published by the RBI.

B. The Trustee – IDBI Trusteeship Services Limited

History and Certain Corporate Matters

IDBI Trusteeship Services Limited is the Trustee of the Trust. The Trustee is a registered intermediary with SEBI under the Securities and Exchange Board of India (Debt Securities) Regulations, 1993, as a debt securities trustee. The Trustee has obtained a certificate of registration dated February 14, 2017 (having registration code IND000000460), which is valid until suspended or cancelled by SEBI. The Trustee was incorporated in India under the Companies Act, 1956 with corporate identity number U65991MH2001GOI131154. The Trustee was originally incorporated on March 8, 2001 at Mumbai, Maharashtra. The Trustee's registered office and principal place of business is situated at Asian Building, Ground Floor, 17, R. Kamani Marg, Ballard Estate, Mumbai 400 001, Maharashtra. The Trustee is jointly promoted by IDBI Bank Limited, Life Insurance Corporation and General Insurance Corporation for providing corporate and other trusteeship services.

Background of the Trustee

The Trustee is permitted to engage in the following activities: (a) to act as (i) a debt securities trustee; (ii) a security trustee or facility agent; (iii) a securitization trustee; (iv) a share pledge trustee or share monitoring agent; (v) an escrow agent; (vi) a venture capital fund trustee, trustee of an infrastructure investment trust or a trustee to an AIF; and (b) providing services including (i) safe keeping or locker services; (ii) management of private trusts or execution of wills; and (iii) special corporate services.

The Trustee confirms that it has maintained, and undertakes to ensure that it will at all times maintain, adequate infrastructure personnel and resources to perform its functions, duties and responsibilities with respect to the Trust, in accordance with the Trust Deed, the InvIT Regulations and other applicable law.

The Trustee is not an Associate of the Sponsor or the Investment Manager. Further, neither the Trustee nor any of the promoters or directors of the Trustee (i) are debarred from accessing the securities market by SEBI; (ii) are promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; or (iii) are in the list of wilful defaulters published by the RBI.

Board of Directors of the Trustee

The board of directors of the Trustee is entrusted with the responsibility for the overall management of the Trustee. Please see below the details in relation of the board of directors of the Trustee:

Sr. No.	Name	DIN
1.	Shri J. Samuel Joseph	02262530
2.	Shri Ravishankar G. Shinde	03106953
3.	Shri Madhuri J. Kulkarni	07787126
4.	Smt. Jayashree Ranade	09320683
5.	Smt. Padma Betai	00937921

Key Terms of the Trust Deed

The Trustee has entered into the Trust Deed, in terms of the InvIT Regulations, the key terms of which, are provided below:

1. Powers of the Trustee

The Trustee has been provided with various powers under the Trust Deed in accordance with the Indian Trusts Act, 1882 and the InvIT Regulations, including but not limited to:

- (i) The Trustee shall, in relation to the Trust, have every and all powers that a person competent to contract and acting as a legal and beneficial owner of such property has.
- (ii) The Trustee shall have the power to determine, in accordance with the Investment Management Agreement and the investment objectives of the Trust, distributions to Unitholders and other rights attached to the Units in compliance with the InvIT Regulations and applicable law.
- (iii) The Trustee shall oversee voting of the Unitholders in accordance with the InvIT Regulations.
- (iv) The Trustee shall have the power to do the following, which may be delegated to the Investment Manager:
 - (a) cause offering of the Units through any placement documents;
 - (b) cause any placement documents to be provided to the Bidders;
 - (c) issue and allot Units;
 - (d) summon and conduct meetings of the Unitholders; and
 - (e) approve transfer of the Units.
- (v) The Trustee shall be empowered to make investment decisions with respect to the underlying assets or projects of the Trust including any further investments or divestment, subject to InvIT Regulations. Further, the Trustee is also empowered to:
 - (a) acquire, hold, manage, trade and dispose of shares, stocks, convertibles, debentures, bonds

and other equity or equity-related securities and other debt or mezzanine securities of all kinds issued by any SPVs, infrastructure projects in India, falling within the investment objectives, whether in physical or dematerialised form, including power to hypothecate, pledge or create encumbrances of any kind to be used as collateral security for any borrowings by the Trust;

- (b) avail commercial loans, including the power to hypothecate, pledge or create encumbrances of any kind on the InvIT Assets as collateral security for any such loans availed by the InvIT;
 - (c) keep the capital and monies of the Trust on deposit with banks or other institutions whatsoever;
 - (d) accept contributions;
 - (e) collect and receive the profit, interest, repayment of principal of debt or debt like or equity or equity like, mezzanine securities, dividend, return of capital as and when the same may become due and receivable;
 - (f) invest in securities or in units of mutual funds in accordance with the InvIT Regulations and applicable law;
 - (g) invest in money market instruments including government securities, treasury bills, certificates of deposit and commercial paper in accordance with applicable law;
 - (h) to give, provide and agree to provide to any SPV financial assistance in the form of investment in the Trust's debt securities or share capital of any class including ordinary, preference, participating, non-participating, voting, non-voting or other class, and in the form of investment in securities convertible into share capital; and
 - (i) to invest, acquire, purchase, hold, divest, sale, hypothecate, pledge or otherwise transfer land and building and immovable property of any kind including any rights and interest therein.
- (vi) The Trustee shall have the power to make such reserves out of the income or capital as the Trustee may deem proper and any decisions of the Trustee whether made in writing or implied from its acts, so far as the applicable law may permit, shall be conclusive and binding on the Unitholders. Any distribution made by the Trust from such reserves shall be in terms of the Trust Deed;
- (vii) The Trustee shall have the power to employ and pay at the expense of the Trust, any agent in any jurisdiction whether attorneys, solicitors, brokers, banks, trust companies or other agents whether associated or connected in any way with the Trustee or not, without being responsible for the default of any agent if employed in good faith to transact any business, including without limitation, the power to appoint agents to raise funds, or do any act required to be transacted or done in the execution of the trusts hereof including the receipt and payment of moneys and the execution of documents.
- (viii) The Trustee shall, on behalf of the Trust, appoint an Investment Manager to manage the Trust.
- (ix) The Trustee shall oversee the activities of the Investment Manager and shall obtain a compliance certificate from the investment manager on a quarterly basis or such other time period as prescribed by applicable law.
- (x) The Trustee shall, on behalf of the Trust, appoint a Project Manager for the operation and management of the InvIT Assets.
- (xi) The Trustee shall oversee the activities of the Project Manager and shall obtain a compliance certificate from the project manager on a quarterly basis or such other time period as prescribed by applicable law.
- (xii) The Trustee may appoint any custodian in order to provide custodian services.
- (xiii) The Trustee shall have the power and duty to pay all such duties, fees or taxes (and any interest or

penalty chargeable thereon) as well as to create any reserves for future potential tax liability out of the Trust or the income thereof, as may be permitted under applicable law.

- (xiv) The Trustee shall, subject to the advice of the Investment Manager, have the power to pay Trust expenses out of the funds held by the Trust in accordance with the Trust documents.
- (xv) The Trustee shall have the power to take the opinion of legal or tax counsel in any jurisdiction concerning any disputes or differences arising under the Trust Deed or any matter relating to the Trust and the fees of such counsel shall be paid out of the funds held in the Trust.
- (xvi) The Trustee may sell, rent or buy any property, or borrow property from or carry out any other transaction with the trustees of any other trust or the executors or administrators of any estate provided that such power is delegated to, and exclusively exercised by the Investment Manager pursuant to the Investment Management Agreement.
- (xvii) The Trustee, in consultation with the Investment Manager, shall have the power to accept any property before the time at which it is transferable or payable, pay or allow any claim on any evidence, accept any security payable or immovable in lieu of any amounts payable to it, alter the dates for payment of any amounts payable to it and compromise, compound, abandon or otherwise settle any claim or thing whatsoever relating to the Trust of the Trust Deed.
- (xviii) The Trustee shall, subject to the advice of the Investment Manager, have the power to cause the Trust to borrow funds, including any subordinated equity, bonds or other fund from any person or authority on such terms and conditions and for such periods and for the purpose of the Trust and the InvIT Assets, subject to any approval of the Unitholders, and the power to provide such security for funds borrowed including by way of hypothecation, pledge or creation of encumbrances of any kind on the InvIT Assets as collateral security for any such borrowings.
- (xix) The Trustee may, subject to any advice of the Investment Manager, retain the proceeds received by the Trust from any InvIT Assets.
- (xx) The Trustee, in consultation with the Investment Manager, may make rules to give effect to and carry out the investment objectives. The Trustee may provide, not inconsistent with the provisions of the Trust Deed and the InvIT Regulations, for all or any of the following matters:
 - (a) manner of maintaining of the records and particulars of the Unitholders;
 - (b) norms of investment by the Trust in accordance with the investment objectives of the Trust and in accordance with the powers and authorities of the Trustee;
 - (c) matters relating to entrustment / deposit or handing over of any securities or SPVs of the Trust to any one or more custodians and the procedure relating to the holding thereof by the custodian;
 - (d) such other administrative, procedural or other matters relating to the administration or management of the affairs of the Trust and which matters are not by the very nature required to be included or provided for in the Trust Deed or by the management thereof;
 - (e) procedure for seeking the vote of the Unitholders either by calling a meeting or through postal ballot or otherwise; and
 - (f) procedure for summoning and conducting meetings of Unitholders.
- (xxi) The Trustee, whether by itself or through the Investment Manager, shall cause the depository to maintain the depository register in accordance with applicable law.
- (xxii) The Trustee shall advise the Investment Manager in relation to the appointment of valuer, auditors, registrar and transfer agent, merchant bankers, custodian, credit rating agency and any other intermediary or service provider or agent with respect to the activities pertaining to the Trust.

- (xxiii) The Trustee shall review the reports required in terms of the InvIT Regulations and applicable law, as submitted by the Investment Manager, follow-up with the Investment Manager and intimate to SEBI, as the case may be.
- (xxiv) The Trustee shall have the power to open one or more bank accounts for the purposes of the Trust, to deposit and withdraw money and fully operate the same.
- (xxv) The Trustee shall have the power to take up with SEBI or with the stock exchange(s) as applicable, any matter which has been approved in any meeting of Unitholders, if the matter requires such action, including any reorganisation or restructuring or rearrangement of the assets of the InvIT.
- (xxvi) The Trustee shall also have the following powers and authorities:
 - (a) to institute, conduct, compromise, compound, or abandon any legal proceedings for or on behalf of or in the name of the Trust or the Trustee, and to defend, compound or otherwise deal with any such proceedings against the Trustee or Trustee or its officers or concerning the affairs of the Trust, and also to compound and allow time for payment or satisfaction of any equity due and of any claims or demands by or against the Trust and observe and perform in relation to any decisions thereof;
 - (b) to make and give receipts, releases and other discharges for moneys payable to the Trust and for the claims and demands of the Trust;
 - (c) to enter into all such negotiations and contracts, and, execute and do all such acts, deeds and things for or on behalf of or in the name of the Trust as the Trustee may consider expedient;
 - (d) to sign, seal, execute, deliver and register according to law all deeds, documents, agreements, and assurances;
 - (e) to negotiate, sign, seal, execute and deliver the Trust documents, including but not limited to, any issue agreement, share purchase agreement, services agreement, deed of right of first offer, debenture subscription agreement, escrow agreement, underwriting agreement, loan documentation, placement documents or any other deed, agreement or document;
 - (f) take into their custody and/or control all the capital, assets, property of the Trust and hold the same in trust for the Unitholders in accordance with this Deed, the InvIT Regulations and applicable law; and
 - (g) generally to exercise all such powers as it may be required to exercise under the InvIT Regulations and applicable law for the time being in force and do all such matters and things as may promote the Trust or as may be incidental to or consequential upon the discharge of its functions and the exercise and enforcement of all or any of the powers and rights under the Trust Deed.
- (xxvii) The Trustee may at any time, buy-back the Units from the Unitholders, subject to applicable law.
- (xxviii) The Trustee may, delegate to any committee or any other person, any powers set out above and the duties set out below, provided, however, that the Trustee shall remain responsible and liable for any such persons' acts of commission or omission as determined by a court of competent jurisdiction whose decision is final, binding and non-appealable, except the roles and responsibilities delegated by the Trustee to Investment Manager, Project Manager or any third party expert, or any sub-delegation by the Investment Manager or the Project Manager.

2. *Duties of the Trustee*

The Trustee shall perform its duties as required under the Trust Deed in accordance with the Indian Trusts Act, 1882 and the InvIT Regulations, including but not limited to:

- (i) The Trustee shall carry on and conduct its business in a proper and efficient manner in the best interest of the Unitholders.

- (ii) The Trustee shall appoint an investment manager and project manager in accordance with the InvIT Regulations and applicable law.
- (iii) The Trustee shall, on behalf of the Trust, enter into the Investment Management Agreement with the Investment Manager.
- (iv) The Trustee shall ensure that the Investment Manager performs its obligations as specified below:
 - (a) The Trustee shall ensure that the Investment Manager complies with reporting and disclosure requirements in accordance with InvIT Regulations and in case of any delay or discrepancy, require the Investment Manager to rectify such delay or discrepancy on an urgent basis;
 - (b) The Trustee shall review the transactions carried out between the Investment Manager and its associates and where the Investment Manager has advised that there may be a conflict of interest, it shall obtain a certificate from a practising chartered accountant or valuer, as applicable, that such transaction is on arm's length basis;
 - (c) The Trustee shall review the valuation report submitted by the Investment Manager;
 - (d) The Trustee shall require the Investment Manager to set up such systems and procedures and submit such reports to the Trustee, as may be necessary for effective monitoring of the functioning of the Trust; and
 - (e) The Trustee shall ensure that the Investment Manager convenes meetings of the Unitholders in accordance with the InvIT Regulations and oversee the voting by Unitholders. The Trustee shall ensure that the Investment Manager convenes meetings of Unitholders not less than one every year and the period between such meetings shall not exceed 15 months.
- (v) The Trustee shall provide SEBI and the stock exchange(s), where applicable, such information as may be sought by SEBI or by the stock exchange(s) pertaining to the activity of the Trust. The Trustee shall comply with intimation requirements under the InvIT Regulations and applicable law, including in relation to intimating SEBI in case of any discrepancy in the operation of the InvIT with the InvIT Regulations and any placement documents. The Trustee shall also immediately inform SEBI in case any act which is detrimental to the interest of the Unitholders is noted.
- (vi) The Trustee shall at all times exercise due diligence in carrying out its duties and protecting the interests of the Unitholders.
- (vii) The Trustee shall delegate all such powers to the Investment Manager and the Project Manager as may be required to carry out obligations under the Investment Management Agreement, Project Implementation and Management Agreement and applicable law.
- (viii) The Trustee shall delegate all such powers to the Project Manager as may be required by the Project Manager to carry out its obligations under the Project Implementation and Management Agreement and under Applicable Law.
- (ix) The Trustee shall appoint a new investment manager in accordance with the InvIT Regulations and Applicable Law, in case of change in Investment Manager due to removal or otherwise, within the time period prescribed under the InvIT Regulations. The Trustee shall ensure that the new investment manager shall stand substituted as a party in all the documents to which the earlier investment manager was a party. The Trustee shall also ensure that the earlier investment manager continues to be liable for all its acts of omissions and commissions for the period during which it served as investment manager, notwithstanding its termination.
- (x) The Trustee shall appoint a new project manager in accordance with the InvIT Regulations and applicable law in case of change in Project Manager due to removal or otherwise. The Trustee shall appoint a new project manager within the time period prescribed under the InvIT

Regulations. The Trustee may, either *suo moto* or based on the advice of the concessioning authority(ies) appoint an administrator in connection with an infrastructure project for such terms and on such conditions as it deems fit. The Trustee shall ensure that the new project manager shall stand substituted as a party in all the documents to which the earlier project manager was a party. The Trustee shall also ensure that the earlier project manager continues to be liable for all its acts of omissions and commissions for the period during which it served as project manager, notwithstanding its termination.

- (xi) The Trustee shall obtain the prior approval from the Unitholders in accordance with the InvIT Regulations and from SEBI in case of change in control of the Investment Manager.
- (xii) The Trustee shall ensure that in case of change in control of the Project Manager, written consent is obtained from the concessioning authority(ies) in terms of the concession agreement(s), prior to such change, if applicable.
- (xiii) The Trustee shall ensure that subscription amount is kept in a separate bank account in name of the Trust and is only utilised for adjustment against allotment of Units or refund of money to the applicant till the time such Units are listed and the same will be utilised for objectives of the offering as will be mentioned in the relevant placement documents.
- (xiv) The Trustee shall cause the books of accounts of the InvIT to be in accordance with the Trust Deed.
- (xv) The Trustee shall ensure that all acts, deeds and things are done for the attainment of the investment objective of the Trust and in compliance with the InvIT Regulations and applicable law and to secure the best interests of the Unitholders.
- (xvi) The Trustee shall file such reports as may be required by SEBI or any other regulatory authority or as required under the InvIT Regulations and applicable law with regard to the activities carried on by the Trust.
- (xvii) The Trustee shall periodically review the status of the Unitholders' complaints and their redressal undertaken by the Investment Manager, in accordance with the InvIT Regulations.
- (xviii) The Trustee and its directors, officers, employees and agents shall at all times maintain the greatest amount of confidentiality as regards the activities and assets of the Trust and such other matters connected with them and the Trust generally and shall not disclose any confidential information to any other person, other than the Investment Manager, or the Project Manager, unless such information is required to be disclosed to some regulatory authority, court or any other person under any order of court or any law in force in India.
- (xix) The assets and liabilities of the Trust shall at all times be segregated from the assets and liabilities of the Trustee and the assets and liabilities of other trusts managed by the Trustee.
- (xx) The Trustee shall ensure that the Investment Manager shall ensure that a detailed valuation is undertaken of the InvIT assets by a valuer at such intervals and in the manner as may be prescribed under the InvIT Regulations and applicable law. The Trustee shall ensure that the remuneration of the valuer is not linked to or based on the value of the asset being valued.
- (xxi) The Trustee of the InvIT shall not invest in Units of the Trust.
- (xxii) The Trustee shall fulfil its obligations in terms of the InvIT Regulations.
- (xxiii) The Trustee shall ensure that the activity of the Trust is being operated in accordance with the provisions of the Trust Deed, the InvIT Regulations, applicable law and the Trust documents and in case of any discrepancy, it shall inform SEBI immediately in writing.
- (xxiv) The Trustee shall immediately inform SEBI in case any act which is detrimental to the interest of the Unitholders is noted.

(xxv) The Trustee shall maintain records in accordance with the InvIT Regulations and applicable law.

(xxvi) The Trustee shall wind up the Trust in accordance with the InvIT Regulations and applicable law.
Upon winding up of the Trust, the Trustee shall surrender the certificate of registration to SEBI.

3. *Rights of the Trustee*

The Trustee shall have the following rights:

- (i). The Trustee may, in the discharge of its duties, act upon any advice obtained in writing from any bankers, accountants, brokers, lawyers, professionals, consultants, or other experts acting as advisers to the Trustee.
- (ii). Subject to applicable law, no Unitholder shall be entitled to inspect or examine the Trust's premises or properties (including any holding company and SPVs) without the permission of the Trustee, who shall give such permission, if necessary, in consultation with the Investment Manager. Further, no Unitholder shall be entitled to require discovery of any information respecting any detail of the Trust's activities or any matter which may relate to the conduct of the business of the Trust and which information may, in the opinion of the Trustee and the Investment Manager adversely affect the interest of the Unitholder.
- (iii). The Trustee shall be entitled to reimburse itself and shall be entitled to charge the Trust, and shall be entitled to be indemnified and be kept indemnified from the Trust and from any distributions made by the Trust to the Unitholders, with the expenses, outgoings, taxes, levies, and liabilities (including indemnity obligations of the Trust, if any).
- (iv). The Trustee may accept as sufficient evidence for the value of any investment or for the cost price or sale price thereof or for any other fact within its competence, a certificate by a valuer or any other professional person appointed by the Investment Manager for the purpose.

4. *Liabilities of the Trustee*

The liabilities of the Trustee in terms of the Trust Deed are as follows:

- (i). The Trustee shall only be chargeable for such monies, stocks, funds and securities as the Trustee shall have actually received and shall not be liable or responsible for any banker, broker, custodian or other person in whose hands the same may be deposited or placed, nor for the deficiency or insufficiency in the value of any investments of the Trust nor otherwise for any involuntary loss. Any receipt signed by the Trustee for any monies, stocks, funds, shares, securities, investment or property, paid, delivered or transferred to the Trustee under or by virtue of the Trust Deed or in exercise of the duties, functions and powers of the Trustee shall effectively discharge the Trustee or the person or persons paying, delivering or transferring the same therefrom or from being bound to see to the application thereof, or being answerable for the loss or misapplication thereof provided that the Trustee and such persons shall have acted in good faith, without negligence and shall have used their best efforts in connection with such dealings and matters.
- (ii). The Trustee shall not be under any liability on account of anything done or omitted to be done or suffered by the Trustee in good faith if the Trustee is able to establish that it performed its rights and duties and exercised its powers, as a reasonable person in such a position would have, in compliance with the provisions of the Trust Deed and applicable law.
- (iii). The Trustee shall not be under any obligation to institute, acknowledge the service of, appear in, prosecute or defend any action, suit, proceedings or claim in respect of the provisions hereof or in respect of the InvIT assets or any part thereof or any corporate action which in its opinion would or might involve it in expense or liability unless the Investment Manager shall so request in writing and the Trustee is satisfied that the value of the investment is sufficient to provide adequate indemnity against costs, claims, damages, expenses or demands to which it may be put as Trustee as a result thereof. The costs in relation to such action, suit, proceedings or claims (whether undertaken upon request of Investment Manager or otherwise) incurred by the Trustee in connection with or arising out of the Trust, shall be borne by the Trust.

- (iv). The Trustee shall not be liable in respect of any action taken or damage suffered by it on reliance upon any notice, resolution, direction, consent, certificate, affidavit, statement, certificate of stock, plan of reorganization or (without being limited in any way by the foregoing) other paper or document believed to be genuine and to have been passed, sealed or signed by appropriate authorities or entities.
- (v). The Trustee shall not be liable to the Unitholders for doing or failing to do any act or thing which by reason of any provision of any present or future law or regulation made pursuant thereto, or of any decree, order or judgment of any court, or by reason of any request announcement or similar action (whether of binding legal effect or not) which may be taken or made by any person or body acting with or purporting to exercise the authority of any government (which legally or otherwise) it shall be directed or requested to do or perform or to forbear from doing or performing. If for any reason it becomes impossible or impracticable to carry out any of the provisions of these presents the Trustee shall not be under any liability therefore or thereby.
- (vi). The Trustee shall not be responsible to any Unitholder for the authenticity of any signature affixed to any document or be, in any way, liable for any forged or unauthorized signature on or for acting upon or giving effect to any such forged or unauthorized signature. The Trustee shall be entitled but not bound to require that the signature of any Unitholder to any document required to be signed by him under or in connection with these presents shall be verified to the Trustee's reasonable satisfaction.
- (vii). If the Trustee is required by the InvIT Regulations or any applicable law to provide information regarding the Trust or the Sponsor or the Unitholders, the investments made by the Trust and income therefrom and provisions of these presents and complies with such request in good faith, whether or not it was in fact enforceable, the Trustee shall not be liable to the Unitholders or to any other party as a result of such compliance or in connection with such compliance.
- (viii). The Trustee shall not incur any liability for any act or omission or (as the case may be) failing to do any act or thing which may result in a loss to a Unitholder (by reason of any depletion in the value of the InvIT assets or otherwise), except in the event that such loss is a direct result of fraud, gross negligence or wilful default on the part of the Trustee or results from a breach by the Trustee of this Deed, as determined by a court of competent jurisdiction.
- (ix). If the Trustee engages any external advisors or experts to discharge its obligations or undertakes any work (in consultation with the Investment Manager, in the interest of the Unitholders) which is not covered within the scope of work of the Trustee and such additional work is beyond the obligations of the Trustee under applicable law, the Trustee shall be entitled to recover such costs, charges and expenses which the Trustee may incur in this regard, from the funds of the Trust.
- (x). The liability of the Trustee shall be limited to the extent of the fees received by it, in all circumstances whatsoever except (a) in case of any negligence or misconduct or fraud on the part of the Trustee as may be determined by a court of competent jurisdiction, or (b) any failure on the part of the Trustee to protect the interests of the Unitholders.
- (xi). The exercise of all power and discretion by the Trustee shall be valid only if the same are carried out upon the approval of a majority of the directors on the board of the Trustee to any officer of the Trustee, if the exercise of such powers is within the parameters of such delegated authority.

5. *Provisions relating to Unitholders*

- (i). The aggregate liability of each Unitholder shall be limited to making the capital contribution payable by it in respect of the Units subscribed by it.
- (ii). Each Unit allotted to the Unitholders shall have one vote for any decisions requiring a vote of Unitholders and shall carry such rights as provided in the InvIT Regulations.
- (iii). No Unitholder shall enjoy preferential voting or any other rights over another Unitholder except as permitted under applicable law.

- (iv). In no event shall the Trustee or the Investment Manager be bound to make payment to any Unitholder, except out of the funds held by it for that purpose under the provisions of the Trust Deed.
- (v). A Unitholder whose name and account details are entered in the depository register shall be the only person entitled to be recognised by the Trustee as having a right, title, interest in or to the Units registered in his name and the Trustee shall recognise such holder as an absolute owner and shall not be bound by any notice to the contrary and shall also not be bound to take notice of or to see to the execution of any trust, express or implied, save as expressly provided or as required by any court of competent jurisdiction to recognise any trust or equity or interest affecting the title of the Units.
- (vi). The Unitholders shall not give any directions to the Trustee or the Investment Manager (whether in a meeting of Unitholders or otherwise) if it would require the Trustee or the Investment Manager to do or omit doing anything which may result in:
 - (a) the Trust or the Trustee, in its capacity as the trustee of the Trust or the Investment Manager, in its capacity as the investment manager of the Trust ceasing to comply with applicable law;
 - (b) interference with the exercise of any discretion expressly conferred on the Trustee by the Trust Deed or the Investment Manager by the Investment Management Agreement, or the determination of any matter which requires the agreement of the Trustee or the Investment Manager, provided that nothing shall limit the right of the Unitholder to require the due administration of the Trust in accordance with the Trust Deed.
- (vii). The depository register shall (save in case of manifest error) be conclusive evidence of the number of Units held by each depositor and in the event of any discrepancy between the entries of the depository register and any statement issued by the depository, the entries in the depository register shall prevail unless the depositor proves to the satisfaction of the Trustee and the depository that the depository register is incorrect.
- (viii). The Unitholders shall have the right to call for certain matters to be subject to their consent, in accordance with the InvIT Regulations and applicable law.
- (ix). The Unitholders may, in accordance with the provisions of the Trust documents and applicable law, transfer any of the Units to an investor where such investor accepts all the rights and obligations of the transferor and the Trustee or the Investment Manager shall give effect to such transfer in accordance with applicable law.
- (x). The Trustee shall and shall ensure that the Investment Manager obtains the consent of the Unitholders for the matters prescribed under the InvIT Regulations in accordance with the provisions of the InvIT Regulations, including Regulation 22 of the InvIT Regulations.
- (xi). The Unitholders shall have the right to receive income or distributions in respect of the Units, as provided in the placement documents.

6. *Indemnity*

In addition to the fees, distributions and expense reimbursements herein described, the InvIT Assets shall be utilized to indemnify and hold harmless the Trustee, the Sponsor and any of their respective officers, directors, shareholders, sponsors, partners, members, employees, advisors and agents (“**Indemnified Parties**”) from and against any claims, losses, costs, damages, liabilities and expenses, including legal fees (“**Losses**”) suffered or incurred by them by reason of their activities on behalf of the Trust, unless such Losses resulted from fraud, gross negligence, wilful default or wilful misconduct or breach of any obligations or duties under applicable law by the relevant Indemnified Party, as determined by a court of competent jurisdiction.

7. *Termination*

The InvIT is subject to dissolution and termination in accordance with and subject to the InvIT Regulations and applicable law:

- (i). if the Trust fails to make any offer of Units by way of private placement, within the time period stipulated in the InvIT Regulations or any other time period as specified by SEBI, the Trust shall surrender its certificate to SEBI and cease to operate as an investment infrastructure trust, unless the period is extended by SEBI;
- (ii). upon the liquidation of InvIT Assets;
- (iii). if there are no projects remaining under the Trust and the Trust does not invest in any project for six months thereafter;
- (iv). delisting of the Units in accordance with the InvIT Regulations; or
- (v). illegality of the InvIT under applicable law.

C. The Investment Manager – National Highways Infra Investment Managers Private Limited

History and Certain Corporate Matters

National Highways Infra Investment Managers Private Limited was incorporated as a private limited company on July 25, 2020, under the Companies Act, 2013. The Investment Manager was initially incorporated as a wholly owned subsidiary of NHAI. Subsequently, NHAI transferred its entire shareholding in the Investment Manager to the President of India, acting through the Ministry of Road Transport and Highways, Government of India. Accordingly, at present, the Investment Manager is a government company as defined under the Companies Act, 2013, as amended. The CIN of the Investment Manager is U65929DL2020GOI366835.

The principal business of the Investment Manager in terms of its memorandum of association is, *inter alia*:

- (a) to carry on the business of acting as investment manager investment adviser, trustee, settler, sponsor, promoter, portfolio manager, manager, administrator, attorney, agent, consultant, representative or nominee of or for any collective investment schemes, trusts, special purpose vehicles, infrastructure investment trusts, real estate investment trusts, properties and/or assets of any kind, including any fund set up, formed or established in India or in any other country by the Company or by any other person including bodies corporate, limited liability partnerships, partnerships, trusts, societies, associations of persons or by government, state or local authority (whether incorporated or not) of any other agency or organisation with respect to any class of assets, and to thereby settle, administer, manage, deploy funds, acquire, take up, manage, invest, hold, sell, deal or dispose of all or any property, investments, securities or other assets of any kind whatsoever, acting in such capacity;
- (b) to negotiate and obtain concessions from the appropriate Government/ s for the rights to build, operate and own or transfer highways, interchangers, viaducts and bridges and any other structures, buildings and services that are ancillary thereto in India and upon such terms for such benefits as may be set forth in the concessions or negotiated from time to time and generally to carry on the business of owners, operators or toll collectors or concessionaires of highways, bridges, tunnels, railways, ports, airports, public utilities, telecommunication facilities and any other rights, properties, utilities and services wherever situated; and
- (c) to carry on the business of builders and contractors for the construction, upgradation, maintenance and repairs of roads, highways, bridges, viaducts, buildings, interchangers, tunnels, railways, ports, airports, public utilities, telecommunication and other related works and generally to carry on the business of engineers, contractors, consultants, advisors, managers and administrators in all its branches, mechanical, electrical and telecommunication, engineering and incidental thereto, to provide financing or act as guarantors for project financing to owner where to required.

Background of the Investment Manager

The Trustee, *vide* their letter dated July 31, 2020, appointed NHIIMPL as the investment manager of the proposed Trust, based on the recommendation of the Sponsor.

The Investment Manager confirms that it has, and undertakes to ensure that it will at all times maintain, adequate infrastructure, personnel and resources to perform its functions, duties and responsibilities with respect to the

management of the Trust, in accordance with the InvIT Regulations, the Investment Management Agreement and applicable law.

In accordance with the eligibility criteria specified under the InvIT Regulations, the Investment Manager had a consolidated net worth of not less than ₹ 100 million as on the date of this Final Placement Memorandum.

Neither the Investment Manager nor the promoter or directors of the Investment Manager (i) are debarred from accessing the securities market by SEBI; (ii) are promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; or (iii) are in the list of wilful defaulters published by the RBI.

The IM Board

The IM Board is entrusted with the responsibility for the overall management of the Investment Manager. The Sponsor, acting together with MoRTH, have the right to nominate up to two directors on the Board of the IM. Please see below the details in relation of the IM Board:

Sr. No.	Name	DIN
1.	Shri B. Sriram	02993708
2.	Shri Suresh Goyal	02721580
3.	Shri Alok	02600247
4.	Shri M.P. Sharma	03158413
5.	Shri Shailendra Roy	02144836
6.	Shri Amit Kumar Ghosh	01092172

Brief Biography of the Directors of the Investment Manager

Please see below a brief biography of the directors of the Investment Manager:

Shri B. Sriram, is the chairman and an independent director of the Investment Manager. He has a bachelor's and a master's degree in science from University of Delhi, and is a certificated associate of the Indian Institute of Banking and Finance (formerly known as the Indian Institute of Bankers). He holds a diploma in management from All India Management Association, New Delhi, and a diploma in international law and diplomacy from the Indian Academy of International Law and Diplomacy. He has over 37 years of experience in the field of banking and finance, and is an independent director on the boards of ICICI Bank Limited, TVS Credit Services Limited, Nippon Life India Asset Management Limited and Indiaideas.com Limited. He is a part time member on the governing board of the Insolvency and Bankruptcy Board of India. He was also a former managing director and chief executive officer of IDBI Bank Limited, and a former managing director of State Bank of India.

Shri Suresh Goyal is managing director and chief executive officer of the Investment Manager. He has a bachelor's degree in electrical engineering from Shri Govindram Seksaria Institute of Technology and Science, Indore, and a post-graduate diploma in management from the Indian Institute of Management, Lucknow. He has over several years of experience in the corporate and asset management sector. He was employed with the Macquarie group for over ten years wherein he was involved in various infrastructure investment management projects. At Macquarie, he spent over five years in managing investments in the toll road sector. He was previously associated with Macquarie Infrastructure & Real Assets, Singapore, and has served as Executive Director within Macquarie Asset Management.

Shri M.P. Sharma is an independent director of the Investment Manager. He has a bachelor's degree in law from the University of Delhi, and has passed the institution examinations of the Institution of Engineers, India. He also worked as Chief Engineer and Additional Director General in the Ministry of Road transport and Highways. He has previously served as a technical advisor in the Ministry of Road Transport and Highways, Government of India.

Shri Shailendra Roy is an independent director of the Investment Manager. He has a bachelor's degree in engineering from the Indian Institute of Technology (BHU), and is a graduate of the Wharton Advanced Management Program. He has previously served as a whole-time director of Larsen & Toubro Limited for over eight years, and was on the board of several and associate companies of the L&T Group. He was also a former chief executive officer and managing director of L&T Power Limited. He was associated with the setting up

India's first ultra-supercritical thermal power plant at Khargone for NTPC, the first supercritical power plant, Nabha Power Ltd. and five supercritical power plants across the country.

Shri Alok is the Sponsor nominee director on the Board of the Investment Manager. He has a bachelor's degree in mechanical engineering from Indian Institute of Technology, Kanpur, and has completed a two week training program for IAS officers. He has approximately 28 years of experience in the fields of land administration, rural development, urban development, power sector, public works, and finance.

Shri Amit Kumar Ghosh is the MoRTH nominee director on the Board of the Investment Manager. He is an IAS officer of the Uttar Pradesh cadre. He has a bachelor's degree in electrical and electronics engineering from the Andhra University, and a master's degree in arts in defence studies from the Chaudhary Charan Singh University, Meerut. He is the additional secretary, MoRTH, and is responsible for highway division and land acquisitions.

Brief profiles of the key personnel of the Investment Manager

Set out below are the details of the key personnel of the Investment Manager:

Shri. Mathew George is the Chief Financial Officer of the Investment Manager. He holds a bachelor's degree in engineering (electronics and communication) from the University of Mysore and an executive postgraduate diploma in general management from XLRI, Jamshedpur. He has also completed a global leadership development program from the Michigan Ross School of Business, and participated in a program on infrastructure development and financing at the Indian Institute of Management, Ahmedabad. In the past, he was associated with the L&T group for over 12 years. In his previous capacity, he held the post of chief financial officer of LTIDPL IndvIT Services Limited, the investment management company of the first privately placed infrastructure investment trust in India. He has approximately 25 years of experience in leading project finance, treasury and risk functions in the infrastructure sector as well as management in banking services. He has a wide and varied experience in the banking sector.

Smt. Gunjan Singh is the Company Secretary and Compliance Officer of the Investment Manager. She is a fellow member of the Institute of Company Secretaries of India. She holds a bachelor's degree in law from Chaudhary Charan Singh University, Meerut. She has over a decade of experience in secretarial, legal and compliance functions as well as strategies to drive business growth, protect rights, minimize risk and assure compliance to changing laws and regulations. She has previously been associated with RHC Holding Private Limited, Fortis Escorts Heart Institute, International Panacea Limited and Era Constructions (India) Limited.

Key Terms of the Investment Management Agreement

The Investment Manager has entered into the Investment Management Agreement, in terms of the InvIT Regulations, the key terms of which, are provided below.

1. Powers of the Investment Manager

The Investment Manager has been provided with various powers under the Investment Management Agreement in accordance with the InvIT Regulations, including but not limited to:

- (i). The Investment Manager shall take all decisions in relation to the day-to-day management and administration of InvIT Assets and the investments of the Trust as may be incidental or necessary for the advancement or fulfilment of the investment objectives of the Trust in accordance with the InvIT Regulations and other applicable law. The Investment Manager shall ensure that all investments shall be registered in the name of the Trustee (acting on behalf of the InvIT) or the Trust.
- (ii). The Investment Manager shall, subject to such approval as may be required from the Unitholders, make the investment decisions with respect to the underlying assets or projects of the Trust, including any further investments or divestments, subject to InvIT Regulations and in accordance with the Placement Document, and in this regard is also empowered to do the following acts including:
 - (a) acquire, hold, manage, trade and dispose of shares, stocks, convertibles, debentures,

bonds and other equity or equity-related securities and other debt or mezzanine securities of all kinds issued by any SPVs, infrastructure projects in India, whether in physical or dematerialised form, including power to hypothecate, pledge or create encumbrances of any kind on such securities held by the Trust in such holding companies, and/or SPVs, or infrastructure projects to be used as collateral security for any borrowings by the Trust;

- (b) keep the capital and monies of the Trust in deposit with banks or other institutions, whatsoever;
 - (c) accept contributions;
 - (d) collect and receive the profit, interest, repayment of principal of debt or debt like, or equity or equity like, mezzanine securities, dividend, return of capital of any type by the holding companies, or SPVs, or infrastructure projects and income of the Trust as and when the same may become due and receivable;
 - (e) invest in securities or in units of mutual funds in accordance with the InvIT Regulations and other applicable law;
 - (f) invest in money market instruments including government securities, treasury bills, certificates of deposit and commercial paper in accordance with applicable law;
 - (g) to give, provide and agree to provide to any holding companies, or SPVs financial assistance in the form of investment in the Trust's debt securities or share capital of any class including ordinary, preference, participating, non-participating, voting, non-voting or other class, and in the form of investment in securities convertible into share capital; and
 - (h) to invest, acquire, purchase, hold, divest, sale, hypothecate, pledge or otherwise transfer land and building and immovable property of any kind including any rights and interest therein.
- (iii). The Investment Manager along with the Trustee shall, within a reasonable time from the date of execution of the Investment Management Agreement, appoint a Project Manager for the Trust, by execution of the Project Implementation and Management Agreement.
 - (iv). The Investment Manager shall oversee activities of the Project Manager with respect to compliance with the InvIT Regulations and the Project Implementation and Management Agreement and in terms of the InvIT Regulations and applicable law. The Investment Manager shall obtain a compliance certificate from the Project Manager in the form as may be specified by SEBI, on a quarterly basis or such other intervals as may be prescribed, under applicable law.
 - (v). The Trustee authorizes the Investment Manager to do all such other acts, deeds and things as may be incidental or necessary for the advancement or fulfilment of the investment objectives of the Trust, as set out in the Placement Document, in accordance with the InvIT Regulations and applicable law.
 - (vi). The Investment Manager shall have the power to issue and allot Units in accordance with the InvIT Regulations. The Investment Manager shall have the power to accept subscriptions to Units of the InvIT and issue and allot Units to Unitholders or such other persons and undertake all related activities under applicable law. Further, if the Investment Manager fails to allot or list the Units or refund subscription money within the time specified in the InvIT Regulations, it shall pay necessary interest to the Unitholders thereon, in accordance with applicable law. Further, the Investment Manager shall, subject to and only in accordance with the terms of the Trust documents and applicable law, have the power to transfer the Units.
 - (vii). The Investment Manager, acting on behalf of the Trustee, shall cause the depository to maintain a depository register.

- (viii). The Investment Manager shall make such reserves out of the income or capital as it may deem proper, and any directions of the Trustee in this behalf whether made in writing or implied from their acts shall, so far as the applicable law may permit, be conclusive and binding.
- (ix). The Investment Manager shall have the power to cause the Trust to borrow funds, including any subordinated equity, bonds or other fund from any person or authority (whether Government or otherwise, whether Indian or overseas) on such terms and conditions and for such periods and for the purpose of the Trust and the InvIT Assets, and shall have the power to hypothecate, pledge or create encumbrances, including any assignment of rights, of any kind on such securities held by the InvIT in such Holding Companies, and/or SPVs, or road infrastructure projects to be used as collateral security for any borrowings by the InvIT, subject to any approval of the Unitholders.
- (x). The Investment Manager shall have the power to exercise all rights of the Trust in the InvIT Assets, including voting rights, rights to appoint directors, whether pursuant to securities held by it, or otherwise, in such manner as it deems to be in the best interest of the InvIT, and in accordance with the InvIT Regulations and applicable law. Additionally, if the InvIT has invested in infrastructure projects through the holding company or SPVs, then the Investment Manager, in consultation with the Trustee, shall appoint the majority of the directors of the Holding Company(ies) and/or the SPV(s), in accordance with the applicable law, as well as ensure that in every general meeting including the annual general meeting of any SPV or holding company, the voting of the InvIT is exercised, in accordance with the InvIT Regulations and applicable law.
- (xi). The Investment Manager may use the services of external advisors and rely on the information provided in the due diligence process of assessing investment proposals as it deems necessary in its sole discretion.
- (xii). The Investment Manager shall have the power to employ and pay at the expense of the Trust, any agent in any jurisdiction whether attorneys, solicitors, brokers, banks, trust, companies or other agents, without being responsible for the default of any agent if employed in good faith to transact any business.
- (xiii). The Investment Manager may appoint any custodian in order to provide custodian services, and may permit any property comprised in the Trust to be and remain deposited with a custodian or with any person or persons in India or in any other jurisdiction subject to such deposit as authorised by the Trustee and permissible under the applicable law.
- (xiv). The Investment Manager, in consultation with the Trustee, shall appoint and have the power to appoint, determine the remuneration and enter into, execute, deliver and terminate all documents and agreements, any contracts, agreements, including share purchase agreement, deed of right of first offer and refusal, escrow agreements, debt documentation, underwriting agreements and other Trust documents, any investment pooling agreement, agreement relating to strategic investments, co-investment agreements and other any and all documents and instruments containing customary terms including any amendments or supplements thereto as may be applicable with respect to the activities pertaining to the Trust in a timely manner and as per the provisions of the InvIT Regulations and applicable law.
- (xv). The Investment Manager shall have the power and duty to pay all such duties, fees or taxes (and any interest or penalty chargeable thereon) as well as to create any reserves for future potential tax liability (and any such interest or penalty) out of the Trust's income, in accordance with Applicable Law. The Investment Manager shall exercise due care and prudence in payment of duties and taxes of the Trust and shall endeavour to ensure that there are no material outstanding dues in that behalf, except for any claim or demand made by any tax department or authority subsequently, or any amounts disputed in good faith.
- (xvi). The Investment Manager shall have the power to pay Trust expenses out of the funds of the Trust, or all or any of the InvIT Assets, in such proportion as may be determined from time to time, and the Investment Manager shall be entitled to reimbursement of any such expenditure duly incurred.

- (xvii). The Investment Manager shall have the power to take the opinion of legal / tax counsel in any jurisdiction concerning any difference arising under the Investment Management Agreement or any matter in any way relating to the Investment Management Agreement or to its duties in connection with the Investment Management Agreement.
- (xviii). Subject to applicable law, the Investment Manager shall have the power to:
 - (a) accept any property before the time at which it is transferable or payable;
 - (b) pay or allow any equity or claim on any evidence that it thinks sufficient;
 - (c) accept any composition or any security, movable or immovable, for any equity or other property;
 - (d) allow any time for payment of any equity; and
 - (e) subject to such approval as may be required from the Unitholders, compromise, compound, abandon, submit to arbitration or otherwise settle any equity account, claim or thing whatsoever relating to the Trust or the Investment Management Agreement.
- (xix). Subject to the conditions laid down in any placement document and applicable law, the Investment Manager may retain or reinvest the invested capital portion of any proceeds received by the Trust from any holding company or SPV.
- (xx). The Investment Manager may make rules to give effect to, and carry out the investment objectives, subject to applicable law. In particular, and without prejudice to the generality of such power, the Investment Manager may provide for all or any of the following matters, namely:
 - (a) manner of maintaining of the records and particulars of Unitholders;
 - (b) norms of investment by the Trust in accordance with the investment objectives of the Trust and in accordance with the powers and authorities of the Trustee as set out in the Trust Deed;
 - (c) matters relating to entrustment, deposit or handing over of any securities or SPVs of the Trust to any one or more custodians and the procedure relating to the holding thereof by the custodian;
 - (d) such other administrative, procedural or other matters relating to the administration or management of the affairs of the Trust and which matters are not, by their very nature, required to be included or provided for in the Trust Deed or by the management thereof and which matters are not inconsistent with the investment objectives;
 - (e) procedure for seeking the vote of the Unitholders either by calling a meeting or through postal ballot or otherwise; and
 - (f) procedure for summoning and conducting of meetings of Unitholders.
- (xxi). Subject to applicable law, no Unitholder shall be entitled to inspect or examine the Trust's premises or properties without the prior permission of the Investment Manager. Further, no Unitholder shall be entitled to require discovery of any information with respect to any detail of the Trust's activities or any matter which may be related to the conduct of the business of the Trust and which information may, in the opinion of the Investment Manager, adversely affect the interest of other Unitholders.
- (xxii). Investment Manager, on behalf of the InvIT, may buyback the Units from the Unitholders at the end of the term of the Trust or any other time or in any other manner in accordance with applicable law.

- (xxiii). The Investment Manager shall provide the Trustee with advice and recommendations regarding the extension of loans from the Trust to the holding company and SPV and also subscription to debt securities or quasi-debt securities or any similar kind of securities issued by the holding company and SPV from the Trust or extension of loans from the Trust in compliance with applicable law.
- (xxiv). The Investment Manager shall also have the following powers and authorities:
- (a) to institute, conduct, compromise, compound, or abandon any legal proceedings for or on behalf of or in the name of the Trust, and to defend, compound or otherwise deal with any such proceedings against the Trust or the Investment Manager or their officers or concerning the affairs of the Trust, and also to compound and allow time for payment or satisfaction of any equity due and of any claims or demands by or against the Trust and to refer any differences to arbitration and observe and perform any awards thereof;
 - (b) to make and give receipts, releases and other discharges for moneys payable to the Trust and for the claims and demands of the Trust;
 - (c) to enter into all such negotiations and contracts, and, execute or terminate and do all such acts, deeds and things for or on behalf of or in the name of the Trust as it may consider expedient for or in relation to any of the matters or otherwise for the purposes of the Trust;
 - (d) to ascertain, appropriate, declare and distribute or reinvest the surplus generally or under the Trust, to determine and allocate income, profits and gains in respect of the Trust to and amongst the Unitholders, to carry forward, reinvest or otherwise deal with any surplus and to transfer such sums, as it may deem fit, to one or more reserve funds which may be established by it;
 - (e) to open one or more bank accounts and demat accounts for the purposes of the Trust, to deposit and withdraw money, and fully operate and manage any such account fully;
 - (f) to sign, seal, execute, deliver and register according to applicable law all deeds, documents, and assurances in respect of the Trust;
 - (g) pay out of the income of the Trust, after deducting all expenses, the income and other distributions in accordance with the InvIT Regulations and applicable law;
 - (h) take into their custody or control all the capital, assets, property of the Trust and hold the same in trust for the Unitholders in accordance with the Trust Deed, applicable law and the InvIT Regulations;
 - (i) generally to exercise all such powers as it may be required to exercise under the InvIT Regulations and applicable law for the time being in force and do all such matters and things as may promote the investment objectives of the Trust or as may be incidental to or consequential upon the discharge of its functions and the exercise and enforcement of all or any of the powers and rights under the Investment Management Agreement, Applicable Law and the InvIT Regulations;
 - (j) in accordance with applicable law, individually or collectively, with the Trustee, initiate, prosecute or defend any action or other proceedings in any court of law or through arbitration or in any other manner for recovery of debts or sums of money, right, title or interest, property, claim, matter or thing whatsoever now or hereafter to become due or payable or in any way and belonging to the Trust by any means or on any account whatsoever in respect of and pertaining to the investments made by it and the same actions or proceedings or suits to discontinue or settle, as it shall in its best judgment or discretion deem fit;
 - (k) to issue statement of accounts or Unit certificates (if requested) to the Unitholders on

behalf of the Trustee in accordance with Applicable Law, to submit Units for dematerialisation and to make all applications and execute all documents with the depositories and depository participants as may be necessary in this regard;

- (l) to set up such systems and procedures, and submit such reports, as may be required by the Trustee as necessary for effective monitoring of the functioning of the Trust.

2. *Duties of the Investment Manager*

The Investment Manager shall perform its duties as required under the Investment Management Agreement in accordance with the InvIT Regulations, including but not limited to:

- (i). The Investment Manager shall use best endeavours to carry on and conduct its business in a proper and efficient manner in the best interest of the Unitholders. Further, it shall at all times exercise due diligence in carrying out its duties and protecting the interest of the Unitholders.
- (ii). The Investment Manager shall coordinate with the Trustee, as may be necessary, with respect to the operations of the InvIT.
- (iii). The Investment Manager shall ensure that the valuation of the InvIT Assets is done by the valuer(s) and the valuer(s) acts in accordance with the InvIT Regulations. The Investment Manager shall further ensure that the valuer is not an associate of the Investment Manager and shall be eligible to act as a valuer in accordance with the InvIT Regulations or any clarifications, guidelines, notifications or exemptions issued by SEBI. The Investment Manager shall submit to the stock exchanges valuation reports as required under the InvIT Regulations within fifteen days of the receipt of the valuation report from the valuer. Further, in case of any material development that may have an impact on the valuation of the assets of the InvIT, the Investment Manager shall require the valuer to undertake full valuation of the infrastructure project under consideration within not more than two months from the date of such event and disclose the same to the Trustee and the designated stock exchanges within fifteen days of such valuation.
- (iv). The Investment Manager shall arrange for adequate insurance coverage for the InvIT Assets in accordance with the InvIT Regulations. The Investment Manager shall ensure that the InvIT Assets held by the holding companies or the SPVs are adequately insured.
- (v). The Investment Manager shall maintain proper books of accounts, documents and records with respect to the Trust, to give a true, fair and accurate account of the investments, expenses, earnings, profits etc. of the Trust. The Investment Manager shall ensure that audit of the accounts of the Trust by the auditors is undertaken in accordance with the InvIT Regulations and such report is submitted to the stock exchange(s) within the time stipulated by the stock exchange(s), if any, and in accordance with the InvIT Regulations.
- (vi). The Investment Manager shall declare distributions to Unitholders in accordance with the InvIT Regulations. Subject to applicable law, such percentage of the net distributable cash flows of the SPVs shall be distributed to the Trust in terms of the InvIT Regulations. Such declared distributions shall be made within the time period prescribed by the InvIT Regulations.
- (vii). The Investment Manager shall convene meetings of the Unitholders and maintain records pertaining to the meetings in accordance with the InvIT Regulations and other applicable law.
- (viii). The Investment Manager shall intimate the Trustee prior to any change in control of the Investment Manager to enable the Trustee to seek prior approval from the Unitholders and SEBI, if required under applicable law in this regard, and shall ensure that no such change is given effect to until the approval of the Unitholders and SEBI has been obtained, or the Investment Management Agreement is terminated and a new investment manager has been appointed.
- (ix). The Investment Manager will monitor the Trust, including monitoring current and projected financial position of the Trust and the InvIT Assets, including the SPVs. The Investment Manager shall place before its board of directors, a report on the activity and performance of

the Trust, in accordance with the InvIT Regulations. The Investment Manager shall designate an employee or a director as the compliance officer for monitoring of compliance with the InvIT Regulations and any circulars or guidelines issued thereunder and intimating SEBI in case of non-compliance.

- (x). The Investment Manager shall maintain records pertaining to the activity of the Trust in terms of the InvIT Regulations.
- (xi). The Investment Manager shall manage the Trust in accordance with the InvIT Regulations and the investment objectives of the Trust, and shall ensure that the investments made by the Trust are in accordance with the investment conditions enumerated in the InvIT Regulations, applicable Law and in accordance with the investment objectives and the investment strategy set out in the placement documents. The Investment Manager may review, revise, amend, vary or alter the investment objectives or the investment strategy set out in the placement documents.
- (xii). The Investment Manager shall review the transactions carried out between the Project Manager and its associates and where the Project Manager has advised that there may be a conflict of interest, shall obtain confirmation from a practising chartered accountant or a valuer, as applicable, that such transaction is on an arm's length basis.
- (xiii). The Investment Manager shall ensure adequate and timely redressal of all Unitholders' grievances pertaining to the activities of the InvIT in accordance with the InvIT Regulations.
- (xiv). The Investment Manager shall submit to the Trustee:
 - (a) quarterly reports on the activities of the Trust including receipts for all funds received by it and for all payments made, status of compliance with the InvIT Regulations, performance report, status of development of under-construction projects, within the time period specified under the InvIT Regulations;
 - (b) valuation reports as required under the InvIT Regulations within the time period specified under the InvIT Regulations;
 - (c) proposal/decision to acquire, sell or develop, or bid for any asset or project or expand existing completed assets or projects along with rationale for the same;
 - (d) details of any action which requires approval from the Unitholders as may be stipulated under the InvIT Regulations;
 - (e) details of transactions it enters into with its associates;
 - (f) details of any other material fact including change in its directors, change in its shareholding, any legal proceedings that may have a significant bearing on the activity of the Trust, within such period as stipulated under applicable law;
 - (g) such information, document and records as pertaining to the activities of the Trust as may be reasonably necessary for, and sought by, the Trustee with respect to its responsibilities under the Trust Deed, the InvIT Regulations and Applicable Law; and
 - (h) such other information, document and records as pertaining to its activities, obligations, duties and responsibilities under the Investment Management Agreement, the InvIT Regulations and applicable law, as may be reasonably necessary for, and sought by, the Trustee.
- (xv). The Investment Manager shall be responsible for all activities pertaining to any issue and listing of the Units of the InvIT in accordance with applicable law, including:
 - (a) filing the placement document with SEBI and/or the stock exchange(s) within the prescribed time period;

- (b) dealing with all matters up to the allotment of Units to the Unitholders;
 - (c) obtaining in-principle approval and final listing and trading approvals from the designated stock exchange; and
 - (d) dealing with all matters relating to the issue and listing of the Units.
- (xvi). The Investment Manager shall also ensure that all relevant provisions of the InvIT Regulations and applicable law have been complied with and all statements and disclosures made in any placement document are material, true, correct, not misleading and are adequate disclosures in order to enable the investors to make an informed decision and are in accordance with the InvIT Regulations and applicable law, and such placement document should not contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading.
- (xvii). In terms of the InvIT Regulations, the Investment Manager shall apply for delisting of units of the Trust to SEBI and the designated stock exchange in accordance with the InvIT Regulations and applicable law.
- (xviii). The Investment Manager shall within the time period prescribed under the InvIT Regulations, submit an annual report to all the Unitholders electronically or provide physical copies and to the designated stock exchange.
- (xix). The Investment Manager shall submit half-yearly reports within the time period prescribed under the InvIT Regulations to the stock exchange(s) and provide any information having bearing on the operation or performance of the Trust, as well as price sensitive information and other information that is required in terms of the InvIT Regulations and applicable law.
- (xx). Subject to applicable law, the Investment Manager shall ensure that it shall discharge its obligations under the agreement and the InvIT Regulations in accordance with the corporate governance policies adopted by the Investment Manager in relation to the InvIT.
- (xxi). The Investment Manager shall ensure that prior written consent of the trust lenders is obtained in accordance with the provisions of the trust financing documents.
- (xxii). The Investment Manager will also have the following duties and obligations:
- (a) ensure that computation and declaration of Net Asset Value of the Trust is based on the valuation done by the valuer in accordance with the InvIT Regulations and applicable law;
 - (b) maintain regular interaction with the Trustee regarding performance of the Trust and providing the Trustee with any information in relation to the operations of the Trust as maybe required under applicable law;
 - (c) conducting its affairs and the affairs of the Trust in such a manner that no Unitholder will have any personal liability (except to the extent of their Unitholding, where such Unit is partly paid) with respect to any liability or obligation of the Trust;
 - (d) keeping the Unitholders of the Trust informed and updated on investment activities of the Trust in accordance with the terms of the InvIT Documents;
 - (e) collecting all dividends, fees, property and other payments due and receivable by the Trust declaring distribution to the Unitholders in the manner set out in the Deed and in terms of the InvIT Regulations and applicable law;
 - (f) to ensure that no commission or rebate or any other remuneration, by whatever name called, arising out of transactions pertaining to the Trust is collected by it or its associates for the purpose of the issue of the Units;

- (g) to ensure that the InvIT Assets including the holding companies and the SPVs, have proper legal titles, to the extent applicable, and that all the material contracts entered into on behalf of the Trust or the InvIT Assets are legal, valid, binding and enforceable by and on behalf of the Trust or the InvIT assets, as applicable;
 - (h) to ensure that all the activities of the intermediaries or agents or service providers appointed by it are in accordance with the InvIT Regulations or any guidelines or circulars issued thereunder;
 - (i) to ensure that any possible conflict of interest involving its role as Investment Manager is reported to the Trustee;
 - (j) to ensure that disclosures or reporting to Unitholders, SEBI, the Trustee and the designated stock exchange(s) are in accordance with the InvIT Regulations and applicable law;
 - (k) provide SEBI, the designated stock exchange(s) and Trustee, where applicable, such information as may be sought by SEBI or by the designated stock exchange(s) or Trustee pertaining to the activity of the Trust;
 - (l) submit a compliance certificate to the Trustee, in the form and at such intervals as may be specified under the InvIT Regulations and applicable law;
 - (m) to inform the Trustee in writing about any change in the representations and warranties provided under the Investment Management Agreement; and
 - (n) take any other actions reasonably incidental to any of the foregoing, or necessary or convenient in order to fully effect or evidence any action or transaction contemplated under the Investment Management Agreement.
- (xxiii). Related Party Transactions: The Investment Manager shall provide such assistance to ensure that all related party transactions shall be on an arms-length basis in accordance with relevant accounting standards, in the best interest of the Unitholders, consistent with the strategy and investment objectives of the InvIT and in accordance with the InvIT Regulations.
- (xxiv). The Investment Manager shall provide to the Trustee such assistance as may be required by the Trustee in fulfilling its obligation towards the Trust under applicable law or as may be required by any regulatory authority with respect to the Trust.
- (xxv). The Investment Manager shall rectify any delay or discrepancy or non-compliance of reporting or disclosures requirements under the InvIT Regulations and applicable law on an urgent basis.
- (xxvi). Disclose to the Trustee any pending business transactions, contracts under negotiation and other arrangements with the valuer and any other factors that may interfere with the valuer's ability to give an independent and professional valuation of the assets.

3. *Liabilities of the Investment Manager*

The liabilities of the Investment Manager in terms of the Investment Management Agreement are as follows:

- (i). The Investment Manager shall not be liable in respect of any action taken or damage suffered by it on reliance upon any notice, resolution, direction, consent, certificate, affidavit, statement, certificate of stock, plan of reorganization or, without being limited in any way by the foregoing, other paper or document believed to be genuine and to have been passed, sealed or signed by appropriate authorities or entities.
- (ii). The Investment Manager shall not be liable to the Unitholders for doing or failing to do any act or thing which by reason of any provision of any present or future law or regulation made

pursuant thereto, or of any decree, order or judgment of any court, or by reason of any request, announcement or similar action, whether of binding legal effect or not, which may be taken or made by any person or body acting with or purporting to exercise the authority of any government (legally or otherwise) it shall be directed or requested to do or perform or to forbear from doing or performing. If for any reason it becomes impossible or impracticable to carry out any of the provisions of the Investment Management Agreement, the Investment Manager shall not be under any liability.

- (iii). The Investment Manager shall not be liable to the Unitholder or any of them or to any other party as a result of such compliance or in connection with such compliance if the Investment Manager is required by the InvIT Regulations or applicable law to provide information regarding the Trust or the Unitholders, the Trust investments and income therefrom and provisions of these presents and complies with such request in good faith, whether or not it was in fact enforceable. If permitted under Applicable Law and if reasonably practicable, the Investment Manager shall provide prior written notice to the Trustee and the relevant Unitholders of such disclosure requirement.
- (iv). The Investment Manager shall not incur any liability for any act or omission which may result in a loss to a Unitholder by reason of any depletion in the value of the InvIT Assets or otherwise, except in the event that such loss is a result of fraud or gross negligence or wilful default on the part of the Investment Manager.
- (v). The Investment Manager shall be liable to pay interest to the Unitholders at the rate as may be prescribed in the InvIT Regulations until the distribution is made, and such interest shall not be recovered in the form of fees or any other form payable to the Investment Manager by the Trust.
- (vi). The Investment Manager shall continue to be liable for all of its acts of omission and commission with respect to the activities of the InvIT, notwithstanding surrender of registration of the InvIT to SEBI.
- (vii). The Investment Manager shall be liable to any Unitholder for the authenticity of any signature or of any seal affixed to any endorsement or other document affecting the title to or the transmission of Units or interests in the Trust or of any investments of the Trusts or be in any way liable for any forged or unauthorized signature or seal affixed to such endorsement, transfer or other document, or for acting upon or giving effect to any such forged or unauthorized signature or seal. The Investment Manager shall be bound to require that the signature of any Unitholder to any document required to be signed by such Unitholder, under or in connection with these presents shall be verified to its reasonable satisfaction.

4. *Indemnity*

In addition to the fees, distributions and expense reimbursements herein described, the Trustee shall, from the Trust assets, indemnify and hold harmless the Investment Manager and its respective officers, directors, shareholders, partners, members, employees, advisors and agents (“**Indemnified Parties**”) from and against any claims, losses, costs, damages, liabilities, suits, proceedings and expenses, including legal fees (“**Losses**”) suffered or incurred by them by reason of their activities on behalf of the Trust, unless such Losses resulted from fraud, gross negligence, wilful default or wilful misconduct or breach of any obligations or duties under applicable law by the relevant Indemnified Party, as determined by a court of competent jurisdiction.

The Trustee, its directors, employees and officers (“**Trustee Party**”) shall be indemnified by the Investment Manager against any and all direct and actual losses, actions, claims, suits, proceedings, damages, liabilities, costs and expenses including legal fees, incurred or suffered by the Trustee Party in connection with the breach of any of the terms of the Investment Management Agreement by the Investment Manager, or failure in furnishing information required by SEBI or any regulatory authority with respect to the Trust, or furnishing incorrect information by the Investment Manager under the InvIT Regulations or related to Trust including in any placement document, or arising out of gross negligence, wilful default or misconduct or fraud on part of the Investment Manager, in carrying out its obligations under the Investment Management Agreement, Trust Deed, the other Trust documents, any information memorandum, placement document and applicable law. The Trustee acknowledges and agrees that the

aggregate maximum liability of the Investment Manager in each financial year, shall be limited to the aggregate fees paid to the Investment Manager for the immediately preceding one financial year, in accordance with the terms of the Investment Management Agreement, provided that such aggregate maximum liability shall not be applicable in the event such liability of the Investment Manager to indemnify the Trustee Party for losses or damages suffered arises out of any gross negligence, wilful default or misconduct or fraud of the Investment Manager, as determined by a court of competent jurisdiction.

5. *Termination*

The Investment Management Agreement shall be effective from the date of execution of the Investment Management Agreement and shall terminate in accordance with the terms of the Investment Management Agreement. The appointment of the Investment Manager may be terminated by the Trustee or the Unitholders in accordance with the procedure specified under the InvIT Regulations.

- (i). The Unitholders, other than any party related to the transactions and its associates holding not less than such percentage by value as specified under the InvIT Regulations, may apply in writing to the Trustee for removal of the Investment Manager.
- (ii). Subject to the approval of Unitholders (if required) and compliance with other requirements under Applicable Law, the Investment Management Agreement may be terminated:
 - (a) by the Investment Manager by delivery of a prior written notice of 30 (thirty) business days to the Trustee, subject to appointment of new Investment Manager in accordance with the Investment Management Agreement and the InvIT Regulations;
 - (b) by the Trustee by delivery of a written notice to the Investment Manager at any time, upon breach of any of the terms, covenants, conditions or provisions of the Investment Management Agreement by the Investment Manager and a failure of the Investment Manager to cure the said breach within a period that is earlier of: (a) the period stipulated under applicable law, or (b) 90 business days; or such other period as may be mutually agreed to cure such breach;
 - (c) by the InvIT (acting through the Trustee) pursuant to a resolution of Unitholders; or
 - (d) by any Party by delivery of a written notice to the other Party upon the bankruptcy of such other Party, or if winding up or liquidation proceedings are commenced against such other Party, and such proceedings persist for a period of more than three months.
- (iii). After approval from the Unitholders in accordance with the InvIT Regulations, the Trustee shall appoint a new investment manager and execute a new investment management agreement within three months from the termination of the previous investment management agreement in accordance with applicable law. The Trustee shall also ensure that the new investment manager stands substituted as a party in all documents to which the Investment Manager was a party, in relation to the Trust in its capacity as the Investment Manager. The Investment Manager shall remain in office until the appointment of a new investment manager. The Investment Manager shall continue to be liable for all of its acts, omissions and commissions during its tenure as Investment Manager, notwithstanding the termination of the Investment Management Agreement.
- (iv). Upon removal or replacement of the Investment Manager, the Investment Manager shall, within a period of 90 (ninety) business days, transfer custody of the Trust to the Trustee and give the Trustee all books of accounts, correspondence, documents and records relating to the InvIT which the Investment Manager has in its possession. In the event of removal or resignation of the Investment Manager, the Investment Manager shall be entitled to receive Management Fees only up to the date of such removal or resignation.
- (v). Notwithstanding anything contained hereinabove, (i) in the event that the offer of Units does not occur within the time period stipulated in the InvIT Regulations or such other date as may be mutually agreed to between the Investment Manager and the Trustee, or (ii) in the event of cancellation of registration of the Trust by SEBI, or (iii) winding up of the Trust, then the

Investment Management Agreement shall automatically terminate without any liability on any party.

D. The Project Manager – National Highways InvIT Project Managers Private Limited

History and Certain Corporate Matters

National Highways InvIT Project Managers Private Limited was incorporated as a private limited company on March 9, 2021, under the Companies Act, 2013. The CIN of the Project Manager is U45201DL2021GOI378178.

Background of the Project Manager

The Project Manager is a wholly-owned subsidiary of NHAI.

The Project Manager shall (directly through the appointment of appropriate agents) undertake operations and management of the Trust, including making arrangements for the maintenance of assets held under the Trust. The Project Manager has been appointed as per the terms of the Project Implementation and Management Agreement.

Neither the Project Manager nor any of the promoters or directors of the Project Manager (i) is debarred from accessing the securities market by SEBI; (ii) is a promoter, director or person in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; or (iii) is in the list of wilful defaulters published by the RBI.

Key terms of the Project Implementation and Management Agreement

The Project Manager has entered into the Project Implementation and Management Agreement, in terms of the InvIT Regulations, the key terms of which, are provided below.

1. *Scope of Services*

The scope of services of the Project Manager are as follows:

- i. Whilst the primary obligation under the Concession Agreements remains with the SPV in the manner contemplated therein, the Project Manager shall ensure that the InvIT Assets are operated, maintained and managed as per the terms and conditions of the Concession Agreements, respective O&M Agreements and the InvIT Regulations, either directly or through the appointment and supervision of appropriate agents or contractors or consultants by the SPV or by the Project Manager, and perform obligations as stipulated therein. The Project Manager shall provide and/cause to procure and ensure procurement of all such services as are required to enable the SPV to perform its operation and maintenance related obligations under and in compliance with the Concession Agreements. The responsibilities and the scope of services of the Project Manager include, but not limited to, those specifically provided under the Project Implementation and Management Agreement, which may be modified from time to time.
- ii. Costs and expenses to be paid to any third party (engaged by the SPV or Project Manager, on behalf of the Project SPV, with the consent of the Investment Manager) shall be borne by the SPV in accordance with the terms and conditions of the contract entered into between the SPV and such third party.

2. *Duties of the Project Manager*

The duties of the Project Manager in terms of the Project Implementation and Management Agreement and the InvIT Regulations are as follows:

- i. The Project Manager shall undertake implementation, development, maintenance, operation and management of the InvIT Assets including making arrangements for the appropriate maintenance, either directly or through the appointment and supervision of agents or consultants, if any, as may be necessary

for discharge of its duties under the terms of the Project Implementation and Management Agreement, the O&M Agreements and under the InvIT Regulations.

- ii. The Project Manager shall facilitate and ensure, either directly or through appropriate agents or consultants engaged either by them or through the SPV, the progress of development, approval status and other aspects of the InvIT Assets that may be under development or, of any new projects, until its completion in accordance with any agreement that may be entered into in this regard, including the supervision of agents or consultants appointed for such purpose.
- iii. The Project Manager shall discharge all obligations in respect of achieving timely completion of the infrastructure projects, wherever applicable, implementation, development, operation, maintenance and management of the infrastructure projects in terms of the O&M Agreements, the Project Implementation and Management Agreement and the InvIT Regulations.
- iv. The Project Manager acknowledges that the Trustee and the Investment Manager will be overseeing the activities of the Project Manager in accordance with the InvIT Regulations and accordingly, the Project Manager shall extend complete coordination to enable the Trustee and the Investment Manager to perform such obligations in accordance with the InvIT Regulations. Further, the Project Manager shall provide relevant documents in connection with the Projects, including reports and compliance certificate(s), as may be specified, to the Investment Manager and the Trustee in accordance with the InvIT Regulations, in the form prescribed by SEBI or the Investment Manager, if any.
- v. The Project Manager shall provide the Investment Manager with details of transactions carried out between itself and its associates in relation to the Trust, and disclose any conflict of interest in such cases to the Investment Manager, in accordance with the InvIT Regulations.
- vi. The Project Manager shall intimate the Trustee prior to any Change in Control of the Project Manager to enable the Trustee to seek approval from the relevant authority in accordance with the Concession Agreements or other project documents pertaining to the InvIT Assets, if applicable.
- vii. The Project Manager shall provide to the Trustee and Investment Manager, or to such other person as the Trustee and/or the Investment Manager may authorise and direct, all information that may be necessary for each of them to maintain the records of the InvIT and as may be required for making submissions to SEBI or any other Governmental Authority, including with respect to relevant approvals, consents and other documents required in relation to the Projects and the reporting requirements under the InvIT Regulations, in a proper and timely manner, and in the format prescribed (if any), as required by the Trustee and /or Investment Manager.
- viii. The Project Manager shall appoint one of its qualified employees acceptable to the Investment Manager and the SPV with adequate and appropriate experience as a principal contact for the board of directors of the SPV, the Trustee and the Investment Manager in relation to the Projects and the Services. The Project Manager shall receive directions and instructions from the Investment Manager, which directions or instructions shall have been issued by the Investment Manager on its own or on behalf of the Project SPV, and to take actions in relation to and ensure compliance with such directions and instructions and report back to the Trustee and the Investment Manager.
- ix. The Project Manager shall at all times ensure that the transactions or arrangements entered into by the Project Manager with a related party are on an arm's length basis.
- x. The Project Manager shall promptly inform the Parties in writing of any act, occurrence or event, which the Project Manager believes is reasonably likely to increase the cost of or the time for implementation taken in relation to any InvIT Asset, or materially to change the financial viability, quality or function of any InvIT Asset.

- xi. If any defects are found in the maintenance, materials and workmanship of the Services provided under the Project Implementation and Management Agreement by the Project Manager and/or by the PM Agents, the Project Manager shall promptly, in consultation and agreement with the other Parties, regarding appropriate remedying of the defects, and at its own cost, repair, replace or otherwise make good (as any SPV shall, at its discretion, determine) such defects as well as any damage caused by such defect.
- xii. The Project Manager shall be liable to the other Parties for any direct loss or damage attributable to the non-performance or breach of the obligations of the Project Manager including those of the PM Agents, under the Project Implementation and Management Agreement. The Trustee and the Investment Manager acknowledge and agree that the aggregate maximum liability of the Project Manager shall be limited to the fees payable to the Project Manager in accordance with the terms of the Project Implementation and Management Agreement.
- xiii. The duties of Project Manager shall also include the following:
 - a. providing the necessary certification as may be required under applicable laws and the InvIT Regulations;
 - b. facilitate and ensure execution and completion of activities in relation to any InvIT Assets under development in accordance with and in the manner contemplated in any agreement entered into by any or all the InvIT Assets;
 - c. exercising diligence and vigilance in carrying out its duties directly or through its agents/contractors of the SPV and protecting the InvIT Assets;
 - d. keeping the Investment Manager informed on all matters which have a material bearing on the operations of the InvIT Assets, and attending meetings with the Investment Manager and/or the SPV, as may be required;
 - e. liaising with Governmental Authorities in respect of its obligations under the Project Implementation and Management Agreement and the O&M Agreements;
 - f. taking appropriate measures to mitigate the risks which may be encountered by the InvIT in respect of the InvIT Assets, including creation of risk registers and periodic risk audits either directly or through its agents;
 - g. keeping proper records for actions taken in respect of the InvIT Assets; and
 - h. complying with the instructions of the Investment Manager and the Trustee and the provisions of the InvIT Regulations.
- xiv. The Parties may, from time to time, agree to the provision of certain additional services to be rendered by the Project Manager. If, in the assessment of the Project Manager, such additional services are required for the purposes of carrying out its duties and obligations under the Project Implementation and Management Agreement, the O&M Agreements, and Applicable Law, the Project Manager shall notify the Parties in writing of such requirement, including the fee payable and the terms and conditions for such additional services, and obtain prior written approval of the Parties in this regard.
- xv. In case of any inconsistency or discrepancy between the Project Implementation and Management Agreement and the O&M Agreements, the Project Manager shall bring the same into the notice of the Investment Manager. The Investment Manager shall issue instructions (in writing) for resolving the inconsistency, to the Project Manager. The Project Manager shall be bound to comply with the instructions of the Investment Manager.

- xvi. Notwithstanding anything to the contrary contained in the Project Implementation and Management Agreement, nothing contained in the Project Implementation and Management Agreement shall be construed to limit or restrict the performance of any duties or obligations of the Project Manager, Investment Manager or the Trustee contained in the InvIT Regulations and other Applicable Law.
- xvii. During the term of the Project Implementation and Management Agreement, in the event the representations provided by the Project Manager under the Project Implementation and Management Agreement, become untrue or incorrect or incomplete in any respect, the Project Manager shall, within a reasonable time, inform the Trustee and Investment Manager of such event.
- xviii. The Project Manager shall promptly and periodically notify the Investment Manager regarding any deficiency in the services of the SPV Team or any third party contractor or service provider engaged either directly by the Project Manager or through the SPV, along with an assessment report covering, amongst others, the details of deficiency in service, remedial measures and financial impact on the Project SPV. Any such deficiency shall be remedied in the manner provided in the Project Implementation and Management Agreement.
- xix. Other than on account of any non-compliance or deficiency, the Project Manager shall promptly notify the Investment Manager regarding any proposed change in the SPV Team along with an assessment report covering, amongst other things, rationale for the change and its assessment of the same and professional competence of the persons proposed to be appointed to the SPV Team. The Project Manager shall not grant consent for any change in the SPV Team without prior consultation with, and approval of, the Investment Manager, in accordance with the Project Implementation and Management Agreement.

3. *Indemnity*

The Trustee, the Investment Manager, the Project SPV and their respective directors, employees, officers and the InvIT (“**Indemnified Parties**”) shall be indemnified by the Project Manager against any claims, suits, proceedings, losses, costs, damages, liabilities and expenses, including legal fee from and incurred or suffered by the Indemnified Parties in connection with the breach of any of the terms of the Project Implementation and Management Agreement by the Project Manager, or failure in furnishing information required by SEBI or any regulatory authority with respect to the InvIT, or furnishing wrong information by the Project Manager under the InvIT Regulations or related to InvIT including in any offer documents, or arising out of gross negligence, wilful default, wilful misconduct or fraud on part of the Project Manager, in carrying out its obligations under the Project Implementation and Management Agreement, the other InvIT Documents and Applicable Law. The Trustee and the Investment Manager acknowledge and agree that the aggregate maximum liability of the Project Manager in each financial year shall be limited to the fees payable to the Project Manager in such financial year in accordance with the terms of the Project Implementation and Management Agreement, provided that such maximum aggregate liability shall not be applicable in the event such liability of the Project Manager arises out of any gross negligence, wilful default, wilful misconduct or fraud on the part of the Project Manager, as determined by a court of competent jurisdiction.

4. *Termination*

- (i). The Project Implementation and Management Agreement shall remain effective, unless terminated by the parties in accordance with the provisions hereto or extended by mutual consent expressed in writing by the parties, for the period that the concession agreement is in force or such other period as may be mutually agreed between the Parties (“**Validity Period**”).
- (ii). Prior to the expiry of its Validity Period, the Project Implementation and Management Agreement, may be terminated:
 - (a) by the Investment Manager after consultation with the Trustee by delivery of a written notice of 30 (thirty) business days, specifying the reasons for such termination, to the Project Manager at

any time, subject to appointment of new project manager in accordance with the Project Implementation and Management Agreement and the InvIT Regulations; or

- (b) by the Investment Manager after consultation with the Trustee by delivery of a written notice to the Project Manager at any time, upon breach of any of the terms, covenants, conditions or provisions of the Project Implementation and Management Agreement by the Project Manager and a failure of the Project Manager to remedy the said breach within a period of 60 Business Days or such other period as may be mutually agreed by the parties; or
 - (c) by any party by delivery of a written notice to the other party upon the bankruptcy of such other party or if insolvency resolution process, winding up or liquidation proceedings, whether voluntary or involuntary, are commenced against such other party (and such proceedings persist for a period of more than three months).
- (iii). Notwithstanding anything contained hereinabove, the Trustee in consultation with the Investment Manager shall appoint a new project manager and execute a new project implementation and management agreement within three months from the termination of the earlier project implementation and management agreement in accordance with applicable law. The Trustee and Investment Manager shall also ensure that the new project manager stands substituted as a party in all documents to which the Project Manager was a party. The Project Manager shall remain in office until the appointment of a new project manager. The Project Manager shall continue to be liable for all its acts and omissions and commissions notwithstanding its termination until the appointment of a new project manager.
- (iv). The termination of the Project Implementation and Management Agreement shall not affect the rights and obligations of the parties accrued prior to such termination.
- (v). In case of early termination prior to the expiry of the Validity Period, the Project Manager shall be entitled to and the Trustee shall be liable to pay (from the funds of the InvIT) to the Project Manager the reimbursement of all out of pocket expenses incurred by the Project Manager while performing services in terms of the Project Implementation and Management Agreement up to that date. The fees shall be paid to the Project Manager within a period of 60 business days from the date of receipt of demand in this regard from the Project Manager failing which the fees, or any part thereof, which remains outstanding shall attract interest at the rate of 10% per annum on the outstanding amount.
- (vi). Notwithstanding anything contained hereinabove, the termination of any of the O&M Agreements, as the case may be, will not result in the termination of Project Implementation and Management Agreement, and the Project Implementation and Management Agreement shall continue to be in force in respect of the other O&M Agreements that are not terminated and the InvIT Assets.
- (vii). Notwithstanding anything herein contained, in the event of:
- (a) any amendment or supplement or restatement of any of the O&M agreements or execution of a new O&M agreement;
- the same shall be deemed to have been incorporated in the Project Implementation and Management Agreement and the Agreement shall stand modified to such extent.
- (viii). Notwithstanding anything contained hereinabove, the Project Implementation and Management Agreement shall automatically terminate: (i) in the event the offer of the Units does not occur within the time period stipulated in the InvIT Regulations, or such other date as may be mutually agreed to between the parties; (ii) in the event of cancellation of the registration of the Trust by SEBI; or (iii) upon winding up of the Trust, in accordance with the InvIT Regulations.

In case of any inconsistency between the Project Implementation and Management Agreement or any InvIT Documents, and the InvIT Regulations or any applicable law, the InvIT Regulations or applicable law shall prevail.

CORPORATE GOVERNANCE

The section below is a summary of the corporate governance framework in relation to the Trust, adopted by the Investment Manager.

1. Investment Manager

1.1. Board of Directors

Composition of the Board of Directors of the Investment Manager

In addition to applicable provisions of the Companies Act, 2013, the board of directors should adhere to the following:

- (a). Not less than 50% of the board of directors shall comprise of independent directors and not directors or members of the governing board of the Investment Manager of another infrastructure investment trust registered under the Securities and Exchange Board of India (Infrastructure Investment Trust) Regulations, 2014, as amended;
- (b). the chairman of the board of directors should be a non-executive independent director; and
- (c). collective experience of directors should cover a broad range of commercial experience, particularly experience in infrastructure sector (including the applicable sub-sector), investment management or advisory and financial matters.

The Investment Manager will be governed, amongst other things, by its articles of association. Please note that the procedure by which the Sponsor and unitholders may appoint nominee directors on the board of the IM is set out in the articles of association of the Investment Manager. The articles of association of the Investment Manager have been uploaded on <https://nhaiinvit.in/>, and the same has also been made part of the “*Material Contracts and Documents for Inspection*”, as disclosed in page 357 of this Final Placement Memorandum.

Quorum

The quorum shall be at least 50% of the number of directors on the board. At least 50% of the directors present shall be independent directors.

Frequency of meetings

The board of directors should meet at least four times every year, with a maximum gap of 120 days between any two successive meetings. Additionally, the board of directors should meet prior to any meeting of the unitholders and approve the agenda for unitholders’ meetings.

1.2. Remuneration of directors

Remuneration including sitting fees of the directors will be decided by the board of directors, from time to time.

1.3. Committees of the board of directors

(a). Audit Committee

Composition of the Audit Committee

The audit committee should comprise at least 50% of independent directors and will comprise of at least three members. The chairperson of the audit committee should be an independent director. All members of the audit committee should be financially literate and at least one member should have accounting or related financial management expertise. The company secretary shall act as the secretary to the audit committee.

Quorum

The quorum shall be at least 50% of the members of the Audit Committee, of which at least 50% of

the members present, shall be independent directors.

Frequency of meetings

The audit committee should meet at least four times every year, with a maximum gap of 120 days between any two successive meetings. Additionally, the audit committee should meet prior to any declaration of distributions and provide recommendations to the board of directors regarding any proposed distributions.

Scope of the Audit Committee

The terms of reference of the audit committee should include the following:

The terms of reference of the audit committee should include the following:

- (i). recommending to the board of directors the appointment, re-appointment and replacement, remuneration and terms of appointment of the statutory auditor of the Trust and the audit fee, subject to the approval of the unitholders;
- (ii). reviewing and monitoring with the management, the independence and performance of statutory auditors of the Trust, and adequacy and effectiveness of the audit process and internal control systems, as necessary;
- (iii). reviewing management letters/letters of internal control weaknesses issued by the statutory auditors and the findings of any internal investigations in relation to the Trust, into matters where there is suspected fraud or irregularity or a failure of internal control systems of a material nature, discussing such findings with internal and statutory auditors and reporting the matter to the board of directors;
- (iv). reviewing the annual financial statements and auditor's report thereon of the Trust and the Investment Manager, before submission to the board of directors for approval, with particular reference to:
 - changes, if any, in accounting policies and practices and reasons for such change;
 - major accounting entries involving estimates based on the exercise of judgment by management;
 - significant adjustments made in the financial statements arising out of audit findings;
 - compliance with listing and other legal requirements relating to financial statements;
 - disclosure of any related party transactions; and
 - qualifications in the draft audit report;
- (v). reviewing, with the management, the Trust's financial disclosure and reporting process and all periodic financial statements, including but not limited to quarterly, half-yearly and annual financial statements of the Trust, whether standalone or consolidated or in any other form as may be required under applicable law, before submission to the board of directors for approval;
- (vi). reviewing the management's discussion and analysis of financial condition and results of operations;
- (vii). reviewing and evaluating the adequacy of financial controls, risk management systems and internal audit function if any of the Trust, including the structure of the internal audit department, staffing and seniority of the official heading the department, reporting structure coverage and frequency of internal audit;
- (viii). reviewing, with the management, the statement of uses/application of funds raised through an issue of units by the Trust (including but not limited to public issue, rights issue, preferential issue, private placements, etc.) and any issue of debt securities, and the statement of funds utilised for purposes other than those stated in the offer documents/ notice, and making appropriate recommendations to the board of directors for follow-up action;

- (ix). (a) reviewing the procedures put in place by the Investment Manager for reviewing related party transactions, the indemnification of expenses or liabilities incurred by the Investment Manager, and the setting of fees or charges payable out of the Trust's assets, (b) reviewing the statement of significant related party transactions, submitted by the management; and (c) approving or any subsequently modifying transactions of the Trust with related parties, and recommending such transactions to the board of directors or the unitholders, as may be required, in terms of the InvIT Regulations;
- (x). overseeing loans and investments of the Trust, including (a) reviewing the investment decisions with respect to the underlying assets or projects of the Trust from the Sponsor including any further investments or divestments and (b) approving any proposal in relation to acquisition of assets, further issue of units including in relation to acquisition or assets; and undertaking other functions to ensure protection of the interest of unitholders;
- (xi). giving recommendations to the board of directors regarding appointment, re-appointment and replacement, remuneration and terms of appointment of the valuer of the Trust; as well as reviewing and monitoring the independence and performance of the valuer of the Trust;
- (xii). providing recommendations to the board of directors regarding any proposed distributions, and evaluating any defaults or delay in payment of distributions to the unitholders or dividends by the Project SPV to the Trust and payments to any creditors of the Trust or the Project SPV, and recommending remedial measures; and
- (xiii). formulating any policy for the Investment Manager as necessary, in relation to its functions, as specified above.

The terms of reference of the Audit Committee shall include, *inter alia*, the following acts:

- (i). deciding on the timing, pricing and all the terms and conditions in relation to a proposed issue of securities or units by the Company or the Trust, including the determination of the minimum subscription for such issue, pricing, allotment, any rounding off in the event of over subscription as permitted under applicable law in consultation with the lead managers, etc. and accepting any amendments, modifications, variations or alterations thereto;
- (ii). accepting and appropriating the proceeds of a proposed issue of securities or units by the Company or the Trust;
- (iii). finalizing the allotment of units or securities of Company or the Trust on the basis of the applications received, including the basis of the allotment;
- (iv). reviewing the investment decisions with respect to the underlying assets or projects of the Trust from the Sponsor including any further investments or divestments to ensure protection of the interest of unitholders;
- (v). entering into debt financing documentation, debenture subscription agreements and the share purchase agreements in connection with a proposed issue of securities or units by the Company or the Trust;
- (vi). authorizing and approving, the incurring of expenditure and payment of fees, commission, remuneration and expenses in connection with a proposed issue of securities or units by the Company or the Trust;
- (vii). settling all questions, difficulties or doubts that may arise in regard to a proposed issue of securities or units by the Company or the Trust, including in respect of the offer or allotment of units or securities, and the utilization of the issue proceeds (including in accordance with the investment strategy of the Trust, or in any other manner as the Committee may deem fit subject to the provisions of the Securities and Exchange Board of India (Infrastructure Investment

Trusts) Regulations, 2014, as may be applicable) and matters incidental thereto as it may, deem fit and delegating such of its powers as may be deemed necessary to the officials of the Company;

- (viii). authorising any director or directors of the Investment Manager or other officer or officers of the Investment Manager, including by the grant of power of attorney, to do such acts, deeds and things as such authorized person in his/her/its absolute discretion may deem necessary or desirable in connection with the issue, offer and allotment of securities or units by the Company or the Trust; and
- (ix). to do all such acts, deeds, matters and things and execute all such other documents, etc., deemed necessary or desirable for such purpose of in relation to a proposed issue of securities or units by the Company or the Trust.

(b). Stakeholders' Relationship Committee

Composition of the Stakeholders' Relationship Committee

The stakeholders' relationship committee should comprise at least three members. At least one member of the committee shall be an independent director. The chairperson of this committee shall be a non-executive director.

Quorum

The quorum shall be at least 50% of the members of the committee.

Frequency of meetings

The stakeholders' relationship committee should meet at least four times every year, or as frequently as determined by the board of directors or as directed by the trustee of the Trust, with a maximum gap of 120 days between any two successive meetings.

Scope of the Stakeholders' Relationship Committee

The terms of reference of the stakeholders' relationship committee should include the following:

- (i). consider and resolve grievances of the unitholders, including complaints related to the transfer of units, non-receipt of annual report and non-receipt of declared distributions;
- (ii). review of any litigation related to unitholders' grievances;
- (iii). update unitholders on acquisition / sale of assets by the Trust and any change in the capital structure of the Project SPV;
- (iv). reporting specific material litigation related to unitholders' grievances to the board of directors;
- (v). approve report on investor grievances to be submitted to the Trustee;
- (vi). undertaking all functions in relation to resolution of any conflicts of interest;
- (vii). coordination with the unitholders on matters in connection with voting (including in respect of actions which require approval of the unitholders in accordance with applicable law); and
- (viii). provide the unitholders with regular updates and information on the operation or performance of the Trust.

(c). Nomination and Remuneration Committee

Composition of the Nomination and Remuneration Committee

The nomination and remuneration committee should comprise at least three members. At least one member of the committee shall be an independent director. The chairperson of this committee shall be a non-executive director.

Quorum

The quorum shall be at least 50% of the members of the committee.

Frequency of meetings

The nomination and remuneration committee should meet as frequently as determined by the board of directors or as directed by the trustee of the Trust, with a maximum gap of 120 days between any two successive meetings.

Scope of the Nomination and Remuneration Committee

The terms of reference of the nomination and remuneration committee should include the following:

- (i) ensuring compliance with the requirements of the Companies Act, 2013;
- (ii) making all decisions in relation to appointment or replacement or removal of (a) independent directors; (b) any key managerial personnel; and (c) directors on the board of directors of the Project SPV; and
- (iii) formulating the following policies:
 - (a) the policy for appointment of independent directors (including the qualification and experience requirements, compensation model, performance parameters, process for appointment and removal);
 - (b) the policy for nomination of directors on the board of directors of the Project SPV (including qualification and experience requirements, compensation model, performance parameters, process for appointment and removal); and
 - (c) the human resources policy (in relation to employment terms including remuneration for the key managerial personnel).

1.4. Operating Committee(s) of the Investment Manager

(a) Investment and Finance Committee

Composition of the Investment and Finance Committee

The investment and finance committee will comprise at least three members, out of which one member shall be the chief executive officer of the Investment Manager, and at least one member shall be an independent director.

Quorum

The quorum shall be at least 50% of the members of the Investment and Finance Committee.

Frequency of meetings

The Investment and Finance Committee shall meet as and when expedient.

Scope of the Investment and Finance Committee

The terms of reference of the Investment and Finance Committee should include the following:

- (i). Completing all legal, statutory and procedural formalities, including opening bank accounts, escrow accounts, approving and filing, where applicable, draft offer documents, offer documents and final

offer documents to be filed with SEBI and the stock exchanges and such other authorities, as may be applicable, and making necessary amendments or alterations, therein in relation to a proposed issue of securities or units by the Company or the Trust, or any other forms or applications required to be filed with any other statutory agencies or relevant authorities in accordance with applicable law and do all acts in relation thereto;

- (ii). to negotiate, finalise and settle and to execute where applicable and deliver or arrange the delivery of the draft placement memorandum, placement memorandum, final placement memorandum, the preliminary and final international wraps, the agreements and all other documents, deeds, agreements and instruments and any notices, supplements and corrigenda thereto, as may be required or desirable in relation to a proposed issue of securities or units by the Company or the Trust;
- (iii). to appoint and enter into arrangements with the trustee, sponsors, lead managers and any other agencies or persons or intermediaries in relation to a proposed issue of securities or units by the Company or the Trust, and to negotiate and finalise the terms of their appointment;
- (iv). to appoint the registrar and other intermediaries to a proposed issue of securities or units by the Company or the Trust, in accordance with the InvIT Regulations and other statutory and/or regulatory requirements;
- (v). to submit undertakings/certificates, make applications, seek or provide clarifications, obtain approvals and seek exemption, where necessary, to or from the Securities and Exchange Board of India, stock exchanges, Registrar of Companies and such other statutory and governmental authorities in connection with a proposed issue of securities or units by the Company or the Trust, where necessary and accept on behalf of the Board such conditions and modifications as may be prescribed or imposed by any of them while granting such approvals, consents, permissions and sanctions as may be required in relation to a proposed issue of securities or units by the Company or the Trust;
- (vi). to give or authorise the giving by concerned persons of such declarations, affidavits, certificates, consents and authorities as may be required from time to time;
- (vii). to seek, if required, the consent of the lenders, parties with whom the Project SPV has entered into various commercial and other agreements, all concerned government and regulatory authorities in India or outside India, and any other consents that may be required in connection with a proposed issue of securities or units by the Company or the Trust;
- (viii). to issue all documents and authorise one or more officers of the Company to sign all or any of the aforesaid documents;
- (ix). to seek the listing of the units or other securities on any Indian stock exchange, submitting the listing application to such stock exchanges and taking all actions as may be necessary in connection with obtaining such listing and trading approval;
- (x). to authorise the maintenance of a register of unitholders/shareholders;
- (xi). authorizing and empowering authorized officers for and on behalf of the Investment Manager, to execute and deliver, on a several basis, any agreements and arrangements as well as amendments or supplements thereto that the authorized officer considers necessary, desirable or advisable, in connection with a proposed issue of securities or units by the Company or the Trust, including, without limitation, engagement letter(s), memoranda of understanding, the listing agreements, the registrar's agreement, the depositories agreements, the placement agreement with the lead managers (and other entities as appropriate), the escrow agreement, confirmation of allocation notes and any agreement or document in connection thereto, with, and to make payments to or remunerate by way of fees, commission, brokerage or the like, the lead managers, registrar, escrow agents, accountants, auditors, legal counsel, depositories, trustees, custodians, credit rating agencies and all such persons or agencies as may be involved in or concerned with any proposed issue of securities or units by the Company or the Trust, if any; and any such agreements or documents so executed and delivered and

acts and things done by any such authorized officer shall be conclusive evidence of the authority of the authorized officer and the Company in so doing; and

- (xii). to do all such acts and deeds as may be required to issue units of the Trust in dematerialised form and to sign agreements and/or such other documents as may be required with the National Securities Depository Limited the Central Depository Services (India) Limited and such other agencies, as may be required in this connection.

1.5. Articles of Association of the Investment Manager

The articles of association should not include any affirmative rights for the Sponsor.

1.6. Policies to be adopted by the Board of Directors of the Investment Manager

The Investment Manager has adopted the following policies in relation to management of the Trust:

(i). Code of conduct

The Trust and the Parties to the Trust shall comply with the Code at all time, in accordance with the InvIT Regulations, for all matters for which they are dealing / acting on behalf of the Trust, including that:

1. the Trust and the Parties to the Trust shall conduct all affairs of the Trust in the interest of all the unitholders of the Trust (“**Unitholders**”);
2. the Trust and the Parties to the Trust shall make adequate, accurate, explicit and timely disclosure of relevant material information to all Unitholders, the stock exchanges and the Securities and Exchange Board of India (“**SEBI**”) in accordance with the InvIT Regulations and as may be specified by the stock exchanges from time to time;
3. the Trust and the Parties to the Trust shall try to avoid conflicts of interest, as far as possible, in managing the affairs of the Trust and keep the interest of all Unitholders paramount in all matters. In case such events cannot be avoided, it shall be ensured that appropriate disclosures are made to the Unitholders and they are fairly treated;
4. the Trust and Parties to the Trust shall ensure that fees charged by them with respect to activity of InvIT shall be fair and reasonable;
5. the Investment Manager shall carry out the business of the Trust and invest in accordance with the investment objectives (as disclosed in the preliminary placement memorandum, placement memorandum and the final placement memorandum, as applicable) and take investment decisions solely in the interest of Unitholders;
6. the Trust, the Parties to the Trust and any third party appointed by the Investment Manager shall not use any unethical means to sell, market or induce any person to buy units of the Trust and where a third party appointed by the Investment Manager fails to comply with this condition, the Investment Manager shall be held liable for the same;
7. the Trust and the Parties to the Trust shall maintain high standards of integrity and fairness in all their dealings and in the conduct of their business;
8. the Trust and the Parties to the Trust shall render at all times high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment; and
9. the Trust and the Parties to the Trust shall not make any exaggerated statement, whether oral or written, either about their qualifications or capabilities or experience.

In case of any discrepancy, the provisions of applicable law shall prevail over the provisions of the code. Notwithstanding the above, the aforesaid code will stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the Unitholders of the Trust.

(ii). Anti-Bribery And Corruption Policy

- a. The Trust maintains and promotes the highest ethical and legal standards in its business, especially in relation to bribery and corruption, and expect employees of the Trust and those with whom the Trust does business to do the same.
- b. The policy on bribery and corruption applies to the Trust’s dealings in both the public and the private sectors, and any violation of this policy is a matter of serious concern.

Management oversight and leadership:

- a. The Trust's audit committee, together with its chief executive officer, chief financial officer and Compliance Officer, are responsible for providing leadership, resources and active support for the implementation of the policy.
- b. The compliance officer appointed to ensure compliance of the policy ("**Compliance Officer**"), who may be a person other than the compliance officer of the Trust appointed as per the requirements of Companies Act, 2013, as amended, will communicate the policy to all levels of the Trust, project SPVs of the Trust ("**Project SPV**") and relevant external parties at least annually, and at such other times as he considers appropriate, such as when the policy is amended or updated.

Definitions of bribery and corruption:

- a. "ABC" means anti-bribery and corruption.
- b. "Anti-Bribery Laws" means the ABC laws and regulations, which shall include, the Prevention of Corruption Act, 1988, relevant portions of the Indian Penal Code, 1860, the Central Vigilance Commission Act, 2003, applicable to, the Trust and its employees.
- c. "Bribe / Bribery" means the giving, acceptance, solicitation or facilitation of a financial advantage to or by any person which (i) does or might induce, influence or reward the improper performance or non performance of any activity or function in either the public or private sector, (ii) which in itself constitutes the improper performance of a relevant function or activity, or (iii) is intended to obtain or retain business or a business advantage.
- d. A promise or offer to give, accept, solicit or facilitate a financial advantage will also constitute Bribery. Equally, a violation may occur if you do anything which is prohibited through another person, as much as if you did it yourself.
- e. A financial advantage may be anything of value. It can be a payment, payoff, influence payment or a 'kickback'. Equally, it may also take the form of a gift, hospitality or entertainment, or be something intangible, like an offer of employment.
- f. "Corruption" means dishonest or fraudulent conduct by those in power, typically involving Bribery.
- g. The term "Official" includes any person who holds a legislative, judicial or administrative position of any kind; any official, employee or representative of, or any other person acting in an official capacity or performing a public function on behalf of: a government (including any entity it owns or controls) or any government authority or agency; the legislature; the judiciary; a political party or political candidate; or a public international organization.

Prohibition on bribery:

- a. The Trust prohibits:
 - (i) Giving Bribes including:
 - Bribing someone to get a contract or other business advantage such as a license, consent or permit (including from that person or by using that person's influence);
 - Bribing any Official in order to influence any official decision, or to induce them to use their influence to affect any act or decision of a governmental authority; or
 - Bribing any officer, employee or agent of a company or body corporate with which the Trust interacts in the conduct of Trust's activities and operations for the purpose of influencing any act or decision of that company or body corporate.
 - (ii) Receiving Bribes including:
 - Asking, agreeing to or receiving a Bribe from anyone in exchange for giving or continuing to give a person any business, or any business advantage, or for otherwise improperly performing any activity or function.
- b. Circumstances which may suggest an increased risk of Bribery or Corruption and which should therefore be discussed with the Compliance Officer include:
 - (i) Intermediaries (as defined below) engaged by the Trust which is accused of improper practices;
 - (ii) A party with whom the Trust does business requests payment in cash or to offshore accounts;

- (iii) Requests for payment, entertainment or hospitality at a time when the recipient is making an important decision that affects or could be perceived to affect the operations of the Trust;
 - (iv) Refusal by any Intermediary to use written agreements;
 - (v) Requests or directions to record (or issue receipts) for payments or fees in a manner which does not reflect their true nature;
 - (vi) Previous relationships between Trust's employees or Intermediaries and a government office or Official;
 - (vii) Requests for special payments, such as a 'special acceleration fee' or any other payment to reduce delay or remove the need to comply with applicable procedures.
- c. The above examples are not exhaustive and any matters which give you cause for concern should be promptly raised with the Compliance Officer.
 - d. Practices that may appear typical or customary may still be unlawful and in breach of the policy.
 - e. The Trust should always consider whether any conduct may give an appearance that it creates an obligation on, or may influence, the recipient (or a third party) to act in a way that may be improper, or which may be perceived as being capable of influencing an Official exercise of discretionary authority, even where this is not the intention. Such conduct should be discussed with the Compliance Officer.

Dealing with intermediaries:

- a. The term intermediaries ("**Intermediaries**") refers to an associate's representatives, vendors, contractors, sub-contractors, consultants and any other persons engaged by an associate, or who are engaged to act for the associate in its business dealings with any government or official, or in obtaining governmental approvals.
- b. The Trust engages Intermediaries only for ordinary and legitimate business purposes and only on arms-length, commercially reasonable terms.
- c. Any contracts between associates and Intermediaries must be in writing and must be signed by the parties.
- d. Different types of Intermediaries are subject to different ABC risk assessment and risk mitigation measures. It is clarified that such provisions and procedures would be prepared by the Trust in consultation with the Compliance Officer which are to be followed when engaging an Intermediary and for the Trust's standard anti-bribery related contractual provisions which are to be included in the Trust's contracts with Intermediaries.

In general:

- a. The Trust expects that Intermediaries and vendors with which it does business to either formally acknowledge and abide by relevant aspects of the policy by way of an undertaking, or to have adequate anti-bribery and corruption policies and procedures of its own in place.
- b. When engaging an Intermediary, an associate should:
 - (i) perform proportionate and risk-based due diligence checks on the Intermediary based on an understanding of the potential relationship (e.g. the sector in which the Intermediary operates, the type of services it will be providing and the level of interaction it will have with Officials or private sector parties); and
 - (ii) consider and respond appropriately to the findings of that due diligence, particularly where areas of high concern are identified.

Charitable donations:

- a. The Trust supports the work of registered and reputable charities.
- b. However, unless appropriate procedures are adopted, there is a risk that charitable donations given by the Trust or its employees may be perceived as seeking to improperly influence decisions which affect the Trust, or to induce those who have authority to make such decisions to give an improper business advantage to the Trust.

- c. The key principles regarding donations are as follows:
 - (i) donations must not be made using Trust's funds, under the Trust's name, or in connection with the Trust, without first obtaining specific approval from the Compliance Officer;
 - (ii) where making a donation as a private citizen, Trust's employee should ensure it is made clear to the recipient and in any publicly available material that the donation is not being made for or on behalf of the Trust, or in connection with the activities of the Trust; and
 - (iii) A donation should not be made either privately or by the Trust if the intent or possible effect of the donation is or may be to influence the decisions of any Official or other person on matters affecting the Trust.
- d. All donations must be properly recorded and accounted for in the central register of political and charitable donations maintained by the Compliance Officer.

Gifts, Hospitality and Entertainment ("GH&E"):

- a. The Trust recognizes that constructive business relationships may include occasional, incidental provision of gifts, hospitality and entertainment.
- b. However, gifts, hospitality and entertainment which are or may be seen as exceptional, lavish or disproportionate, or given to certain individuals who have the ability to make decisions affecting the Trust, may be regarded as improper or unlawful.
- c. As a general rule, gifts, hospitality and entertainment must:
 - (i) be reasonable and proportionate in terms of frequency, value and the status/seniority of the recipient;
 - (ii) be provided in an open and transparent manner; and
 - (iii) always be provided for legitimate business purposes and in kind only.
- d. The Trust and its employees must not:
 - (i) offer gifts, hospitality and entertainment, or anything else of value, which might influence the decisions of counterparties or Officials in connection with the business of the Trust; or
 - (ii) accept any gifts, hospitality and entertainment, or anything else of value, which might influence their own decisions.
- e. The Trust shall comply with GH&E at all time, in accordance with the InvIT Regulations, including that:
 - GH&E which is or may be regarded as, exceptional, lavish or disproportionate and/or intended to induce or reward improper conduct is prohibited.
 - Trust and its employees must not offer, provide, accept or solicit gifts in the form of cash, cash equivalents, commissions, loans, securities or goods/services at below-market value.
 - The Trust must pay all costs associated with GH&E (e.g. transport, accommodation and meals) directly to suppliers and not to the recipients of the GH&E.
 - GH&E must not be offered or provided to family members or friends of the recipient.
 - Approval of GH&E, including GH&E relating to Officials, is required in accordance with the policy and must be obtained in advance of any offer or acceptance of GH&E. If circumstances clearly prevent obtaining advance approval, the GH&E must be reported to the Compliance Officer at the earliest available opportunity.
 - Failure to comply with the policy may result in disciplinary action, including possible termination of employment.
 - All GH&E must be properly recorded and accounted for in the books and records and must be supported by original receipts.
 - All GH&E approval forms (whether approved or declined) must be held on file by the Compliance Officer for a period of five years.

- GH&E with a value in excess of Rs. 5,000 must be approved by the Compliance Officer and in excess of Rs. 10,000 must be approved by the managing director of the Trust, and all such GH&E shall be recorded by the Compliance in the annual GH&E central register.
 - The annual GH&E central register must be submitted to, and reviewed annually by, the Audit Committee.
- f. Trust's employees should consider the above guidelines in respect of all gifts, hospitality and entertainment which they propose to offer or accept.

Facilitation Payments:

- a. The Trust is committed to complying with the laws applicable to its business. The trust acknowledges that facilitation payments, which usually are small payments made to obtain or expedite routine actions for specific performance, are not permitted under the laws of many jurisdictions and that authorities in many parts of the world are seeking to eliminate such practices.
- b. If an employee of the Trust becomes aware that a facilitation payment may be made, this must be referred to the Compliance Officer, who will consider, consult as necessary and recommend action.
- c. The Compliance Officer will report to the Audit Committee on any matters relating to facilitation payments.

Conflict of Interest:

- a. Employees of the Trust must seek to avoid any real or perceived conflict between their private interests and the performance of their duties to the Trust.
- b. A conflict of interest arises when an individual's private interests influence, or may appear to influence, the objective exercise of his or her duties to the Trust. Conflicts of interest can arise where, for example, an employee and/or the Trust is considering business arrangements involving the Trust which may provide the employee with a private benefit, or where an employee position within the Trust gives them an opportunity to provide special advantages or benefits to a partner, child or friend.
- c. If a situation arises which may give rise to a conflict of interest involving an employee, another employee or an external party in connection with matters affecting the Trust, the employee must promptly raise this with the Compliance Officer.

Books and Records:

- a. The books and records of the Trust must reflect, accurately and fairly, the transactions of the Trust and dispositions of its assets, including ensuring that a transaction is accurately described in its books and records and the amount of each transaction is accurately recorded.
- b. No payment on behalf of the Trust is to be approved or made with the express or implied agreement or the intention that any part of it is to be used for a purpose other than that described by the documents supporting the payment.
- c. Employees should never agree to requests for false invoices or for payments of expenses that are unusual, excessive, inadequately or improperly described, or otherwise raise questions under the policy.
- d. No undisclosed or unrecorded funds or assets are to be established or used for any purpose.

Training:

- a. Employees of the Trust will receive regular (at least annual) training relevant to their role to ensure that they:
 - (i) understand the Anti-Bribery Laws applicable to them;
 - (ii) are aware of and understand the policy;
 - (iii) are equipped to respond to the specific risks which relate to their particular role; and
 - (iv) know what the Trust expects of them.
- b. Where appropriate Intermediaries will also receive training appropriate to their role. The nature of such training and those Intermediaries who are to be subject to it will be determined by the Compliance Officer.

- c. Employees of the Trust should check with the Compliance Officer in connection with engaging Intermediaries and any training obligations which apply.

Whistle-blowing, investigations and non-retaliation:

- a. Employees and Intermediaries (anonymously or by name) who are aware of possible or suspected corrupt acts by colleagues, demands for Bribes or other violations of Anti-Bribery Laws or the policy must report these to the Compliance Officer or head of department. Any such reports will be promptly investigated by the Trust.
- b. An employee of the Trust or Intermediary will not suffer demotion or any other adverse consequences for refusing to pay Bribes or for reporting in good faith possible corrupt acts by colleagues, demands for Bribes or other suspected violations of Anti-Bribery Laws applicable where the Trust operates or the policy, even if it may result in the Trust losing business.
- c. Any Trust employee who retaliates, or attempts to retaliate, against a person who has made a report relating to a violation of Anti-Bribery Laws or the policy will be subject to disciplinary action, which may include termination of their employment with the Trust.

Compliance:

- a. Any employee of the Trust who violates any Anti-Bribery Law or any aspect of the policy will be subject to disciplinary action, which may include termination of their employment with the Trust.
- b. Employees of the Trust should understand that additionally, they could be subject to civil and criminal liability for violations of applicable law.
- c. Violations of any Anti-Bribery Laws or the policy should be reported.

Continuous monitoring and improvement:

- a. The Audit Committee and Compliance Officer are responsible for monitoring the implementation of, compliance with and periodic review and updating of the policy, including to comply with changes in Anti-Bribery Laws.
- b. In line with this, the Compliance Officer will report:
 - on a regular basis, on general compliance by the Trust with the policy and its effectiveness; and
 - to the Audit Committee annually on the above matters in connection with the annual ABC risk assessment and audit.
 - The Compliance Officer will also notify the Audit Committee should he/she become aware of any particular instance of non-compliance (or suspicion of non-compliance) with Anti-Bribery Laws or the policy.
 - The Trust carries out an annual ABC risk assessment and audit to assess the effectiveness of the policy. The terms of reference of such audits are set annually by the Audit Committee, which will also oversee the annual audit. Where issues are identified, the Audit Committee will prescribe appropriate remedial measures to be implemented by the Trust in order to address these.
 - Any material deficiencies in the policy which are identified by employees of the Trust during the year should be reported to the Compliance Officer for an appropriate action to be taken.

The Compliance Officer:

The Trust employs a Compliance Officer who is responsible for day to day implementation and oversight of the policy. Their responsibilities also include:

- a. receiving and investigating reports of ABC-related incidents;
- b. escalating known ABC issues to the Audit Committee, as appropriate;
- c. reporting to the Audit Committee as set out above;
- d. ensuring employees of the Trust complete ABC questionnaires and certifications (as relevant) in a timely manner;
- e. maintenance of the central donations register and annual gifts, hospitality and entertainment register; conducting regular spot checks of compliance with the policy and the Trust's books and records;
- f. providing guidance to Trust's employees on the policy; and
- g. Record keeping in connection with the policy and associated training.

Advice and Assistance:

Employees should contact the Compliance Officer for advice and assistance on any matters relating to the policy.

Minimum Due Diligence Requirements:

In the event that the InvIT considers any new investment opportunity, independent and reputable consultants shall be engaged to conduct the respective due diligence for all key workstreams. The key workstreams include: (i) traffic, (ii) technical, (iii) financial and tax, (iv) legal and (v) anti-corruption and anti-bribery aspects, environmental health safety aspects and compliance as well as (vi) reputational risk assessment of a remaining existing minority unitholder in an asset, if any.

KYC Compliances:

Any person who is a unitholder in the Trust or any Project SPV holding the Trust assets would be required to comply with the stringent KYC norms that is in line with international market standards and customary policies of global financial institutions of repute, including sanctions enacted by OFAC or the European Union or other similar bodies. Any person who does not meet these requirements is not eligible to become a unitholder/shareholder of these entities or be appointed as Investment Manager or Project Manager.

Reporting of Litigation:

Relevant information (e.g. parties, forum, nature of dispute/claim, monetary amount involved and status) pertaining to all litigations/disputes (matters above a monetary threshold of ₹ 80 million) of all Project SPVs shall be prepared on a quarterly basis, and be made available to all the unitholders, if requested for by any unitholder.

Compliance with InvIT Documents and InvIT Regulations:

All current and future Project SPVs shall amend their respective Articles of Association to include a requirement that the Project SPVs shall, at all times, conduct their affairs in compliance with the provisions of the Trust documents and the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended.

(iii). Borrowing Policy

The Investment Manager is required to ensure that all funds borrowed in relation to the Trust are in compliance with the InvIT Regulations. Accordingly, the Investment Manager, has adopted the Borrowing Policy pursuant to the resolution of the IM Board dated February 3, 2021. The Borrowing Policy was subsequently amended pursuant to resolution of the IM Board dated September 27, 2021. For details of the Borrowing Policy, please see the section entitled “*Financial Indebtedness and Deferred Payments – Borrowing Policy*” on page 239.

(iv). Policy on Related Party Transactions (“RPT Policy”)

The Investment Manager has adopted the RPT Policy pursuant to a resolution of its board of directors dated February 3, 2021, in relation to Trust. The RPT Policy is adopted to regulate the transactions of the Trust with its related parties based on the laws and regulations applicable to the Trust and best practices with the objective of ensuring proper approval, supervision and reporting of the transactions between the Trust and its related parties. For details of the RPT Policy, please see “*Related Party Transactions – Procedure for dealing with Related Party Transactions*” on page 251.

(v). Distribution policy

The Investment Manager has adopted the Distribution Policy pursuant to a resolution of its board of directors dated February 3, 2021, in relation to Trust. The Distribution Policy was subsequently amended pursuant to the resolution of the IM Board dated September 27, 2021. For details of the Distribution Policy, please see the section entitled “*Distribution*” on page 248.

(vi). Policy on appointment of auditor and valuer of the Trust

For details on the Policy on appointment of the auditor and the valuer of the Trust, adopted by the IM Board pursuant to its resolution dated February 3, 2021, see “*Other Parties Involved in the Trust – Policy on Appointment of Auditor and Valuer*” on page 143.

(vii). Policy on unpublished price-sensitive information and dealing in units by the parties to the Trust

The Investment Manager has adopted the UPSI Policy pursuant to a resolution of the IM Board on February 3, 2021. The UPSI Policy was subsequently amended pursuant to resolution of the IM Board dated September 27, 2021. The purpose of the policy is, *inter alia*, to ensure that the Trust complies with applicable law, including the InvIT Regulations or such other Indian laws, regulations, rules or guidelines prohibiting insider trading and governing disclosure of material, unpublished price sensitive information (“UPSI”).

The key principles of the UPSI Policy are set out below:

- a) The Investment Manager shall promptly disclose to the public all UPSI that would impact price discovery no sooner than credible and concrete information comes into being in order to make such information generally available;
- b) The Investment Manager shall follow uniform and universal dissemination of UPSI to avoid selective disclosure;
- c) The Compliance Officer shall be responsible for deciding whether a public announcement is necessary for verifying or denying rumours and then making the disclosure, in accordance with the procedure specified in the Policy for Determining Materiality of Information for Periodic Disclosures;
- d) The Compliance Officer shall also make an appropriate and fair response to the queries on news reports and requests for verification of market rumours by regulatory authorities, in accordance with the procedure specified in the Policy for Determining Materiality of Information for Periodic Disclosures;
- e) While dealing with analysts or research persons or large investors like institutions, the Investment Manager shall provide only public information. Alternatively, the information given to analysts or research persons shall be simultaneously made public at the earliest; and
- f) The Investment Manager shall handle all UPSI on a “need to know basis”, provided that UPSI may be disclosed to persons who need such information for furtherance of legitimate purposes, performance of duties or discharge of legal obligations in relation to the Trust.

Further, the UPSI Policy also provides the process and procedures for closure of the trading window for dealing in Units, pre-clearance of dealing in units and approval requirements, disclosure by insiders, inquiry into leak of any UPSI and handling and investigation into complaints by whistleblowers.

(viii). Investor Grievance Redressal Policy

The key principles of the Policy are set out below:

Principles of the Policy:

- All Investors shall be treated equally.
- Complaints raised by Investors shall be dealt with promptly and with courtesy.
- Investors shall be fully informed of avenues to escalate their complaints / grievances outside as well as within the organization and their rights to alternative remedy, if they are not fully satisfied with the response to their complaints. Within the organization, investors shall write to the stakeholders’ relationship

committee formulated by the Board in this regard (“**Stakeholders’ Relationship Committee**”), for further redressal.

- The Trust shall resolve all complaints efficiently and fairly within the regulatory framework.

Grievance redressal mechanism:

The Trust has an established mechanism for investor services and grievance handling, with the Stakeholders’ Relationship Committee appointed by the Trust for this purpose, being an important functional node.

Some of the key steps undertaken by the Trust for handling Investor Grievances are enumerated as follows:

- The Stakeholders’ Relationship Committee is entrusted with handling all unit related matters viz., transfer, transmission, transposition, nomination, dividend, change of name / address / signature, registration of mandate / Power of Attorney, replacement / DEMAT / REMAT of units.
- Investors can lodge a complaint for non-receipt of any right available to them or failure of the Trust to comply with any statutory obligation by giving details of their name, folio no., DP ID / Client ID, nature and full particulars of their complaint directly to the Stakeholders’ Relationship Committee, including for matters relating to units/dividend transferred to Investor Education and Protection Fund (IEPF).
- Any information, other than those specified above or any supporting documentation required for redressal of the complaint shall be informed to the investors by the Stakeholders’ Relationship Committee. Investors are requested to furnish all the requisite information along with duly executed documents at the earliest to avoid any delay in redressal of their complaints.
- In case of non-satisfactory response from Stakeholders’ Relationship Committee, investor can also lodge their complaints with the compliance officer of the Trust through the Trust’s designated e-mail ID for investor grievances as mentioned on the website of the Trust or the draft placement memorandum. The designated e-mail ID is also displayed on the Trust’s website. Alternatively, investors can send their complaints at the SEBI Complaints Redress Systems platform.
- Investor grievances received through any other channel (including Registrar and Unit Transfer Agents (RTA)) shall be reviewed regularly and replied/resolved appropriately. Investor grievances received and resolved directly by RTA shall be reviewed by compliance officer periodically.
- If the investor doesn’t receive a reply from the Stakeholders’ Relationship Committee / compliance officer within stipulated turnaround time of 30 working days, the investor may write to the Trust again, however, investors are urged to refrain from sending multiple reminders during the above mentioned turn around period for redressal of their complaints.
- Investors are requested to approach the Stakeholders’ Relationship Committee, or in case of any inaction by the Stakeholders’ Relationship Committee, the compliance officer of the Trust, for redressal of their concerns prior to raising their concerns with the regulatory authorities.
- The Trust shall periodically obtain status report of the Complaints from the compliance officer of the Trust. Further, internally secretarial staff checks the designated investor grievances e-mail ID on daily basis to check whether any new complaint has been lodged.
- The Trust shall make annual disclosures of the statement of investor complaints in its annual report.
- The compliance officer of the Trust is authorised to amend the Policy from time to time to give effect to any changes / amendments notified by any regulatory authority. The amended Policy shall be placed before the unitholders for noting and ratification.

(ix). ***Employment, Safety, Environment and Governance (“ESG”) Policy***

The key principles of the ESG Policy are set out below:

Employment, Health and Safety (“EHS”):

In connection with EHS, the Investment Manager shall:

- Promote a positive EHS culture.
- Comply with all statutory and other applicable legal and regulatory requirements with respect to EHS and seeks to ensure its Intermediaries do the same.
- Incorporate EHS considerations in business processes, including by ensuring appropriate health and safety measures are adopted, ensuring employees are provided with, and use, protective equipment when dealing with potential hazards, and by the provision of regular occupational health and safety training for employees.
- Identify, monitor and control EHS risks which arise in connection with its projects and operations, including in subcontracted works.
- Record and review all accidents, occupational health and safety related incidents and lost time days and investigate all serious occupational health and safety incidents, including in subcontracted works.
- Ensure that all of its workplaces which are exposed to high-risk hazards have appropriate emergency plans in place.
- Screen, evaluate and engage Intermediaries based on its EHS management systems and practice.
- Encourage communication, consultation and collaboration with all employees and stakeholders.

Workers' Rights:

To achieve the Trust's objective in connection with workers' rights, the Investment Manager shall:

- Respect the rights of its employees, including by providing fair and timely wages, supporting their work-life balance, providing safe working conditions, fostering worker engagement, including by the provision to employees of information on workers' rights and of mechanisms to raise employment related grievances, and permitting freedom of association.
- Prohibit the use of any child or young workers and the use of any form of forced or compulsory labour in connection with its business.
- Prohibit all forms of discrimination and abuse in its work place.
- Complies with all statutory and other applicable legal and regulatory requirements with respect to workers' rights.
- Have in place policies governing the provision to its employees of overtime, vacation and public holidays and maternity, sickness and disability benefits.
- Protect the rights of migrant workers in accordance with applicable statutory and other legal requirements.
- Screen, evaluate and engage Intermediaries based on their respect for workers' rights.
- Monitor compliance with and risks to workers' rights in connection with Projects, including in subcontracted works.
- Encourage communication, consultation and collaboration with all employees and stakeholders.

The Environment:

To achieve the Trust's objective in connection with the environment, the Investment Manager shall:

- Seek to adopt sustainable and resource-efficient processes and to conserve natural resources, reduce adverse environmental impacts (such as waste and environmental emissions) and enhance energy efficiency.
- Comply with all statutory and other applicable legal and regulatory requirements with respect to the environment (including by seeking all required environmental clearances, permits, and licenses, and maintaining a register of these) and seek to ensure Intermediaries do the same.
- Seek to identify, monitor and control environmental risks which arise in connection with its projects and operations, including in subcontracted works.

Dealing with Intermediaries:

The term intermediaries ("**Intermediaries**") refers to an associate's representatives, vendors, contractors, sub-contractors, consultants and any other persons engaged by an associate, or who are engaged to act for the associate in its business dealings with any government or official, or in obtaining governmental approvals.

In general:

- The Trust expects that Intermediaries and vendors with which it does business either formally acknowledge and abide by relevant aspects of this policy by way of an undertaking, as suitably incorporated in their appointment terms, or to have adequate ESG policies and procedures of their own in place.
- When engaging an Intermediary, the associate should:
 - perform proportionate and risk-based due diligence checks on the Intermediary; and
 - consider and respond appropriately to the findings of that due diligence, particularly where areas of high concern are identified.

Training:

The Trust's employees will receive training to ensure they understand applicable ESG law, are aware of and understand this policy, are equipped to respond to specific risks which relate to their particular role and know what the Trust expects of them. Where appropriate, Intermediaries will also receive training appropriate to their role.

Process for reporting possible violations of applicable law or this policy:

The Trust will promptly investigate reports of possible or suspected violations of applicable ESG law or this policy in accordance with this policy. Employees or Intermediaries will not be demoted or suffer any other unfavourable treatment as a result of making a good faith report of a possible violation of applicable law or this policy, even if it may result in the Trust losing business. If any employee of the Trust violates this policy or retaliates against another employee who has reported a possible violation of applicable law or this policy then they will be subject to disciplinary action, which may include termination of employment.

Management leadership, oversight, implementation and review:

The Audit Committee, together with its chief executive officer, chief financial officer and compliance officer are responsible for providing leadership, resources and active support for the implementation of this policy. The compliance officer appointed to ensure compliance of the ESG Policy ("**Compliance Officer**"), who may be a person other than the compliance officer of the Trust appointed as per the requirements of Companies Act, 2013, as amended, will communicate this policy to the Trust and relevant external parties at least annually, and at other appropriate times, such as when this policy is amended or updated. The Audit Committee will oversee compliance with this policy. The Compliance Officer is responsible for its day to day implementation. The Trust shall have an annual ESG risk assessment and audit to assess the effectiveness of this policy. The terms of reference of such audits are set annually by the Audit Committee, which will also oversee the annual audit. Where issues are identified, the Audit Committee will prescribe solutions to be implemented by the Trust. The Compliance Officer will report on general compliance with this policy and its effectiveness on a regular basis to the Audit Committee annually in connection with the annual ESG risk assessment and audit. The Compliance Officer will also notify the Audit Committee should they become aware of any non-compliance (or potential non-compliance) with applicable law or this policy. If an employee identifies a deficiency in this policy they should report it to the Compliance Officer who will initiate appropriate action.

Advice and assistance:

Employees should contact the Compliance Officer for advice and assistance on any matters relating to this policy.

(x). Asset Acquisition and Unit Funding Policy ("A&F Policy")

The Investment Manager has adopted the A&F Policy pursuant to a resolution of the IM Board on September 30, 2021.

Objective of the A&F Policy: Under the InvIT Regulations, the Investment Manager shall make investment decisions with respect to any further investment in accordance with the investment strategy of

the Trust. Additionally, as per the Investment Management Agreement, the Investment Manager is empowered to do all such other acts, deeds and things as may be incidental or necessary for the advancement or fulfilment of the investment objectives of the Trust.

The objective of the A&F Policy is to lay the framework for the Investment Manager to pursue acquisition opportunities that may be offered by NHAI as part of its monetisation strategy.

The A&F Policy will be updated annually and any amendment, modification or change in the policy will require approval from the Audit Committee and the IM Board and subsequently approval of the Unitholders under the Regulation 22(5) of InvIT Regulations. Further, any acquisitions under the A&F Policy shall be subject to and in compliance with other relevant policies.

Decision making forum: The Audit Committee of the IM Board, *inter alia* has the responsibility, for “overseeing the loans and investments of the Trust, including (a) reviewing the investment decisions with respect to the underlying assets or projects of the Trust from the Sponsor including any further investments or divestments and (b) approving any proposal in relation to acquisition of assets, further issue of units including in relation to acquisition or assets; and undertaking other functions to ensure protection of the interest of unitholders.” In case the terms of reference of the Investment & Finance Committee are amended to include any of the above responsibilities, the A&F Policy will be suitably amended.

Working Committee: The management of the Investment Manager will form a working committee, comprising employees and / or consultants with skills such as finance, technical, legal, secretarial etc. to evaluate opportunities and undertake the detailed analysis. The working committee will screen the proposals and manage the entire process as encapsulated in this policy. The nodal officer for activities in the A&F Policy will be Vice President (Investment & Acquisitions). The working committee will share its reports and analysis and engage with Audit Committee through the Managing Director and Chief Executive Officer of the IM.

Process:

- a. **Three year Acquisition Plan:** The management of the Investment Manager will prepare a three (3) years’ rolling acquisition plan for the Trust (“**3 Year Acquisition Plan**”). The 3 Year Acquisition Plan would be based on inputs received from NHAI about its monetisation plans. The rolling plan will also include the potential sources of funding, including target leverage. This will be evaluated and approved by the Audit Committee and subsequently by the IM Board.
- b. **Target Assets:** The Trust will work with the Sponsor to develop a potential list of opportunities that will meet the following criteria, *inter alia*:
 - i. Operating toll roads with minimum 1 (one) year operations;
 - ii. Minimum 20 years of residual concession period for tolling; and
 - iii. Transitional support to be offered by NHAI.
- c. **Annual Acquisitions Plan:** With preparation of the annual budget of the Trust, based on inputs received from NHAI, the management will prepare an annual acquisition plan at the beginning of each financial year (“**Annual Acquisition Plan**”), The Annual Acquisition Plan will include likely Target Assets, estimated valuation and potential sources of funding. The Annual Acquisition Plan will also include estimated expenses for due diligence and other transaction costs.
- d. **Valuation Parameters:** The Annual Acquisition Plan will also include the parameters that drive valuation of the roads, such as cost of equity, WPI, target leverage, interest rates etc. These parameters will be provided in a range, and will be based on inputs from the management, parameters/assumptions used by the independent valuer for valuation of existing roads, relevant market and transaction multiples etc. The parameters such as WPI, interest rates etc. shall be reviewed at a minimum of six (6) months interval, subject to any significant changes in the market

conditions and/or macro-environment. The parameters for the first year shall be finalised and approved by the Audit Committee within 60 days of completion of the InvIT launch.

Valuation for future acquisitions should be derived using discounted cash flow methodology on a post-tax basis. The discounting rate shall be computed based on last 6 months' average of Government of India 10 years Bond Yield plus appropriate risk margin.

- e. **Due diligence agencies:** The Investment Manager will undertake an independent evaluation for all potential acquisition opportunities, including carrying out a detailed diligence exercise. The Investment Manager will empanel the key advisors with relevant experience and credentials for carrying out various work streams of due diligence, such as traffic analysis and forecasting, technical evaluation, legal and regulatory, finance, accounting and tax, human resources, environment, health and safety (EHS), secretarial, insurance advisors. This is only an indicative list and may be updated depending upon the nature and size of the Target Assets.
- f. **Financial Model:** A standalone financial model would be developed to assess the acquisition opportunities. The financial model will be audited by an external agency. If a transaction advisor/ merchant banker is engaged, then such party could be entrusted the task of developing the financial model.
- g. **Capital Structure:** The overall capital structure of the Trust shall be optimized using appropriate leverage to improve the risk-adjusted returns for unitholders while maintaining a AAA credit rating and ensuring compliance with leverage limits prescribed under the InvIT Regulations. Any equity infusion into the Trust would be raised as per InvIT Regulations and the guidelines issued thereunder.
- h. **Decision making process:**
 - i. The working committee will screen the proposals and manage the entire process as encapsulated in the A&F Policy.
 - ii. The working committee will present to the Audit Committee, details of the roads made available for monetisation by NHAI, for its initial screening. In the initial screening proposal, the management will also seek the Audit Committee's approval for tentative expenses that may be incurred for evaluation of the roads.
 - iii. Based on approval received from the Audit Committee, the working committee will initiate due diligence and other processes required for presenting a proposal to the Audit Committee for its decision.
 - iv. The working committee will keep the Audit Committee updated on the progress of the diligence, red flag issues, etc. on a regular basis.
 - v. The working committee will initiate discussions with investors by making the financial model and related data available to the directors, including investor directors, based on suitable undertakings and trading lock-ins, as may be required under the InvIT Regulations.
 - vi. Discussions would also be initiated to obtain term sheets from lenders for their interest in the funding that may be required for funding the acquisition of roads.
 - vii. A transition plan would be prepared in consultation with Project Manager, including any transition arrangement with NHAI.
 - viii. The final proposal presented to the Audit Committee will contain, *inter alia*, summary of findings of the due diligence reports, legal review of the concession and other agreements, financial model output, transition and acquisition plan, further due diligence to be conducted,

expenses incurred till date and future expected expenses, potential sources of funding including indicative term-sheets from bank(s), recommended valuation range etc.

- ix. The Audit Committee will evaluate the proposal and recommend to the IM Board for its decision regarding the offer to be made to NHAI.
- x. Any binding offer made by the Trust to NHAI in respect of acquisition of Target Asset(s) shall be made after approval by the IM Board and the unitholders under Regulation 22(5) of the InvIT Regulations. A detailed agenda for the meeting of the unitholders shall be provided, including the offer details as set out in the InvIT Regulations.

2. Project SPV

2.1. Board of Directors of Project SPV

The Investment Manager, in consultation with the Trustee, shall appoint majority of the board of directors of the Project SPV.

OTHER PARTIES INVOLVED IN THE TRUST

The Auditor

Background and terms of appointment

The Investment Manager, in consultation with the Trustee, has appointed A.R. & Co., Chartered Accountants (Firm Registration No. 002744C) with effect from November 6, 2020, as the statutory auditors of the Trust for a period up to the first financial year after the date of listing of the Units. The Auditors have audited the Audited Financial Information and have examined the Projections of Revenue from Operations and Cash Flow from Operating Activities, and their reports in relation to such Audited Financial Information dated August 18, 2021, and September 27, 2021, and their report on the Projections of Revenue from Operations and Cash Flow from Operating Activities dated September 28, 2021, respectively, have been included in this Final Placement Memorandum.

Functions, Duties and Responsibilities of the Auditor

The functions, duties and responsibilities of the Auditor will be in accordance with the InvIT Regulations. Presently, in terms of the InvIT Regulations, the Auditor is required to comply with the following conditions at all times:

1. the Auditor shall conduct audit of the accounts of the Trust and draft the audit report based on the accounts examined and after taking into account the relevant accounting and auditing standards, as may be specified by SEBI;
2. the Auditor shall, to the best of his information and knowledge, ensure that the accounts and financial statements give a true and fair view of the state of the affairs of the Trust, including profit or loss and cash flow for the period and such other matters as may be specified;
3. the Auditor shall have a right of access at all times to the books of accounts and vouchers pertaining to activities of the Trust; and
4. the Auditor shall have a right to require such information and explanation pertaining to activities of the Trust as he may consider necessary for the performance of his duties as auditor from the employees of the Trust or holding company or Parties to the Trust or holding company or the special purpose vehicles or any other person in possession of such information.

The Valuer

Background and terms of appointment

The Investment Manager, in consultation with the Trustee, has appointed RBSA Valuation Advisors LLP with effect from December 29, 2020, as the valuers of the Trust for a period up to the first financial year after the date of listing of the Units. In accordance with the InvIT Regulations, the Valuers have undertaken a full valuation of the Project SPV which is proposed to be acquired by the Trust, and their report in relation to such valuation as on March 31, 2021, has been included in this Final Placement Memorandum.

Functions of the Valuer

The functions, duties and responsibilities of the Valuer will be in accordance with the InvIT Regulations. Presently, in terms of the InvIT Regulations, the Valuer is required to comply with the following conditions at all times:

1. the Valuer shall ensure that the valuation of the Trust assets is impartial, true and fair and is in accordance with Regulation 21 of the InvIT Regulations;
2. the Valuer shall ensure that adequate and robust internal controls to ensure the integrity of its valuation reports;

3. the Valuer shall ensure that it has sufficient key personnel with adequate experience and qualification to perform valuations;
4. the Valuer shall ensure that it has sufficient financial resources to enable it to conduct its business effectively and meet its liabilities;
5. the Valuer and any of its employees involved in valuing of the assets of the Trust, shall not, (i) invest in units of the Trust or in the assets being valued; and (ii) sell the assets or units of the Trust held prior to being appointed as the Valuer, until the time such person is designated as valuer of the Trust and not less than six months after ceasing to be valuer of the Trust;
6. the valuer shall conduct valuation of the Trust's assets with transparency and fairness and shall render, at all times, high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment;
7. the valuer shall act with independence, objectivity and impartiality in performing the valuation;
8. the valuer shall discharge its duties towards the Trust in an efficient and competent manner, utilizing its knowledge, skills and experience in best possible way to complete given assignment;
9. the valuer shall not accept remuneration, in any form, for performing a valuation of the Trust's assets from any person other than the Trust or its authorized representative;
10. the valuer shall before accepting any assignment, from any related party of the InvIT, disclose to the Trust any direct or indirect consideration which the valuer may have in respect of such assignment;
11. the valuer shall disclose to the Trust any pending business transactions, contracts under negotiation and other arrangements with the investment manager or any other party whom the Trust is contracting with and any other factors that may interfere with the valuer's ability to give an independent and professional valuation of the assets;
12. the valuer shall not make false, misleading or exaggerated claims in order to secure assignments;
13. the valuer shall not provide misleading valuation, either by providing incorrect information or by withholding relevant information;
14. the valuer shall not accept an assignment which interferes with its ability to do fair valuation; and
15. the valuer shall, prior to performing a valuation, acquaint itself with all laws or regulations relevant to such valuation.

Further, in accordance with the InvIT Regulations, a full valuation shall be conducted by the valuer not less than once every financial year. However, the Investment Manager shall conduct a valuation through a SEBI registered valuer for any quarter, based on the specific request of any unitholder.

Policy on Appointment of Auditor and Valuer

The Investment Manager has adopted a policy on the appointment of auditor and valuer of the Trust, which will stand amended, to the extent of any amendment to the InvIT Regulations or applicable law, details of which are provided below:

Appointment and Role of Auditor of the Trust

- (i). The Investment Manager, in consultation with the trustee to the Trust (the "**Trustee**"), shall appoint the auditor of the Trust (the "**Auditor**"), in a timely manner and in accordance with the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended or supplemented, including any guidelines, circulars, notifications and clarifications framed or issued thereunder (the "**InvIT Regulations**").

- (ii). The Investment Manager shall ensure that the appointment of the Auditor and the fees payable to the Auditor is approved by the unitholders of the Trust (“**Unitholders**”) in accordance with the InvIT Regulations.
- (iii). The Investment Manager shall appoint an Auditor for a period of not more than five consecutive years; provided that the Auditor, not being an individual, may be reappointed for a period of another five consecutive years, subject to approval of Unitholders in the annual meeting in accordance with the InvIT Regulations.
- (iv). The Auditor shall conduct the audit of the accounts of the Trust and draft the audit report based on the accounts examined by it after taking into account the relevant accounting and auditing standards under applicable law, including the InvIT Regulations and any guidelines, circulars, notifications and clarifications framed or issued by the Securities and Exchange Board of India (“**SEBI**”), as may be specified from time to time.

The Auditor shall comply with the conditions prescribed under the InvIT Regulations at all times, including the following:

- (a). The accounts of the Trust shall be subjected to audit by the Auditors and shall be accompanied by a report of the Auditors in such manner and at such intervals as may be prescribed under applicable law, including InvIT Regulations;
- (b). the Auditor shall, to the best of his information and knowledge, ensure that the accounts and financial statements give a true and fair view of the state of the affairs of the Trust, including profit or loss and cash flow for the period and such other matters as may be specified by SEBI;
- (c). the Auditor shall have a right of access at all times to the books of accounts and vouchers pertaining to activities of the Trust; and
- (d). the Auditor shall have a right to obtain such information and explanation pertaining to activities of the Trust as he may consider necessary for the performance of his duties as auditor from the employees of Trust or any holding company or parties to the Trust or any holding company or the special purpose vehicle(s) or any other person in possession of such information.
- (e). The auditor should have subjected itself to the Peer review process of ICAI and holds such a valid certificate.
- (v). The Investment Manager, in consultation with the Trustee, shall have the right to take all necessary steps to remove the Auditor who ceases to comply with the eligibility criteria required under the InvIT Regulations and applicable law. In case of removal of the auditor and appointment of another auditor to the Trust, approval from the Unitholders shall be required in accordance with Regulation 22(5)(f) of the InvIT Regulations. Additionally, any change in the auditor of the Project SPV shall be made in accordance with the Companies Act, 2013, as amended.

Appointment and Role of Valuer of the Trust

- (i). The Investment Manager, in consultation with Trustee, shall appoint the valuer of the Trust (“**Valuer**”), in a timely manner and shall determine the remuneration of such Valuer, in accordance with the InvIT Regulations. A ‘Valuer’ shall have the meaning provided under the InvIT Regulations.
- (ii). The remuneration of the Valuer shall not be linked to or based on the value of the assets being valued.
- (iii). The Valuer shall not be an associate of any of the Sponsor or the Investment Manager or Trustee.
- (iv). The Valuer shall be eligible to act as a valuer in accordance with the InvIT Regulations or any clarifications, guidelines, notifications or exemptions issued by SEBI.
- (v). A Valuer shall not undertake valuation of the same project for more than four years consecutively, provided that the Valuer may be reappointed after a period of not less than two years from the date it ceases to be the Valuer of the Trust.
- (vi). The Valuer shall not undertake valuation of any assets in which it has either been involved with the acquisition or disposal within the last twelve months other than such cases where the Valuer was engaged by the Trust for such acquisition or disposal.

(vii). The Valuer shall comply with the following conditions at all times:

- (a) the Valuer shall ensure that the valuation of the Trust assets is impartial, true and fair and is in accordance with the InvIT Regulations;
- (b) the Valuer shall ensure adequate and robust internal controls to ensure the integrity of its valuation reports;
- (c) the Valuer shall ensure that it has sufficient key personnel with adequate experience and qualification to perform valuations;
- (d) the Valuer shall ensure that it has sufficient financial resources to enable it to conduct its business effectively and meet its liabilities;
- (e) the Valuer and any of its employees involved in valuing of the assets of the Trust, shall not:
 - invest in units of the Trust or in the assets being valued; and
 - sell the assets or units of the Trust held prior to being appointed as the Valuer, until the time such person is designated as Valuer of the Trust and not less than six months after ceasing to be Valuer of the Trust;
- (f) the Valuer shall conduct valuation of the Trust assets with transparency and fairness and shall render, at all times, high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment;
- (g) the Valuer shall act with independence, objectivity and impartiality in performing the valuation;
- (h) the Valuer shall discharge its duties towards the Trust in an efficient and competent manner, utilizing its knowledge, skills and experience in best possible way to complete given assignment;
- (i) the Valuer shall not accept remuneration, in any form, for performing a valuation of the Trust assets from any person other than the Trust or its authorized representative;
- (j) the Valuer shall before accepting any assignment, from any related party of the Trust, disclose to the Trust, by disclosing to the Investment Manager or the Trustee, any direct or indirect consideration which the Valuer may have in respect of such assignment;
- (k) the Valuer shall disclose to the Trust, through the Investment Manager, any pending business transactions, contracts under negotiation and other arrangements with the Investment Manager or any other party whom the Trust is contracting with and any other factors that may interfere with the Valuer's ability to give an independent and professional valuation of the assets, and other necessary disclosures required under the InvIT Regulations;
- (l) the Valuer shall not make false, misleading or exaggerated claims in order to secure assignments;
- (m) the Valuer shall not provide misleading valuation, either by providing incorrect information or by withholding relevant information;
- (n) the Valuer shall not accept an assignment which interferes with its ability to do fair valuation; and
- (o) the Valuer shall, prior to performing a valuation, acquaint itself with all laws or regulations relevant to such valuation.

(viii). The Investment Manager in consultation with the Trustee shall have the right to take all necessary steps to remove the Valuer who ceases to comply with the eligibility criteria required under the InvIT Regulations and applicable law. If the removal of the Valuer and appointment of another valuer to the Trust is taken up at a meeting of the Unitholders at the request of the Unitholders, such removal of the Valuer shall be approved by the Unitholders in accordance with the InvIT Regulations.

INDUSTRY OVERVIEW

The information contained in this section is derived from various government, other industry sources and reports including report by CARE Advisory Research and Training Limited on Update on Road Infrastructure Industry, dated March 18, 2021 (“**CARE Report**”). Neither we nor any other person connected with the Offer has independently verified this information. Industry sources and publications generally state that the information contained therein has been obtained from sources generally believed to be reliable, but that their accuracy, completeness and underlying assumptions are not guaranteed, and their reliability cannot be assured. Industry publications are also prepared based on information available as of specific dates and may no longer be current or reflect current trends. Accordingly, investment decisions should take these limitations into account. All references to years refer to calendar years except as otherwise stated. References to Indian financial years (“**FY**”) are to the one-year period ending March 31 of the named year.

Overview of the Indian Economy

In April 2021, the International Monetary Fund (“**IMF**”), projected that India would reclaim the status of the world's fastest-growing economy with projected growth at 12.5% in FY2021. In July 2021, the IMF lowered India's gross domestic product (“**GDP**”) forecast in FY2021 to 9.5%. This was on account of the severe setback caused by the COVID-19 second wave. Further, in July 2021, the IMF revised their growth forecast for FY2022 to 8.5% from their earlier prediction of 6.9% in April 2021. (Source: *International Monetary Fund - World Economic Outlook - Managing Divergent Recoveries, April 2021 and World Economic Outlook Update, July 2021*). According to the Reserve Bank of India (“**RBI**”), the Indian economy stopped shrinking in the October-December quarter of FY2021, projecting a nominal GDP growth rate of 0.1% in the third quarter of FY 2021 for the period October-December 2020 and 0.7% growth in the final quarter of FY2021 for the period January-March of FY2021. According to central bank, India's economy will shrink 7.5% in FY21, lower from its earlier assessment on 9.5%. While, the Government intensified its effort to cushion the Indian economy from the impact of the COVID-19 pandemic and announced economic stimulus packages, Government Final Consumption Expenditure (GFCE) was 10.9% of GDP in the July-September quarter of FY2021 compared to 18.1% in the April-June quarter of FY2021. On the assumption that the COVID-19 vaccine is distributed on a large-scale basis in the calendar year 2021 and there is no widespread resurgence of further infections, the Indian economy is poised to grow (real GDP) by 11% in 2021-22. (Source: *CARE Report*). Further, in July 2021, the Asian Development Bank lowered India's economic growth forecast for the FY2022 to 10% from its projection of 11% released in April 2021. (Source: *Asian Development Outlook (ADO) 2021 Supplement: Renewed Outbreaks and Divergent Recoveries, July 2021*)

India has been one of the world's fastest growing economies with GDP growth in the last 10 years reaching a high of almost 8.5 per cent as reported by the World Bank. According to the World Bank's Ease of Doing Business 2020 report, India moved up 14 places to rank 63, due to positive developments in the areas of starting a business, dealing with construction permits, trading across borders and resolving insolvency. (Source: *Doing Business 2020 – Comparing Business Regulation in 190 Economies prepared by the World Bank*)

The table below sets forth a comparison between India's real GDP growth rate in 2019 and 2020, and its expected real GDP growth rate in 2021, as compared to advanced economies in Asia, emerging markets and developing economies in Asia, and the world generally on a calendar year basis:

	<u>Real GDP growth rate</u>		<u>Projected GDP growth rate</u>
	<u>2019</u>	<u>2020</u>	<u>2021</u>
(in percentage)			
India	4.2	-10.3	8.8
Advanced Economies Asia	1.2	-4.2	2.9
Japan	0.7	-5.3	2.3
Korea	2.0	-1.9	2.9
Australia	1.8	-4.2	3.0
Taiwan province of China	2.7	0.0	3.2
Singapore	0.7	-6.0	5.0
Hong Kong SAR	-1.2	-7.5	3.7
New Zealand	2.2	-6.1	4.4
Macao SAR	-4.7	-52.3	23.9
Emerging Markets and Developing Economies Asia	5.5	-1.7	8.0

Global.....	2.8	-4.4	5.2
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(Source: International Monetary Fund, World Economic Outlook Database, October 2020 (the “IMF Report October 2020”))

As shown in the table above, India’s pace of growth has outperformed global growth. The Indian economy began to regain momentum with clear signs of increase in consumption and investment towards the end of the third quarter of Fiscal 2019 according to OECD Economic Survey of India, only to be slowed by COVID-19, which resulted in the Government of India (“**GoI**”) enforcing a country-wide lockdown in late March 2020. (Source: *OECD Economic Survey of India 2019 prepared by OECD available at Étude économique 2019 de l’Inde (oecd.org)*). Due to the COVID-19 pandemic, the IMF reports that global growth has dipped -4.4% in 2020. Similarly, in India, economic growth was projected to decline by -10.3% by the IMF in 2020. Manufacturing and construction sectors have been severely affected by the pandemic, with growth down by 39.3% and 50.3% respectively. (Source: *CARE Report*).

Nevertheless, according to the IMF, global recovery with 5.2 per cent growth is projected for 2021. Similarly, the World Bank projects that despite a resurgence of COVID-19 cases in early 2021, the global economy will strengthen gradually over time as consumption, trade and general sentiment improve along with ongoing vaccination. However, the impact of the pandemic on investment and human capital is expected to negatively affect growth prospects and key development goals in emerging market and developing economies (“**EMDEs**”). (Source: *Chapter 1, World Bank Global Economic Prospects dated January 2021*)

In order to propel recovery of the Indian economy, in November 2020, the GoI announced a third stimulus package of approximately U.S.\$16.1 billion, bringing total stimulus plans so to around 15% of GDP. The Reserve Bank of India’s (“**RBI**”) decision to withhold interest rate increases and expand the money supply policy has stimulated consumption growth. Increasing demand has in turn restored price growth.

Limiting the spread of the virus, providing relief for vulnerable populations, and overcoming vaccine-related challenges are expected to be key immediate policy priorities in India. As the pandemic abates, policymakers are expected to balance the risks from large and growing debt loads with those from slowing the economy through fiscal tightening. To confront the adverse consequences of the pandemic, it will be critical to foster resilience by safeguarding health and education, prioritizing investments in digital technologies and green infrastructure, improving governance, and enhancing debt transparency. Global cooperation will be crucial in addressing many of these challenges. The widespread deployment of effective vaccines is also expected to play a key role in halting the pandemic’s progression, and to strengthen economic activity by improving confidence and financial market conditions.

This baseline scenario assumes that voluntary and mandatory pandemic control measures will be diligently maintained over the next several quarters until after widespread vaccination becomes available. From its recent increases in several major economies, the daily number of infections is assumed to decline in the first half of 2021 in most countries. In advanced economies and major EMDEs, vaccination campaigns initiated in early 2021 are expected to reach widespread coverage in the second half of 2021 but would be expected to be delayed by two to four quarters in other EMDEs and LICs, partly due to logistical impediments. Activity is expected to improve as the pandemic abates, vaccines are rolled out, and financial conditions remain benign, supported by accommodative monetary policy (Source: *World Bank Global Economic Prospects dated January 2021*).

Overview of the Infrastructure Sector in India

India has the second largest road network in the world, spanning a total of 5.89 million kilometres (kms). This road network transports 64.5% of all goods in the country and 90% of India’s total passenger traffic uses road network to commute. This road network comprises mainly of national highways, expressways, state highways, major district roads, other district roads and village roads. Out of this, around 0.1 million kms were national highways as on FY2020. More than 8,000 km of national highways were built from 1 April 2020 to 15 January 2021, an increase of 8% over the same period in the last financial year. The GoI is hopeful that this pace of work should allow it to surpass the FY target of 11,000 kms by March 31, 2021, despite the ongoing COVID-19 related challenges (Source: *CARE Report*). Many reforms have been initiated in the infrastructure sector to minimize the effect of the unprecedented crisis from COVID-19 observed in this FY. In May 2020, the Government, adding to its past measures and that of RBI, announced a consolidated stimulus package of Rs 20 lakh crore (US\$ 283.73 billion). The stimulus package was pivoted on “Atma Nirbhar Bharat”, where Micro, Small and Medium Enterprises (“**MSMEs**”) received a huge financial package in terms of collateral free debt, guarantee for subordinate debt through Funds-of-Funds, and interest subvention scheme. The GoI also introduced Pradhan Mantri Garib Kalyan Rojgar Abhiyaan, a rural infrastructure and employment generation scheme, for the benefit of returnee migrants.

In financial year 2020, the GoI focused on enhancing expenditure on infrastructure and has planned to invest around 100 lakh crores in infrastructure in the next 5 years as part of the National Infrastructure Pipeline (“NIP”) announced in December 2019. As part of the NIP, roads projects are expected to receive 19 per cent of the project capital expenditure for the period from Fiscal 2020 to 2025, which together with energy, urban and railways, accounted for over 70 per cent of projected capital expenditure during the period from Fiscal 2020-2025. According to the Union Budget 2020-21 the total outlay for the transportation sector in financial year 20-21 is ₹1,69,637 crore. Since 2015 and 2016, the GoI has been increasing its capital expenditure significantly. In the Union Budget 2021-2022, the GoI proposes to sharply increase capital expenditure further by 34.5% against the Union Budget 2020-2021, bringing capital expenditure to ₹5.54 lakh crore, of which ₹44,000 crore will be provided for projects, programmes/departments that are in need of further funds. In addition to government funding, in its Union Budget 2020-2021, the GoI recognized importance of a “National Monetization Pipeline” under its Asset Monetization Programme which includes NHAI Operational Toll Roads. As part of that, the InvIT sponsored by NHAI was named in the Union Budget 2020-2021 specifically. The GoI also set out additional economic corridors that are being planned and under construction, including section of the Mumbai-Kanyakumari corridor, the Madurai-Kollam Corridor, the Chittoor-Thatchur Corridor and additional works in the State of Assam. (Source: Government of India, Ministry of Finance, Union Budget Speech 2021 – 2022).

Overview of the Road Sector in India

India has one of the largest road networks in the world, with approximately 59 lakh kilometers of roads comprising expressways, national highways, state highways, major district roads and rural roads (which include other district roads and village roads). India’s national highways carry 40% of the total road-based traffic despite constituting only 2.2% of the total road network. State highways and the major district roads together constitute a secondary system of road transportation and contribute significantly to the development of India’s rural economy and industrial growth. The secondary system also carries about 40% of the total road traffic, although it constitutes only 13% of the total road network. At the tertiary level are the other district roads and the rural roads. (Source: Twelfth Five Year Plan (2012- 2017), Economic Sectors, Volume II (“Twelfth Five Year Plan”) and the NHAI website at www.nhai.org/roadnetwork.htm)

The Ministry of Road Transport and Highways (“MoRTH”) set a target of constructing roads worth Rs. 15 lakh crores by FY 2022 – 2023. In the GoI’s Union Budget for 2021-2022, a total of ₹1,18,101 crores have been budgeted for the MoRTH on schemes and projects, including ₹1,08,230 crores for capital expenditure, increasing from ₹91,823 crores budgeted in the 2020-2021 Union Budget and ₹78,248 crores spent in 2019-2020. This reflects an increase at CAGR of 13.10% in the budget outlay for road transport and highways. (Source: Government of India, Ministry of Finance, Union Budget 2020 – 2021; Government of India, Ministry of Finance, Union Budget Speech 2021 – 2022; <https://www.ibef.org/download/Roads-November-2020.pdf>, Press Release, Ministry of Road Transport & Highways dated May 7, 2020 available at: <https://pib.gov.in/PressReleasePage.aspx?PRID=1621779>) According to the Technical Consultant, social distancing protocols as a result of COVID-19 will have a major impact on the travel habits of people and impact upon road traffic. The population in lesser income group groups will continue to travel on mass public transportation. The population in higher income category groups will use private transportation more. However, the burden on roads is bound to increase with the increase in GDP and purchasing power of the people. While COVID-19 has impacted the auto industry and sales have reduced, according to the Technical Consultant, all major auto brands are developing promotional schemes such as more discounts and EMI schemes. These schemes could potentially lead to more affordability and access to modes of private transport, consequently increasing passenger traffic on the road.

Vehicle Traffic and Road Transport in India

According to the MoRTH, the number of vehicles on Indian roads grew at a compounded average rate of approximately 10% per annum between 2007 and 2017, outstripping growth in road length. (Source: MoRTH Road Transport Yearbook 16-17 available at <https://morth.nic.in/sites/default/files/Road%20Transport%20Year%20Book%202016-17.pdf>).

Sales and production of vehicles have continued to grow in FY 2020 despite the ongoing COVID-19 pandemic. Passenger vehicle wholesales expanded by 14% to 3,10,294 units in October 2020 as compared to October 2019. (Source: Data from Society of India Automobile Manufacturers as reported by Press Trust of India on Business Standard on 11 November 2020 available at https://www.business-standard.com/article/automobile/passenger-vehicle-wholesale-up-14-to-3-10-294-units-in-october-siam-120111100692_1.html)

Road transport has emerged as the dominant segment in India’s growth. In 2017, the Government launched the

implementation of an umbrella programme for the National Highways – “Bharatmala Pariyojana Phase-I” for construction/ up-gradation of National Highways of 34,800 kms length over a period of 5 years (2017- 2018 to 2021- 2022) at an estimated outlay of Rs. 5,35,000 Crore. (Source: Ministry of Road Transport and Highways Annual Report 2019-2020 at https://morth.nic.in/sites/default/files/Ministry%20Annual%20Report_2019-20.pdf)

The Government also launched the Electronic Toll Collection (“ETC”) system, which has been implemented on a pan-India basis to remove bottlenecks and ensure seamless movement of traffic and collection of user fees, using passive Radio Frequency Identification (RFID) technology. The ETC system is operational on more than 500 National Highways (NH) fee plazas. (Source: Ministry of Road Transport and Highways Annual Report 2019-2020 at https://morth.nic.in/sites/default/files/Ministry%20Annual%20Report_2019-20.pdf)

National Highways

Overview

There are currently approximately 1,32,500 kilometers of national highways in India, constituting approximately 2.2% of India’s entire road network but carrying approximately 40% of total road traffic. (Source: NHAI website; NHAI Annual Report 2019-2020)

The MoRTH is primarily responsible for the development and maintenance of National Highways. It executes its objectives through the National Highway Authority of India (“NHAI”), National Highways and Infrastructure Development Corporation Limited (“NHIDCL”), other state public works departments and border roads organisations.

As at the date of publication of the Twelfth Five Year Plan in 2013, approximately 23% of the national highways’ length was four-lane road, approximately 54% was two-lane road and approximately 23% was single-lane road. An additional 10,000 kilometers of roads were due to be constructed in the five- year period from 2013, setting a target of approximately 65,000 kilometers of national highways by 2022. (Source: Twelfth Five Year Plan; MoRTH Annual Report) As of the end of the five-year period, 58% of roads which were proposed to be built has since been completed. Other than construction of roads in the North East region and other Himalayan states responsibility of which was handed over to a government corporation called the NHIDCL, as of 2019. (Source: Appraisal Document of Twelfth Five Year Plan, Annual Report for 2018-19 of the National Highways Authority of India available at: https://nhai.gov.in/nhai/sites/default/files/2020-11/NHAI_AR_18_19_ENG_for_web.pdf).

राष्ट्रीय राजमार्ग विकास परियोजना
NADP
NATIONAL HIGHWAYS DEVELOPMENT PROJECT



1. Based upon Survey of India map with the permission of the Surveyor General of India.
2. The responsibility for the correctness of internal details rests with the publisher.
3. The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.
4. The external boundaries and coastlines of India agree with the Record/Master Copy certified by Survey of India.
5. Certified for Publication by Coastlines of India vide letter no. *एच. टी. 407 162-AD/रक़रक़* - XXX, Dated 13/3/2003

Prepared By: Information Technology & Planning Division, NHAI

Regulatory framework for the highways infrastructure industry

The MoRTH is responsible for the formulation and administration of policies for road transport, national highways and transport research, and consults with other central ministries, departments, state governments, organizations and individuals. The aim of the MoRTH is to increase mobility and the efficiency of the road transport system in India. (Source: Ministry of Road Transport and Highways website at www.morth.nic.in)

The development of road transport, including *inter alia*, the construction and maintenance needed to keep pace with the economic development of India, is one of the responsibilities of the MoRTH. Currently, the MoRTH is responsible for around 58,97,671 kilometers of roads, including 1,32,500 kilometers of National Highways. The MoRTH has overseen the National Highways Development project (“**NHDP**”) to upgrade and strengthen National Highways, this includes the Bharatmala Pariyojana project (described below). Overall in 2020, there were progress across various road transport projects whereby 33,500 kilometers of road projects have now been completed out of a total of 50,000 kilometers that are progressed. The pace of work has increased such that an approximately additional 200 kilometers of roads was constructed in the first nine months of financial year 2019-2020 compared to the corresponding period of financial year 2018-2019. (Source: Ministry of Road Transport and Highways Annual Report 2019-2020 at https://morth.nic.in/sites/default/files/Ministry%20Annual%20Report_2019-20.pdf)

The National Highways Authority of India

NHAI was constituted by the National Highways Authority of India Act, 1988. NHAI is responsible for the development, maintenance and management of national highways entrusted to it and for matters connected or incidental thereto. It became operational in February 1995 with the appointment of a full-time chairman and other members. A total of 50,329 kilometers of national highways were entrusted to NHAI out of a total of 58,97,671 kilometers. NHAI is mandated to develop 22,660 kilometers out of the 34,800 kilometers to be developed under Bharatmala Pariyojana (as described below). (Source: NHAI Annual Report 2018-2019)

Construction of national highways has grown at a steady pace. According to the GoI’s Economic Survey in 2020-2021, during the decade ending in FY2019, construction of national highways recorded a CAGR of 7.25 per cent. According to CARE Advisory Research and Training, NHAI oversaw construction of 3,979 kilometers of national highways in 2019-2020. According to MoRTH, the construction of all roads, including national highways, has increased from 6,061 kilometers in 2015-2016 to 10,855 kilometers in 2018-2019 and a further 3,380 kilometers of national highways were constructed during 2019-2020. The rate of construction has also increased from 12 km per day in 2014-2015 to a peak of 30 km per day in 2019. (Source: Economic Survey 2019-2020, Vol II, Chapter 8 https://www.indiabudget.gov.in/economicsurvey/doc/vol2chapter/echap08_vol2.pdf; Economic Survey 2020-2021, Vol II, Chapter 8; CARE Report)

The NHAI are seeking private sector investment to realise GoI’s road construction targets and have financing solutions in place. The NHAI have signed a Memorandum of Understanding with the National Investment and Infrastructure Fund to create special purpose vehicles in order to fund future greenfield projects. It intends to raise Rs. 40,000 crore to monetize its highway assets through Infrastructure Investment Trusts (InvITs). (Source: CARE Report)

According to the CARE Report, the GoI’s 2020-2021 Economic Survey, due to the ongoing impact of COVID-19, construction of roads has been lagging due to lockdown disruptions and the displacement of labour. However, as the road sector continues to be a major focus of the GoI, restrictions on road constructions were the first to be loosened and the rate of road construction is expected to gain momentum in coming months. CARE notes that 3,951 kilometers constructed from April to September 2020. The MoRTH have set a target of 60 kilometers per day rate of construction. The length of roads awarded has decreased from a peak of 17,054 kilometers in 2017-2018 to 2,103 kilometers in 2019-2020. However, GoI’s continued to push for growth in the road sector and stepped up its awards of roads in 2020-2021 as part of its response to the COVID-19 pandemic. A further 4,500 kilometers of roads were expected to be awarded in 2020. (Source: CARE Advisory Research and Training Limited, Update on Road Infrastructure Industry, December 2020; Economic Survey 2019-2020, Vol II, Chapter 8 https://www.indiabudget.gov.in/economicsurvey/doc/vol2chapter/echap08_vol2.pdf; Economic Survey 2020-2021, Vol II, Chapter 8 https://www.indiabudget.gov.in/economicsurvey/doc/vol2chapter/echap08_vol2.pdf).

Bharatmala Pariyojana

In October 2017, the Government launched Bharatmala Pariyojana, its flagship highway development programme which envisions the development of 50 economic corridors, provide connectivity to 550 districts in the country through National Highway linkages and improve the average speed of road travel in India. Bharatmala Pariyojana envisages the development of so-called Economic Corridors, Inter-Corridor & Feeder Roads, Border and International Connectivity Roads, Coastal and Port Connectivity Roads and Expressways, and proposes to connect all District Headquarters with National Highways (NH). Phase –I of Bharatmala Pariyojana, which is scheduled to be completed in 2022, envisages the development of 34,800 km of roads for a total investment of

Rs. 5,35,000 crore including Rs. 10,000 crore for NHDP.

The project focuses on optimizing efficiency of freight and passenger movement across the country focusing on needs of tribal areas, areas of economic activity, places of religious and tourist interest, border areas, coastal areas and trade routes with neighboring countries. Ten corridors have been prioritized and as part of an optimization exercise, identified to be of most economic importance. The proposed corridors are expected to bring economic benefits to future users by reducing mileage and reduce vehicular population. (Source: *Annual Report for 2018-19 of the National Highways Authority of India* available at https://nhai.gov.in/nhai/sites/default/files/2020-11/NHAI_AR_18_19_ENG_for_web.pdf)

As of December 2019, 9,674 kilometers (347 kilometers being awarded and terminated) of the Bharatmala Pariyojana were awarded and 3,555 kilometers were under bidding and in October 2020, the GoI announced that 2,921 kilometers have since been constructed. As part of its implementation, NHAI acquired for the project 7491 hectares in financial year 2016-2017, 9,494 hectares in financial year 2017-2018, 29,374 hectares in 2018-2019 and 7,774 hectares in 2019-2020, expedited by the use of new IT solutions like the Land Acquisition Portal. (Source: *Ministry of Road Transport and Highways Annual Report 2019-2020* at https://morth.nic.in/sites/default/files/Ministry%20Annual%20Report_2019-20.pdf; *Annual Report for 2018-19 of the National Highways Authority of India* available at https://nhai.gov.in/nhai/sites/default/files/2020-11/NHAI_AR_18_19_ENG_for_web.pdf; CARE Advisory Research and Training Limited, *Update on Road Infrastructure Industry*, December 2020 CARE)

Key Drivers of Road Sector Investment

Key growth drivers of road sector investment include:

- *Increase in focus on infrastructure development:* road construction is amongst one of the critical sub-segments of infrastructure development undertaken by the GoI as a result of the economic impact brought by COVID-19 and as a critical driver of economic growth and employment creation. The GoI plans to develop a total of 66,117km of roads under different programmes such as the NHDP, the Special Accelerated Road Development in North East and Left Wing Extremism and the GoI has identified development of 2,000 km of coastal roads to improve the connectivity between ports and remote villages. A total of 200,000 km of national highways is expected to be completed by 2022. An increase in road construction is generally held to indicate the government's focus on infrastructure creation. (Source: *CARE Report*)
- *Increase in expenditure towards road construction:* An increase in expenditure towards road construction by the GoI is expected to drive growth within the road sector. The Ministry of Road Transport and Highways has set a target of constructing roads valued at Rs.15 lakh crores by fiscal year 2022 to 2023. The GoI has also proposed making additional allocations towards roads, higher than that given in the Union Budget 2020-21, which at Rs.91,823 crores was already 11% more than what was allocated in fiscal year 2019-2020. Centre for Monitoring Indian Economy (“CMIE”) projects that investment into the road sector will continue to grow as summarized in the table below:

Year	Value of projects commissioned	Capacity addition
	Rs. million	Km
Mar-20	52,897	349
Jun-20	68,791	461
Sep-20	1,39,595	1,860
Dec-20	2,82,698	2,265
Mar-21 E	1,87,563	1,125
Jun-21 E	1,89,861	1,785
Sep-21 E	1,34,664	631
Dec-21 E	2,12,457	895
Mar-22 E	97,559	893

(Source: CMIE)

(Source: CARE Report)

- *Toll revenue and other revenue streams:* In the next five years, NHAI anticipates that it will generate Rs. 1 Lakh crore annually from tolls and other sources. (Source: CARE Report)
- *Increase in roads awarded and completed:* NHAI anticipates that the awarding of highways for the current fiscal year 2021 may outpace the highways awarded in fiscal year 2019 and 2020. NHAI expects a pipeline for future construction with 7,696 km of highways awarded till December 31, 2020, more than double than the highway contracts awarded in fiscal year 2020. The MoRTH has also set a daily target of highway construction of 60km per day. (Source: CARE Report)

These growth drivers, together with the policy reforms discussed below are amongst the factors that contributed to and encouraged by the GoI to increase private participation in the roads industry.

According to revised norms for BOT (as defined below) projects, NHAI will have to hand over 90% of the project land to private developers. Projects awarded under BOT was 37.62% of the total projects awarded as of December 2019. This has attracted foreign private investment as well in recent years. In April 2020, the Asian Development Bank granted a loan of US\$177 million to the GoI to upgrade state highways in Maharashtra. (Source: Press Release, Asian Development Bank dated 27 April 2020 available at: <https://www.adb.org/news/adb-approves-177-million-loan-road-improvement-indias-maharashtra-state>; <https://www.ibef.org/download/Roads-November-2020.pdf>; MoRTH Annual Reports and NHAI)

Policy Framework for the Infrastructure Sector

NHAI is the agency responsible for the development, maintenance and management of national highways.

At the state level, the overall policy, development program and resource planning for the road sector is carried out by the state's planning body in consultation with the central level planning commission and the state ministry of roads. The state PWDs and road development corporations are the implementing agencies at the state level and are responsible for the implementation, operation and maintenance of state highways, major district roads and rural roads in certain states.

Recent Policy Reforms

Recently, the Government has enacted several policy reforms to boost investment in the infrastructure sector. For example, the RBI provided relief to Concessionaires affected by COVID-19. Over and above the relief provided by RBI, NHAI introduced a comprehensive policy to provide support to the Concessionaire in the form of

extension of contracts, low interest loan to ensure there to no cash management issue, relief for submission of premium, amongst others.

In addition, MoRTH issued the revised Model Concession Agreement for Built-Operate-Transfer (“**BOT**”) (Toll) projects to revive private sector interest and incentivizing timely work by concessionaires. NHAI has also introduced FASTag, an electronic toll collection system, on a number of toll plazas on the national highways. FASTag is meant to provide ease of transaction for road users as the payment of tolls can be made electronically and any topping up of money on FASTag can be done online.

In 2017, the CCEA approved Bharatmala project with an aim to improve road connectivity to coastal and border areas, remote areas, religious places and tourist places. As part of the project, there will be construction, rehabilitation and widening of about 1,500 major bridges and 200 railways over bridges and railways under bridges on national highways and improvements on newly declared national highways. (Source: <http://pib.nic.in/newsite/PrintRelease.aspx?relid=137248>)

In September 2015, NHAI modified Circular No. NHAI/11033/CGM (FA)/4/2015 to permit 100% equity divestment after two years of construction completion for all BOT projects, irrespective of the year of award. In that same circular, NHAI also allowed the concessionaire to use the proceeds from the sale of divested equity in incomplete NHAI projects, any other highway projects, any other power sector projects and/or to retire debt to financial institutions in any other infrastructure projects. In addition, in March 2014, the MoRTH approved a policy for rationalization of premium quoted by concessionaires to salvage stressed highway projects that were awarded through March 4, 2014.

The Department of Economic Affairs at the Ministry of Finance in India published a report on revisiting and revitalizing the PPP model of infrastructure in November 2015. A number of the recommendations set out in the report, such as the hybrid annuity model (“**HAM**”) for implementing highway projects and electronic tolling, have been implemented since the publication of the report. (Source: *Report of the Committee on revisiting and revitalizing public private partnership model of infrastructure, November 2015*).

On February 9, 2016, the HAM was approved by the Cabinet Committee. (Source: <https://morth.nic.in/sites/default/files/implementing.pdf>)

The CCEA has authorized NHAI to monetize public funded national highway projects which are operational and are generating toll revenues for at least two years after the COD through the toll-operate-transfer (“**TOT**”) model. As of November 20, 2019, around 75 operational national highway projects have been identified for monetization under the TOT model (Source: <https://pib.gov.in/PressReleasePage.aspx?PRID=1592541>). TOT projects have been separated into bundles for bidding purposes and the bids for the fifth such bundle was submitted by December 23, 2020 to NHAI. (Source: *NHAI release dated 28 September 2020 at https://nhai.gov.in/nhai/sites/default/files/2020-09/NHAI_INVITES_BIDS_FOR_THE_FIFTH_BUNDLE_OF_HIGHWAY_PROJECTS_ON_TOT_MODEL.pdf*).

The TOT model is expected to facilitate efficient toll realization through the private sector and create business opportunities for developers that specialize in the O&M of highways and for investors that may be averse to construction risks but are able to make long term investments in road infrastructure projects. (Source: <http://pib.nic.in/newsite/PrintRelease.aspx?relid=148306>)

NHAI has also, from time to time, issued rules and amendments to the rules relating to the collection of fees imposed on users of the national highways, among other roads. The first of such rules is the National Highways Fee (Determination of Rates and Collection) Rules 2008, with amendments made almost every year. The most recent amendment is dated 15 May, 2020. (Source: *NHAI's Toll Information System website at <http://tis.nhai.gov.in/miscellaneousinfo?language=en>*)

OUR BUSINESS

Overview

We are a registered infrastructure investment trust under the InvIT Regulations. We primarily intend to own, operate and maintain a portfolio of five Toll Roads (*defined below*) in the Indian states of Gujarat, Rajasthan, Telangana, and Karnataka under the Toll Operate Transfer (“**TOT**”) model conceived by NHAI. These Toll Roads are operated and maintained pursuant to concessions granted by the NHAI. The Toll Roads comprise of five stretches spanning a total length of 389 kms.

Our Sponsor is NHAI, an autonomous authority of the GoI under the MoRTH constituted on June 15, 1989 by an Act of the Indian Parliament titled - The National Highways Authority of India Act, 1988 (the “**NHAI Act**”). NHAI was operationalised in February 1995 with the appointment of a full-time Chairman and other members of the board. The functioning of NHAI is governed by the NHAI Act and the rules, and regulations framed thereunder.

The Project SPV has entered into five (5) independent Concession Agreements with the NHAI for concessions of each of the Toll Roads. We expect to satisfy all conditions precedent and commence our Concessions in accordance with the terms of the Concession Agreements. For further details, see “*Summary of the Concession Agreements*”, “*Management’s Discussion and Analysis of Financial Position and Results of Operations*” and “*Use of Proceeds*”.

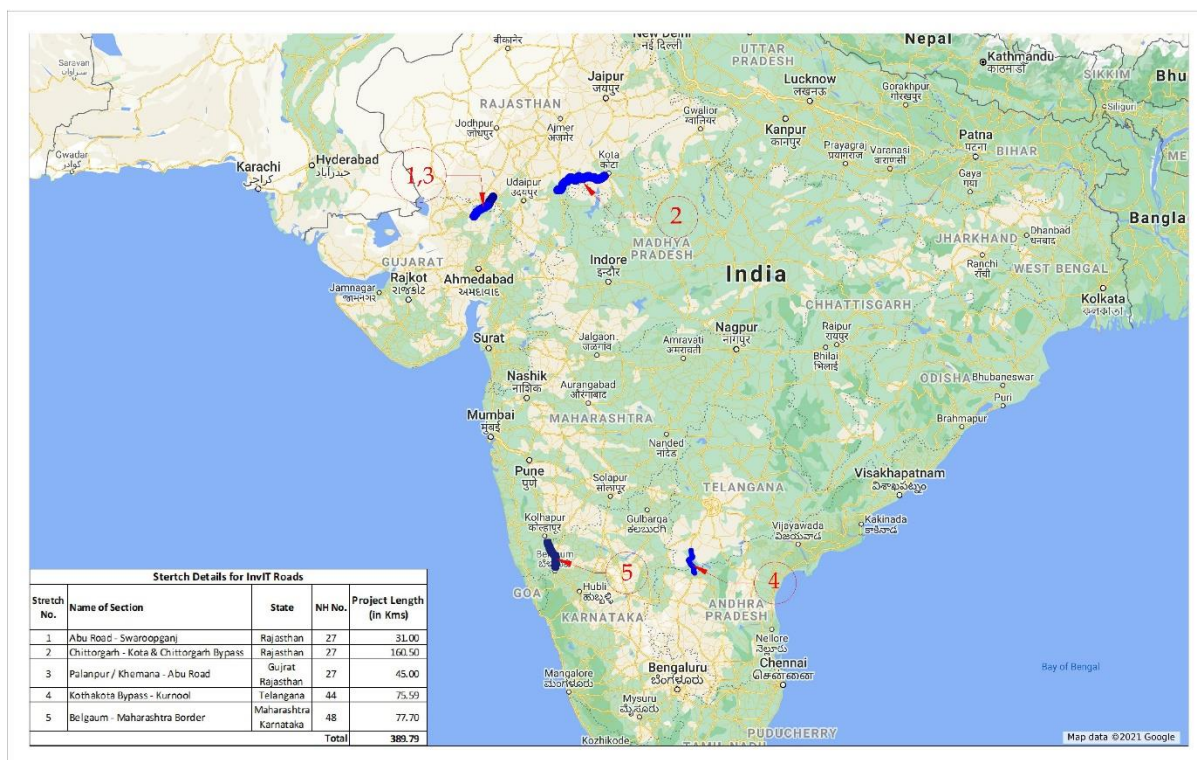
The Concession Agreements provide the Project SPV the right to collect tolls for a period of 30 years from users of each Toll Road, with certain overlay activities and the construction of additional toll lanes in respect of certain of the Toll Roads (the “**Initial Improvement Works**”) to be completed by the Project SPV within 24 months from the Appointed Date (as defined in “*Summary of the Concession Agreements*”). Responsibility for the supervision of the operation and maintenance of the Toll Roads also vests with us. In return, the Project SPV is required to pay the concession fee to the NHAI prior to the commencement of the Concession, as set out in the respective Concession Agreements. For further information on the provisions of the Concession Agreements, see “*Summary of the Concession Agreements*”.

Pursuant to the Formation Transactions and the Proposed Transfer, the Trust has acquired 100% of the equity shares of the Project SPV from the Sponsor. For additional information about the Proposed Transfer, please see the section headed “*Formation Transactions in Relation to the Trust*”.

From the Appointed Date, the Project SPV will own, operate and maintain the following toll road assets (the “**Toll Roads**”):

- Palanpur/Khemana – Abu Road Project (“**Asset 1**”): Abu Road section of NH 27 with a total length of 45 kms, connecting the states of Gujarat and Rajasthan;
- Abu Road – Swaroopganj Project (“**Asset 2**”): Swaroopganj section of NH 27 with a total length of 31 kms, in the state of Rajasthan;
- Maharashtra/ Karnataka Border (Kagal) – Belgaum Project (“**Asset 3**”): Belgaum – Kagal section of NH 48 with a total length of 77.7 kms, connecting the states of Karnataka and Maharashtra;
- Chittorgarh – Kota & Chittorgarh Bypass Project (“**Asset 4**”): Chittorgarh – Kota section of NH 27 with a total length of 160.5 kms, in the state of Rajasthan; and
- Kothakota Bypass – Kurnool Highway Project (“**Asset 5**”): Kothakota bypass – Kurnool of NH 44 with a total length of 74.6 kms, connecting the states of Telangana to Andhra Pradesh.

The following map depicts the location of the Toll Roads that comprise our concession:



Note:

(1) This map is for illustrative purposes only, is not to scale and is subject to change at any time.

Strengths of the Trust

Experienced Sponsor with consistent track record in operating and maintaining projects in the roads and highways sector in India

Our Sponsor, NHAI is India's national agency responsible for the development, maintenance and management of India's national highways network. Our Sponsor has a consistent track record of growth and operational performance. Our Sponsor manages the development of National Highways Development Project ("NHDP") under the mandate of MoRTH, GoI to develop 46,635 kilometers of roads, 30,508 kilometers of which have already been laned. Currently, another 10,640 kilometers are being implemented under 319 contracts. Our Sponsor has already completed construction of 7,573 kilometres and 8,169 kilometers of national highways during FY20 and FY21, which amounts to construction of 28.16 kilometers of road on a daily basis. As part of the NHDP, our Sponsor infuses funds into immediate areas of development and enables private sector participation bringing about a healthy participatory economy.

Our Sponsor is also involved in the *Bharatmala Pariyojana* project (*more information available in the Industry Overview section*) and envisages development of 50 economic corridors, that would provide connectivity to 550 districts through national highway linkages and improve average road travel speed. Out of the total 34,800 kms of approval granted by the Cabinet Committee on Economic Affairs ("CCEA") to our Sponsor for Phase-1 of *Bharatmala Pariyojana*, our Sponsor has already completed construction of 27,500 kms of national highways as part of the *Bharatmala Pariyojana*, Phase-1. A further 12,413 kilometers have been awarded and 2,921 kilometers have been constructed as of August 2020. (*Source: NHAI Annual Report 2018-2019*)

The following table sets forth our Sponsor's performance and growth in terms of kilometres of roads awarded and constructed for the financial years indicated:

NHAI Roads Awarded and Constructed (kms)

Financial year (FY)	Awarded	Completed
2014-15	3,067	1,501

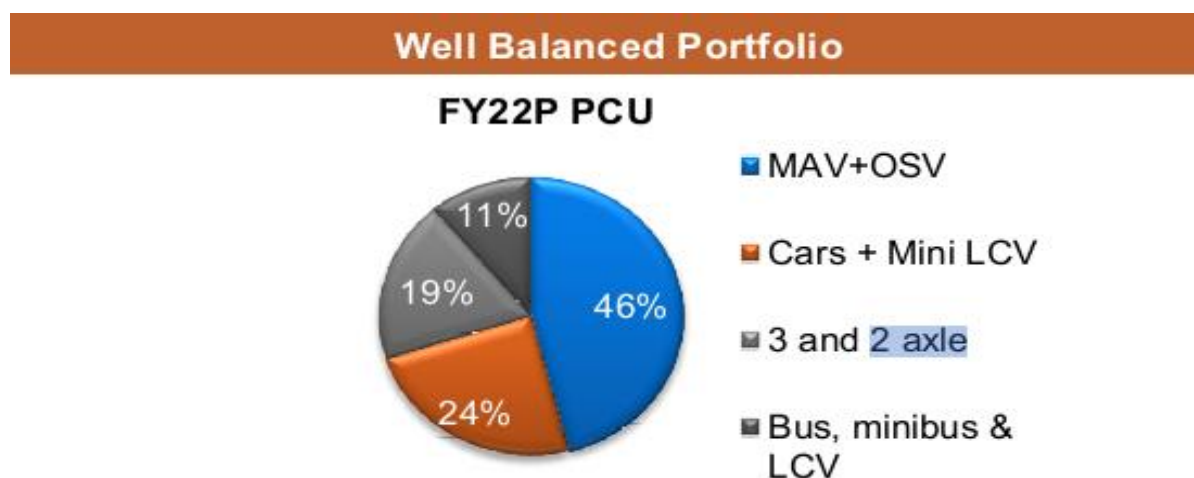
2015-16	4,344	1,988
2016-17	4,364	2,628
2017-18	7,400	3,071
2018-19	2,200	3,380
2019-20	3,211	3,929
2020-2021	1,330	3,951

Source: CARE Report

Backed by NHAI as our Sponsor, we believe we are well positioned to drive new initiatives in the road sector in India. For more details about our Sponsor and the projects, please see “Industry Overview” on page 146 of this Final Placement Memorandum.

Sizeable portfolio of diversified long-term revenue generating Toll Road assets

We own 100% of the Project SPV. The Project SPV will own, operate and maintain toll-road projects in India. We believe the Toll Roads currently have a healthy mix of passenger and commercial traffic. According to the Traffic Consultants, the expected overall split of passenger and commercial traffic across the Toll Roads for FY2022 is 11% for bus, minibuses and light commercial vehicles (LCV), 19% for 3 and 2 axle vehicles, 24% for cars and mini LCVs, and 46% for multi axle vehicle (MAV) and oversized vehicles (OSV), respectively. We also believe the Toll Roads possess a good mix of captive short distance traffic and long-distance traffic. In addition, the range of commodities transported by commercial traffic across the Toll Roads varies from agricultural products and other perishable goods to steel, cement and multiple industrial products, representing a broad cross-section of the Indian economy. Each Toll Road has a distinct set of users based on its local economy, which results in significant independence of traffic across the Toll Roads. As a result, we expect the geographical diversification of the Toll Roads to reduce our reliance on the local economy of any single state or district. The diversified composition of traffic along the Toll Roads is expected to provide us with stable cash flows.



Source: Traffic Reports from the Traffic Consultants. For more details, please refer to Annexure C.

We believe that the Toll Roads have revenue growth potential due to expected growth in traffic volumes as a result of regional growth and expected increases in toll fees as a result of inflation adjustments.

Presence in strategic regions/ Strategic geographic location of portfolio assets

The Toll Roads comprise five stretches of toll roads located in the Indian states of Gujarat, Rajasthan, Telangana, and Karnataka. Two (2) Toll Roads are located in southern India while the remaining three (3) are located in central – western India. According to the Traffic Consultants, these corridors are among the two primary corridors for long distance commercial traffic movement and have witnessed high traffic growth rates in the past few years.

- **Asset 1 – Palanpur/Khemana – Abu Road Project:** This project stretch starts at Palanpur in the State of Gujarat and ends at Abu Road in the state of Rajasthan.

- **Asset 2 – Abu Road – Swaroopganj Project:** This project stretch mainly falls in the state of Rajasthan, India. As *per* the Traffic Consultants, this project is one of the main highway corridors connecting Gujarat with an important tourist destination of Mount Abu. Palanpur, Ahmedabad, Mount Abu and Udaipur are some of the important cities which are used by traffic plying on this stretch.
- **Asset 3 – Maharashtra/ Karnataka Border (Kagal) – Belgaum Project:** This project stretch starts at Belgaum in the State of Karnataka and ends at the Maharashtra/ Karnataka Border.
- **Asset 4 – Chittorgarh – Kota & Chittorgarh Bypass Project:** This project stretch starts from Chittorgarh and ends at Kota Bypass about 10 km short of Chambal River Hanging Bridge. This project is divided into three sections based on toll plaza junctions. The project road is short in length and reduces travel time between Kota and Chittorgarh, providing congestion free services.
- **Asset 5 – Kothakota Bypass – Kurnool Highway Project:** This project stretch connects the state of Telangana with Andhra Pradesh. The project road offers the shortest itinerary, in length and travel time between Kothakota and Kurnool.

We believe that future development of highways along the Toll Roads as highlighted by the Traffic Consultants in their Traffic Reports and the increased government initiatives such as *Bharatmala Pariyojana* to improve efficiency across roads in India, will provide an impetus to the growth in traffic on the Toll Roads. Furthermore, each of the Toll Roads lie upon significant inter-city connection routes within the populous states of Maharashtra, Karnataka, Rajasthan, Telangana and Andhra Pradesh, with captive passenger and commercial traffic.

Experienced management team with industry experience

We are managed by qualified personnel of the Investment Manager who have management and operational experience in the roads and highways sector. In addition, qualified personnel of the Project Manager manage our projects. For further details, see the sections headed “*Parties to the Trust – The Investment Manager – National Highways Infra Investment Managers Private Limited*” on page 104 of this Final Placement Memorandum. We believe that the experience and leadership of these teams will contribute to our growth and success and will position the Toll Road assets to be operated and managed in an efficient manner.

Growth opportunities and access to Sponsor’s portfolio

Through our relationship with the Sponsor, and in accordance with the approval granted by the Chairman of NHAI, by way of communication dated March 29, 2021, our Sponsor will offer to us around 1,500 km of roads in the next three (3) years (“**Future Assets**”). The process of identification of Future Assets, offer of Future Assets to Trust and completion of transfer of Future Assets to the Trust including valuation mechanism may be refined and/or modified in line with the internal policies of NHAI. We believe that this access to future toll road assets of the Sponsor or its existing or future subsidiaries will be an important source of growth in the future.

Favourable Concession Agreements terms with Low Counterparty Risk

We believe we have excellent Concession Agreements terms with low counterparty risk due to the creditworthiness of our Sponsor. We believe this, along with the following factors, provide for excellent prospects for our business:

- **Long Concession Life with the possibility for an extension.** Our Concession Agreements are for a period of 30 years from the relevant Appointed Date. We believe this is a sufficiently long period that provides us with ample opportunity to refinance the assets on a fully amortized basis. For details, see “*Summary of the Concession Agreements*”.
- **Termination Payments.** Furthermore, our Concession Agreements provide for termination payments under various default scenarios such as NHAI events of default or *force majeure* events. Under the Concession Agreements, NHAI is obligated to make termination payments in the case of a concessionaire event of default. NHAI’s strong track record of meeting its obligations when they become due gives us confidence that any termination payments will be made in a timely manner. Such termination payments may be used to compensate our creditors. For details, see “*Summary of the Concession Agreements*”.

- *Minimal Price Risk.* The toll rates for all Toll Roads are determined with reference to published base toll rates and are adjusted annually at the beginning of each fiscal year equal to 40% of the movement in the wholesale price index measured in December of the preceding year plus a fixed 3% as per NHAI Fee Rules. Given India's long track record of increasing inflation rates as well as the 3% fixed portion of the increase, we anticipate a continuing increase in toll rates over the life of the concession. We expect that this formula will minimize any risk of increasing operating costs over time.
- *Prohibition Against Additional Tollways.* Subject to certain exemptions, NHAI is prohibited from constructing, or permitting the construction of, any competing expressway or other toll road ("**Additional Tollway**") between specified stretches of each Toll Road at any time during the relevant Concession Period. We will be compensated in line with the terms of the Concession Agreement if our toll collection activities are impacted by the Additional Tollway. NHAI is also obligated to use its best efforts to ensure that the tolls to be levied on vehicles using the Additional Tollway are at least 25% higher than the toll rates of the impacted Toll Road.
- *Prohibition Against Competing Roads.* Subject to certain exemptions, NHAI is prohibited from constructing a Competing Road (as such term is defined in the Concession Agreements) of each of the Toll Roads during the respective Concession Periods.
- *Installation of Additional Check Plazas.* Under the Concession Agreements, subject to certain restrictions we are permitted to install temporary or permanent fee collection booths to prevent fee evasion by users of the Toll Roads. We believe the installation of these check plazas will significantly decrease leakage in the Toll Roads, increasing cash collections and performance.

Strategies of Our Trust

Organic growth through proactive management

Our principal investment strategy is to proactively manage the Toll Road assets to support growth. In particular, the Investment Manager will seek to maintain or improve the Project SPV's net incomes by, among other initiatives, curbing leakages, conducting proper due diligence, formulating and adopting policies and procedures and structuring investments to address tax or regulatory considerations. The Project Manager will assist the Investment Manager by carrying out the operations, management and maintenance of the project in accordance with the Concession Agreement and the Project Implementation Agreement and by procuring, operating and maintaining the project's toll management systems, including but not limited to, employing staff for toll collection, monitoring toll collection and providing security arrangements at toll plazas.

The Investment Manager will also focus on minimizing project operating expenses. The roads and highways sector are a highly competitive sector that is capital intensive and requires significant expenditure. Our ability to efficiently manage the costs associated with the Toll Road assets is critical to maintaining the Project SPV's profit margins. The Investment Manager also intends to focus on increasing the margins of the Project SPV by strengthening internal processes and systems so as to improve utilization of resources and reduce costs. As part of our operations and maintenance systems and processes, the Investment Manager intends to work closely with the Project Manager to promote best practices, to minimize downtime or defects with respect to the Toll Road assets and to monitor performance of toll booth operators and maintenance contractors. The Investment Manager also intends to work with the Project Manager and the Project SPV to upgrade technology as needed, to manage any leakages in toll collections and to streamline collection, route and maintenance operations. With this focus on proactive asset management and operating expense minimization, the Investment Manager hopes to increase our profit margins and achieve long-term growth.

Acquisition of toll road projects

The Investment Manager intends to expand our initial portfolio by identifying and selectively acquiring additional toll road projects that meet our investment criteria described below. The Investment Manager intends to capitalize on opportunities to acquire road projects in India that provide attractive cash flows and yields. While evaluating acquisition opportunities, the Investment Manager intends to focus on, among other things, the following investment criteria in order to make asset selections:

- *Yield thresholds.* The Investment Manager will seek to acquire assets with yields that are estimated to be above our cost of capital so as to maintain or enhance returns to the Unitholders;

- *Traffic characteristics.* The Investment Manager will seek to acquire assets with potential for traffic growth;
- *Residual concession period.* The Investment Manager will actively seek projects with residual concession periods of sufficient duration to meet the investment objectives of the Trust to generate stable returns and ensure long-term growth;
- *Geographic diversity.* The Investment Manager will seek projects in a variety of geographical locations in India to mitigate concentration risk and to take advantage of regional growth; and
- *Other.* In addition, the Investment Manager will also take into account factors such as estimated *maintenance* costs based on technical assessments of projects under evaluation, the impact of acquisitions on our expected distributions, and the requirements under the InvIT Regulations to propel our portfolio of completed and revenue generating projects and under-construction projects.

Optimization of capital structure

The Investment Manager will seek to employ appropriate financing policies and diversify its sources of financing with the objective of minimizing our overall cost of capital. The Investment Manager shall ensure that the Trust operates within the InvIT Regulations for borrowing, whereby the maximum level of external debt in the Trust Group will not exceed 70% (or such other percentage as may, from time to time, be prescribed in the InvIT Regulations) of the value of the assets of the Trust. If it is in the interests of the Unitholders, the Investment Manager may also consider pursuing growth opportunities that require raising additional capital through the issuance of new Units, in accordance with the process laid down by SEBI.

Seamlessly transition all aspects of the Toll Roads upon acquisition

Each of the Toll Roads are publicly funded toll roads which have been operated, pursuant to an annual toll contract, by sub-contractors of NHAI. Upon acquisition of the Toll Roads pursuant to our Concession Agreements, we expect to seamlessly transition the O&M of each of the Toll Roads in a timely and efficient manner to ensure a smooth transition of operation of the Toll Roads and in order to minimize disruption to toll collection or road usage.

We expect to take over the O&M of the Chittorgarh - Kota & Chittorgarh Bypass Toll Road and Maharashtra/ Karnataka Border (Kagal) - Belgaum Toll Road immediately upon commencement of the Concession Period. However, with respect to the (i) Abu Road – Swaroopganj Toll Road (ii) Palanpur/Khemana – Abu Road and the (iii) Kothakota Bypass – Kurnool Highway Toll Road, we will take over the operation and maintenance of these Toll Roads upon expiration of their existing BOT concessions on March 24, 2024, March 24, 2024, and September 15, 2026 respectively.

Furthermore, the Sponsor, Project Manager and the Project SPV have entered into a transitional support agreement for the purpose of the Sponsor providing the transitional support to (i) the Project Manager in respect of its obligations under the Project Implementation and Management Agreement, and (ii) the Project SPV in respect of its O&M obligations and tolling obligations (*as provided under the Concession Agreements*). The terms and conditions of the transitional support agreement shall, in respect of each Concession Agreement and the Project Implementation and Management Agreement, be effective and binding on the Parties for a period of 6 (six) months commencing from the appointed date of the respective Concession Agreements, unless terminated earlier by mutual consent.

Our Investment Manager's well-equipped team of professionals alongwith pavement engineers, transport planners, environment and social experts will ensure proactive operations and maintenance strategies for the Toll Roads.

Improve toll collection efficiencies across the Toll Roads

We intend to transition from the existing semi-automatic and hybrid ETC toll collection methods currently employed at the Toll Roads to automated toll collection system which we expect will improve efficiency, reduce leakage and decongest toll plazas. The adoption of automated toll collection system involves, among other things, the upgradation of toll management software to record vehicles crossing toll plazas, the usage of robust two-fold toll monitoring (including an automated traffic counter and vehicle classifiers to be installed at each toll lane and a remote video monitoring center to be established at our head office) and strict implementation of ETC at the toll lanes. This strategy is in line with the GoI's recent initiatives to increase digitization, including the adoption of FASTags for all toll collections across India. Hitherto, the Toll Roads have seen an increasing share of ETC/FASTag-based toll collection, and according to the Traffic Consultants, this share is expected to grow further

following the GOI's recent initiative in January 2021 mandating electronic toll payments. For more details, please see the **Annexure C** of this Final Placement Memorandum.

Further, we intend the project SPVs to engage with local communities around the Toll Roads to improve our relationship with users. We intend to adopt practices such as, conducting community consultation, supporting road safety, computer literacy programs, installing rainwater harvesting systems and planting trees. We believe these practices will improve our reputation with our key stakeholders including communities and road users.

Summary of Our Toll Roads

	AP	AS	KK	MH-B	CK
Highway.....	NH27	NH27	NH44	NH48	NH27
State	Gujarat /Rajasthan	Rajasthan	Telangana	Karnataka	Rajasthan
Original COD.....	Mar-09	Mar-09	Dec-09	Jul-04	Mar-09
Length (km)	45	31	74.6	77	160.5
No. of Lanes.....	4	4	4	4	4
Km Chainage (km).....	601-646	646 – 677	135.5 - 211	515 – 592.705	891.9 – 1052.4
Toll Plaza (Kilometric point location)	Khemana (602)	Undvaria (670.75)	Pullur (200.95)	Hattargi (537.77), Kognoli (591.30)	Bassi (929.63), Aroli (986.45), Dhaneshwar (1032.98)
Pavement Type.....	Flexible	Flexible	Flexible	Rigid/ Flexible	Rigid/ Flexible
Initial Development Model	Annuity	Annuity	Annuity	Annuity	EPC
Annuity Concession End.....	Mar-24	Mar-24	Sep-26	Dec-19	-
Current Concessionaire ⁽³⁾	L&T IDPL	L&T IDPL	Cube Highways	-	-
Tolling Handover date ⁽⁴⁾	Appointed date	Appointed date	Appointed date	Appointed date	Appointed date
O&M Handover date.....	Mar-24	Mar-24	Sep-26	Appointed Date	Appointed Date
Current Rev.(INR Cr) ⁽¹⁾	71.35	59.06	127.53	114.87	88.65
InvIT - Concession period.....	30 Years	30 Years	30 Years	30 Years	30 Years
Capacity augmentation (1st year post completion)	FY35	FY33	FY34	FY25	-
Fastag enablement date	16-Feb-21	16-Feb-21	16-Feb-21	16-Feb-21	16-Feb-21
Fastag penetration ⁽²⁾	96%	97%	95%	84% (Hattargi) 94% (Kognoli)	93% (Bassi) 86% (Aroli) 93% (Dhaneshwar)

Source: Traffic reports, National Highways Infra Trust

Notes:

- (1) Based on committed revenue paid by tolling contractors to NHAI under current contracts for FY21;
- (2) As on 16 Mar 2021 for AP, AS; 28 Feb 2021 for KK; 25 Feb '21 for MH-B and 7 Mar '21 for CK.
- (3) Maintenance for project stretches to continue under scope of existing concessionaire until end of current concession.

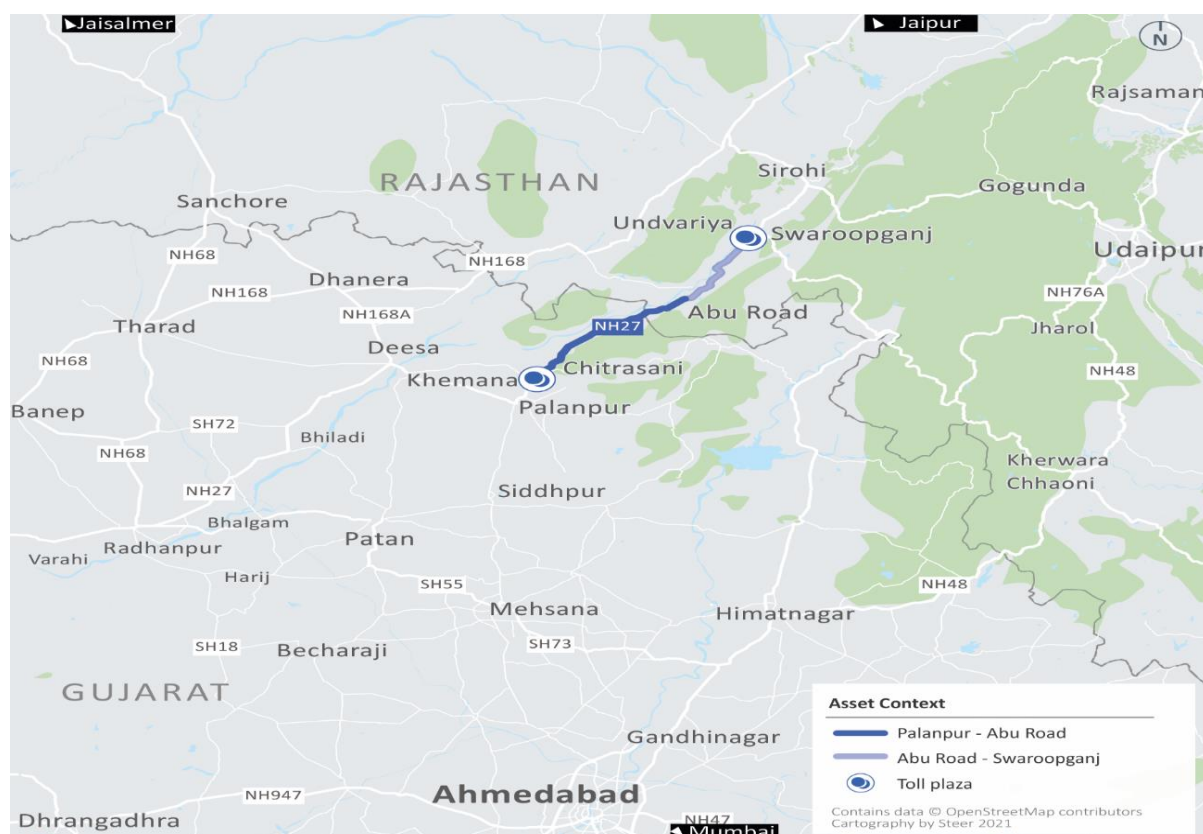
- (4) Appointed date as per the relevant Concession Agreements. Transitional support agreement has been entered into between NHAI and the Trust to manage tolling and O&M for the first 6 months

Description of Our Toll Roads

1. Palanpur/Khemana – Abu Road Project (“Asset 1”)

Project overview

According to the Traffic Consultants, the four-lane Asset 1 starts south of Abu Road on the NH 27 at KM 295+000 with a total Asset length of 45 km ending at KM 340+000. Khemana toll plaza, at Km 339+000, is located just south of Chitrangani village. Asset 1 is one of the key connectors between western Gujarat in the south and Rajasthan and other northern and eastern Indian states. NH27, the second-longest highway in India, caters to the north-west movement between Haryana, Punjab, Delhi, and the different business centres of Gujarat, and east-west movement between Silchar and Porbandar, connecting major centres of economic activity such as Guwahati, Silguri, Lucknow and Udaipur. The movement of cars, jeeps and vans (CJV) on Asset 1 is predominantly local and of a short distance, typically between Palanpur, Swaroopganj, Deesa and other small towns. In contrast, multi axle vehicle (MAV) traffic is long-distance in nature, connecting Rajasthan, Punjab, Delhi, and Haryana in the north to industrial cities like Morbi, Jamnagar and Gandhidham, and ports such as Kandla and Mundra in Gujarat.



Salient growth features and traffic generators

According to the Traffic Consultants, the key economic activities surrounding the region where Asset 1 is located comprise of industries such as dairy, textile, diamond polishing, and marble processing. Palanpur is a major hub for dairy production, having one of the largest dairies in the State – Banas Dairy. Mehsana is a town located south of Palanpur and is also known for its dairy production and related processing services. According to the Traffic Consultants, the key commodities carried by goods vehicles on Asset 1 include construction materials at 20% (including cement, clay, powder), manufacturing products and metals at 16%, agricultural and perishables at 13%, petroleum products at 10% and coal at 6%. The Khemana toll plaza also caters to a significant port-bound traffic including Gandhidham industrial cluster (about 30% of MAV traffic by volume) while connecting the regional centres, i.e. Bhilwara, Jodhpur, etc., with the port towns Kandla and Mudra in the Kutch region. There is also a

significant amount of traffic carrying powder and other inputs to ceramic-based industry located in the Morbi area of Gujarat.

Traffic volume and composite of vehicles

Historical traffic data

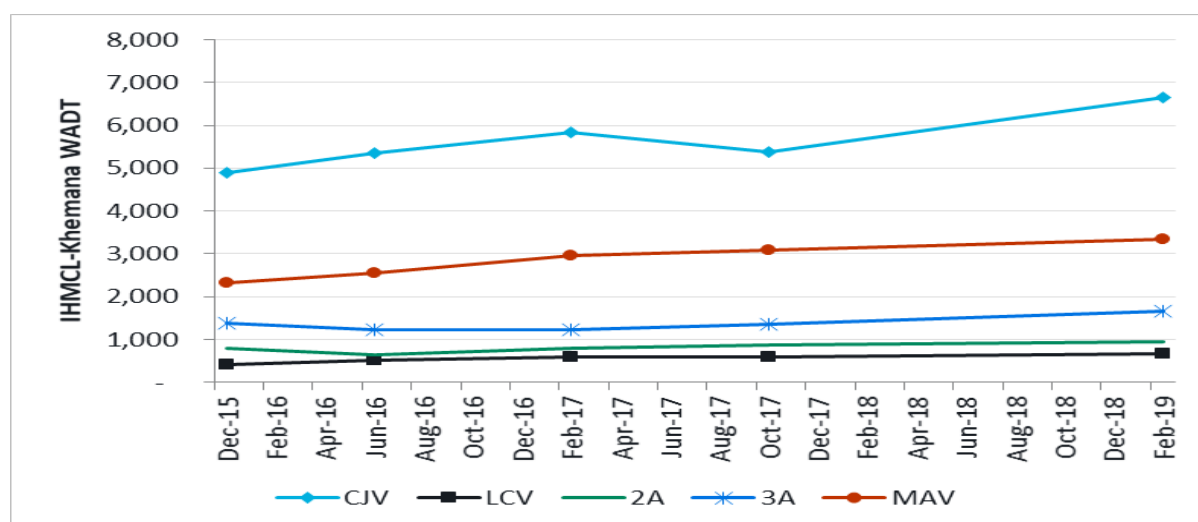
The following table shows the historical traffic counts of Asset 1, according to the Traffic Consultants:

Indian Highway Management Company Limited (IHMCL) counts are available on Asset 1 Khemana toll plaza starting from December 2015 (FY16) and ending in February 2019 (FY19). The point-in-time CAGR between June 2016 and February 2019 shows a PCU growth of 11%, representing positive historical growth of the traffic on Asset 1. This CAGR however, does not signify the actual growth that Asset 1 has witnessed as the counts are not adjusted for seasonality. However, according to the Traffic Consultants, they do provide a relevant basis for evaluating the historical trajectory of the traffic profile using Asset 1.

Vehicle type							CAGR
	December 2015	June 2016	February 2017	October 2017	August 2018	February 2019	(February 2019 vs June 2016)
CJV	4,905	5,349	5,831	5,366	3,996	6,648	8.9%
LCV	424	512	606	589	377	668	10.5%
2A/Buses	786	647	805	883	515	960	15.9%
3A	1,390	1,219	1,239	1,358	1,670	1,668	5.9%
MAV	2,328	2,551	2,971	3,082	4,817	3,333	12.5%
Total	9,834	10,279	11,453	11,279	11,375	13,279	10.1%
PCU	22,550	23,199	26,246	26,846	32,793	30,542	10.8%

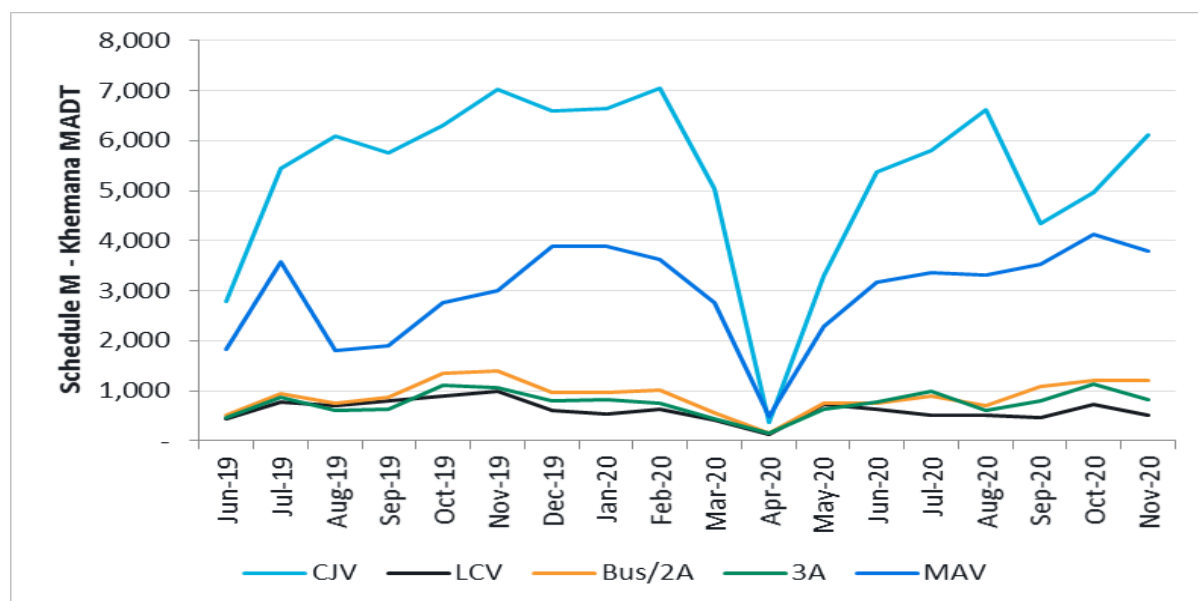
Source: Traffic Report, Steer analysis of data

The figure below represents provides a graphical representation of the table above. The key categories of CJV and MAV as well as the key contributors to revenue, have shown an upward trend in historical performance. The data from these point-in-time that IHMCL counts, signifies a growing trend of traffic on Asset 1.



Monthly Average Daily Traffic

The chart below presents data available on a monthly basis starting June 2019 up to November 2020 for the Khemana toll plaza on Asset 1. The dip in monthly traffic in months of March, April and May is due to the nationwide lockdowns due to COVID-19¹.



The table below presents the MADT for November 2019 and November 2020 (i.e. the time periods for which IHMCL data is available (only for Undavariya plaza), for comparison purposes:

Vehicle Type	Asset 1 – Khemana toll plaza		Asset 2 – Undavariya toll plaza	
	November 2019	November 2020	November 2019	November 2020
CJV	7,026	6,121	5,329	5,904
LCV	981	513	942	569
Bus/2A	1,389	1,194	1,186	1,278
3A	1,050	811	892	887
MAV	3,006	3,797	3,151	4,043
OSV	68	7	16	7
Total	13,520	12,443	11,516	12,688
PCU	29,647	30,024	27,229	31,479

Source: Traffic Reports

Historical counts (Detailed Project Report (DPR)) on Asset 1 - Khemana toll plaza

	February 2018	November 2020
CJV	6,445	7,691
LCV	685	423

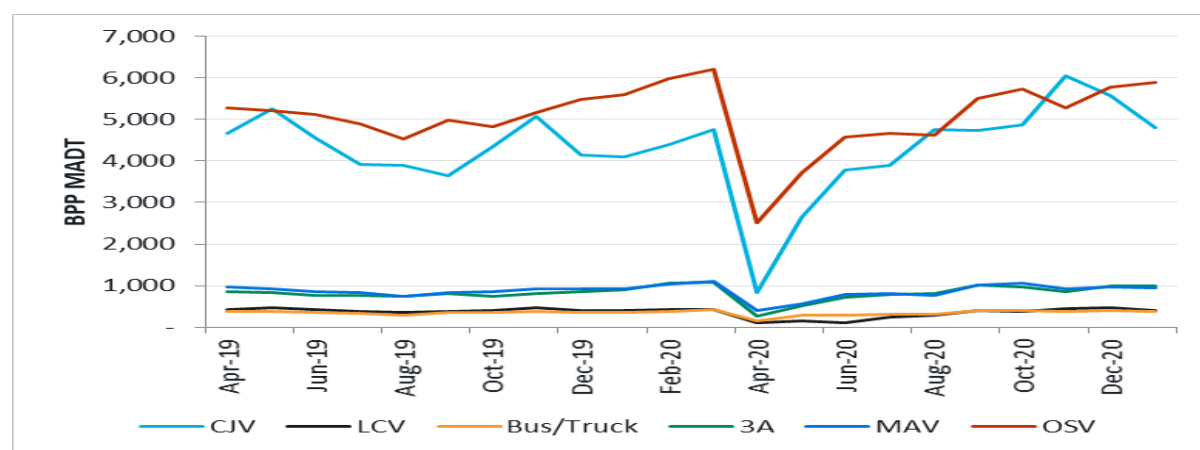
¹ Q4 FY20 saw an outbreak of the virus known as COVID-19 throughout the world (labelled as 'pandemic' by the World Health Organisation in March FY20). The Indian government issued a countrywide 'lockdown' on the March 25, 2020, which lasted until June 8, 2020. The pandemic has resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, worship places, etc.). (Source: Traffic Reports)

	February 2018	November 2020
Buses	258	420
2A	569	776
3A	1,455	1,125
MAV	3,418	4,659
Total.....	12,830	15,094
PCU	29,700	36,254

From the above, the Traffic Consultants note that the PCU levels for Asset 1 Khemana toll plaza is around 36,000 PCU².

Monthly reported traffic on the surrounding assets/connecting roads

The reported traffic volume on a connecting road, Beawar-Pali-Pindwara (BPP), was shared with the Traffic Consultants for the duration of April 2019 to December 2020 (as per chart below). BPP acts as a major feeder to both: Asset 1 and 2, with similar destinations for long-distance traffic such as the ports, Morbi, Jamanagar, in addition to Ahmedabad and other major towns in Gujarat. Hence, according to the Traffic Consultants it is reasonable to believe that the traffic profile on this Asset will mirror the profile on Asset 1 and 2.

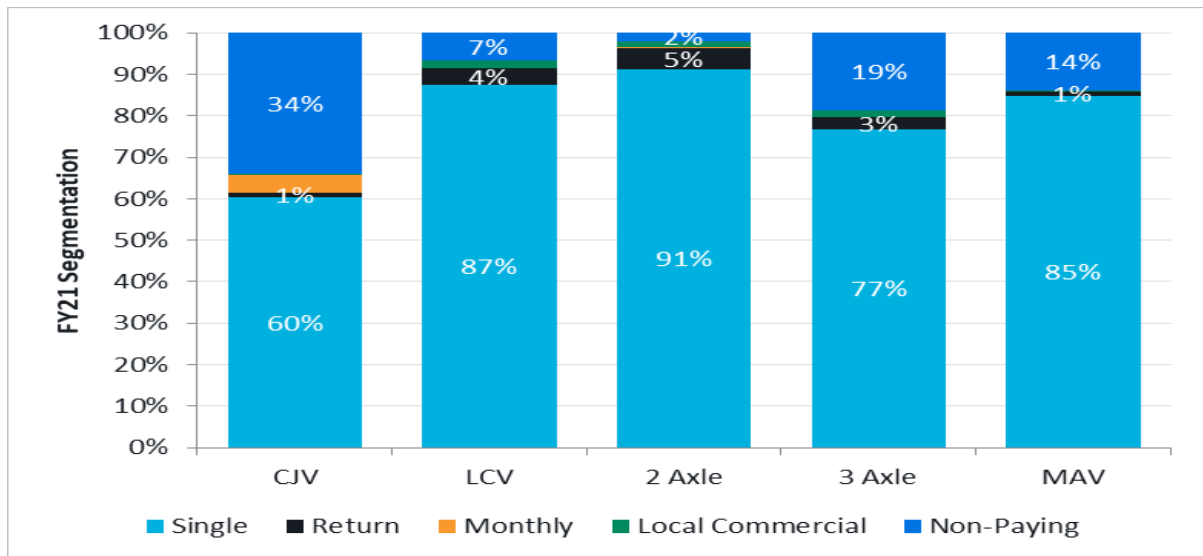


(Source: Traffic Reports)

Toll Segmentation

The chart below presents the estimated segmentation based on traffic data from the latest months of FY21 for Toll Plaza Khemana. In addition, the Traffic Consultant has also forecasted toll segmentation for FY23. For further details in this regard, please refer to **Annexure C** of this Final Placement Memorandum.

² The volume counts were undertaken at different times of the month, so a small variation is expected depending on the week the surveys were carried out (Source: Traffic Reports)



Source: Traffic Report, Steer analysis based on client data.

Base year Annual Average Daily Traffic (AADT)

The Traffic Consultants table below shows FY21 AADTs estimated using the counts and the Seasonality Correction Factors (SCFs):

Asset	Asset 1 Toll Plaza - Khemana
CJV	6,481
LCV	379
Buses	360
2A	761
3A	1,033
MAV	4,402
Total	13,416
PCU	33,318

Source: Traffic Report, Steer analysis based on client data.

Elasticity recommendations

As per the Traffic Consultants, elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in the drivers of traffic demand. When multiplied with forecasts of said growth drivers, they provide the forecasts of background traffic growth rates. Due to the gaps in continuous and consistent data availability on Asset 1, it was infeasible for the Traffic Consultants to conduct a traditional statistical based growth and regression-based analysis to estimate underlying elasticity assumptions for future growth. Accordingly, the Traffic Consultants have provided elasticity recommendations for Asset 1. For more details on this, please refer to Table 4.13 of Annexure C to this Final Placement Memorandum.

Projected Traffic Data: Growth in Passenger Car Unit (PCU)

The Traffic Consultants project that there will be continued sustained growth in PCU of Asset 1 across all vehicle types till FY2050. The below table shows the expected PCUs by financial year. For detailed analysis on the traffic growth rates, please refer to **Annexure C** of this Final Placement Memorandum.

Khemana	FY21	FY22	FY27	FY32	FY37	FY42	FY47	FY50
CJV	6,216	6,737	9,821	13,626	18,708	24,292	30,703	34,920
LCV	347	360	429	499	586	660	736	781
Bus	360	374	445	518	593	669	745	791
2 Axle.....	761	778	865	948	1,033	1,110	1,185	1,228
3 Axle.....	1,033	1,041	1,095	1,224	1,363	1,498	1,634	1,717
MAV	4,402	4,473	5,295	6,786	8,723	10,755	13,054	14,564
Total.....	13,416	14,073	18,318	24,030	31,508	39,551	48,688	54,670
PCU.....	33,318	34,312	41,896	53,435	68,336	84,111	101,909	113,542

Source: Steer analysis

Operation and maintenance

The Palanpur/Khemana – Abu Road Toll Road is currently operated under the BOT (Annuity) model, whereby the concessionaire is responsible for construction, operation and maintenance of the toll road while the relevant authority collects tolls and makes annuity payments to the concessionaire. The current concessionaire is L&T Interstate Road Corridor Limited. We expect the current concessionaire to undertake routine and major maintenance works, as per the requirement of its current concession obligations, up to the termination of its concession period and our O&M Handover Date for the Palanpur/Khemana – Abu Road Toll Road is March 25, 2024. Following our takeover of O&M on March 25, 2024, we plan to perform ongoing major maintenance works on a regular basis to maintain in good condition the Palanpur/Khemana – Abu Road Toll Road.

Tollable Length and Toll Rates

In terms of tollable length, the Palanpur/Khemana – Abu Road Toll Road comprises 45 km of roads. In India, toll rates are as per notification by the Ministry of Road Transport and Highways in the National Gazette. The present toll rates are determined with reference to the published base toll rates and are adjusted annually at the beginning of each fiscal year equal to 40% of the movement in the wholesale price index in December of the preceding year plus a fixed 3%.

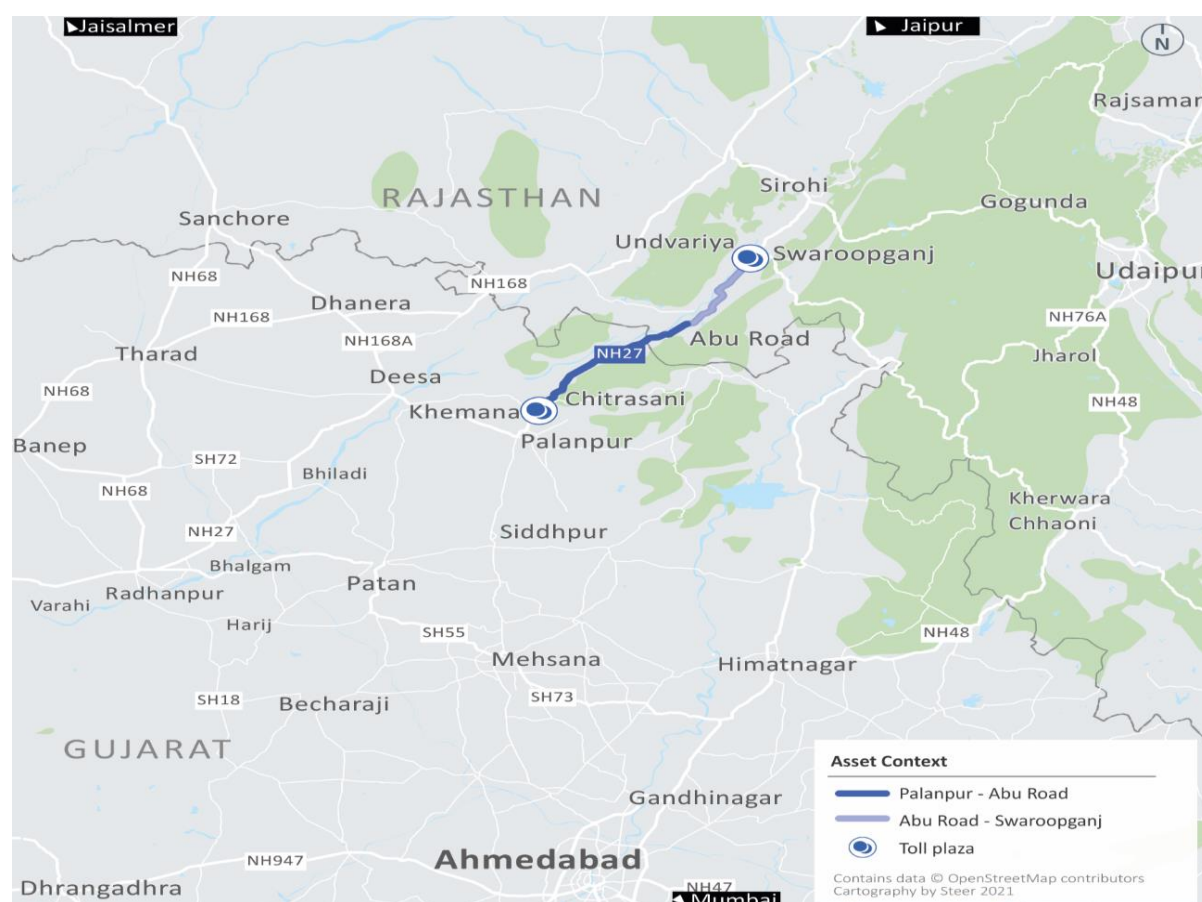
According to the NHAI's toll notification dated March 26, 2021, the toll rates at the Khemana toll plaza for the Palanpur/Khemana – Abu Road Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Toll Plaza
			(Rs.)	
Car/Jeep/Van or LMV	65	95	2,100	30
LCV, LGV or Minibus.....	100	155	3,395	50
Bus/Truck (2 axles).....	215	320	7,110	105
Vehicles with up to 3 axles	235	350	7,760	115
HCM/EME or MAV with 4 to 6 axles	335	500	11,155	165
Oversized vehicles with 7 or more axles.....	405	610	13,580	205

2. Abu Road – Swaroopganj Road Project (“Asset 2”)

Project overview

According to the Traffic Consultants, the four-lane Asset 2 starts near Swaroopganj on the NH 27 at KM 264+000 with a total Asset length of 31 km ending at KM 295+000 near Abu Road. Asset 2 has one toll plaza at Undavariya at Km 270+250. Asset 2 forms one of the key connectors between western Gujarat in the south and Rajasthan and other northern and eastern Indian states. NH27, the second-longest highway in India, caters to the north-west movement between Haryana, Punjab, Delhi, and the different business centres of Gujarat, and east-west movement between Silchar and Porbandar, connecting major centres of economic activity such as Guwahati, Silguri, Lucknow and Udaipur. The movement of cars, jeeps and vans on Asset 2 is predominantly local and of a short distance between Palanpur, Swaroopganj, Deesa and other small towns. Multi axle vehicle (MAV) traffic on the other hand is long-distance in nature, connecting Rajasthan, Punjab, Delhi, and Haryana in the north to industrial cities like Morbi, Jamnagar and Gandhidham, and ports like Kandla and Mundra in Gujarat.



Salient growth features and traffic generators

According to the Traffic Consultants, the key economic activities surrounding the region where Asset 2 is located comprises of industries such as dairy, textile, diamond polishing, and marble processing. According to the Traffic Consultants' detailed project report, the key commodities carried by goods vehicles on Asset 2, includes construction materials at 20% (including cement, clay, powder), manufacturing products and metals at 16%, agricultural and perishables at 13%, petroleum products at 10% and coal at 6%. The Undavariya toll plaza also caters to a significant port-bound traffic including Gandhidham industrial cluster (about 30% of MAV traffic by volume) while connecting the regional centres, i.e. Bhilwara, Jodhpur, etc., with the port towns Kandla and Mudra in the Kutch region. There is also a significant amount of traffic carrying powder and other inputs to ceramic-based industry located in the Morbi area of Gujarat.

Traffic volume and composite of vehicles

Historical traffic data

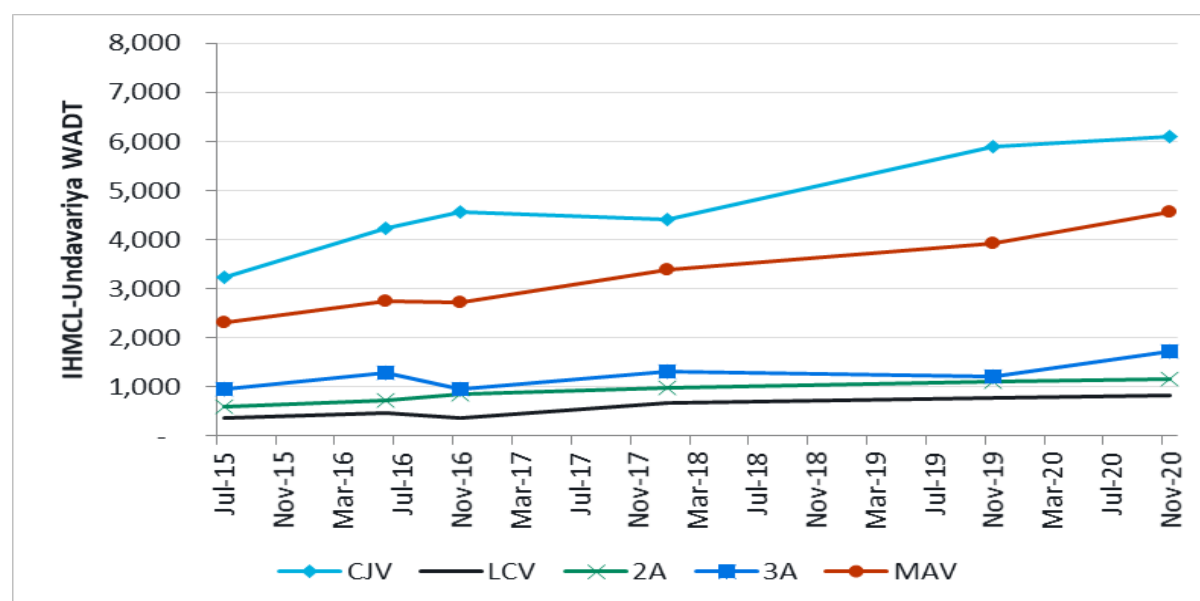
The following table shows the historical traffic counts of Asset 2 according to the Traffic Consultants:

IHMCL counts are available on Undavariya toll plaza of Asset 2 starting in July 2015 (FY16) and ending in November 2019 (FY20). Similar to Asset 1, the point-in-time CAGR between June 2016 and November 2020 shows a PCU growth of 11%, representing a positive historical growth of the traffic on Asset 2. This CAGR however, does not signify the actual growth that Asset 2 has witnessed as the counts are not adjusted for seasonality. However, according to the Traffic Consultants, they do provide a relevant basis for evaluating the historical trajectory of the traffic profile using Asset 2.

							CAGR
							(November 2020 vs June 2016)
Vehicle type	July 2015	June 2016	November 2016	January 2018	November 2019	November 2020	
CJV	3,219	4,232	4,559	4,414	5,893	6,108	8.4%
LCV	362	466	371	665	758	819	13.6%
2A/Buses	597	711	852	968	1,110	1,151	11.5%
3A	958	1,282	956	1,307	1,206	1,720	6.9%
MAV	2,318	2,744	2,708	3,390	3,919	4,551	12.1%
Total	7,455	9,436	9,446	10,746	12,893	14,363	10.0%
PCU	18,863	23,263	22,726	27,501	31,645	36,492	10.7%

Source: Traffic Report, Steer analysis of data

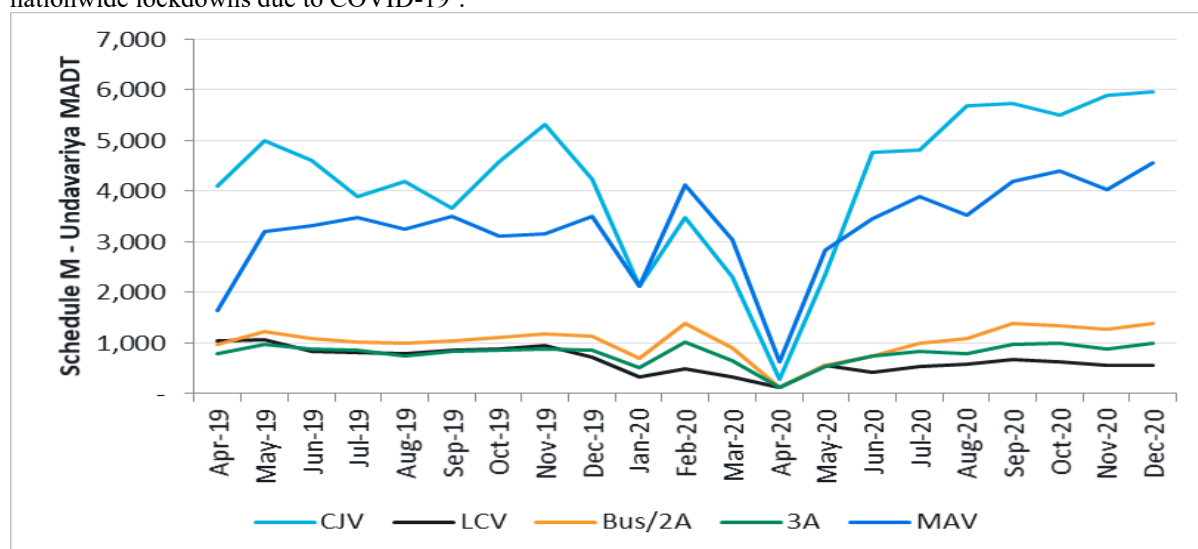
The figure below represents provides a graphical representation of the table above. The key categories of CJV and MAV as well as the key contributors to revenue have shown an upward trend in historical performance. The data from these point-in-time that the IHMCL counts, signifies a growing trend of traffic on Asset 2.



Source: Steer analysis; *markers indicate the months for which the information is available

Monthly Average Daily Traffic

The chart below presents data available on a monthly basis starting April 2019 up to December 2020 for the Undavariya toll plaza on Asset 2. The dip in monthly traffic in months of March, April and May is due to the nationwide lockdowns due to COVID-19³.



Source: Traffic Reports

The table below presents the MADT for November 2019 and November 2020 (i.e. the time periods for which IHMCL data is available (only for Undavariya plaza), for comparison purposes:

Vehicle Type	Asset 1 – Khemana toll plaza		Asset 2 – Undavariya toll plaza	
	November 2019	November 2020	November 2019	November 2020
CJV	7,026	6,121	5,329	5,904
LCV	981	513	942	569
Bus/2A	1,389	1,194	1,186	1,278
3A	1,050	811	892	887
MAV	3,006	3,797	3,151	4,043
OSV	68	7	16	7
Total	13,520	12,443	11,516	12,688
PCU	29,647	30,024	27,229	31,479

Source: Traffic Reports

Historical counts (Detailed Project Report (DPR)) on Asset 2 – Undavariya toll plaza

	February 2018	November 2020
CJV	4,817	6,938
LCV	347	539

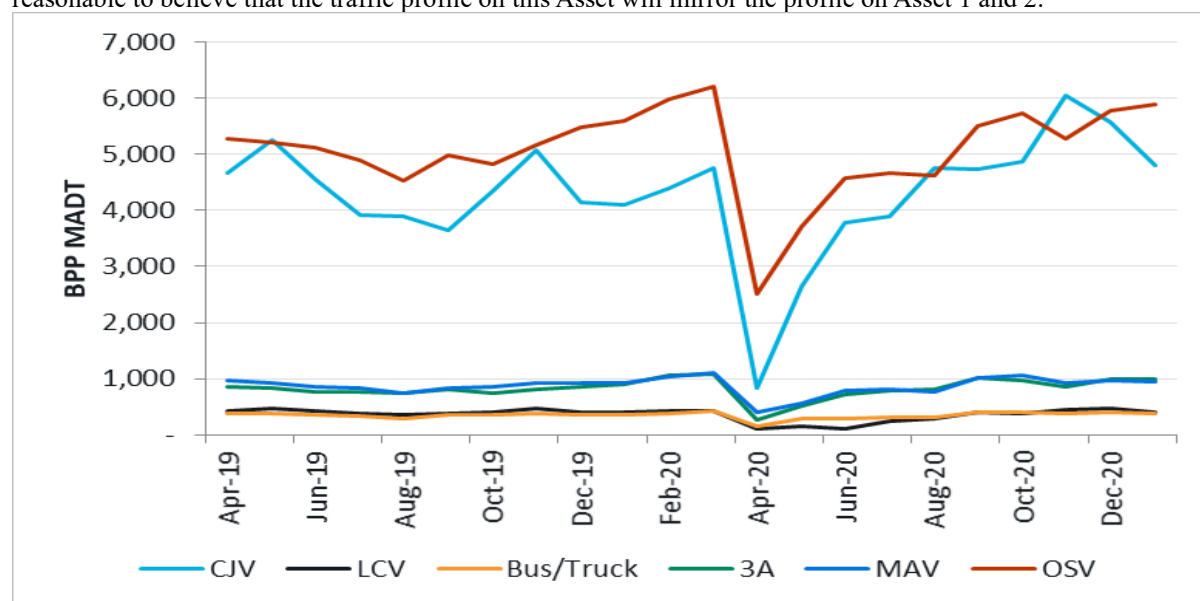
³ Q4 FY20 saw an outbreak of the virus known as COVID-19 throughout the world (labelled as 'pandemic' by the World Health Organisation in March FY20). The Indian government issued a countrywide 'lockdown' on the March 25, 2020, which lasted until June 8, 2020. The pandemic has resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, worship places, etc.). (Source: Traffic Reports)

	February 2018	November 2020
Buses.....	501	568
2A	524	719
3A	1,109	1,062
MAV	3,473	5,354
Total	10,771	15,180
PCU	27,368	38,887

From the above, the Traffic Consultants note that the PCU levels for Asset 2 Undavariya toll plaza is around 38,000 PCU⁴.

Monthly reported traffic on the surrounding assets/connecting roads

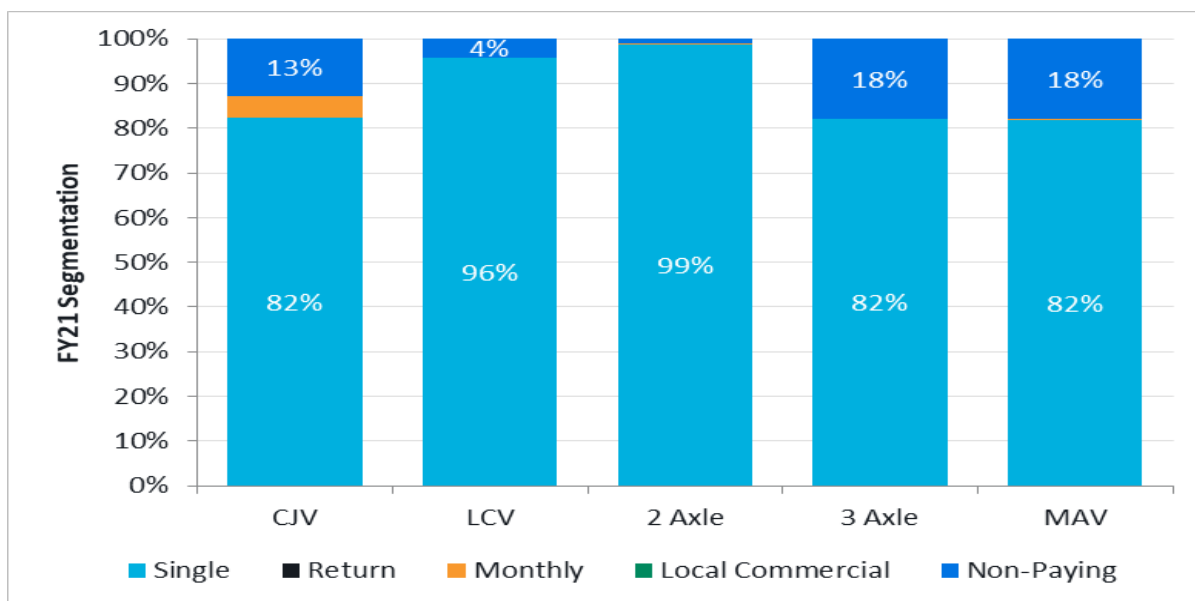
The reported traffic volume on a connecting road, Beawar-Pali-Pindwara (BPP), was shared with the Traffic Consultants for the duration of April 2019 to January 2021 (as per chart below). BPP acts as a major feeder to both: Asset 1 and 2, with similar destinations for long-distance traffic such as the ports, Morbi, Jamanagar, in addition to Ahmedabad and other major towns in Gujarat. Hence, according to the Traffic Consultants it is reasonable to believe that the traffic profile on this Asset will mirror the profile on Asset 1 and 2.



Toll Segmentation

The chart below presents the estimated segmentation based on traffic data from the latest months of FY21 for Toll Plaza Undavariya. In addition, the Traffic Consultant has also forecasted toll segmentation for FY23. For further details in this regard, please refer to **Annexure C** of this Final Placement Memorandum:

⁴ The volume counts were undertaken at different times of the month, so a small variation is expected depending on the week the surveys were carried out (Source: Traffic Reports)



Source: Traffic Report, Steer analysis based on client data.

Base year Annual Average Daily Traffic (AADT)

The Traffic Consultants table below shows FY21 AADTs estimated using the counts and the Seasonality Correction Factors (SCFs):

Asset	Asset 2 Toll Plaza - Undavariya
CJV	5,847
LCV	483
Buses	487
2A	705
3A	975
MAV	5,058
Total	13,555
PCU	35,834

Source: Traffic Report, Steer analysis based on client data.

Elasticity recommendations

As per the Traffic Consultants, elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in the drivers of traffic demand. When multiplied with forecasts of said growth drivers, they provide the forecasts of background traffic growth rates. Due to the gaps in continuous and consistent data availability on Asset 2, it was infeasible for the Traffic Consultants to conduct a traditional statistical based growth and regression-based analysis to estimate underlying elasticity assumptions for future growth. Accordingly, the Traffic Consultants have provided elasticity recommendations for Asset 2. For more details on this, please refer to Table 4.13 of Annexure C to this Final Placement Memorandum.

Projected Traffic Data: Growth in Passenger Car Unit (PCU)

The Traffic Consultants project that there will be continued sustained growth in PCU of Asset 2 across all vehicle types till FY2050. The below table shows the expected PCUs by financial year. For detailed analysis on the traffic growth rates, please refer to **Annexure C** of this Final Placement Memorandum.

Undavariya	FY21	FY22	FY27	FY32	FY37	FY42	FY47	FY50
CJV	5,490	5,951	8,675	12,035	16,524	21,456	27,119	30,844
LCV	414	430	512	596	699	788	878	932
Bus	487	506	602	701	802	905	1,008	1,069
2 Axle.....	705	721	801	876	957	1,029	1,098	1,138
3 Axle.....	975	982	1,031	1,150	1,284	1,411	1,539	1,617
MAV	5,058	5,169	6,161	7,784	10,147	12,511	15,185	16,942
Total.....	13,555	14,201	18,309	23,753	31,131	38,910	47,729	53,498
PCU.....	35,834	36,961	45,041	56,797	73,138	89,847	108,678	120,985

Source: Steer analysis

Operation and maintenance

The Abu Road – Swaroopganj Toll Road is currently operated under the BOT (Annuity) model, whereby the concessionaire is responsible for construction, operation and maintenance of the toll road while the relevant authority collects tolls and makes annuity payments to the concessionaire. The current concessionaire is L&T Interstate Road Corridor Limited. We expect the current concessionaire to undertake routine and major maintenance works, as per the requirement of its current concession obligations, up to the termination of its concession period and our O&M Handover Date for the Abu Road – Swaroopganj Toll Road on March 25, 2024. Following our takeover of O&M on March 24, 2024, we plan to perform ongoing major maintenance works on a regular basis to maintain in good condition the Abu Road – Swaroopganj Toll Road.

Tollable Length and Toll Rates

In terms of tollable length, the Abu Road – Swaroopganj Toll Road comprises 31 km of roads. In India, toll rates are as per notification by the Ministry of Road Transport and Highways in the National Gazette. The present toll rates are determined with reference to the published base toll rates and are adjusted annually at the beginning of each fiscal year equal to 40% of the movement in the wholesale price index in December of the preceding year plus a fixed 3%.

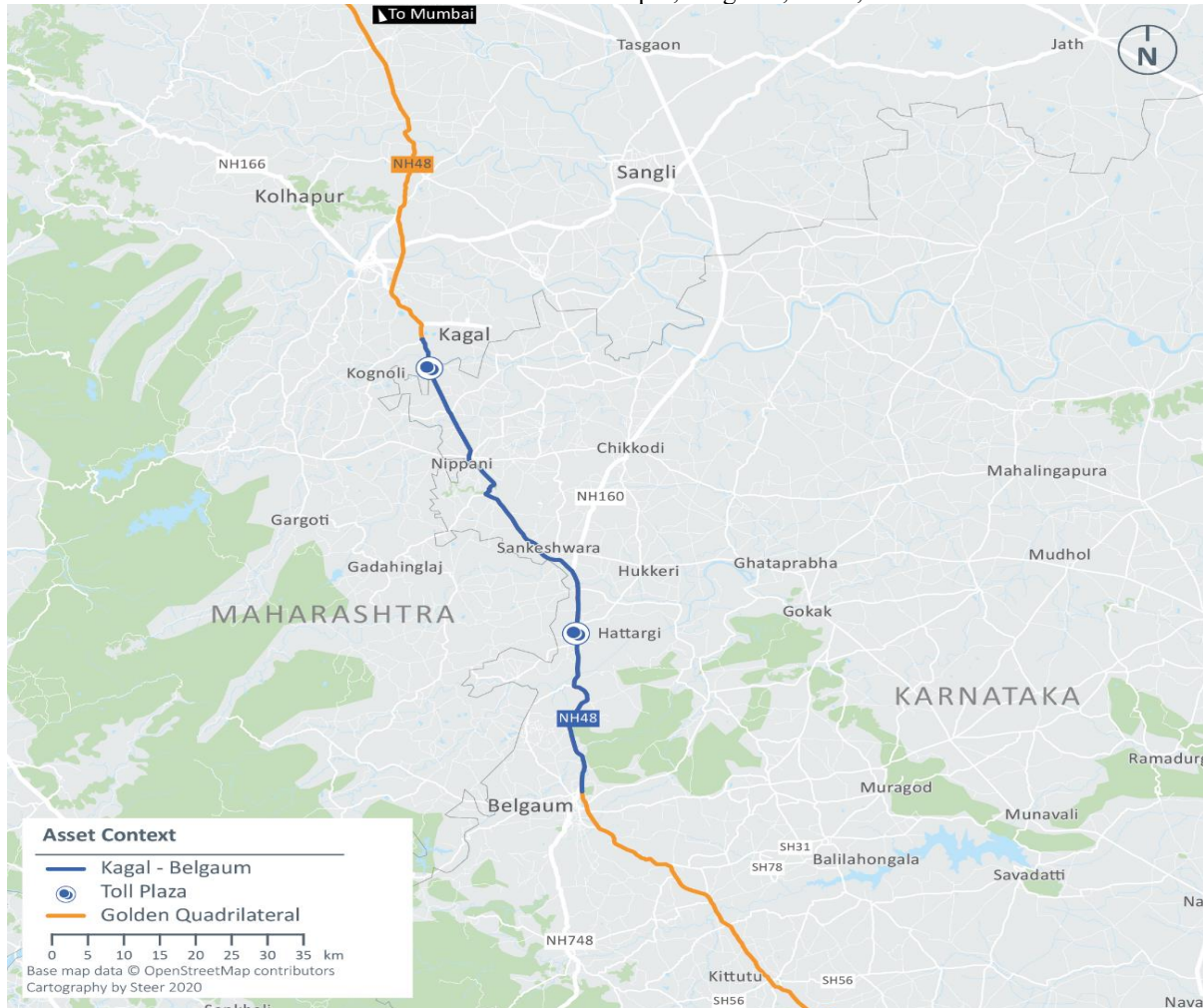
According to the NHAI's toll notification dated March 26, 2021, the toll rates at the Undawariya toll plaza for the Abu Road – Swaroopganj Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Toll Plaza
				(Rs.)
Car/Jeep/Van or LMV	40	60	1,340	20
LCV, LGV or Minibus.....	65	100	2,170	35
Bus/Truck (2 axles).....	135	205	4,545	70
Vehicles with up to 3 axles	150	225	4,955	75
HCM/EME or MAV with 4 to 6 axles.....	215	320	7,125	105
Oversized vehicles with 7 or more axles.....	260	390	8,675	130

3. *Maharashtra Border – Belgaum Project Toll Road (“Asset 3”)*

Project overview

According to the Traffic Consultants, the four-lane Asset 3 starts just south of Kagal in Karnataka on the NH 48 (at KM 592+240) with a total Asset length of 77.7 kms and ends at Belgaum (KM 515+000). Asset 3 has two (2) toll plazas at Kognoli (Km 591+240) and Hattargi (KM 537.770). The tolls at Kognoli are associated with 55 km of the Asset, while those at Hattargi are related to the remaining 22 km. Asset 3 is part of NH 48, which connects Delhi in the north to Chennai in the south covering seven (7) states in India. Regionally, it also connects the cities of Mumbai in the west to Bangalore/Chennai in the south. The Asset 3 forms a part of the Golden Quadrilateral connecting the four older metropolitan cities in India (Delhi-Mumbai-Chennai-Kolkata). The Asset 3 also serves short distance traffic between the towns and cities of Kolhapur, Belgaum, Hubli, Belur and Dharwad.



Salient growth features and traffic generators

According to the Traffic Consultants, Asset 3 serves regions that manufacture heavy machine tools, automotive parts, industrial manufacturing products with access to high deposits of bauxite, uranium in close proximity. Besides the manufacturing sector, the Asset also serves a large sugarcane-producing belt and has several sugar mills in its vicinity. Other commercial agricultural goods such as tobacco are also produced in the region. Belgaum is a major commercial hub for fruits, vegetables, meat, poultry, fish, and wood in Karnataka with numerous sugar industries and a Special Economic Zone. Hindalco Industries Limited is a major aluminum and copper manufacturing company located in Belgaum. Belur Industrial Area is also situated in the proximity of the Asset, approximately 70 km from Belgaum, which is home to major industries including Tata motors Ltd, Tata Marcopolo Motors Limited, TATA Hitachi Construction Machinery Co, gas bottling plants for both BPCL and HPCL along with some medium-scale industries related to chemical, pharmaceutical, fertilizers etc. These industries contribute to the traffic on the Asset: MAVs carrying new cars from the KIA motors manufacturing unit

in Anantapur, Andhra Pradesh to Maharashtra can also be observed on the road. There is a Maharashtra Industrial Development Corporation's (MIDC) industrial area near Kagal which includes manufacturing plants, chemical/plastic processing factories, etc. In addition to the local and regional industries, Asset 3 also records trucks carrying machinery including spare parts originating from Pune to destinations along the stretch to cities such as Belgaum, Bangalore, Chennai, and other cities. It caters to long-distance movement of automobiles and spare parts from the Sriperumbudur industrial region in Chennai's vicinity.

Traffic volume and composite of vehicles

Historical traffic data

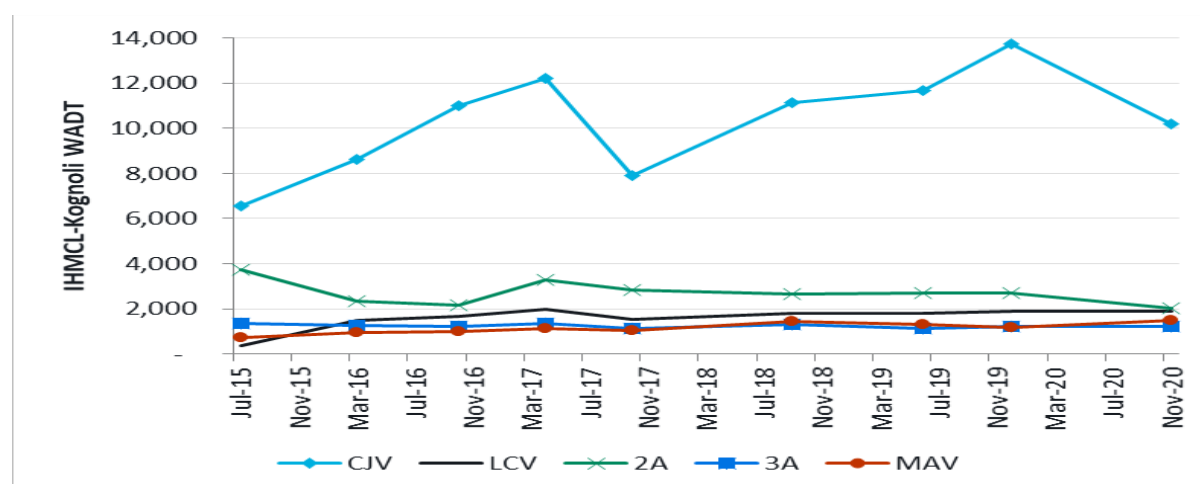
The following table shows the historical traffic data of Asset 3, according to the Traffic Consultants:

IHMCL counts are available on Asset 3 - **Kognoli toll plaza** starting in March 2016 (FY16) and ending in November 2020 (FY21). As shown in the table below, the point-in-time CAGR between these months shows a PCU growth of 2.6%. This CAGR however, does not signify the actual growth that Asset 3 has witnessed as the counts are not adjusted for seasonality. However, according to the Traffic Consultants, they do provide a relevant basis for evaluating the historical trajectory of the traffic profile using Asset 3.

Vehicle type	March 2016	October 2016	April 2017	October 2017	September 2018	June 2019	December 2019	November 2019	CAGR (March 2016 to November 2020)
CJV.....	8,637	10,984	12,207	7,911	11,150	11,664	13,736	10,203	3.5%
LCV.....	1,509	1,655	2,000	1,551	1,801	1,795	1,888	1,888	4.9%
2A/bus.....	2,351	2,159	3,265	2,852	2,655	2,709	2,698	2,022	(3.2%)
3A.....	1,264	1,230	1,365	1,127	1,303	1,124	1,230	1,207	(1.0%)
MAV.....	969	1,007	1,142	1,032	1,431	1,321	1,183	1,503	9.8%
Total.....	14,733	17,036	19,981	14,477	18,342	18,614	20,736	16,827	2.9%
PCU.....	26,120	28,170	34,245	26,837	32,174	31,805	33,680	29,504	2.6%

Source: Traffic Report, Steer analysis of data

The figure below represents provides a graphical representation of the table above. The key categories of CJV and MAV as well as the key contributors to revenue, have shown an upward trend in historical performance. The data from these point-in-time that IHMCL counts, signifies a growing trend of traffic on Asset 3.

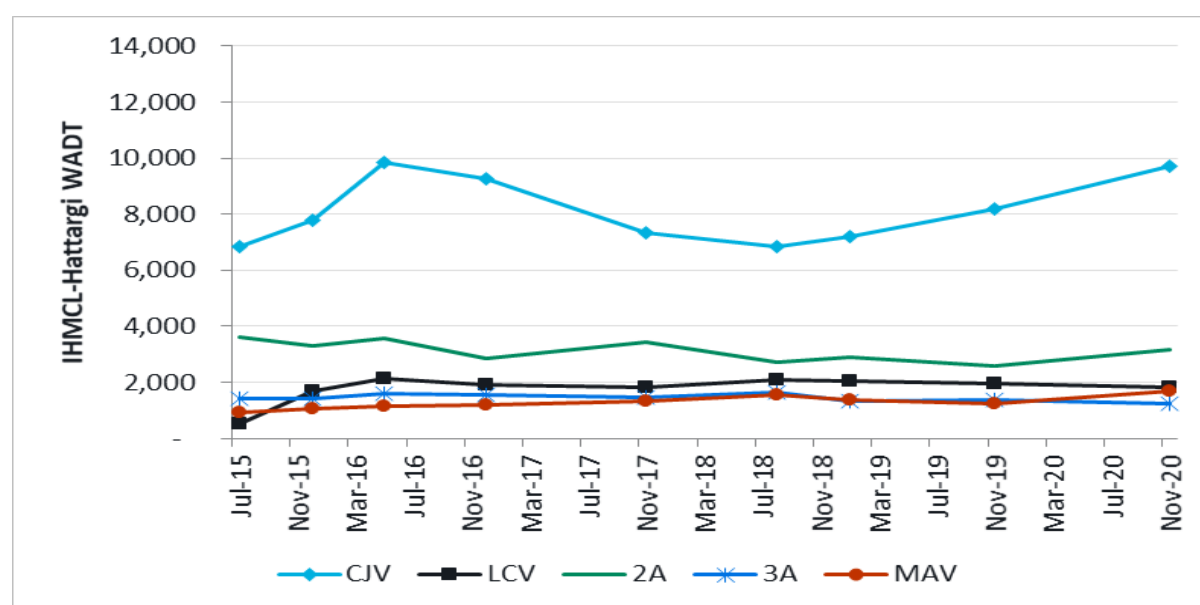


IHMCL counts are available on Asset 3 - **Hattargi toll plaza** starting in May 2016 (FY17) and ending in November 2020 (FY21). As shown in the table below, the point-in-time CAGR between these months shows a PCU growth of 1.8%. This CAGR however, does not signify the actual growth that Asset 3 has witnessed as the counts are not adjusted for seasonality. However, according to the Traffic Consultants, they do provide a relevant basis for evaluating the historical trajectory of the traffic profile using Asset 3.

Vehicle	May 2016	December 2016	November 2017	August 2018	January 2019	November 2019	November 2020	CAGR (May-16 to Nov-20)
CJV	9,839	9,273	7,333	6,821	7,203	8,183	9,705	2.2%
LCV	2,120	1,933	1,826	2,083	2,061	1,975	1,807	(1.5%)
2A	3,579	2,839	3,442	2,738	2,883	2,590	3,163	2.5%
3A	1,578	1,565	1,447	1,632	1,313	1,376	1,242	(5.2%)
MAV	1,169	1,183	1,323	1,546	1,377	1,250	1,677	8.4%
Total	18,288	16,795	15,376	14,823	14,839	15,376	17,598	1.1%
PCU	33,764	30,717	30,715	30,026	29,088	28,678	33,195	1.8%

Source: Traffic Report, Steer analysis of data

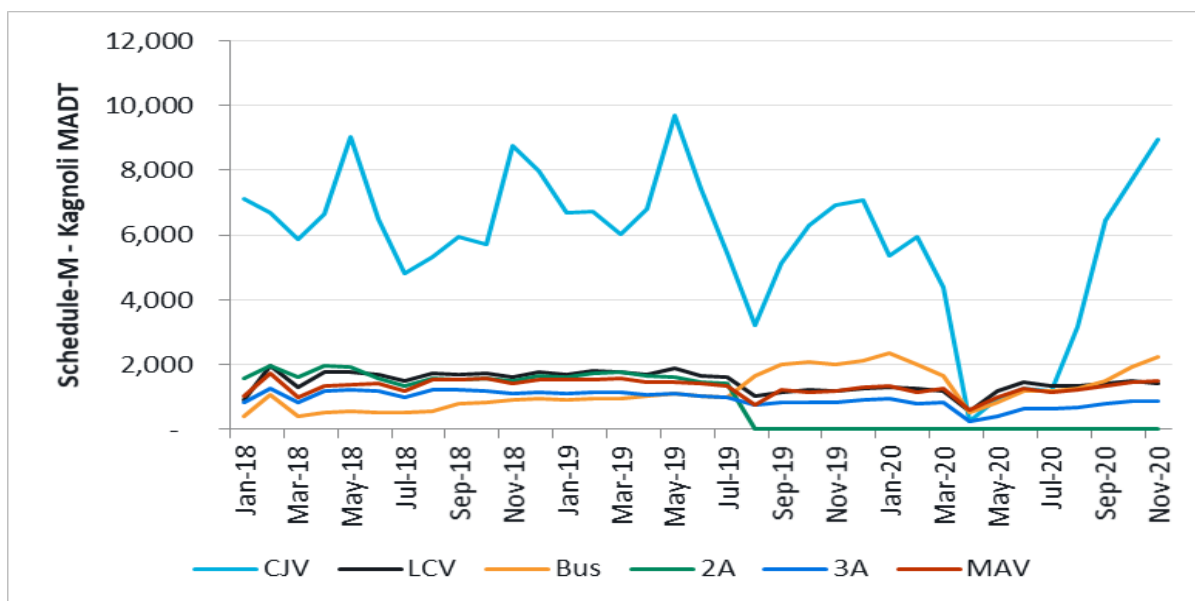
The figure below represents provides a graphical representation of the table above. The key categories of CJV and MAV as well as the key contributors to revenue have shown an upward trend in historical performance. The data from these point-in-time that the IHMCL counts, signifies a growing trend of traffic on Asset 3.



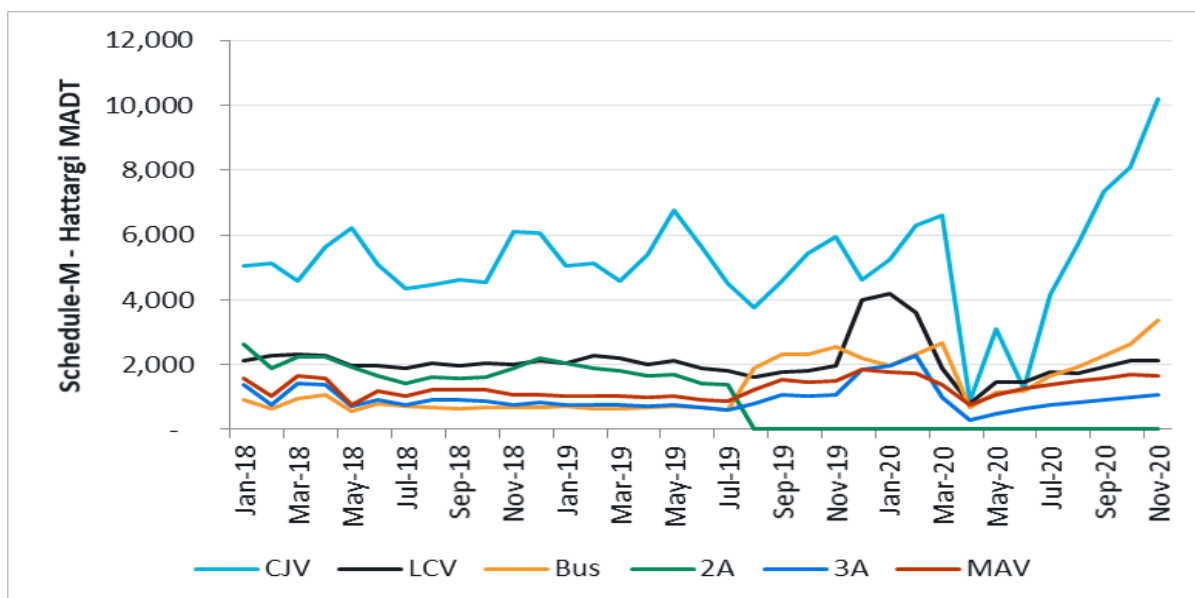
Monthly Average Daily Traffic

The chart below presents the reported traffic volume for toll plaza Kognoli and Hattargi on Asset 3, in terms of monthly average daily traffic (MADT) from January 2018 (FY18) to November 20 (FY21). The dip in monthly traffic in months of March, April and May is due to the nationwide lockdowns due to COVID-19⁵.

⁵ Q4 FY20 saw an outbreak of the virus known as COVID-19 throughout the world (labelled as 'pandemic' by the World Health Organisation in March FY20). The Indian government issued a countrywide 'lockdown' on the March 25, 2020, which lasted until June 8, 2020. The pandemic has resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, worship places, etc.). (Source: Traffic Reports)



Source: Steer analysis. * The drop in 2A and rise of bus traffic in Aug-19 is due to 2A and bus data being aggregated: both 2A and bus are shown under Bus category from Aug-19 onwards.



Source: Traffic Reports

The table below presents the MADT for November 2019 and November 2020 (i.e. the time periods for which IHMCL data is available for Hattargi plaza and December 2019 and November 2020 for Kognoli plaza, for comparison purposes.

Vehicle Type	Asset 3 – Kognoli toll plaza		Asset 3 – Hattargi toll plaza	
	Dec-19	Nov-20	Nov-19	Nov-20
CJV	7,062	8,950	5,951	10,206
LCV	1,286	1,425	1,967	2,124
Bus.....	2,140	2,239	2,539	3,378
2A		—	—	—
3A	925	887	1,059	1,049
MAV.....	1,290	1,492	1,481	1,647

	Asset 3 – Kognoli toll plaza		Asset 3 – Hattargi toll plaza	
OSV	2	2	9	7
Total	12,705	14,995	13,007	18,410
PCU	25,389	28,517	27,991	35,686

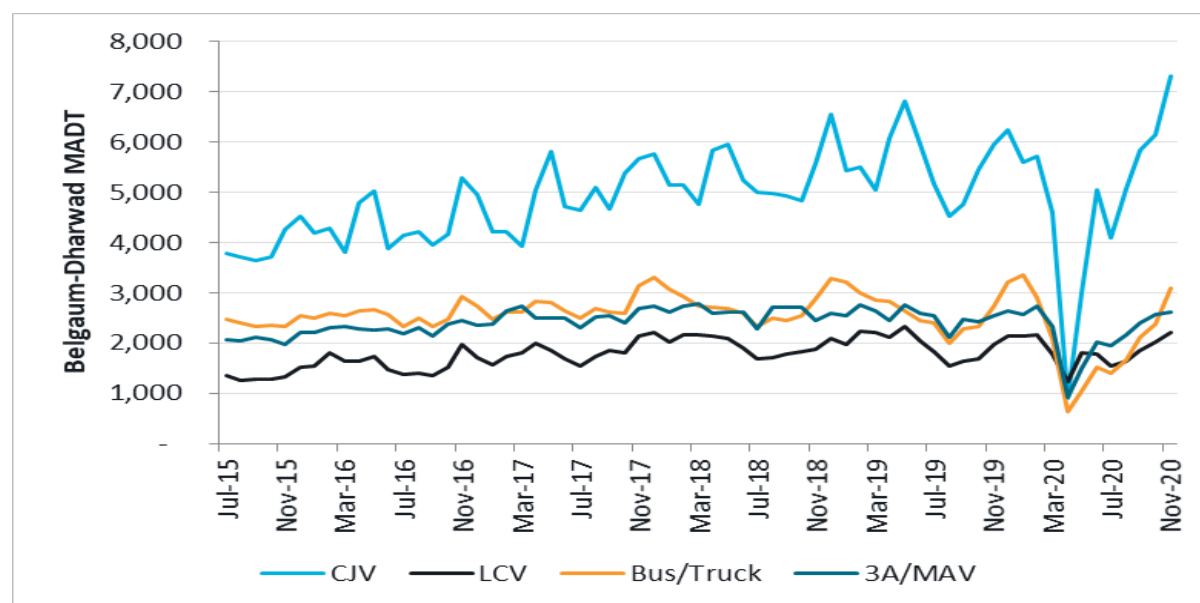
Source: Traffic Reports

Historical counts (Detailed Project Report (DPR)) on Asset 3 – Kognoli and Hattargi toll plaza

Asset	TP1 Kognoli	TP2 Hattargi
CJV	8,361	8,712
LCV	1,915	2,061
Buses	503	723
2A	942	1,266
3A	973	1,025
MAV	1,628	1,663
Total	14,326	15,454
PCU	25,832	28,347

Monthly reported traffic on the surrounding assets/connecting roads

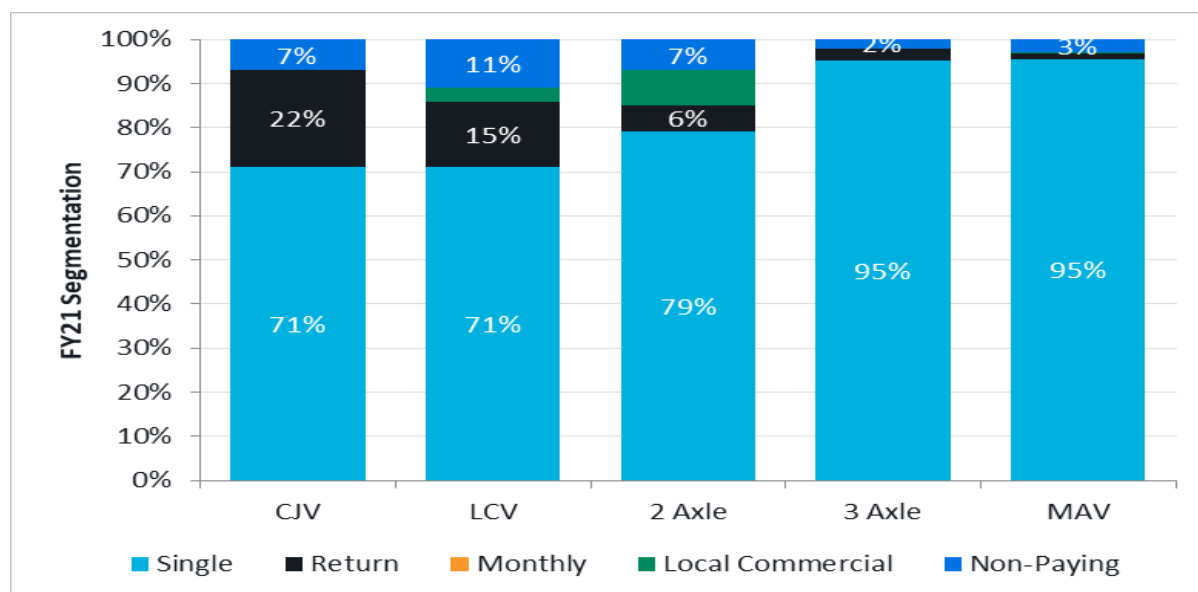
The reported traffic volume on a connecting road, Belgaum-Dharwad (Hirebagewadi toll plaza), was shared with the Traffic Consultants for the duration of April 2012 to January 2021 (as per chart below). This Belgaum-Dharwad (Hirebagewadi toll plaza) lies south of Asset 3 and is part of the national Golden Quadrilateral corridor connecting Mumbai-Pune to Bangalore and Chennai. The traffic profile of heavy vehicles which are predominantly long distance is very similar on both: Asset 3 and this Belgaum-Dharwad (Hirebagewadi toll plaza). Accordingly, the Traffic Consultants believe that the data on the Belgaum – Dharwad Asset is a reasonable reflection of the traffic profile on Asset 3. For comparison purposes, the Traffic Consultants have used the traffic profile between July 2015 and December 2020 for presentation below:



Source: Traffic Report, Steer analysis of data

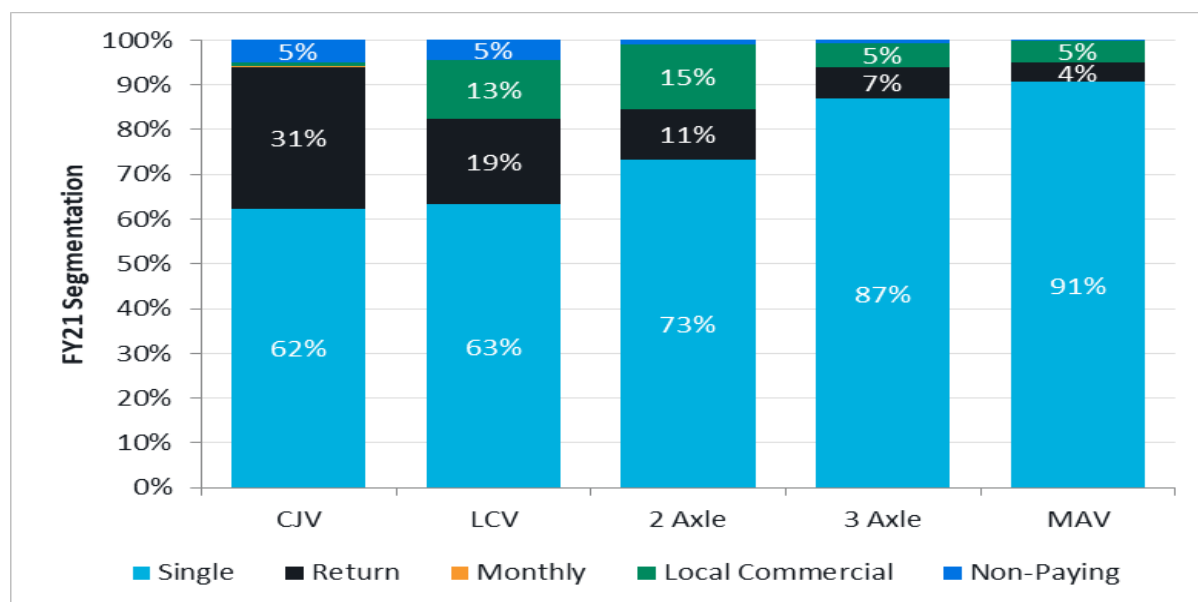
Toll Segmentation

The chart below presents the estimated segmentation based on traffic data from the latest months of FY21 for Toll Plaza Kognoli. In addition, the Traffic Consultant has also forecasted toll segmentation for FY23. For further details in this regard, please refer to **Annexure C** of this Final Placement Memorandum.



Source: Traffic Report, Steer analysis of traffic data for September-December 2020.

The chart below presents the estimated segmentation based on traffic data from the latest months of FY21 for Toll Plaza Hattargi. In addition, the Traffic Consultant has also forecasted toll segmentation for FY23. For further details in this regard, please refer to **Annexure C** of this Final Placement Memorandum.



Source: Traffic Report, Steer analysis of traffic data for September-December 2020.

Base year Annual Average Daily Traffic (AADT)

The Traffic Consultants table below shows FY21 AADTs estimated using the counts and the Seasonality Correction Factors (SCFs):

Asset	Asset 3 – toll plaza Kognoli	Asset 3 – toll plaza Hattargi
CJV	9,984	9,669
LCV	2,110	2,324
Buses	778	858
2A	1,164	2,051
3A	1,027	1,217
MAV	1,628	1,690
Total	16,694	17,810
PCU	29,391	33,144

Source: Traffic Report, Steer analysis based on client data.

Elasticity recommendations

As per the Traffic Consultants, elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in the drivers of traffic demand. When multiplied with forecasts of said growth drivers, they provide the forecasts of background traffic growth rates. Due to the gaps in continuous and consistent data availability on Asset 3, it was infeasible for the Traffic Consultants to conduct a traditional statistical based growth and regression-based analysis to estimate underlying elasticity assumptions for future growth. Accordingly, the Traffic Consultants have provided elasticity recommendations for Asset 3. For more details on this, please refer to Table 4.15 of **Annexure C** to this Final Placement Memorandum.

Projected Traffic Data: Growth in Passenger Car Unit (PCU)

The Traffic Consultants project that there will be continued sustained growth in PCU of Asset 3 across all vehicle types until FY2050. The below table shows the expected PCU by financial year for the toll plaza – Kognoli and Hattargi on Asset 3. The below table shows the expected PCUs by financial year. For detailed analysis on the traffic growth rates, please refer to **Annexure C** of this Final Placement Memorandum.

Kognoli	FY21	FY22	FY27	FY32	FY37	FY42	FY47	FY50
CJV	9,060	9,580	13,082	17,340	22,347	28,130	34,792	39,230
LCV	2,066	2,125	2,464	2,764	3,063	3,363	3,665	3,848
Bus	778	795	877	956	1,033	1,108	1,182	1,226
2 Axle.....	1,164	1,189	1,298	1,415	1,529	1,640	1,750	1,815
3 Axle.....	1,027	1,062	1,168	1,343	1,526	1,716	1,912	2,033
MAV	1,628	1,716	2,036	2,540	3,111	3,749	4,455	4,912
Total.....	16,694	17,465	22,081	27,651	34,041	41,277	49,468	54,860
PCU.....	29,391	30,651	37,156	45,384	54,673	65,050	76,628	84,170
Hattargi	FY21	FY22	FY27	FY32	FY37	FY42	FY47	FY50
CJV	8,525	9,015	12,310	16,317	21,028	26,470	32,739	36,916
LCV	2,246	2,310	2,679	3,004	3,330	3,655	3,984	4,182
Bus	858	876	966	1,053	1,138	1,221	1,303	1,351

Hattargi	FY21	FY22	FY27	FY32	FY37	FY42	FY47	FY50
2 Axle.....	2,051	2,095	2,287	2,493	2,693	2,889	3,082	3,197
3 Axle.....	1,217	1,258	1,383	1,590	1,807	2,032	2,265	2,408
MAV	1,690	1,781	2,113	2,637	3,229	3,891	4,624	5,098
Total.....	17,810	18,593	23,196	28,724	35,031	42,139	50,153	55,414
PCU.....	33,144	34,486	41,259	49,788	59,341	69,945	81,711	89,345

Operation and maintenance

The Maharashtra/Karnataka Border (Kagal) - Belgaum Toll Road is under the operation and maintenance contract of the Authority until the appointed date in the relevant Concession Agreement, whereby the Authority is responsible for construction, operation and maintenance of the toll road while the relevant authority collects tolls and makes annuity payments to the concessionaire. The project stretch is currently under the management of the Authority.

After the initial phase of routine maintenance and operations for a one-year period on this project road, the Authority is expected to take up the 6-laning/capacity augmentation work in FY23, post which we plan to perform the required major maintenance works on a regular basis to maintain the project highway in good condition.

Tollable Length and Toll Rates

In terms of tollable length, the Maharashtra/Karnataka Border (Kagal) - Belgaum Toll Road comprises 77.7 km of roads. In India, toll rates are as per notification by the Ministry of Road Transport and Highways in the National Gazette. The present toll rates are determined with reference to the published base toll rates and are adjusted annually at the beginning of each fiscal year equal to 40% of the movement in the wholesale price index in December of the preceding year plus a fixed 3%.

According to the NHAI's toll notification dated March 24, 2021, the toll rates at the Kognoli toll plaza of the Maharashtra Border - Belgaum Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Kognoli Toll Plaza
			(Rs.)	
Car/Jeep/Van	75	115	2,500	40
LCV	120	180	4,040	60
Bus/Truck	255	380	8,465	125
Vehicles with up to 3 axles	275	415	9,235	140
HCM/EME (3 to 6 axles).....	400	595	13,275	200
Oversized vehicles (Vehicles with 7 or more axles)	485	725	16,165	240
Local car, jeep, van or light motor vehicle (used for non-commercial purpose)		285		

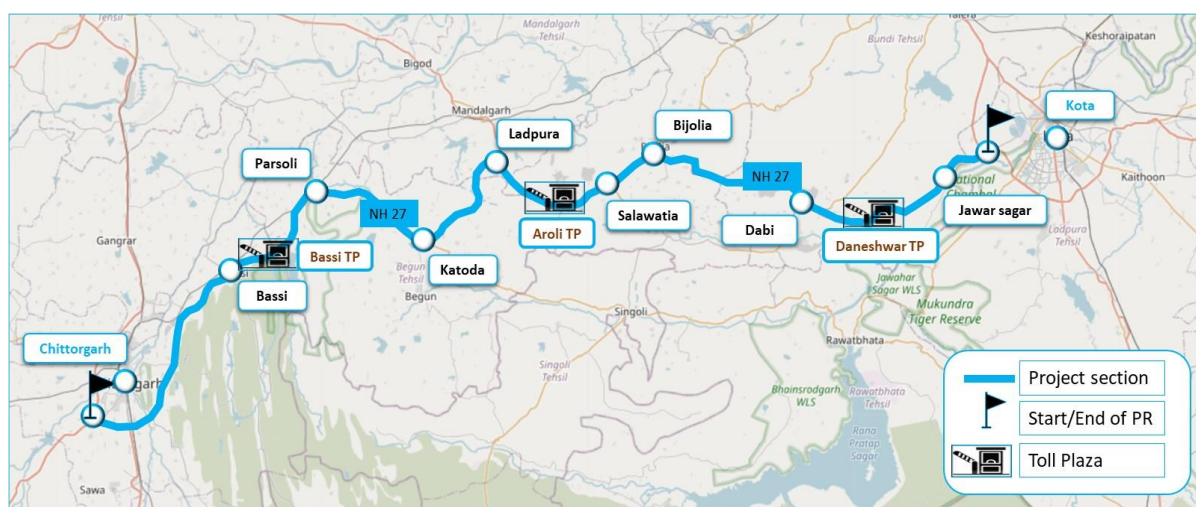
According to the NHAI's toll notification dated March 24, 2021, the toll rates at the Hattargi toll plaza of the Maharashtra Border - Belgaum Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Hattargi Toll Plaza
			(Rs.)	
Car/Jeep/Van	30	45	980	15
LCV	45	70	1,580	25
Bus/Truck	100	150	3,310	50
Vehicles with up to 3 axles	110	160	3,610	55
HCM/EME (3 to 6 axles)	155	235	5,190	80
Oversized vehicles (Vehicles with 7 or more axles)	190	285	6,315	95
Local car, jeep, van or light motor vehicle (used for non-commercial purpose)		285		

4. Chittorgarh – Kota & Chittorgarh Bypass Project

Project overview

According to the Traffic Consultants, Asset 4 is a 4-lane, 160.5 km long stretch, on national highway (NH) 27, with three (3) toll plazas at Airoli, Bassi and Dhaneshwar. The project highway, NH-27, is part of the East – West corridor envisaged under National Highway Development Program (Phase – II). The total length of NH-27 is roughly 3,530 km starting from Porbandar in the state of Gujarat and ending at Silchar in the state of Assam while passing through the states of Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar and West Bengal. NH-27 connects important tourist and industrial cities and towns like Porbandar (port city), Rajkot, Palanpur, Udaipur, Chittorgarh, Jhansi, Kanpur, Lucknow, Muzaffarpur, Purnea, Siliguri, Jalpaiguri. The project road section of Chittorgarh – Kota of NH-27 starts from Chittorgarh (Km 891.929) and ends at Kota (Km 1052.429) with total length of 160.5 km in the state of Rajasthan. The major settlements located along the project road section are Ladpura and Bijolia. In the wider context, Asset 4 serves the east-west long-distance traffic which is majorly plying between Lucknow/Gorakhpur/eastern region and Palanpur/Rajkot/ western region. Apart from long distance traffic, it also serves the short distance traffic which is mainly generated between Bundi/ Kota/ Baran and Udaipur/ Chittorgarh areas. There are three (3) existing toll plazas on the project road near Bassi, Aroli and Dhaneshwar.



Source: Ramboll Traffic Report

Salient growth features and traffic generators

According to the Traffic Consultants, the project stretch mostly falls in four districts, namely Chittorgarh, Bhilwara, Bundi and Kota district.

The Chittorgarh district is situated in south-east part of Rajasthan. The economy of the district is predominated by agriculture with about 72% of the workers being involved in agriculture or as agricultural labourers. The major crops grown in the district are maize, soybean, groundnut, sorghum, cotton and black gram in kharif season and wheat, mustard, gram, barley and opium in rabi season. Also, cultivation of fruits and vegetables is done in limited portions of land. The district is rich in mineral resources like barytes, china clay, limestone, sandstone and ochre. Several industries like cement, fabric processing units, chemical and fertilizer manufacturing units, polypropylene, HDPE woven sacks and fabric manufacturing units are present in the district. The cement plants include Birla Corporation Limited, Wonder Cement Limited, Aditya Cement Limited, Lafarge India Private Ltd. and J K Cement Works. Hindustan Zinc Limited has various plants spread across the district which produce sulphuric acid, refined zinc, refined lead. There is an atomic power plant and a heavy water plant located at Rawatbhata beside Rana Pratap Sagar dam. In addition to this, the presence of Chittorgarh fort and palaces makes it a famous tourist destination.

The Bhilwara district is located in the south-eastern part of Rajasthan and its economy driven by agriculture with 62.6% of the total workers involved in the primary sector. The major crops grown in the district include maize, oil seeds, wheat, pulses, jowar, barley and fibres with small quantities of different spices, bajra and some fruits and vegetables. The major agro-based industries here are oil mills, flour mills, ice candy manufacturing units, dal mills and units producing biscuits, confectionary items, khandsari, masala and cattle feed. The district is also well established in textile industry and known as Vastra Nagari and Manchester of Rajasthan. It is famous for manufacturing of synthetics and cotton mix fabric and synthetic yarn. The mineral resources available in the district include lead, zinc, soap stone, china clay, feldspar, quartz, mica, marble, granite, asbestos and garnet. It is one of the largest producers of raw material required for ceramic industry –quartz feldspar, china clay.

The Bundi district is famous for its contribution to agriculture. Major agricultural crops include pulses, wheat, gram, barley, cotton, tobacco and oil seeds. Among oil seeds, mustard and rapeseed are the mostly produced. Important fruit trees in Bundi include orange, pomegranate, lemon, guava and mango. Textile, tourism, handicrafts and small-scale industries play a pivotal role in the economic prosperity of Bundi in Rajasthan. Polyester fiber is the major produce as a part of textiles. The district is famous for its beautiful forts and palaces which have been converted into heritage hotels and step-well reservoirs to attract more tourists.

The Kota district is the trade centre for cotton, millet, wheat, coriander and oilseeds. Major cultivated crops include soybean, paddy and maize in kharif season while rapeseed & mustard, wheat, coriander and gram in rabi season. Ramganj mandi in Kota is famous for the stone and coriander market. It is the largest market for coriander in India. The industries prevalent in the district include cotton and oilseed milling, textile weaving, distilling, dairying, and the manufacture of metal handicrafts. Kota city is also known as the “Education hub of India” with the presence of a number of coaching institutes for engineering and medical entrance exams.

Traffic volume and composite of vehicles

Historical traffic data

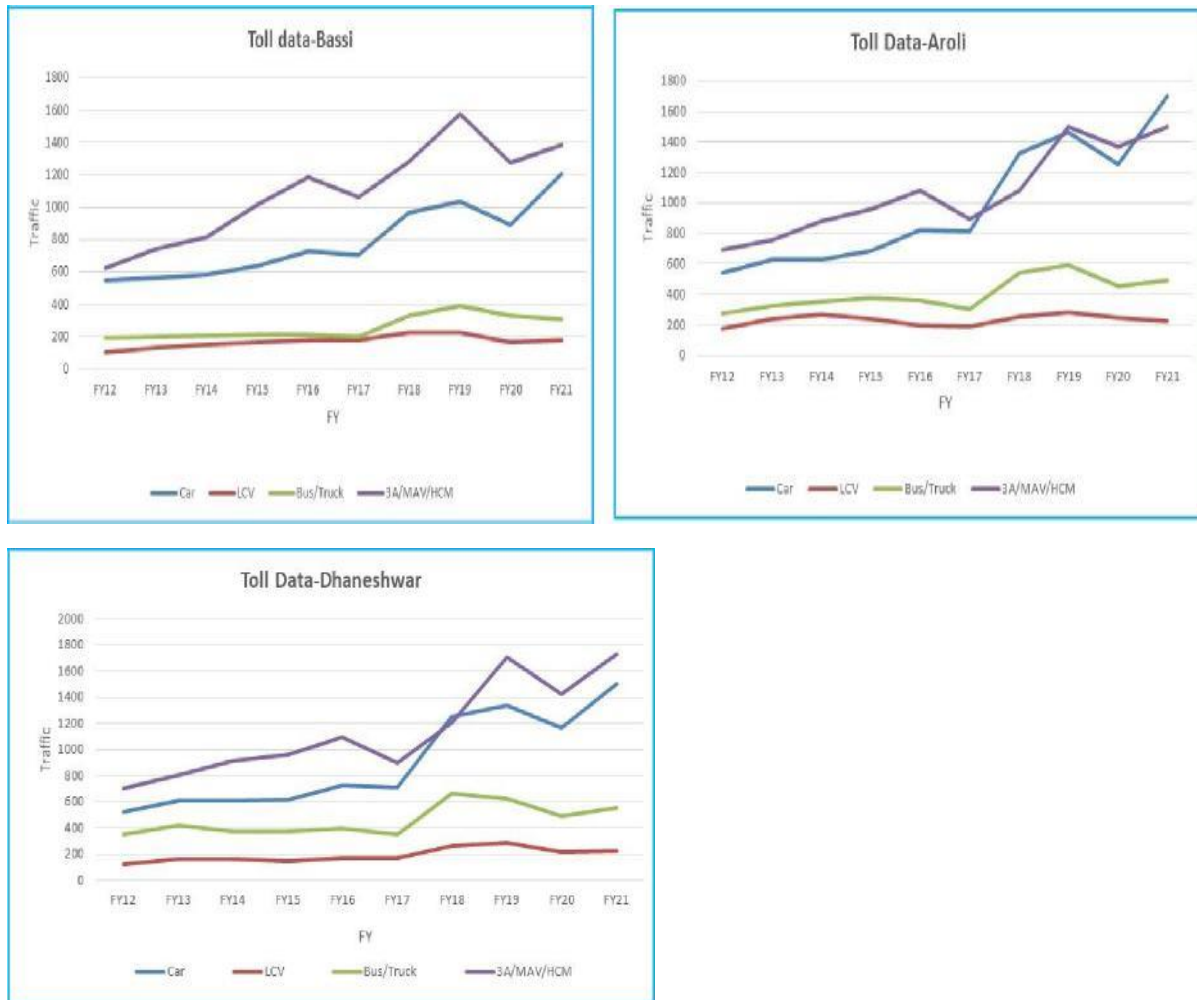
The following table shows the historical traffic counts of Asset 4 according to the Traffic Consultants:

FY/Mode	Car	LCV	Bus/2A	3A/MAV
End point growth in %				
Bassi Toll Plaza				
FY20 vs FY12	6.3	6.5	7.0	9.4
FY20 vs FY16	7.0	0.6	9.6	4.7
Aroli Toll Plaza				
FY20 vs FY12	11.1	4.4	6.5	8.9

FY20 vs FY16		12.9		0.9		3.8		7.3
Dhaneshwar Toll Plaza								
FY20 vs FY12		10.6		7.3		4.4		9.2
FY20 vs FY16		13.5		7.3		5.5		8.3

Source: Traffic Report, Ramboll analysis of data

The figures below provide a graphical representation of past traffic data for each of the toll plaza locations and a comparison of the year on year traffic at the toll plazas:



Source: Traffic Report, Ramboll analysis of data

According to the Traffic Consultants, the comparison of the past data shows a double-digit growth in cars between FY12 and FY20 at Aroli and Dhaneshwar toll plazas and 6% growth at Bassi toll plaza. LCVs have shown a 4-5% growth in the long term at the three (3) toll plazas. The growth in Bus/2A trucks has been 4-7% percent in FY12 and FY20 comparison. MAVs have shown a positive and high growth in the past.

Toll Segmentation

The chart below presents a segmentation of total traffic assessed from the toll data of FY20 for the three (3) toll plazas of Asset 4:

Ticket Type/Modes	Car	LCV	Bus	2A Truck	3A Truck	MAV
Bassi Toll Plaza						

Single		69.1		61.3		50.2		50.2		77.0		78.7
Return		25.4		22.5		18.8		18.8		11.0		8.6
Monthly Pass												
Local personal												
Local commercial		1.0		8.6		19.9		19.9		8.3		12.6
Exempt		4.5		7.6		11.1		11.1		3.8		0.2
Total		100.0		100.0		100.0		100.0		100.0		100.0
Aroli Toll Plaza												
Single		66.3		63.7		54.2		54.2		80.0		90.8
Return		30.2		23.2		24.0		24.0		15.7		8.8
Monthly Pass												
Local personal												
Local commercial		0.9		6.8		12.4		12.4		0.8		0.3
Exempt		2.6		6.3		9.4		9.4		3.5		0.2
Total		100.0		100.0		100.0		100.0		100.0		100.0
Dhaneswar Toll Plaza												
Single		61.9		55.9		40.7		40.7		71.3		87.8
Return		26.8		32.9		33.7		33.7		21.5		11.7
Monthly Pass												
Local personal												
Local commercial		8.5		6.0		14.8		14.8		4.6		0.3
Exempt		2.8		5.2		10.8		10.8		2.7		0.1
Total		100.0		100.0		100.0		100.0		100.0		100.0

Source: Traffic Report, Ramboll analysis.

Projected Traffic Data: Growth Passenger Car Unit (PCU)

The Traffic Consultants project that there will be continued sustained growth in PCU of Asset 4 across all vehicle types until FY2050. The below table shows the expected PCU by financial year:

Bassi	FY22	FY27	FY32	FY37	FY42	FY47	FY50
PCU.....	11,225	14,833	19,042	23,665	28,931	34,860	38,742

Airoli	FY22	FY27	FY32	FY37	FY42	FY47	FY50
PCU.....	14,646	19,236	24,580	30,446	37,117	44,615	49,519

Dhaneswar	FY22	FY27	FY32	FY37	FY42	FY47	FY50
PCU.....	15,284	20,018	25,524	31,562	38,420	46,122	51,158

Operation and maintenance

The Chittorgarh – Kota & Chittorgarh Bypass Toll Road is currently operated and maintained by the Authority. Following our takeover of the project road, we plan to perform ongoing major maintenance works on a regular basis to maintain the highway in good condition.

Tollable Length and Toll Rates

In terms of tollable length, the Chittorgarh – Kota & Chittorgarh Bypass Toll Road comprises 160.5 km of roads. In India, toll rates are as per notification by the Ministry of Road Transport and Highways in the National Gazette. The present toll rates are determined with reference to the published base toll rates and are adjusted annually at the beginning of each fiscal year equal to 40% of the movement in the wholesale price index in December of the preceding year plus a fixed 3%.

According to the NHAI's toll notification dated March 18, 2021, the toll rates at the Airoli toll plaza for the Chittorgarh – Kota & Chittorgarh Bypass Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Airoli Toll Plaza
			(Rs.)	
Car/Jeep/Van	70	100	2,260	35
LCV	110	165	3,645	55
Bus/Truck	230	345	7,645	115
Vehicles with up to 3 axles	250	375	8,335	125
HCM/EME.....	360	540	11,985	180
Vehicles with 7 or more axles.....	440	655	14,590	220

According to the NHAI's toll notification dated March 18, 2021, the toll rates at the Bassi toll plaza for the Chittorgarh – Kota & Chittorgarh Bypass Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Bassi Toll Plaza
			(Rs.)	
Car/Jeep/Van	80	120	2,655	40
LCV	130	195	4,285	65
Bus/Truck	270	405	8,980	135
Vehicles with up to 3 axles	295	440	9,795	145
HCM/EME.....	420	635	14,080	210
Vehicles with 7 or more axles.....	515	770	17,145	255

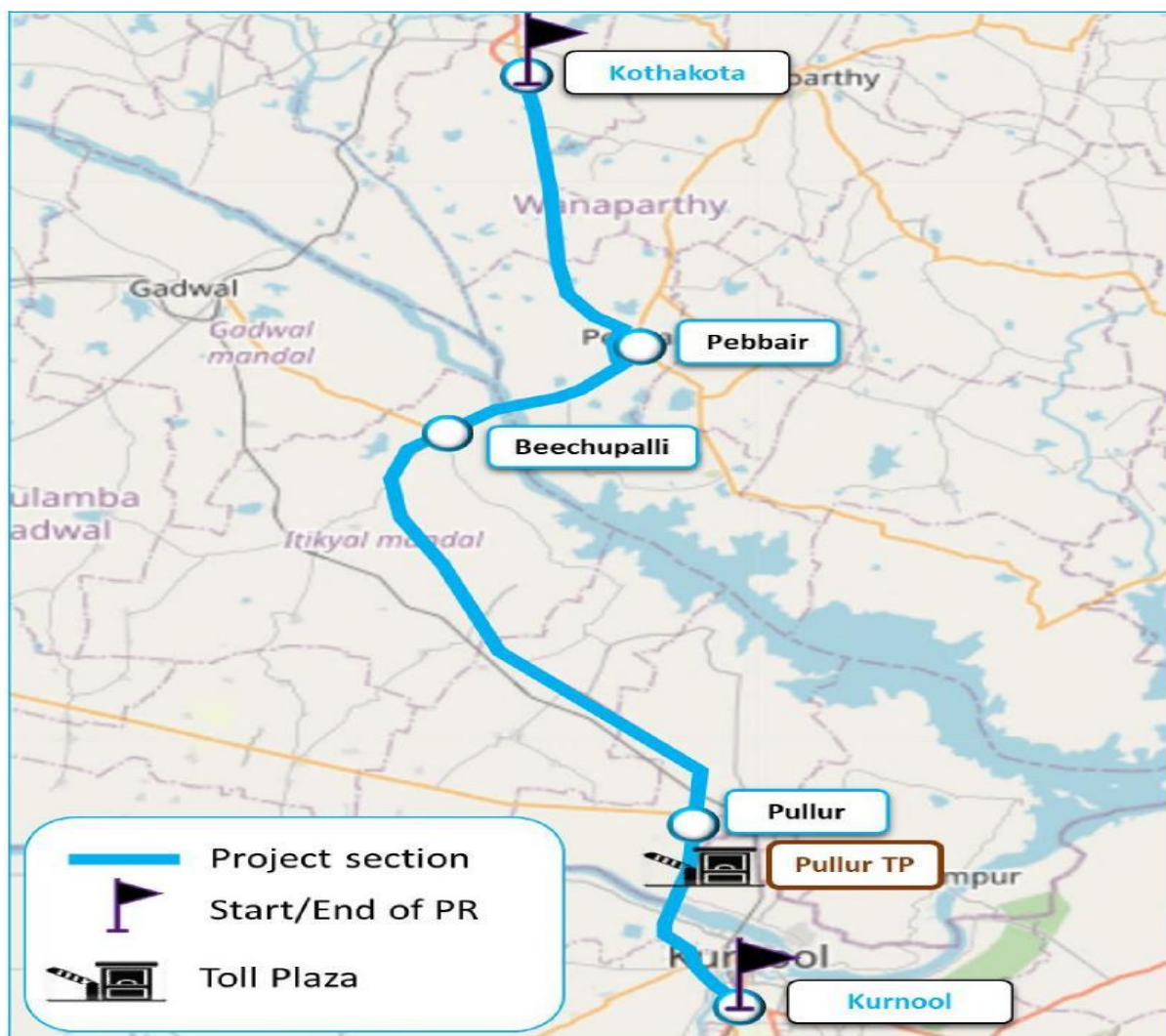
According to the NHAI's toll notification dated March 18, 2021, the toll rates at the Dhaneshwar toll plaza for the Chittorgarh – Kota & Chittorgarh Bypass Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for Commercial Vehicle Registered within the district of the Dhaneshwar Toll Plaza
			(Rs.)	
Car/Jeep/Van	65	100	2,205	35
LCV	105	160	3,560	55
Bus/Truck	225	335	7,460	110
Vehicles with up to 3 axles	245	265	8,135	120
HCM/EME.....	350	525	11,695	175
Vehicles with 7 or more axles.....	425	640	14,240	215

5. Kothakota Bypass – Kurnool Highway Project

Project overview

According to the Traffic Consultants, Asset 5 is a 4-lane, 74.6 kms long stretch, on national highways (NH) 44 which starts in Telangana State and ends at Kurnool in the state of Andhra Pradesh, with one toll plaza at Pullur. The project road serves for long distance traffic which is majorly plying between Hyderabad/Nagpur/northern region and Bengaluru/Mysuru/southern region. Apart from long distance traffic, it also serves the short distance traffic which is mainly generated between Mahbubnagar/ Kothakota/ Wannaparthy/ Pebbair and Kurnool/Ananthpur areas. NH-44, which is the project highway for Asset 5 is the longest highway in India connecting Srinagar with Kanyakumari and is part of North-South corridor envisaged under National Highway Development Program (Phase – II). NH-44 passes through the cities of Jammu, Jalandhar, Delhi, Faridabad, Agra, Gwalior, Jhansi, Sagar, Nagpur, Hyderabad, Bengaluru and Salem.



Salient growth features and traffic generators

According to the Traffic Consultants, the project stretch mostly passes through the districts of Wanaparthy in the state of Telangana and Kurnool in the state of Andhra Pradesh.

The Wanaparthy district is situated in south-east part of Telangana State, sharing border with the state of Andhra Pradesh. Wanaparthy district is surrounded by Mahabubnagar district in north, Nagarkurnool district in east, the state of Andhra Pradesh in south and Jogulamba Gadwal district in west. Agriculture is the main livelihood of the people in Wanaparthy district with 75% total workers engaged in agro-based labour. Red sandy soil and sandy loam soil covers 89% of the area. Paddy, groundnut, jowar, maize, red gram, castor, cotton and chili are the major crops cultivated within the district. Wanaparthy district, being one of the newly formed districts finds its place in backward districts of the state. Sri Ranganayaka Temple, Ghanpur Fort, Pangal Fort, Wanaparthy Palace, Saralasagar Project are few tourist attractions present in the district.

The Kurnool District is situated in Western part of Andhra Pradesh. It is surrounded by Nagarkurnool, Wanaparthy districts of Telangana state in north, Kadapa and Anantapur Districts in south, the Bellary district of Karnataka state in west and Prakasam District in east. Almost half of the geographical area is under agriculture use. Paddy, cotton, tomato and onion are the major crops grown in the district. Mining/quarrying is the prevailing industry in the district. District has deposits of limestone, iron ore, barites and shale within its geographical area. Belum Caves, Mahanandi, Manthralayam, Srisailem and Rollapadu sanctuary are the main tourist attractions in the district.

Traffic volume and composite of vehicles

Historical traffic data

The following table shows the historical traffic counts of Asset 5 according to the Traffic Consultants:

FY/Mode	Car	LCV	BUS/2A	3A	MAV
FY16	4,648	2,200	2,085	1,924	1,281
FY18	6,268	2,616	2,091	2,224	2,031
FY19	5,289	2,795	1,806	1,841	2,108
FY20	6,651	3,198	2,085	1,838	2,413
FY21	6,022	2,995	743	1,192	2,325
YOY growth					
FY18 vs FY16	16.1	9.0	0.1	7.5	25.9
FY19 vs FY18	-15.6	6.8	-13.6	-17.2	3.8
FY20 vs FY19	25.8	14.4	15.4	-0.2	14.5
FY21 vs FY20	-9.5	-6.4	-64.4	-35.2	-3.6

Source: Traffic Report, Ramboll analysis of data

Toll Segmentation

The chart below presents a segmentation of total traffic assessed from the toll data for the fourth quarter of FY19 (January 2019 to March 2019), FY20 and the three quarters of FY21 (April 2020 to December 2020) for the toll plaza of Asset 5:

Ticket Type/Modes	Car	LCV	Bus	2A Truck	3A Truck	MAV
Single	53.3	59.3	19.6	86.3	85.0	94.0
Return	37.2	37.6	76.6	9.9	10.4	2.5
Monthly Pass						
Local personal						
Local commercial	0.7	0.0	0.0	0.0	0.0	0.2
Exempt	8.9	3.1	3.8	3.7	4.7	3.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Traffic Report, Ramboll analysis

Projected Traffic Data: Growth Passenger Car Unit (PCU)

The Traffic Consultants project that there will be continued sustained growth in PCU of Asset 5 across all vehicle types until FY2050. The below table shows the expected PCU by financial year:

Pullur	FY22	FY27	FY32	FY37	FY42	FY47	FY50
PCU	34,314	43,707	54,610	66,507	80,080	95,411	105,485

Operation and maintenance

The Kothakota Bypass – Kurnool Highway Toll Road is currently operated under the BOT (Annuity) model, whereby the concessionaire is responsible for construction, operation and maintenance of the toll road while the relevant authority collects tolls and makes annuity payments to the concessionaire. The current concessionaire is Andhra Pradesh Expressway Limited. We expect the current concessionaire to undertake routine and major maintenance works, as per the requirement of its current concession obligations, up to the termination of its concession period and our O&M Handover Date for the Kothakota Bypass – Kurnool Highway Toll Road on September 16, 2026. Following our takeover of O&M on September 16, 2026, we plan to perform ongoing major

maintenance works on a regular basis to maintain in good condition the Kothakota Bypass – Kurnool Highway Toll Road.

Tollable Length and Toll Rates

In terms of tollable length, the Kothakota Bypass – Kurnool Highway Toll Road comprises 74.6 km of roads. In India, toll rates are as per notification by the Ministry of Road Transport and Highways in the National Gazette. The present toll rates are determined with reference to the published base toll rates and are adjusted annually at the beginning of each fiscal year equal to 40% of the movement in the wholesale price index in December of the preceding year plus a fixed 3%.

According to the NHAI's toll notification dated March 25, 2021, the toll rates at the Pullur toll plaza for the Kothakota Bypass – Kurnool Highway Toll Road are as follows:

Vehicle Type	Single Journey	Multiple Journey	Monthly Pass	Fee for
				Commercial Vehicle Registered within the district of the Pullur Toll Plaza
			(Rs.)	
Car/Jeep/Van	115	170	3,805	55
LCV	185	275	6,150	90
Bus/Truck	385	580	12,885	195
Vehicles with up to 3 axles	420	635	14,055	210
HCM/EME (Vehicles with 4 to 6 axles)	605	910	20,205	305
Vehicles with 7 or more axles	740	1,105	24,600	370

Operation and Maintenance Services

Our key business activity will be the operation and maintenance of the Toll Road assets pursuant to, and in accordance with, the provisions of the concessions and other road project related agreements (as applicable). The Project SPV is required to operate and maintain the Toll Road assets in accordance with the Concession Agreement, including by modifying, repairing or otherwise making improvements to the roads. In particular, the Concession Agreement requires the Project SPV to maintain the Toll Roads to certain standards during the concession period. Our Sponsor has used, and will likely to continue to use, independent engineers to carry out periodic tests to assess the quality of the roads or bridges and their related maintenance.

The Project Manager, together with the Project SPV, will be responsible for managing the critical day-to-day operation and maintenance of the Toll Road assets. The Project Manager, through the relevant Project Implementation Agreement, will provide project and contract management support, such as liaising with and supervising sub-contractors, managing design, planning and the obtaining of necessary licenses and approvals for the projects.

A Project SPV is generally responsible for carrying out operation and maintenance activities at its toll road during its concession period. The scope of a Project SPV's operation and maintenance activities is usually defined in the relevant concession agreement. Within the scope of such operation and maintenance obligations, the Project SPV may be required to undertake routine and periodic maintenance of project roads, maintain and comply with safety standards to ensure smooth and safe traffic movement, deploy adequate human resources for incident management, maintain proper medical and sanitary arrangements for personnel deployed at the site and prevent any unauthorized entry to and exit from the project as may be required.

A maintenance management system is used to ensure that all maintenance is systematically and correctly scheduled, carried out and recorded. In addition, it is used to assure planning, control and monitoring of each maintenance activity. Maintenance methodologies and system performance are regularly reviewed and examined for optimisation of resource deployment.

Operations

Toll collection system

Toll is collected for each journey through each of the toll plazas. Signs setting out the toll rates for the Toll Road assets are displayed at the toll booths and tolls can be paid or tendered by the driver of any vehicle in the following manners:

Cash

Tolls paid by means of cash are collected by toll collectors at the manual toll booths.

Electronic toll collection

In 2014, an electronic toll collection (“ETC”) system based on radio-frequency identification (“RFID”) technology was introduced. The RFID technology based FASTags required vehicles to affix FASTags on windscreens to enable toll plazas to auto-debit toll fees from a linked account, without requiring vehicles to stop for transactions. This ETC based on RFID did not pick up until a transport ministry directive in July 2019 called for equipping all toll lanes across national highways in India to mandate the same. The Authority has made FASTag (cashless payment mechanism) at toll plazas mandatory. Toll collections through FASTags are inching closer to 90% as the government continues to push the digital mode of transaction at national highways across India. The total penetration of FASTag has reached around 87%, with over 100 toll plazas achieving around 90% penetration (*Source: CARE Report*). For more details on the ETC and FASTags system and its impact on each of the Toll Roads, please refer to the Traffic Reports in **Annexure C** of this Final Placement Memorandum.

Monitoring

Toll collection

Payments at the toll plazas, both electronic as well as cash payments, are processed through a semi-automated or a fully automated toll collection system, depending on complexity of the project. Both these systems collect and store traffic and payment data, thereby reducing the need for manual operation. A semi-automated system consists of a revenue collection software desktop, a barrier gate, smart cards and monitoring cameras and a fully automated system includes equipment such as vehicle counting classifier, vehicle audit system, communication channels and traffic control equipment in addition to all the components of a semi-automated system.

For the purpose of identifying categories of vehicles and to charge an appropriate toll rate, the automatic vehicle identification based in-road/infrared sensors are also used. The Project SPV would use weigh-in-motion technology for projects where weight-based toll collection is mandated. The weight based tolling systems are integrated with the fully automatic toll collection system for enhanced revenue controls.

There are cameras installed particularly for capturing and recording any toll evasion incidents by vehicles. There is also a back-up power supply system to ensure that there is no interruption to power supply at the toll plazas in order to maintain a stable power supply for the sub-systems and equipment. Servers used in the toll collection systems at the toll plazas are capable of real time uploading of transaction data from toll lane equipment and performing an automatic daily backup to prevent any toll data loss and to enable quick system recovery, which would allow the Project SPV to collect variable amounts of tolls depending on the class of motor vehicles and serves as a traffic information system.

Only certain authorised persons have access to the toll collection systems and the activities are recorded for security purposes. The Project SPV is responsible for operating the toll collection system at its toll plaza and taking regular preventive and corrective measures to maintain such systems at the highest levels of security and reliability.

Traffic control

There are helpline numbers displayed along the national highways for communication between the road users and the control room in case of any emergency. This provides a reliable communication channel for the road users in cases of an exigency where they need to communicate with staff at the Control Room. The Project SPV would take regular preventive and corrective measures to maintain the emergency telephone system at the highest levels of reliability and safety. The Project SPV is required to carry out regular patrolling and regulate and maintain traffic order within the projects. Emergency telephone systems and emergency helpline numbers are provided at all projects where such systems and numbers are required by the Concession Agreement. There are also patrol vehicles that continuously move on the section of the project that it is assigned to, which will intervene to regulate traffic and carry out surveillance activities.

Traffic and motorway assistance services

Traffic assistance

The Project SPV would provide emergency assistance to motorists using the toll roads. They station patrol/light recovery vehicles on each toll road, which are deployed to patrol the toll roads on a continuous basis.

In the case of a vehicle breakdown or traffic accident, the Control Room will announce the occurrence via mobile phones or handsets to instruct a mobile supervisor and a recovery supervisor to proceed to the scene immediately, and file relevant reports with the police if personal injury is involved. At the scene of a traffic accident or vehicle breakdown, the mobile supervisor will report to the Control Room on the situation of the incident, ensure safety of the scene and apply first aid to injured persons, if any. The recovery supervisor will determine whether the vehicle can be recovered on site or deploy recovery vehicles for towing. The traffic officer will stop the traffic, close the affected lane where necessary and direct trapped vehicles away to other unaffected lanes.

Safety Measures

Under the Concession Agreement, the concessionaire is obligated to abide by certain safety requirements, which include measures such as road signs, pavement marking, traffic control devices, roadside furniture, highway design elements, enforcement and emergency response. The concessionaire must abide by among others, applicable laws and applicable permits, the Manual for Safety in Road Design as issued by the Ministry of Shipping, Road Transport and Highways, relevant standards and guidelines of the Indian Roads Congress and good industry practice. NHAI also carries out safety audits of the projects by appointing a safety consultant employing a team comprising of, among others, one road safety expert and one traffic planner. These safety requirements apply to all phases of construction, operation and maintenance with emphasis on identification of factors associated with accidents and implementation of appropriate remedial measures.

Management

We will be managed, upon the listing of the Units on the Stock Exchanges, by qualified personnel of the Investment Manager and Investment Committee, if formed, with members who will have management and operational experience in the roads and highways sector. For further details about the Investment Manager, please see the sections headed “*Parties to the Trust – The Investment Manager – National Highways Infra Investment Managers Private Limited*” on page 104 of this Final Placement Memorandum.

Consequent to the completion of the Formation Transactions, the Investment Manager, in consultation with the Trustee, will appoint a majority of the directors on the board of the Project SPV in accordance with the InvIT Regulations, and such directors would form part of the quorum. The Project SPV’s board of directors will also thereafter form committees, if required, under the Companies Act, 2013 and rules made thereunder.

Seasonality

Traffic volume tends to decrease during the monsoon season and conversely tends to increase during holiday seasons. While the northern parts of India experience monsoon rains during the period from June or July until September or October every year, the southern parts of India, especially coastal parts of Andhra Pradesh, experience monsoon rains even during the months of October to December. The monsoon season may also restrict the Trust’s ability to carry on activities related to its operation and maintenance of toll roads. For further details on risk associated with seasonality, please see the section headed “*Risk Factors – Risks Relating to Our Business*”

and the Concession Agreements – Our business will be subject to seasonal fluctuations that may affect our cash flows” on page 67 of this Final Placement Memorandum. Conversely, traffic volume tends to increase during holiday seasons.

Property

The Investment Manager’s corporate offices are located in G - 5 & 6, Sector 10, Dwarka, New Delhi – 110075 from which all its administrative and reporting activities are conducted.

Insurance

The Trust’s operations are subject to hazards inherent in providing operation and maintenance services, such as risk of equipment failure, work accidents, fire, earthquake, flood and other force majeure events. This includes hazards that may cause injury and loss of life, damage and destruction of property, equipment and environmental damage. The Sponsor requested SEBI for an exemption dated March 4, 2021 from the strict application of paragraph 6(a)(vi) of Schedule III to the InvIT Regulations. The exemption was sought on the basis that as of the date of the Placement Memorandum, the initial InvIT Assets would be held by the Sponsor and the tolling rights pertaining to the InvIT Assets would only be transferred in favour of the Project SPV on the Appointed Date in terms of the Concession Agreements. Consequently, insurance in respect of the InvIT Assets, will be taken by the Project SPV for the InvIT Assets after the Appointed Date. SEBI has by way of letter dated March 17, 2021, bearing reference number SEBI/HO/DDHS/DDHS3/OW/MA/P/2021/6250/1, acceded to the exemption request and accordingly, the Investment Manager undertakes to obtain adequate insurance for the Project SPV within 30 days of the closure of the Offer.

Legal Proceedings

The Project SPV, the Sponsor, the Investment Manager, the Project Manager and the Trustee may be involved in legal proceedings or claims from time to time. As on date of the Final Placement Memorandum, certain proceedings or claims involving the Sponsor and certain of its Associates and the Trustee, are currently pending at different levels of adjudication before various courts, tribunals and regulatory authorities. For a description of the material legal proceedings that are outstanding, please see the section headed “*Legal and other Information*” on page 264 of this Final Placement Memorandum.

SUMMARY OF THE CONCESSION AGREEMENTS

The following are summaries of the concession agreements entered into by the National Highways Infra Projects Private Limited in relation to its business. The descriptions and summaries of the agreements below are not, nor do they purport to be complete descriptions or summaries of all terms of such agreements. Certain terms used in this section have the meaning assigned to them in the respective concession agreements. Copies of these concession agreements are also available for inspection at the registered office of the Trust. For details, refer to “Material Contracts and Documents for Inspection ” on page 357.

1. **Concession Agreement between Concessionaire and NHAI dated March 30, 2021 in respect of the Kotha Kota Kurnool Project**

The Concessionaire has entered into a concession agreement for operation, maintenance, and management of the Kotha Kota Kurnool Project Highway (as defined below) on toll, operate and transfer (TOT) basis (the “**Kotha Kota Kurnool Concession Agreement**”), for a period of 30 years from the Appointed Date (i.e., the date on which all Conditions Precedent have been satisfied. NHAI has, *vide* letter dated August 5, 2021, extended the date for satisfying the Concessionaire’s Conditions Precedent to October 31, 2021) or such date on which the Kotha Kota Kurnool Concession Agreement is terminated by a termination notice (“**Kotha Kota Kurnool Concession Period**”).

Certain Definitions

“**Kotha Kota Kurnool Project**” means the operation and maintenance of the Kotha Kota Kurnool Project Highway in accordance with the provisions of the Kotha Kota Kurnool Concession Agreement and includes all works, services and equipment relating to or in respect of the scope of the Kotha Kota Kurnool Project as set forth in the Kotha Kota Kurnool Concession Agreement;

“**Kotha Kota Kurnool Project Assets**” means all physical and other assets relating to and forming part of the Site including (a) rights over the Site in the form of licence, Right of Way or otherwise; (b) tangible assets such as civil works and equipment including foundations, embankments, pavements, road surface, interchanges, bridges, culverts, road overbridges, drainage works, traffic signals, sign boards, kilometre- stones, toll plazas, electrical systems, communication systems, rest areas, relief centers, maintenance depots and administrative offices; (d) all rights of the Concessionaire under the project agreements; (e) security deposits; (f) insurance proceeds; and (g) Applicable Permits and authorisations relating to or in respect of the Kotha Kota Kurnool Project Highway, but does not include Additional Facilities; and

“**Kotha Kota Kurnool Project Highway**” means the Site comprising the existing road comprising:

Stretch	State	Start (Km)	End (Km)	Length
Kothakota Bypass-Kurnool	Telangana	135.469	211.000	74.622

and all Kotha Kota Kurnool Project Assets.

Grant of Concession

Subject to and in accordance with the terms and conditions set forth in the Kotha Kota Kurnool Concession Agreement, NHAI has granted to the Concessionaire, and the Concessionaire has accepted the concession for a period of 30 years, including the exclusive right, license and authority during the subsistence of the Kotha Kota Kurnool Concession Agreement to operate, manage and maintain the Kotha Kota Kurnool Project Highway.

Subject to and in accordance with the terms and conditions set forth in the Kotha Kota Kurnool Concession Agreement, the Concessionaire is entitled to undertake the following in accordance with the terms of the Kotha Kota Kurnool Concession Agreement, applicable laws and applicable permits:

- i. Right of Way, access and license to the Site for the purpose of and to the extent conferred by the provisions of the Kotha Kota Kurnool Concession Agreement;
- ii. manage, operate and maintain the Kotha Kota Kurnool Project Highway and regulate the use thereof by

third parties in accordance with terms hereof;

- iii. demand, collect and appropriate the fees from vehicles and persons liable for payment of fees for using the Kotha Kota Kurnool Project Highway or any part thereof and refuse entry of any vehicle to the Kotha Kota Kurnool Project Highway if the fee due is not paid;
- iv. perform and fulfill all of the Concessionaire's obligations under and in accordance with the Kotha Kota Kurnool Concession Agreement;
- v. bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the Concessionaire under the Kotha Kota Kurnool Concession Agreement; and
- vi. neither assign, transfer or sublet or create any lien or encumbrance on the Kotha Kota Kurnool Concession Agreement, or the concession granted thereby, or on the whole or any part of the Kotha Kota Kurnool Project Highway nor transfer, lease or part possession thereof, save and except as expressly permitted by the Kotha Kota Kurnool Concession Agreement.

Fees

The Concessionaire is entitled to, during the Kotha Kota Kurnool Concession Period, levy, collect and appropriate fees from users of the Kotha Kota Kurnool Project Highway pursuant to and in accordance with the provisions in the Kotha Kota Kurnool Concession Agreement and National Highways Fee (Determination of Rates and Collection) Rules, 2008 as amended (the "**Fee Rules**") and to appropriate the same. In accordance with the terms of the Kotha Kota Kurnool Concession Agreement, the Concessionaire shall not collect any fees in relation to exempted vehicles. The fees collected by Concessionaire shall be deposited in the escrow account and appropriated in accordance with the relevant provisions of the Kotha Kota Kurnool Concession Agreement.

Sub Rule 6(6) of the above-mentioned Fee Rules states,

“

(a) The fee shall be collected by the Central Government or the executing Authority as the case may be and for a specified period in accordance with the terms of agreement entered by the Concessionaire.

(b) The fee as notified as per Concession Agreement shall be leviable till the end of the concession period and after the Concession Agreement is over, the fee shall be collected by the Central Government executing authority at a reduced rate of 40% of the fee on the date of transfer of such section of National Highways, bridge, tunnel or bypass, as the case may be, to be revised annually in accordance with these rules:

Provided that after the recovery of capital cost through user fee realised, in respect of a public funded project, the fee leviable would be reduced to 40% of the user fee for such section of National Highways, bridge, tunnel or bypass as the case may be, to be revised annually in accordance with these rules.”

In respect of the above, NHAI has clarified that Rule 6 of the Fee Rules provides that the user fee to be notified by Government as per the format of Schedule M of Concession Agreement shall be leviable till the end of the concession period. Hence, the user fee rate shall only be reduced after the concession period is over.

Concession Fees

As consideration for the grant of the Concession, the Concessionaire is required to pay a concession fee to NHAI equivalent to ₹ 1,940.1 crore as a Condition Precedent. The Concessionaire agrees that payment of the concession fee constitutes essential condition of the Concession Agreement.

For the purposes of stamp duty payment, concession agreements are generally considered to be agreements which are not lease deeds and stamp duty of ₹ 100.00 is typically paid for such concession agreements. However, stamp duty authorities of certain states in India have issued notices to some concessionaires alleging inadequate stamp duty on the concession agreements executed between the concessionaires and the NHAI. The stamp authorities allege that since concession agreements relate to the letting of tolls to the concessionaires in the form of leases, or as development agreements, such agreements were required to be stamped as lease agreements or development agreements, as applicable. The stamp duty for a lease agreement or a development agreement ranges between 1.0% and 11.0% of the annual rent or premium payable or the market value of the property. Furthermore, stamp duty authorities may impose penalties for payment of inadequate stamp duty, which could extend up to ten (10)

times the amount of the stamp duty payable. Accordingly, concession agreements that have not been stamped as such could be considered to be inadequately stamped. The High Courts of Allahabad and Maharashtra have also held that a concession agreement ought to be stamped as a lease agreement and have upheld the imposition of a higher stamp duty on such agreements.

While we have paid stamp duty of ₹ 100.00 on each of our Concession Agreements in accordance with usual practice, if any demand for payment of a higher stamp duty or penalty is imposed, it would increase the costs of the Toll Roads.

In respect of above, NHAI has clarified that:

- (i) As on date, GST is not applicable on Concession Fee. However, if it becomes applicable at a later stage, this shall be considered as change in law.
- (ii) There is no requirement of stamp duty in case of Concession Agreements since Fee Rules provided for levy and collection of user fee and not toll tax. In case, in future any such demand arises, it shall be treated as change in law.

Escrow Account

The provisions in relation to the escrow account in the Kotha Kota Kurnool Concession Agreement are only applicable if the obligations of the Concessionaire under the Kotha Kota Kurnool Concession Agreement are financed by the Lenders.

The Concessionaire shall, prior to the Appointed Date, open and establish the escrow account with the escrow bank and all funds constituting the financing package related to the Kotha Kota Kurnool Project shall be credited to such escrow account. During the Kotha Kota Kurnool Concession Period all fees and any other revenues including the proceeds of any rentals, deposits, capital receipts or insurance claims from or in respect of the Kotha Kota Kurnool Project Highway shall be deposited therein. In addition, all disbursements or payments by NHAI pursuant to the Kotha Kota Kurnool Concession Agreement, including, if any, in relation to the change of scope in the Kotha Kota Kurnool Project shall be deposited by NHAI in the escrow account.

Disbursements from Escrow Account

The Concessionaire shall give, at the time of the opening of the escrow account, irrevocable instructions by way of an escrow agreement substantially in form set forth in the Kotha Kota Kurnool Concession Agreement to the escrow bank instructing, *inter alia*, that the deposits into the escrow account shall subject to the provisions of the Kotha Kota Kurnool Concession Agreement, be appropriated in the following order every month and if not due in a month then appropriated proportionately in such month and retained in the escrow account and paid out therefrom in the month when due unless otherwise expressly provided in the instruction letter:

- i. all taxes due and payable by the Concessionaire for and in respect of the Kotha Kota Kurnool Project Highway;
- ii. concession fee;
- iii. all payments relating to construction of the Kotha Kota Kurnool Project Highway, subject to and in accordance with the conditions, if any, set forth in the financing agreements;
- iv. operation and maintenance expenses;
- v. operation and maintenance expenses and other costs and expenses incurred by NHAI in accordance with the provisions of the Kotha Kota Kurnool Concession Agreement, and certified by NHAI as due and payable to it;
- vi. monthly proportionate provision of debt service payment due in an accounting year;
- vii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire; and
- viii. balance, if any, in accordance with the instructions of the Concessionaire.

Disbursements upon Termination

Notwithstanding anything to the contrary contained in the escrow agreement and subject to the provisions of the Kotha Kota Kurnool Concession Agreement, in the case of termination, the amounts standing to the credit of the escrow account shall be disbursed towards:

- i. all taxes due and payable by the Concessionaire for and in respect of the Kotha Kota Kurnool Project Highway;
- ii. payment due to the lenders;
- iii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire;
- iv. retention and payments relating to the liability for defects and deficiencies;
- v. incurred or accrued operation and maintenance expenses;
- vi. any other payments required to be made under the Kotha Kota Kurnool Concession Agreement; and
- vii. balance, if any, in accordance with the instructions of the Concessionaire.

Change of Scope

NHAI may, notwithstanding anything to the contrary contained in the Kotha Kota Kurnool Concession Agreement, require the Concessionaire to make alterations/ modifications in the scope of the Kotha Kota Kurnool Project as contemplated by the Kotha Kota Kurnool Concession Agreement. If the cumulative costs relating to all the change of scope orders exceed 5% of the concession fee in any continuous period of 3 years immediately preceding the date of such change of scope order or if such cumulative costs exceed 25% of the concession fee at any time during the Kotha Kota Kurnool Concession Period, NHAI may award any works or services, to any person on the basis of open competitive bidding and the Concessionaire shall be entitled to take part in such competitive bidding with a right to match the first-ranked bid. All such changes shall be made by NHAI by an order issued in accordance with the procedure set forth in the Kotha Kota Kurnool Concession Agreement.

Termination of the Kotha Kota Kurnool Concession Agreement

Termination by either party

Either Party may in its discretion terminate the Kotha Kota Kurnool Concession Agreement by giving a termination notice to the other party if a force majeure event subsists for a period of 120 days or more within a continuous period of 365 days. Before issuing such termination notice, the party intending to issue the termination notice shall inform the other party of such intention and grant 15 days' time to make a representation, and may after the expiry of such 15 days period, whether or not it is in receipt of such representation, in its sole discretion issue the termination notice.

Termination by the NHAI

In the event of any of the defaults specified below have occurred, and if the Concessionaire has failed to cure such breach or default within the period provided for the same in the Kotha Kota Kurnool Concession Agreement, then NHAI shall be entitled to issue a notice of its intention to terminate the Kotha Kota Kurnool Concession Agreement, with a copy to the lenders. The following events shall constitute an event of default by the Concessionaire (a “**Concessionaire Default**”) unless they have occurred as a result of any breach of the Kotha Kota Kurnool Concession Agreement by NHAI or due to force majeure:

- i. the performance security has been encashed and appropriated in accordance with the Kotha Kota Kurnool Concession Agreement and the Concessionaire has failed to replenish or provide fresh performance security within a cure period of 15 days;
- ii. subsequent to the replenishment or furnishing of fresh performance security in accordance with the Kotha Kota Kurnool Concession Agreement, the Concessionaire fails to cure, within a cure period of 60 days, the Concessionaire Default for which whole or part of the performance security was appropriated;

- iii. the Concessionaire abandons or manifests intention to abandon the operation and maintenance of the Kotha Kota Kurnool Project Highway without the prior written consent of NHAI;
- iv. the Concessionaire fails to roll over, renew and furnish new bank guarantee performance security subject to and in accordance with terms of the Kotha Kota Kurnool Concession Agreement, at least 3 months prior to expiry of subsisting bank guarantee;
- v. the Concessionaire is in breach of the Maintenance Requirements or the Safety Requirements;
- vi. the Concessionaire has failed to make any payment to NHAI within the period specified in the Kotha Kota Kurnool Concession Agreement;
- vii. upon occurrence of a financial default, the lenders' representative has by notice required NHAI to undertake suspension or termination, as the case may be, in accordance with the substitution agreement and the Concessionaire fails to cure the default within the specified cure period;
- viii. a breach of any of the project agreements by the Concessionaire causes a material adverse effect;
- ix. the Concessionaire creates any encumbrance in breach of the Kotha Kota Kurnool Concession Agreement;
- x. the Concessionaire repudiates the Kotha Kota Kurnool Concession Agreement or otherwise takes any action or evidences or conveys an intention not to be bound by the Kotha Kota Kurnool Concession Agreement;
- xi. a change in ownership occurs in breach of the provisions of the Kotha Kota Kurnool Concession Agreement;
- xii. there is a transfer, pursuant to law either of the rights and/or obligations of the Concessionaire under any of the project agreements, or of all or part of the assets or undertaking of the Concessionaire, and such transfer causes a material adverse effect;
- xiii. an execution levied on any of the assets of the Concessionaire has caused a material adverse effect;
- xiv. the Concessionaire is adjudged bankrupt or insolvent, or if a trustee or receiver is appointed for the Concessionaire or for the whole or material part of its assets that has a material bearing on the Kotha Kota Kurnool Project;
- xv. the Concessionaire has been, or is in the process of being liquidated, dissolved, wound-up, amalgamated or reconstituted in a manner that would cause, in the reasonable opinion of NHAI, a material adverse effect;
- xvi. a resolution for winding up of the Concessionaire is passed or any petition for winding up of the Concessionaire is admitted by a court of competent jurisdiction and a provisional liquidator or receiver is appointed and such order has not been set aside within 90 days of the date thereof or the Concessionaire is ordered to be wound up by Court except for the purpose of amalgamation or reconstruction; provided that, as part of such amalgamation or reconstruction, the entire property, assets and undertaking of the Concessionaire are transferred to the amalgamated or reconstructed entity and that the amalgamated or reconstructed entity has unconditionally assumed the obligations of the Concessionaire under the Kotha Kota Kurnool Concession Agreement and the project agreements; and provided that:
 - a. the amalgamated or reconstructed entity has the capability and operating experience necessary for the performance of its obligations under the Kotha Kota Kurnool Concession Agreement and the project agreements;
 - b. the amalgamated or reconstructed entity has the financial standing to perform its obligations under the Kotha Kota Kurnool Concession Agreement and the project agreements and has a credit worthiness at least as good as that of the Concessionaire as at Appointed Date; and
 - c. each of the project agreements remains in full force and effect;

- xvii. any representation or warranty of the Concessionaire herein contained which is, as of the date hereof, found to be materially false, incorrect or misleading;
- xviii. the Concessionaire submits to NHAI any statement, notice or other document, in written or electronic form, which has a material effect on NHAI's rights, obligations or interests and which is false in material particulars;
- xix. the Concessionaire has failed to fulfil any obligation, for which failure termination has been specified in the Kotha Kota Kurnool Concession Agreement;
- xx. the Concessionaire commits a default in complying with any other provision of the Kotha Kota Kurnool Concession Agreement if such default causes a material adverse effect on NHAI;
- xxi. an escrow default occurs and the Concessionaire fails to cure the default within a cure period of 15 days;

Termination by Concessionaire

If any of the defaults specified below shall have occurred, and NHAI fails to cure such default within a cure period of 90 days or such longer period as has been expressly provided in the Kotha Kota Kurnool Concession Agreement, NHAI shall be deemed to be in default of the Kotha Kota Kurnool Concession Agreement, unless the default has occurred as a result of any breach of the Kotha Kota Kurnool Concession Agreement by the Concessionaire or due to force majeure:

- i. NHAI commits a material default in complying with any of the provisions of the Kotha Kota Kurnool Concession Agreement and such default has a material adverse effect on the Concessionaire; or
- ii. NHAI repudiates the Kotha Kota Kurnool Concession Agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be bound by the Kotha Kota Kurnool Concession Agreement.

Termination Payments

The termination payment pursuant to the Kotha Kota Kurnool Concession Agreement becomes due and payable to the Concessionaire by NHAI within 15 days of the Concessionaire furnishing to NHAI an NOC issued by the lenders/ lenders' representative recording/ effecting release/ vacation/ discharge of the charge on Kotha Kota Kurnool Project receivables (if any) created by Concessionaire for securing repayment of the debt. If NHAI fails to disburse the full termination payment within 15 days, NHAI shall pay interest at a rate equal to 3% above the bank rate on the amount of termination payment remaining unpaid.

Upon termination of the Kotha Kota Kurnool Concession Agreement by the NHAI on account of occurrence of a Concessionaire Default, the NHAI shall pay the Concessionaire by way of termination payment 70% of the Unexpired Cash Flow.

Upon termination of the Kotha Kota Kurnool Concession Agreement by the Concessionaire on account of occurrence of an NHAI Default, the Concessionaire shall be entitled to receive from NHAI by way of termination payment a sum equal to 105% of the Unexpired Cash Flow.

Technical Clarifications on the Concession Agreements

For details in relation to the technical clarifications received from NHAI in relation to the Concession Agreements, please refer to "*Annexure D - Technical clarifications on the Concession Agreements*" on page 6670.

2. *Concession Agreement between Concessionaire and NHAI dated March 30, 2021 in respect of the Chittorgarh Kota Project*

The Concessionaire has entered into a concession agreement for operation, maintenance, and management of Chittorgarh Kota Project Highway (as defined below) on toll, operate and transfer (TOT) basis (the "**Chittorgarh Kota Concession Agreement**"), for a period of 30 years from the Appointed Date (i.e., the date on which all Conditions Precedent have been satisfied. NHAI has, *vide* letter dated August 5, 2021, extended the date for satisfying the Concessionaire's Conditions Precedent to October 31, 2021) or such date on which

the Chittorgarh Kota Concession Agreement is terminated by a termination notice (“**Chittorgarh Kota Concession Period**”).

Certain Definitions

“**Chittorgarh Kota Project**” means the operation and maintenance of the Chittorgarh Kota Project Highway in accordance with the provisions of the Chittorgarh Kota Concession Agreement and includes all works, services and equipment relating to or in respect of the scope of the Chittorgarh Kota Project as set forth in the Chittorgarh Kota Concession Agreement;

“**Chittorgarh Kota Project Assets**” means all physical and other assets relating to and forming part of the Site including (a) rights over the Site in the form of licence, Right of Way or otherwise; (b) tangible assets such as civil works and equipment including foundations, embankments, pavements, road surface, interchanges, bridges, culverts, road overbridges, drainage works, traffic signals, sign boards, kilometre- stones, toll plazas, electrical systems, communication systems, rest areas, relief centers, maintenance depots and administrative offices; (d) all rights of the Concessionaire under the project agreements; (e) security deposits; (f) insurance proceeds; and (g) Applicable Permits and authorisations relating to or in respect of the Chittorgarh Kota Project Highway, but does not include Additional Facilities; and

“**Chittorgarh Kota Project Highway**” means the Site comprising the existing road comprising:

Stretch	State	Start (Km)	End (Km)	Length
Chittorgarh-Kota and Chittorgarh Bypass	Rajasthan	891.29	1052.429	160.500

and all Chittorgarh Kota Project Assets.

Grant of Concession

Subject to and in accordance with the terms and conditions set forth in the Chittorgarh Kota Concession Agreement, NHAI has granted to the Concessionaire, and the Concessionaire has accepted the concession for a period of 30 years, including the exclusive right, license and authority during the subsistence of the Chittorgarh Kota Concession Agreement to operate, manage and maintain the Chittorgarh Kota Project Highway.

Subject to and in accordance with the terms and conditions set forth in the Chittorgarh Kota Concession Agreement, the Concessionaire is entitled to undertake the following in accordance with the terms of the Chittorgarh Kota Concession Agreement, applicable laws and applicable permits:

- i. Right of Way, access and license to the Site for the purpose of and to the extent conferred by the provisions of the Chittorgarh Kota Concession Agreement;
- ii. manage, operate and maintain the Chittorgarh Kota Project Highway and regulate the use thereof by third parties in accordance with terms hereof;
- iii. demand, collect and appropriate the fees from vehicles and persons liable for payment of fees for using the Chittorgarh Kota Project Highway or any part thereof and refuse entry of any vehicle to the Chittorgarh Kota Project Highway if the fee due is not paid;
- iv. perform and fulfill all of the Concessionaire’s obligations under and in accordance with the Chittorgarh Kota Concession Agreement;
- v. bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the Concessionaire under the Chittorgarh Kota Concession Agreement; and
- vi. neither assign, transfer or sublet or create any lien or encumbrance on the Chittorgarh Kota Concession Agreement, or the concession granted thereby, or on the whole or any part of the Chittorgarh Kota Project Highway nor transfer, lease or part possession thereof, save and except as expressly permitted by the Chittorgarh Kota Concession Agreement.

Fees

The Concessionaire is entitled to, during the Chittorgarh Kota Concession Period, levy, collect and appropriate fees from users of the Chittorgarh Kota Project Highway pursuant to and in accordance with the provisions in the Chittorgarh Kota Concession Agreement and the Fee Rules and to appropriate the same. In accordance with the terms of the Chittorgarh Kota Concession Agreement, the Concessionaire shall not collect any fees in relation to exempted vehicles. The fees collected by Concessionaire shall be deposited in the escrow account and appropriated in accordance with the relevant provisions of the Chittorgarh Kota Concession Agreement.

Sub Rule 6(6) of the above-mentioned Fee Rules states,

“

(a) The fee shall be collected by the Central Government or the executing Authority as the case may be and for a specified period in accordance with the terms of agreement entered by the Concessionaire.

(b) The fee as notified as per Concession Agreement shall be leviable till the end of the concession period and after the Concession Agreement is over, the fee shall be collected by the Central Government executing authority at a reduced rate of 40% of the fee on the date of transfer of such section of National Highways, bridge, tunnel or bypass, as the case may be, to be revised annually in accordance with these rules:

Provided that after the recovery of capital cost through user fee realised, in respect of a public funded project, the fee leviable would be reduced to 40% of the user fee for such section of National Highways, bridge, tunnel or bypass as the case may be, to be revised annually in accordance with these rules.”

In respect of the above, NHAI has clarified that Rule 6 of the Fee Rules provides that the user fee to be notified by Government as per the format of Schedule M of Concession Agreement shall be leviable till the end of the concession period. Hence, the user fee rate shall only be reduced after the concession period is over.

Concession Fees

As consideration for the grant of the Concession, the Concessionaire is required to pay a concession fee to NHAI equivalent to ₹ 1,193.40 crore as a Condition Precedent. The Concessionaire agrees that payment of the concession fee constitutes essential condition of the Concession Agreement.

For the purposes of stamp duty payment, concession agreements are generally considered to be agreements which are not lease deeds and stamp duty of ₹ 100.00 is typically paid for such concession agreements. However, stamp duty authorities of certain states in India have issued notices to some concessionaires alleging inadequate stamp duty on the concession agreements executed between the concessionaires and the NHAI. The stamp authorities allege that since concession agreements relate to the letting of tolls to the concessionaires in the form of leases, or as development agreements, such agreements were required to be stamped as lease agreements or development agreements, as applicable. The stamp duty for a lease agreement or a development agreement ranges between 1.0% and 11.0% of the annual rent or premium payable or the market value of the property. Furthermore, stamp duty authorities may impose penalties for payment of inadequate stamp duty, which could extend up to ten (10) times the amount of the stamp duty payable. Accordingly, concession agreements that have not been stamped as such could be considered to be inadequately stamped. The High Courts of Allahabad and Maharashtra have also held that a concession agreement ought to be stamped as a lease agreement and have upheld the imposition of a higher stamp duty on such agreements.

While we have paid stamp duty of ₹ 100.00 on each of our Concession Agreements in accordance with usual practice, if any demand for payment of a higher stamp duty or penalty is imposed, it would increase the costs of the Toll Roads.

In respect of above, NHAI has clarified that:

- (i) As on date, GST is not applicable on Concession Fee. However, if it becomes applicable at a later stage, this shall be considered as change in law.
- (ii) There is no requirement of stamp duty in case of Concession Agreements since Fee Rules provided for levy and collection of user fee and not toll tax. In case, in future any such demand arises, it shall be treated as change in law.

Escrow Account

The provisions in relation to the escrow account in the Chittorgarh Kota Concession Agreement are only applicable if the obligations of the Concessionaire under the Chittorgarh Kota Concession Agreement are financed by the Lenders.

The Concessionaire shall, prior to the Appointed Date, open and establish the escrow account with the escrow bank and all funds constituting the financing package related to the Chittorgarh Kota Project shall be credited to such escrow account. During the Chittorgarh Kota Concession Period all fees and any other revenues including the proceeds of any rentals, deposits, capital receipts or insurance claims from or in respect of the Chittorgarh Kota Project Highway shall be deposited therein. In addition, all disbursements or payments by NHAI pursuant to the Chittorgarh Kota Concession Agreement, including, if any, in relation to the change of scope in the Chittorgarh Kota Project shall be deposited by NHAI in the escrow account.

Disbursements from Escrow Account

The Concessionaire shall give, at the time of the opening of the escrow account, irrevocable instructions by way of an escrow agreement substantially in form set forth in the Chittorgarh Kota Concession Agreement to the escrow bank instructing, *inter alia*, that the deposits into the escrow account shall subject to the provisions of the Chittorgarh Kota Concession Agreement, be appropriated in the following order every month and if not due in a month then appropriated proportionately in such month and retained in the escrow account and paid out therefrom in the month when due unless otherwise expressly provided in the instruction letter:

- i. all taxes due and payable by the Concessionaire for and in respect of the Chittorgarh Kota Project Highway;
- ii. concession fee;
- iii. all payments relating to construction of the Chittorgarh Kota Project Highway, subject to and in accordance with the conditions, if any, set forth in the financing agreements;
- iv. operation and maintenance expenses;
- v. operation and maintenance expenses and other costs and expenses incurred by NHAI in accordance with the provisions of the Chittorgarh Kota Concession Agreement, and certified by NHAI as due and payable to it;
- vi. monthly proportionate provision of debt service payment due in an accounting year;
- vii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire; and
- viii. balance, if any, in accordance with the instructions of the Concessionaire.

Disbursements upon Termination

Notwithstanding anything to the contrary contained in the escrow agreement and subject to the provisions of the Chittorgarh Kota Concession Agreement, in the case of termination, the amounts standing to the credit of the escrow account shall be disbursed towards:

- i. all taxes due and payable by the Concessionaire for and in respect of the Chittorgarh Kota Project Highway;
- ii. payment due to the lenders;
- iii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire;
- iv. retention and payments relating to the liability for defects and deficiencies;
- v. incurred or accrued operation and maintenance expenses;
- vi. any other payments required to be made under the Chittorgarh Kota Concession Agreement; and
- vii. balance, if any, in accordance with the instructions of the Concessionaire.

Change of Scope

NHAI may, notwithstanding anything to the contrary contained in the Chittorgarh Kota Concession Agreement, require the Concessionaire to make alterations/ modifications in the scope of the Chittorgarh Kota Project as contemplated by the Chittorgarh Kota Concession Agreement. If the cumulative costs relating to all the change of scope orders exceed 5% of the concession fee in any continuous period of 3 years immediately preceding the date of such change of scope order or if such cumulative costs exceed 25% of the concession fee at any time during the Chittorgarh Kota Concession Period, NHAI may award any works or services, to any person on the basis of open competitive bidding and the Concessionaire shall be entitled to take part in such competitive bidding with a right to match the first-ranked bid. All such changes shall be made by NHAI by an order issued in accordance with the procedure set forth in the Chittorgarh Kota Concession Agreement.

Termination of the Chittorgarh Kota Concession Agreement

Termination by either party

Either Party may in its discretion terminate the Chittorgarh Kota Concession Agreement by giving a termination notice to the other party if a force majeure event subsists for a period of 120 days or more within a continuous period of 365 days. Before issuing such termination notice, the party intending to issue the termination notice shall inform the other party of such intention and grant 15 days' time to make a representation, and may after the expiry of such 15 days period, whether or not it is in receipt of such representation, in its sole discretion issue the termination notice.

Termination by the NHAI

In the event of any of the defaults specified below have occurred, and if the Concessionaire has failed to cure such breach or default within the period provided for the same in the Chittorgarh Kota Concession Agreement, then NHAI shall be entitled to issue a notice of its intention to terminate the Chittorgarh Kota Concession Agreement, with a copy to the lenders. The following events shall constitute an event of default by the Concessionaire (a “**Concessionaire Default**”) unless they have occurred as a result of any breach of the Chittorgarh Kota Concession Agreement by NHAI or due to force majeure:

- i. the performance security has been encashed and appropriated in accordance with the Chittorgarh Kota Concession Agreement and the Concessionaire has failed to replenish or provide fresh performance security within a cure period of 15 days;
- ii. subsequent to the replenishment or furnishing of fresh performance security in accordance with the Chittorgarh Kota Concession Agreement, the Concessionaire fails to cure, within a cure period of 60 days, the Concessionaire Default for which whole or part of the performance security was appropriated;
- iii. the Concessionaire abandons or manifests intention to abandon the operation and maintenance of the Chittorgarh Kota Project Highway without the prior written consent of NHAI;
- iv. the Concessionaire fails to roll over, renew and furnish new bank guarantee performance security subject to and in accordance with terms of the Chittorgarh Kota Concession Agreement, at least 3 months prior to expiry of subsisting bank guarantee;
- v. the Concessionaire is in breach of the Maintenance Requirements or the Safety Requirements;
- vi. the Concessionaire has failed to make any payment to NHAI within the period specified in the Chittorgarh Kota Concession Agreement;
- vii. upon occurrence of a financial default, the lenders' representative has by notice required NHAI to undertake suspension or termination, as the case may be, in accordance with the substitution agreement and the Concessionaire fails to cure the default within the specified cure period;
- viii. a breach of any of the project agreements by the Concessionaire causes a material adverse effect;
- ix. the Concessionaire creates any encumbrance in breach of the Chittorgarh Kota Concession Agreement;

- x. the Concessionaire repudiates the Chittorgarh Kota Concession Agreement or otherwise takes any action or evidences or conveys an intention not to be bound by the Chittorgarh Kota Concession Agreement;
- xi. a change in ownership occurs in breach of the provisions of the Chittorgarh Kota Concession Agreement;
- xii. there is a transfer, pursuant to law either of the rights and/or obligations of the Concessionaire under any of the project agreements, or of all or part of the assets or undertaking of the Concessionaire, and such transfer causes a material adverse effect;
- xiii. an execution levied on any of the assets of the Concessionaire has caused a material adverse effect;
- xiv. the Concessionaire is adjudged bankrupt or insolvent, or if a trustee or receiver is appointed for the Concessionaire or for the whole or material part of its assets that has a material bearing on the Chittorgarh Kota Project;
- xv. the Concessionaire has been, or is in the process of being liquidated, dissolved, wound-up, amalgamated or reconstituted in a manner that would cause, in the reasonable opinion of NHAI, a material adverse effect;
- xvi. a resolution for winding up of the Concessionaire is passed or any petition for winding up of the Concessionaire is admitted by a court of competent jurisdiction and a provisional liquidator or receiver is appointed and such order has not been set aside within 90 days of the date thereof or the Concessionaire is ordered to be wound up by Court except for the purpose of amalgamation or reconstruction; provided that, as part of such amalgamation or reconstruction, the entire property, assets and undertaking of the Concessionaire are transferred to the amalgamated or reconstructed entity and that the amalgamated or reconstructed entity has unconditionally assumed the obligations of the Concessionaire under the Chittorgarh Kota Concession Agreement and the project agreements; and provided that:
 - a. the amalgamated or reconstructed entity has the capability and operating experience necessary for the performance of its obligations under the Chittorgarh Kota Concession Agreement and the project agreements;
 - b. the amalgamated or reconstructed entity has the financial standing to perform its obligations under the Chittorgarh Kota Concession Agreement and the project agreements and has a credit worthiness at least as good as that of the Concessionaire as at Appointed Date; and
 - c. each of the project agreements remains in full force and effect;
- xvii. any representation or warranty of the Concessionaire herein contained which is, as of the date hereof, found to be materially false, incorrect or misleading;
- xviii. the Concessionaire submits to NHAI any statement, notice or other document, in written or electronic form, which has a material effect on NHAI's rights, obligations or interests and which is false in material particulars;
- xix. the Concessionaire has failed to fulfil any obligation, for which failure termination has been specified in the Chittorgarh Kota Concession Agreement;
- xx. the Concessionaire commits a default in complying with any other provision of the Chittorgarh Kota Concession Agreement if such default causes a material adverse effect on NHAI;
- xxi. an escrow default occurs and the Concessionaire fails to cure the default within a cure period of 15 days;

Termination by Concessionaire

If any of the defaults specified below shall have occurred, and NHAI fails to cure such default within a cure period of 90 days or such longer period as has been expressly provided in the Chittorgarh Kota Concession Agreement, NHAI shall be deemed to be in default of the Chittorgarh Kota Concession Agreement, unless the default has occurred as a result of any breach of the Chittorgarh Kota Concession Agreement by the Concessionaire or due to force majeure:

- i. NHAI commits a material default in complying with any of the provisions of the Chittorgarh Kota Concession Agreement and such default has a material adverse effect on the Concessionaire; or
- ii. NHAI repudiates the Chittorgarh Kota Concession Agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be bound by the Chittorgarh Kota Concession Agreement.

Termination Payments

The termination payment pursuant to the Chittorgarh Kota Concession Agreement becomes due and payable to the Concessionaire by NHAI within 15 days of the Concessionaire furnishing to NHAI an NOC issued by the lenders/ lenders' representative recording/ effecting release/ vacation/ discharge of the charge on Chittorgarh Kota Project receivables (if any) created by Concessionaire for securing repayment of the debt. If NHAI fails to disburse the full termination payment within 15 days, NHAI shall pay interest at a rate equal to 3% above the bank rate on the amount of termination payment remaining unpaid.

Upon termination of the Chittorgarh Kota Concession Agreement by the NHAI on account of occurrence of a Concessionaire Default, the NHAI shall pay the Concessionaire by way of termination payment 70% of the Unexpired Cash Flow.

Upon termination of the Chittorgarh Kota Concession Agreement by the Concessionaire on account of occurrence of an NHAI Default, the Concessionaire shall be entitled to receive from NHAI by way of termination payment a sum equal to 105% of the Unexpired Cash Flow.

Technical Clarifications on the Concession Agreements

For details in relation to the technical clarifications received from NHAI in relation to the Concession Agreements, please refer to “*Annexure D - Technical clarifications on the Concession Agreements*” on page 6670.

3. Concession Agreement between Concessionaire and NHAI dated March 30, 2021 in respect of the Maharashtra Belgaum Project

The Concessionaire has entered into a concession agreement for operation, maintenance, and management of Maharashtra Belgaum Project Highway (as defined below) on toll, operate and transfer (TOT) basis (the “**Maharashtra Belgaum Concession Agreement**”), for a period of 30 years from the Appointed Date (i.e., the date on which all Conditions Precedent have been satisfied. NHAI has, *vide* letter dated August 5, 2021, extended the date for satisfying the Concessionaire's Conditions Precedent to October 31, 2021) or such date on which the Maharashtra Belgaum Concession Agreement is terminated by a termination notice (“**Maharashtra Belgaum Concession Period**”).

Certain Definitions

“**Maharashtra Belgaum Project**” means the operation and maintenance of the Maharashtra Belgaum Project Highway in accordance with the provisions of the Maharashtra Belgaum Concession Agreement and includes all works, services and equipment relating to or in respect of the scope of the Maharashtra Belgaum Project as set forth in the Maharashtra Belgaum Concession Agreement;

“**Maharashtra Belgaum Project Assets**” means all physical and other assets relating to and forming part of the Site including (a) rights over the Site in the form of licence, Right of Way or otherwise; (b) tangible assets such as civil works and equipment including foundations, embankments, pavements, road surface, interchanges, bridges, culverts, road overbridges, drainage works, traffic signals, sign boards, kilometre- stones, toll plazas, electrical systems, communication systems, rest areas, relief centers, maintenance depots and administrative offices; (d) all rights of the Concessionaire under the project agreements; (e) security deposits; (f) insurance proceeds; and (g) Applicable Permits and authorisations relating to or in respect of the Maharashtra Belgaum Project Highway, but does not include Additional Facilities; and

“**Maharashtra Belgaum Project Highway**” means the Site comprising the existing road comprising:

Stretch	State	Start (Km)	End (Km)	Length
Maharashtra/Karnataka Border	Karnataka and	515.00	592.705	77.705

(Kagal)- Belgaum	Maharashtra			
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and all Maharashtra Belgaum Project Assets.

Grant of Concession

Subject to and in accordance with the terms and conditions set forth in the Maharashtra Belgaum Concession Agreement, NHAI has granted to the Concessionaire, and the Concessionaire has accepted the concession for a period of 30 years, including the exclusive right, license and authority during the subsistence of the Maharashtra Belgaum Concession Agreement to operate, manage and maintain the Maharashtra Belgaum Project Highway.

Subject to and in accordance with the terms and conditions set forth in the Maharashtra Belgaum Concession Agreement, the Concessionaire is entitled to undertake the following in accordance with the terms of the Maharashtra Belgaum Concession Agreement, applicable laws and applicable permits:

- i. Right of Way, access and license to the Site for the purpose of and to the extent conferred by the provisions of the Maharashtra Belgaum Concession Agreement;
- ii. manage, operate and maintain the Maharashtra Belgaum Project Highway and regulate the use thereof by third parties in accordance with terms hereof;
- iii. demand, collect and appropriate the fees from vehicles and persons liable for payment of fees for using the Maharashtra Belgaum Project Highway or any part thereof and refuse entry of any vehicle to the Maharashtra Belgaum Project Highway if the fee due is not paid;
- iv. perform and fulfill all of the Concessionaire's obligations under and in accordance with the Maharashtra Belgaum Concession Agreement;
- v. bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the Concessionaire under the Maharashtra Belgaum Concession Agreement; and
- vi. neither assign, transfer or sublet or create any lien or encumbrance on the Maharashtra Belgaum Concession Agreement, or the concession granted thereby, or on the whole or any part of the Maharashtra Belgaum Project Highway nor transfer, lease or part possession thereof, save and except as expressly permitted by the Maharashtra Belgaum Concession Agreement.

Fees

The Concessionaire is entitled to, during the Maharashtra Belgaum Concession Period, levy, collect and appropriate fees from users of the Maharashtra Belgaum Project Highway pursuant to and in accordance with the provisions in the Maharashtra Belgaum Concession Agreement and Fee Rules and to appropriate the same. In accordance with the terms of the Maharashtra Belgaum Concession Agreement, the Concessionaire shall not collect any fees in relation to exempted vehicles. The fees collected by Concessionaire shall be deposited in the escrow account and appropriated in accordance with the relevant provisions of the Maharashtra Belgaum Concession Agreement.

Sub Rule 6(6) of the above-mentioned Fee Rules states,

“

(a) The fee shall be collected by the Central Government or the executing Authority as the case may be and for a specified period in accordance with the terms of agreement entered by the Concessionaire.

(b) The fee as notified as per Concession Agreement shall be leviable till the end of the concession period and after the Concession Agreement is over, the fee shall be collected by the Central Government executing authority at a reduced rate of 40% of the fee on the date of transfer of such section of National Highways, bridge, tunnel or bypass, as the case may be, to be revised annually in accordance with these rules:

Provided that after the recovery of capital cost through user fee realised, in respect of a public funded project, the fee leviable would be reduced to 40% of the user fee for such section of National Highways, bridge, tunnel or

bypass as the case may be, to be revised annually in accordance with these rules.”

In respect of the above, NHAI has clarified that Rule 6 of the Fee Rules provides that the user fee to be notified by Government as per the format of Schedule M of Concession Agreement shall be leviable till the end of the concession period. Hence, the user fee rate shall only be reduced after the concession period is over.

Concession Fees

As consideration for the grant of the Concession, the Concessionaire is required to pay a concession fee to NHAI equivalent to ₹ 2,328.7 crore as a Condition Precedent. The Concessionaire agrees that payment of the concession fee constitutes essential condition of the Concession Agreement.

For the purposes of stamp duty payment, concession agreements are generally considered to be agreements which are not lease deeds and stamp duty of ₹ 100.00 is typically paid for such concession agreements. However, stamp duty authorities of certain states in India have issued notices to some concessionaires alleging inadequate stamp duty on the concession agreements executed between the concessionaires and the NHAI. The stamp authorities allege that since concession agreements relate to the letting of tolls to the concessionaires in the form of leases, or as development agreements, such agreements were required to be stamped as lease agreements or development agreements, as applicable. The stamp duty for a lease agreement or a development agreement ranges between 1.0% and 11.0% of the annual rent or premium payable or the market value of the property. Furthermore, stamp duty authorities may impose penalties for payment of inadequate stamp duty, which could extend up to ten (10) times the amount of the stamp duty payable. Accordingly, concession agreements that have not been stamped as such could be considered to be inadequately stamped. The High Courts of Allahabad and Maharashtra have also held that a concession agreement ought to be stamped as a lease agreement and have upheld the imposition of a higher stamp duty on such agreements.

While we have paid stamp duty of ₹ 100.00 on each of our Concession Agreements in accordance with usual practice, if any demand for payment of a higher stamp duty or penalty is imposed, it would increase the costs of the Toll Roads.

In respect of above, NHAI has clarified that:

- (i) As on date, GST is not applicable on Concession Fee. However, if it becomes applicable at a later stage, this shall be considered as change in law.
- (ii) There is no requirement of stamp duty in case of Concession Agreements since Fee Rules provided for levy and collection of user fee and not toll tax. In case, in future any such demand arises, it shall be treated as change in law.

Escrow Account

The provisions in relation to the escrow account in the Maharashtra Belgaum Concession Agreement are only applicable if the obligations of the Concessionaire under the Maharashtra Belgaum Concession Agreement are financed by the Lenders.

The Concessionaire shall, prior to the Appointed Date, open and establish the escrow account with the escrow bank and all funds constituting the financing package related to the Maharashtra Belgaum Project shall be credited to such escrow account. During the Maharashtra Belgaum Concession Period all fees and any other revenues including the proceeds of any rentals, deposits, capital receipts or insurance claims from or in respect of the Maharashtra Belgaum Project Highway shall be deposited therein. In addition, all disbursements or payments by NHAI pursuant to the Maharashtra Belgaum Concession Agreement, including, if any, in relation to the change of scope in the Maharashtra Belgaum Project shall be deposited by NHAI in the escrow account.

Disbursements from Escrow Account

The Concessionaire shall give, at the time of the opening of the escrow account, irrevocable instructions by way of an escrow agreement substantially in form set forth in the Maharashtra Belgaum Concession Agreement to the escrow bank instructing, *inter alia*, that the deposits into the escrow account shall subject to the provisions of the Maharashtra Belgaum Concession Agreement, be appropriated in the following order every month and if not due in a month then appropriated proportionately in such month and retained in the escrow account and paid out therefrom in the month when due unless otherwise expressly provided in the instruction letter:

- i. all taxes due and payable by the Concessionaire for and in respect of the Maharashtra Belgaum Project Highway;
- ii. concession fee;
- iii. all payments relating to construction of the Maharashtra Belgaum Project Highway, subject to and in accordance with the conditions, if any, set forth in the financing agreements;
- iv. operation and maintenance expenses;
- v. operation and maintenance expenses and other costs and expenses incurred by NHAI in accordance with the provisions of the Maharashtra Belgaum Concession Agreement, and certified by NHAI as due and payable to it;
- vi. monthly proportionate provision of debt service payment due in an accounting year;
- vii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire; and
- vii. balance, if any, in accordance with the instructions of the Concessionaire.

Disbursements upon Termination

Notwithstanding anything to the contrary contained in the escrow agreement and subject to the provisions of the Maharashtra Belgaum Concession Agreement, in the case of termination, the amounts standing to the credit of the escrow account shall be disbursed towards:

- i. all taxes due and payable by the Concessionaire for and in respect of the Maharashtra Belgaum Project Highway;
- ii. payment due to the lenders;
- iii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire;
- iv. retention and payments relating to the liability for defects and deficiencies;
- v. incurred or accrued operation and maintenance expenses;
- vi. any other payments required to be made under the Maharashtra Belgaum Concession Agreement; and
- vii. balance, if any, in accordance with the instructions of the Concessionaire.

Change of Scope

NHAI may, notwithstanding anything to the contrary contained in the Maharashtra Belgaum Concession Agreement, require the Concessionaire to make alterations/ modifications in the scope of the Maharashtra Belgaum Project as contemplated by the Maharashtra Belgaum Concession Agreement. If the cumulative costs relating to all the change of scope orders exceed 5% of the concession fee in any continuous period of 3 years immediately preceding the date of such change of scope order or if such cumulative costs exceed 25% of the concession fee at any time during the Maharashtra Belgaum Concession Period, NHAI may award any works or services, to any person on the basis of open competitive bidding and the Concessionaire shall be entitled to take part in such competitive bidding with a right to match the first-ranked bid. All such changes shall be made by NHAI by an order issued in accordance with the procedure set forth in the Maharashtra Belgaum Concession Agreement.

Termination of the Maharashtra Belgaum Concession Agreement

Termination by either party

Either Party may in its discretion terminate the Maharashtra Belgaum Concession Agreement by giving a

termination notice to the other party if a force majeure event subsists for a period of 120 days or more within a continuous period of 365 days. Before issuing such termination notice, the party intending to issue the termination notice shall inform the other party of such intention and grant 15 days' time to make a representation, and may after the expiry of such 15 days period, whether or not it is in receipt of such representation, in its sole discretion issue the termination notice.

Termination by the NHAI

In the event of any of the defaults specified below have occurred, and if the Concessionaire has failed to cure such breach or default within the period provided for the same in the Maharashtra Belgaum Concession Agreement, then NHAI shall be entitled to issue a notice of its intention to terminate the Maharashtra Belgaum Concession Agreement, with a copy to the lenders. The following events shall constitute an event of default by the Concessionaire (a “**Concessionaire Default**”) unless they have occurred as a result of any breach of the Maharashtra Belgaum Concession Agreement by NHAI or due to force majeure:

- i. the performance security has been encashed and appropriated in accordance with the Maharashtra Belgaum Concession Agreement and the Concessionaire has failed to replenish or provide fresh performance security within a cure period of 15 days;
- ii. subsequent to the replenishment or furnishing of fresh performance security in accordance with the Maharashtra Belgaum Concession Agreement, the Concessionaire fails to cure, within a cure period of 60 days, the Concessionaire Default for which whole or part of the performance security was appropriated;
- iii. the Concessionaire abandons or manifests intention to abandon the operation and maintenance of the Maharashtra Belgaum Project Highway without the prior written consent of NHAI;
- iv. the Concessionaire fails to roll over, renew and furnish new bank guarantee performance security subject to and in accordance with terms of the Maharashtra Belgaum Concession Agreement, at least 3 months prior to expiry of subsisting bank guarantee;
- v. the Concessionaire is in breach of the Maintenance Requirements or the Safety Requirements;
- vi. the Concessionaire has failed to make any payment to NHAI within the period specified in the Maharashtra Belgaum Concession Agreement;
- vii. upon occurrence of a financial default, the lenders' representative has by notice required NHAI to undertake suspension or termination, as the case may be, in accordance with the substitution agreement and the Concessionaire fails to cure the default within the specified cure period;
- viii. a breach of any of the project agreements by the Concessionaire causes a material adverse effect;
- ix. the Concessionaire creates any encumbrance in breach of the Maharashtra Belgaum Concession Agreement;
- x. the Concessionaire repudiates the Maharashtra Belgaum Concession Agreement or otherwise takes any action or evidences or conveys an intention not to be bound by the Maharashtra Belgaum Concession Agreement;
- xi. a change in ownership occurs in breach of the provisions of the Maharashtra Belgaum Concession Agreement;
- xii. there is a transfer, pursuant to law either of the rights and/or obligations of the Concessionaire under any of the project agreements, or of all or part of the assets or undertaking of the Concessionaire, and such transfer causes a material adverse effect;
- xiii. an execution levied on any of the assets of the Concessionaire has caused a material adverse effect;
- xiv. the Concessionaire is adjudged bankrupt or insolvent, or if a trustee or receiver is appointed for the Concessionaire or for the whole or material part of its assets that has a material bearing on the Maharashtra Belgaum Project;

- xv. the Concessionaire has been, or is in the process of being liquidated, dissolved, wound-up, amalgamated or reconstituted in a manner that would cause, in the reasonable opinion of NHAI, a material adverse effect;
- xvi. a resolution for winding up of the Concessionaire is passed or any petition for winding up of the Concessionaire is admitted by a court of competent jurisdiction and a provisional liquidator or receiver is appointed and such order has not been set aside within 90 days of the date thereof or the Concessionaire is ordered to be wound up by Court except for the purpose of amalgamation or reconstruction; provided that, as part of such amalgamation or reconstruction, the entire property, assets and undertaking of the Concessionaire are transferred to the amalgamated or reconstructed entity and that the amalgamated or reconstructed entity has unconditionally assumed the obligations of the Concessionaire under the Maharashtra Belgaum Concession Agreement and the project agreements; and provided that:
 - a. the amalgamated or reconstructed entity has the capability and operating experience necessary for the performance of its obligations under the Maharashtra Belgaum Concession Agreement and the project agreements;
 - b. the amalgamated or reconstructed entity has the financial standing to perform its obligations under the Maharashtra Belgaum Concession Agreement and the project agreements and has a credit worthiness at least as good as that of the Concessionaire as at Appointed Date; and
 - c. each of the project agreements remains in full force and effect;
- xvii. any representation or warranty of the Concessionaire herein contained which is, as of the date hereof, found to be materially false, incorrect or misleading;
- xviii. the Concessionaire submits to NHAI any statement, notice or other document, in written or electronic form, which has a material effect on NHAI's rights, obligations or interests and which is false in material particulars;
- xix. the Concessionaire has failed to fulfil any obligation, for which failure termination has been specified in the Maharashtra Belgaum Concession Agreement;
- xx. the Concessionaire commits a default in complying with any other provision of the Maharashtra Belgaum Concession Agreement if such default causes a material adverse effect on NHAI;
- xxi. an escrow default occurs and the Concessionaire fails to cure the default within a cure period of 15 days;

Termination by Concessionaire

If any of the defaults specified below shall have occurred, and NHAI fails to cure such default within a cure period of 90 days or such longer period as has been expressly provided in the Maharashtra Belgaum Concession Agreement, NHAI shall be deemed to be in default of the Maharashtra Belgaum Concession Agreement, unless the default has occurred as a result of any breach of the Maharashtra Belgaum Concession Agreement by the Concessionaire or due to force majeure:

- i. NHAI commits a material default in complying with any of the provisions of the Maharashtra Belgaum Concession Agreement and such default has a material adverse effect on the Concessionaire; or
- ii. NHAI repudiates the Maharashtra Belgaum Concession Agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be bound by the Maharashtra Belgaum Concession Agreement.

Termination Payments

The termination payment pursuant to the Maharashtra Belgaum Concession Agreement becomes due and payable to the Concessionaire by NHAI within 15 days of the Concessionaire furnishing to NHAI an NOC issued by the lenders/ lenders' representative recording/ effecting release/ vacation/ discharge of the charge on Maharashtra Belgaum Project receivables (if any) created by Concessionaire for securing repayment of the debt. If NHAI fails to disburse the full termination payment within 15 days, NHAI shall pay interest at a rate equal to 3% above the

bank rate on the amount of termination payment remaining unpaid.

Upon termination of the Maharashtra Belgaum Concession Agreement by the NHAI on account of occurrence of a Concessionaire Default, the NHAI shall pay the Concessionaire by way of termination payment 70% of the Unexpired Cash Flow.

Upon termination of the Maharashtra Belgaum Concession Agreement by the Concessionaire on account of occurrence of an NHAI Default, the Concessionaire shall be entitled to receive from NHAI by way of termination payment a sum equal to 105% of the Unexpired Cash Flow.

Technical Clarifications on the Concession Agreements

For details in relation to the technical clarifications received from NHAI in relation to the Concession Agreements, please refer to “Annexure D - Technical clarifications on the Concession Agreements” on page 6670.

4. Concession Agreement between Concessionaire and NHAI dated March 30, 2021 in respect of the Abu Road – Swaroopganj Project

The Concessionaire has entered into a concession agreement for operation, maintenance, and management of Abu Road – Swaroopganj Project Highway (as defined below) on toll, operate and transfer (TOT) basis (the “**Abu Road – Swaroopganj Concession Agreement**”), for a period of 30 years from the Appointed Date (i.e., the date on which all Conditions Precedent have been satisfied. NHAI has, *vide* letter dated August 5, 2021, extended the date for satisfying the Concessionaire’s Conditions Precedent to October 31, 2021) or such date on which the Abu Road – Swaroopganj Concession Agreement is terminated by a termination notice (“**Abu Road – Swaroopganj Concession Period**”).

Certain Definitions

“**Abu Road – Swaroopganj Project**” means the operation and maintenance of the Abu Road – Swaroopganj Project Highway in accordance with the provisions of the Abu Road – Swaroopganj Concession Agreement and includes all works, services and equipment relating to or in respect of the scope of the Abu Road – Swaroopganj Project as set forth in the Abu Road – Swaroopganj Concession Agreement;

“**Abu Road – Swaroopganj Project Assets**” means all physical and other assets relating to and forming part of the Site including (a) rights over the Site in the form of licence, Right of Way or otherwise; (b) tangible assets such as civil works and equipment including foundations, embankments, pavements, road surface, interchanges, bridges, culverts, road overbridges, drainage works, traffic signals, sign boards, kilometre- stones, toll plazas, electrical systems, communication systems, rest areas, relief centers, maintenance depots and administrative offices; (d) all rights of the Concessionaire under the project agreements; (e) security deposits; (f) insurance proceeds; and (g) Applicable Permits and authorisations relating to or in respect of the Abu Road – Swaroopganj Project Highway, but does not include Additional Facilities; and

“**Abu Road – Swaroopganj Project Highway**” means the Site comprising the existing road comprising:

Stretch	State	Start (Km)	End (Km)	Length
Abu Road-Swaroopganj	Rajasthan	646.000	677.000	31.000

and all Abu Road – Swaroopganj Project Assets.

Grant of Concession

Subject to and in accordance with the terms and conditions set forth in the Abu Road – Swaroopganj Concession Agreement, NHAI has granted to the Concessionaire, and the Concessionaire has accepted the concession for a period of 30 years, including the exclusive right, license and authority during the subsistence of the Abu Road – Swaroopganj Concession Agreement to operate, manage and maintain the Abu Road – Swaroopganj Project Highway.

Subject to and in accordance with the terms and conditions set forth in the Abu Road – Swaroopganj Concession Agreement, the Concessionaire is entitled to undertake the following in accordance with the terms of the Abu

Road – Swaroopganj Concession Agreement, applicable laws and applicable permits:

- i. Right of Way, access and license to the Site for the purpose of and to the extent conferred by the provisions of the Abu Road – Swaroopganj Concession Agreement;
- ii. manage, operate and maintain the Abu Road – Swaroopganj Project Highway and regulate the use thereof by third parties in accordance with terms hereof;
- iii. demand, collect and appropriate the fees from vehicles and persons liable for payment of fees for using the Abu Road – Swaroopganj Project Highway or any part thereof and refuse entry of any vehicle to the Abu Road – Swaroopganj Project Highway if the fee due is not paid;
- iv. perform and fulfill all of the Concessionaire's obligations under and in accordance with the Abu Road – Swaroopganj Concession Agreement;
- v. bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the Concessionaire under the Abu Road – Swaroopganj Concession Agreement; and
- vi. neither assign, transfer or sublet or create any lien or encumbrance on the Abu Road – Swaroopganj Concession Agreement, or the concession granted thereby, or on the whole or any part of the Abu Road – Swaroopganj Project Highway nor transfer, lease or part possession thereof, save and except as expressly permitted by the Abu Road – Swaroopganj Concession Agreement.

Fees

The Concessionaire is entitled to, during the Abu Road – Swaroopganj Concession Period, levy, collect and appropriate fees from users of the Abu Road – Swaroopganj Project Highway pursuant to and in accordance with the provisions in the Abu Road – Swaroopganj Concession Agreement and the Fee Rules and to appropriate the same. In accordance with the terms of the Abu Road – Swaroopganj Concession Agreement, the Concessionaire shall not collect any fees in relation to exempted vehicles. The fees collected by Concessionaire shall be deposited in the escrow account and appropriated in accordance with the relevant provisions of the Abu Road – Swaroopganj Concession Agreement.

Sub Rule 6(6) of the above-mentioned Fee Rules states,

“

(a) The fee shall be collected by the Central Government or the executing Authority as the case may be and for a specified period in accordance with the terms of agreement entered by the Concessionaire.

(b) The fee as notified as per Concession Agreement shall be leviable till the end of the concession period and after the Concession Agreement is over, the fee shall be collected by the Central Government executing authority at a reduced rate of 40% of the fee on the date of transfer of such section of National Highways, bridge, tunnel or bypass, as the case may be, to be revised annually in accordance with these rules:

Provided that after the recovery of capital cost through user fee realised, in respect of a public funded project, the fee leviable would be reduced to 40% of the user fee for such section of National Highways, bridge, tunnel or bypass as the case may be, to be revised annually in accordance with these rules.”

In respect of the above, NHAI has clarified that Rule 6 of the Fee Rules provides that the user fee to be notified by Government as per the format of Schedule M of Concession Agreement shall be leviable till the end of the concession period. Hence, the user fee rate shall only be reduced after the concession period is over.

Concession Fees

As consideration for the grant of the Concession, the Concessionaire is required to pay a concession fee to NHAI equivalent to ₹ 741.70 crore as a Condition Precedent. The Concessionaire agrees that payment of the concession fee constitutes essential condition of the Concession Agreement.

For the purposes of stamp duty payment, concession agreements are generally considered to be agreements which are not lease deeds and stamp duty of ₹ 100.00 is typically paid for such concession agreements. However, stamp

duty authorities of certain states in India have issued notices to some concessionaires alleging inadequate stamp duty on the concession agreements executed between the concessionaires and the NHAI. The stamp authorities allege that since concession agreements relate to the letting of tolls to the concessionaires in the form of leases, or as development agreements, such agreements were required to be stamped as lease agreements or development agreements, as applicable. The stamp duty for a lease agreement or a development agreement ranges between 1.0% and 11.0% of the annual rent or premium payable or the market value of the property. Furthermore, stamp duty authorities may impose penalties for payment of inadequate stamp duty, which could extend up to ten (10) times the amount of the stamp duty payable. Accordingly, concession agreements that have not been stamped as such could be considered to be inadequately stamped. The High Courts of Allahabad and Maharashtra have also held that a concession agreement ought to be stamped as a lease agreement and have upheld the imposition of a higher stamp duty on such agreements.

While we have paid stamp duty of ₹ 100.00 on each of our Concession Agreements in accordance with usual practice, if any demand for payment of a higher stamp duty or penalty is imposed, it would increase the costs of the Toll Roads.

In respect of above, NHAI has clarified that:

- (i) As on date, GST is not applicable on Concession Fee. However, if it becomes applicable at a later stage, this shall be considered as change in law.
- (ii) There is no requirement of stamp duty in case of Concession Agreements since Fee Rules provided for levy and collection of user fee and not toll tax. In case, in future any such demand arises, it shall be treated as change in law.

Escrow Account

The provisions in relation to the escrow account in the Abu Road – Swaroopganj Concession Agreement are only applicable if the obligations of the Concessionaire under the Abu Road – Swaroopganj Concession Agreement are financed by the Lenders.

The Concessionaire shall, prior to the Appointed Date, open and establish the escrow account with the escrow bank and all funds constituting the financing package related to the Abu Road – Swaroopganj Project shall be credited to such escrow account. During the Abu Road – Swaroopganj Concession Period all fees and any other revenues including the proceeds of any rentals, deposits, capital receipts or insurance claims from or in respect of the Abu Road – Swaroopganj Project Highway shall be deposited therein. In addition, all disbursements or payments by NHAI pursuant to the Abu Road – Swaroopganj Concession Agreement, including, if any, in relation to the change of scope in the Abu Road – Swaroopganj Project shall be deposited by NHAI in the escrow account.

Disbursements from Escrow Account

The Concessionaire shall give, at the time of the opening of the escrow account, irrevocable instructions by way of an escrow agreement substantially in form set forth in the Abu Road – Swaroopganj Concession Agreement to the escrow bank instructing, *inter alia*, that the deposits into the escrow account shall subject to the provisions of the Abu Road – Swaroopganj Concession Agreement, be appropriated in the following order every month and if not due in a month then appropriated proportionately in such month and retained in the escrow account and paid out therefrom in the month when due unless otherwise expressly provided in the instruction letter:

- i. all taxes due and payable by the Concessionaire for and in respect of the Abu Road – Swaroopganj Project Highway;
- ii. concession fee;
- iii. all payments relating to construction of the Abu Road – Swaroopganj Project Highway, subject to and in accordance with the conditions, if any, set forth in the financing agreements;
- iv. operation and maintenance expenses;
- v. operation and maintenance expenses and other costs and expenses incurred by NHAI in accordance with the provisions of the Abu Road – Swaroopganj Concession Agreement, and certified by NHAI as due and payable to it;

- vi. monthly proportionate provision of debt service payment due in an accounting year;
- vii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire; and
- viii. balance, if any, in accordance with the instructions of the Concessionaire.

Disbursements upon Termination

Notwithstanding anything to the contrary contained in the escrow agreement and subject to the provisions of the Abu Road – Swaroopganj Concession Agreement, in the case of termination, the amounts standing to the credit of the escrow account shall be disbursed towards:

- i. all taxes due and payable by the Concessionaire for and in respect of the Abu Road – Swaroopganj Project Highway;
- ii. payment due to the lenders;
- iii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire;
- iv. retention and payments relating to the liability for defects and deficiencies;
- v. incurred or accrued operation and maintenance expenses;
- vi. any other payments required to be made under the Abu Road – Swaroopganj Concession Agreement; and
- vii. balance, if any, in accordance with the instructions of the Concessionaire.

Change of Scope

NHAI may, notwithstanding anything to the contrary contained in the Abu Road – Swaroopganj Concession Agreement, require the Concessionaire to make alterations/ modifications in the scope of the Abu Road – Swaroopganj Project as contemplated by the Abu Road – Swaroopganj Concession Agreement. If the cumulative costs relating to all the change of scope orders exceed 5% of the concession fee in any continuous period of 3 years immediately preceding the date of such change of scope order or if such cumulative costs exceed 25% of the concession fee at any time during the Abu Road – Swaroopganj Concession Period, NHAI may award any works or services, to any person on the basis of open competitive bidding and the Concessionaire shall be entitled to take part in such competitive bidding with a right to match the first-ranked bid. All such changes shall be made by NHAI by an order issued in accordance with the procedure set forth in the Abu Road – Swaroopganj Concession Agreement.

Termination of the Abu Road – Swaroopganj Concession Agreement

Termination by either party

Either Party may in its discretion terminate the Abu Road – Swaroopganj Concession Agreement by giving a termination notice to the other party if a force majeure event subsists for a period of 120 days or more within a continuous period of 365 days. Before issuing such termination notice, the party intending to issue the termination notice shall inform the other party of such intention and grant 15 days' time to make a representation, and may after the expiry of such 15 days period, whether or not it is in receipt of such representation, in its sole discretion issue the termination notice.

Termination by the NHAI

In the event of any of the defaults specified below have occurred, and if the Concessionaire has failed to cure such breach or default within the period provided for the same in the Abu Road – Swaroopganj Concession Agreement, then NHAI shall be entitled to issue a notice of its intention to terminate the Abu Road – Swaroopganj Concession Agreement, with a copy to the lenders. The following events shall constitute an event of default by the Concessionaire (a “**Concessionaire Default**”) unless they have occurred as a result of any breach of the Abu Road

– Swaroopganj Concession Agreement by NHAI or due to force majeure:

- i. the performance security has been encashed and appropriated in accordance with the Abu Road – Swaroopganj Concession Agreement and the Concessionaire has failed to replenish or provide fresh performance security within a cure period of 15 days;
- ii. subsequent to the replenishment or furnishing of fresh performance security in accordance with the Abu Road – Swaroopganj Concession Agreement, the Concessionaire fails to cure, within a cure period of 60 days, the Concessionaire Default for which whole or part of the performance security was appropriated;
- iii. the Concessionaire abandons or manifests intention to abandon the operation and maintenance of the Abu Road – Swaroopganj Project Highway without the prior written consent of NHAI;
- iv. the Concessionaire fails to roll over, renew and furnish new bank guarantee performance security subject to and in accordance with terms of the Abu Road – Swaroopganj Concession Agreement, at least 3 months prior to expiry of subsisting bank guarantee;
- v. the Concessionaire is in breach of the Maintenance Requirements or the Safety Requirements;
- vi. the Concessionaire has failed to make any payment to NHAI within the period specified in the Abu Road – Swaroopganj Concession Agreement;
- vii. upon occurrence of a financial default, the lenders’ representative has by notice required NHAI to undertake suspension or termination, as the case may be, in accordance with the substitution agreement and the Concessionaire fails to cure the default within the specified cure period;
- viii. a breach of any of the project agreements by the Concessionaire causes a material adverse effect;
- ix. the Concessionaire creates any encumbrance in breach of the Abu Road – Swaroopganj Concession Agreement;
- x. the Concessionaire repudiates the Abu Road – Swaroopganj Concession Agreement or otherwise takes any action or evidences or conveys an intention not to be bound by the Abu Road – Swaroopganj Concession Agreement;
- xi. a change in ownership occurs in breach of the provisions of the Abu Road – Swaroopganj Concession Agreement;
- xii. there is a transfer, pursuant to law either of the rights and/or obligations of the Concessionaire under any of the project agreements, or of all or part of the assets or undertaking of the Concessionaire, and such transfer causes a material adverse effect;
- xiii. an execution levied on any of the assets of the Concessionaire has caused a material adverse effect;
- xiv. the Concessionaire is adjudged bankrupt or insolvent, or if a trustee or receiver is appointed for the Concessionaire or for the whole or material part of its assets that has a material bearing on the Abu Road – Swaroopganj Project;
- xv. the Concessionaire has been, or is in the process of being liquidated, dissolved, wound-up, amalgamated or reconstituted in a manner that would cause, in the reasonable opinion of NHAI, a material adverse effect;
- xvi. a resolution for winding up of the Concessionaire is passed or any petition for winding up of the Concessionaire is admitted by a court of competent jurisdiction and a provisional liquidator or receiver is appointed and such order has not been set aside within 90 days of the date thereof or the Concessionaire is ordered to be wound up by Court except for the purpose of amalgamation or reconstruction; provided that, as part of such amalgamation or reconstruction, the entire property, assets and undertaking of the Concessionaire are transferred to the amalgamated or reconstructed entity and that the amalgamated or reconstructed entity has unconditionally assumed the obligations of the Concessionaire under the Abu Road – Swaroopganj Concession Agreement and the project agreements; and provided that:

- a. the amalgamated or reconstructed entity has the capability and operating experience necessary for the performance of its obligations under the Abu Road – Swaroopganj Concession Agreement and the project agreements;
 - b. the amalgamated or reconstructed entity has the financial standing to perform its obligations under the Abu Road – Swaroopganj Concession Agreement and the project agreements and has a credit worthiness at least as good as that of the Concessionaire as at Appointed Date; and
 - c. each of the project agreements remains in full force and effect;
- xvii. any representation or warranty of the Concessionaire herein contained which is, as of the date hereof, found to be materially false, incorrect or misleading;
 - xviii. the Concessionaire submits to NHAI any statement, notice or other document, in written or electronic form, which has a material effect on NHAI's rights, obligations or interests and which is false in material particulars;
 - xix. the Concessionaire has failed to fulfil any obligation, for which failure termination has been specified in the Abu Road – Swaroopganj Concession Agreement;
 - xx. the Concessionaire commits a default in complying with any other provision of the Abu Road – Swaroopganj Concession Agreement if such default causes a material adverse effect on NHAI;
 - xxi. an escrow default occurs and the Concessionaire fails to cure the default within a cure period of 15 days;

Termination by Concessionaire

If any of the defaults specified below shall have occurred, and NHAI fails to cure such default within a cure period of 90 days or such longer period as has been expressly provided in the Abu Road – Swaroopganj Concession Agreement, NHAI shall be deemed to be in default of the Abu Road – Swaroopganj Concession Agreement, unless the default has occurred as a result of any breach of the Abu Road – Swaroopganj Concession Agreement by the Concessionaire or due to force majeure:

- i. NHAI commits a material default in complying with any of the provisions of the Abu Road – Swaroopganj Concession Agreement and such default has a material adverse effect on the Concessionaire; or
- ii. NHAI repudiates the Abu Road – Swaroopganj Concession Agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be bound by the Abu Road – Swaroopganj Concession Agreement.

Termination Payments

The termination payment pursuant to the Abu Road – Swaroopganj Concession Agreement becomes due and payable to the Concessionaire by NHAI within 15 days of the Concessionaire furnishing to NHAI an NOC issued by the lenders/ lenders' representative recording/ effecting release/ vacation/ discharge of the charge on Abu Road – Swaroopganj Project receivables (if any) created by Concessionaire for securing repayment of the debt. If NHAI fails to disburse the full termination payment within 15 days, NHAI shall pay interest at a rate equal to 3% above the bank rate on the amount of termination payment remaining unpaid.

Upon termination of the Abu Road – Swaroopganj Concession Agreement by the NHAI on account of occurrence of a Concessionaire Default, the NHAI shall pay the Concessionaire by way of termination payment 70% of the Unexpired Cash Flow.

Upon termination of the Abu Road – Swaroopganj Concession Agreement by the Concessionaire on account of occurrence of an NHAI Default, the Concessionaire shall be entitled to receive from NHAI by way of termination payment a sum equal to 105% of the Unexpired Cash Flow.

Technical Clarifications on the Concession Agreements

For details in relation to the technical clarifications received from NHAI in relation to the Concession Agreements,

please refer to “Annexure D - Technical clarifications on the Concession Agreements” on page 6670.

5. Concession Agreement between Concessionaire and NHAI dated March 30, 2021 in respect of the Palanpur Abu Road Project

The Concessionaire has entered into a concession agreement for operation, maintenance, and management of the Palanpur Abu Road Project Highway (as defined below) on toll, operate and transfer (TOT) basis (the “**Palanpur Abu Road Concession Agreement**”), for a period of 30 years from the Appointed Date (i.e., the date on which all Conditions Precedent have been satisfied. NHAI has, *vide* letter dated August 5, 2021, extended the date for satisfying the Concessionaire’s Conditions Precedent to October 31, 2021) or such date on which the Palanpur Abu Road Concession Agreement is terminated by a termination notice (“**Palanpur Abu Road Concession Period**”).

Certain Definitions

“**Palanpur Abu Road Project**” means the operation and maintenance of the Palanpur Abu Road Project Highway in accordance with the provisions of the Palanpur Abu Road Concession Agreement and includes all works, services and equipment relating to or in respect of the scope of the Palanpur Abu Road Project as set forth in the Palanpur Abu Road Concession Agreement;

“**Palanpur Abu Road Project Assets**” means all physical and other assets relating to and forming part of the Site including (a) rights over the Site in the form of licence, Right of Way or otherwise; (b) tangible assets such as civil works and equipment including foundations, embankments, pavements, road surface, interchanges, bridges, culverts, road overbridges, drainage works, traffic signals, sign boards, kilometre- stones, toll plazas, electrical systems, communication systems, rest areas, relief centers, maintenance depots and administrative offices; (d) all rights of the Concessionaire under the project agreements; (e) security deposits; (f) insurance proceeds; and (g) Applicable Permits and authorisations relating to or in respect of the Palanpur Abu Road Project Highway, but does not include Additional Facilities; and

“**Palanpur Abu Road Project Highway**” means the Site comprising the existing road comprising:

Stretch	State	Start (Km)	End (Km)	Length
Palanpur/Khemana- Abu Road	Gujarat and Rajasthan	601.000	646.000	45.000

and all Palanpur Abu Road Project Assets.

Grant of Concession

Subject to and in accordance with the terms and conditions set forth in the Palanpur Abu Road Concession Agreement, NHAI has granted to the Concessionaire, and the Concessionaire has accepted the concession for a period of 30 years, including the exclusive right, license and authority during the subsistence of the Palanpur Abu Road Concession Agreement to operate, manage and maintain the Palanpur Abu Road Project Highway.

Subject to and in accordance with the terms and conditions set forth in the Palanpur Abu Road Concession Agreement, the Concessionaire is entitled to undertake the following in accordance with the terms of the Palanpur Abu Road Concession Agreement, applicable laws and applicable permits:

- i. Right of Way, access and license to the Site for the purpose of and to the extent conferred by the provisions of the Palanpur Abu Road Concession Agreement;
- ii. manage, operate and maintain the Palanpur Abu Road Project Highway and regulate the use thereof by third parties in accordance with terms hereof;
- iii. demand, collect and appropriate the fees from vehicles and persons liable for payment of fees for using the Palanpur Abu Road Project Highway or any part thereof and refuse entry of any vehicle to the Palanpur Abu Road Project Highway if the fee due is not paid;

- iv. perform and fulfill all of the Concessionaire's obligations under and in accordance with the Palanpur Abu Road Concession Agreement;
- v. bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the Concessionaire under the Palanpur Abu Road Concession Agreement; and
- vi. neither assign, transfer or sublet or create any lien or encumbrance on the Palanpur Abu Road Concession Agreement, or the concession granted thereby, or on the whole or any part of the Palanpur Abu Road Project Highway nor transfer, lease or part possession thereof, save and except as expressly permitted by the Palanpur Abu Road Concession Agreement.

Fees

The Concessionaire is entitled to, during the Palanpur Abu Road Concession Period, levy, collect and appropriate fees from users of the Palanpur Abu Road Project Highway pursuant to and in accordance with the provisions in the Palanpur Abu Road Concession Agreement and the Fee Rules and to appropriate the same. In accordance with the terms of the Palanpur Abu Road Concession Agreement, the Concessionaire shall not collect any fees in relation to exempted vehicles. The fees collected by Concessionaire shall be deposited in the escrow account and appropriated in accordance with the relevant provisions of the Palanpur Abu Road Concession Agreement.

Sub Rule 6(6) of the above-mentioned Fee Rules states,

“

(a) The fee shall be collected by the Central Government or the executing Authority as the case may be and for a specified period in accordance with the terms of agreement entered by the Concessionaire.

(b) The fee as notified as per Concession Agreement shall be leviable till the end of the concession period and after the Concession Agreement is over, the fee shall be collected by the Central Government executing authority at a reduced rate of 40% of the fee on the date of transfer of such section of National Highways, bridge, tunnel or bypass, as the case may be, to be revised annually in accordance with these rules:

Provided that after the recovery of capital cost through user fee realised, in respect of a public funded project, the fee leviable would be reduced to 40% of the user fee for such section of National Highways, bridge, tunnel or bypass as the case may be, to be revised annually in accordance with these rules.”

In respect of the above, NHAI has clarified that Rule 6 of the Fee Rules provides that the user fee to be notified by Government as per the format of Schedule M of Concession Agreement shall be leviable till the end of the concession period. Hence, the user fee rate shall only be reduced after the concession period is over.

Concession Fees

As consideration for the grant of the Concession, the Concessionaire is required to pay a concession fee to NHAI equivalent to ₹ 1,146.50 crore as a Condition Precedent. The Concessionaire agrees that payment of the concession fee constitutes essential condition of the Concession Agreement.

For the purposes of stamp duty payment, concession agreements are generally considered to be agreements which are not lease deeds and stamp duty of ₹ 100.00 is typically paid for such concession agreements. However, stamp duty authorities of certain states in India have issued notices to some concessionaires alleging inadequate stamp duty on the concession agreements executed between the concessionaires and the NHAI. The stamp authorities allege that since concession agreements relate to the letting of tolls to the concessionaires in the form of leases, or as development agreements, such agreements were required to be stamped as lease agreements or development agreements, as applicable. The stamp duty for a lease agreement or a development agreement ranges between 1.0% and 11.0% of the annual rent or premium payable or the market value of the property. Furthermore, stamp duty authorities may impose penalties for payment of inadequate stamp duty, which could extend up to ten (10) times the amount of the stamp duty payable. Accordingly, concession agreements that have not been stamped as such could be considered to be inadequately stamped. The High Courts of Allahabad and Maharashtra have also held that a concession agreement ought to be stamped as a lease agreement and have upheld the imposition of a higher stamp duty on such agreements.

While we have paid stamp duty of ₹ 100.00 on each of our Concession Agreements in accordance with usual practice, if any demand for payment of a higher stamp duty or penalty is imposed, it would increase the costs of

the Toll Roads.

In respect of above, NHAI has clarified that:

- (i) As on date, GST is not applicable on Concession Fee. However, if it becomes applicable at a later stage, this shall be considered as change in law.
- (ii) There is no requirement of stamp duty in case of Concession Agreements since Fee Rules provided for levy and collection of user fee and not toll tax. In case, in future any such demand arises, it shall be treated as change in law.

Escrow Account

The provisions in relation to the escrow account in the Palanpur Abu Road Concession Agreement are only applicable if the obligations of the Concessionaire under the Palanpur Abu Road Concession Agreement are financed by the Lenders.

The Concessionaire shall, prior to the Appointed Date, open and establish the escrow account with the escrow bank and all funds constituting the financing package related to the Palanpur Abu Road Project shall be credited to such escrow account. During the Palanpur Abu Road Concession Period all fees and any other revenues including the proceeds of any rentals, deposits, capital receipts or insurance claims from or in respect of the Palanpur Abu Road Project Highway shall be deposited therein. In addition, all disbursements or payments by NHAI pursuant to the Palanpur Abu Road Concession Agreement, including, if any, in relation to the change of scope in the Palanpur Abu Road Project shall be deposited by NHAI in the escrow account.

Disbursements from Escrow Account

The Concessionaire shall give, at the time of the opening of the escrow account, irrevocable instructions by way of an escrow agreement substantially in form set forth in the Palanpur Abu Road Concession Agreement to the escrow bank instructing, *inter alia*, that the deposits into the escrow account shall subject to the provisions of the Palanpur Abu Road Concession Agreement, be appropriated in the following order every month and if not due in a month then appropriated proportionately in such month and retained in the escrow account and paid out therefrom in the month when due unless otherwise expressly provided in the instruction letter:

- i. all taxes due and payable by the Concessionaire for and in respect of the Palanpur Abu Road Project Highway;
- ii. concession fee;
- iii. all payments relating to construction of the Palanpur Abu Road Project Highway, subject to and in accordance with the conditions, if any, set forth in the financing agreements;
- iv. operation and maintenance expenses;
- v. operation and maintenance expenses and other costs and expenses incurred by NHAI in accordance with the provisions of the Palanpur Abu Road Concession Agreement, and certified by NHAI as due and payable to it;
- vi. monthly proportionate provision of debt service payment due in an accounting year;
- vii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire; and
- viii. balance, if any, in accordance with the instructions of the Concessionaire.

Disbursements upon Termination

Notwithstanding anything to the contrary contained in the escrow agreement and subject to the provisions of the Palanpur Abu Road Concession Agreement, in the case of termination, the amounts standing to the credit of the escrow account shall be disbursed towards:

- i. all taxes due and payable by the Concessionaire for and in respect of the Palanpur Abu Road Project

- Highway;
- ii. payment due to the lenders;
- iii. all payments and damages certified by NHAI as due and payable to it by the Concessionaire;
- iv. retention and payments relating to the liability for defects and deficiencies;
- v. incurred or accrued operation and maintenance expenses;
- vi. any other payments required to be made under the Palanpur Abu Road Concession Agreement; and
- vii. balance, if any, in accordance with the instructions of the Concessionaire.

Change of Scope

NHAI may, notwithstanding anything to the contrary contained in the Palanpur Abu Road Concession Agreement, require the Concessionaire to make alterations/ modifications in the scope of the Palanpur Abu Road Project as contemplated by the Palanpur Abu Road Concession Agreement. If the cumulative costs relating to all the change of scope orders exceed 5% of the concession fee in any continuous period of 3 years immediately preceding the date of such change of scope order or if such cumulative costs exceed 25% of the concession fee at any time during the Palanpur Abu Road Concession Period, NHAI may award any works or services, to any person on the basis of open competitive bidding and the Concessionaire shall be entitled to take part in such competitive bidding with a right to match the first-ranked bid. All such changes shall be made by NHAI by an order issued in accordance with the procedure set forth in the Palanpur Abu Road Concession Agreement.

Termination of the Palanpur Abu Road Concession Agreement

Termination by either party

Either Party may in its discretion terminate the Palanpur Abu Road Concession Agreement by giving a termination notice to the other party if a force majeure event subsists for a period of 120 days or more within a continuous period of 365 days. Before issuing such termination notice, the party intending to issue the termination notice shall inform the other party of such intention and grant 15 days' time to make a representation, and may after the expiry of such 15 days period, whether or not it is in receipt of such representation, in its sole discretion issue the termination notice.

Termination by the NHAI

In the event of any of the defaults specified below have occurred, and if the Concessionaire has failed to cure such breach or default within the period provided for the same in the Palanpur Abu Road Concession Agreement, then NHAI shall be entitled to issue a notice of its intention to terminate the Palanpur Abu Road Concession Agreement, with a copy to the lenders. The following events shall constitute an event of default by the Concessionaire (a “**Concessionaire Default**”) unless they have occurred as a result of any breach of the Palanpur Abu Road Concession Agreement by NHAI or due to force majeure:

- i. the performance security has been encashed and appropriated in accordance with the Palanpur Abu Road Concession Agreement and the Concessionaire has failed to replenish or provide fresh performance security within a cure period of 15 days;
- ii. subsequent to the replenishment or furnishing of fresh performance security in accordance with the Palanpur Abu Road Concession Agreement, the Concessionaire fails to cure, within a cure period of 60 days, the Concessionaire Default for which whole or part of the performance security was appropriated;
- iii. the Concessionaire abandons or manifests intention to abandon the operation and maintenance of the Palanpur Abu Road Project Highway without the prior written consent of NHAI;
- iv. the Concessionaire fails to roll over, renew and furnish new bank guarantee performance security subject to and in accordance with terms of the Palanpur Abu Road Concession Agreement, at least 3 months prior to expiry of subsisting bank guarantee;

- v. the Concessionaire is in breach of the Maintenance Requirements or the Safety Requirements;
- vi. the Concessionaire has failed to make any payment to NHAI within the period specified in the Palanpur Abu Road Concession Agreement;
- vii. upon occurrence of a financial default, the lenders' representative has by notice required NHAI to undertake suspension or termination, as the case may be, in accordance with the substitution agreement and the Concessionaire fails to cure the default within the specified cure period;
- viii. a breach of any of the project agreements by the Concessionaire causes a material adverse effect;
- ix. the Concessionaire creates any encumbrance in breach of the Palanpur Abu Road Concession Agreement;
- x. the Concessionaire repudiates the Palanpur Abu Road Concession Agreement or otherwise takes any action or evidences or conveys an intention not to be bound by the Palanpur Abu Road Concession Agreement;
- xi. a change in ownership occurs in breach of the provisions of the Palanpur Abu Road Concession Agreement;
- xii. there is a transfer, pursuant to law either of the rights and/or obligations of the Concessionaire under any of the project agreements, or of all or part of the assets or undertaking of the Concessionaire, and such transfer causes a material adverse effect;
- xiii. an execution levied on any of the assets of the Concessionaire has caused a material adverse effect;
- xiv. the Concessionaire is adjudged bankrupt or insolvent, or if a trustee or receiver is appointed for the Concessionaire or for the whole or material part of its assets that has a material bearing on the Palanpur Abu Road Project;
- xv. the Concessionaire has been, or is in the process of being liquidated, dissolved, wound-up, amalgamated or reconstituted in a manner that would cause, in the reasonable opinion of NHAI, a material adverse effect;
- xvi. a resolution for winding up of the Concessionaire is passed or any petition for winding up of the Concessionaire is admitted by a court of competent jurisdiction and a provisional liquidator or receiver is appointed and such order has not been set aside within 90 days of the date thereof or the Concessionaire is ordered to be wound up by Court except for the purpose of amalgamation or reconstruction; provided that, as part of such amalgamation or reconstruction, the entire property, assets and undertaking of the Concessionaire are transferred to the amalgamated or reconstructed entity and that the amalgamated or reconstructed entity has unconditionally assumed the obligations of the Concessionaire under the Palanpur Abu Road Concession Agreement and the project agreements; and provided that:
 - a. the amalgamated or reconstructed entity has the capability and operating experience necessary for the performance of its obligations under the Palanpur Abu Road Concession Agreement and the project agreements;
 - b. the amalgamated or reconstructed entity has the financial standing to perform its obligations under the Palanpur Abu Road Concession Agreement and the project agreements and has a credit worthiness at least as good as that of the Concessionaire as at Appointed Date; and
 - c. each of the project agreements remains in full force and effect;
- xvii. any representation or warranty of the Concessionaire herein contained which is, as of the date hereof, found to be materially false, incorrect or misleading;
- xviii. the Concessionaire submits to NHAI any statement, notice or other document, in written or electronic form, which has a material effect on NHAI's rights, obligations or interests and which is false in material particulars;
- xix. the Concessionaire has failed to fulfil any obligation, for which failure termination has been specified in the Palanpur Abu Road Concession Agreement;

- xx. the Concessionaire commits a default in complying with any other provision of the Palanpur Abu Road Concession Agreement if such default causes a material adverse effect on NHAI;
- xxi. an escrow default occurs and the Concessionaire fails to cure the default within a cure period of 15 days;

Termination by Concessionaire

If any of the defaults specified below shall have occurred, and NHAI fails to cure such default within a cure period of 90 days or such longer period as has been expressly provided in the Palanpur Abu Road Concession Agreement, NHAI shall be deemed to be in default of the Palanpur Abu Road Concession Agreement, unless the default has occurred as a result of any breach of the Palanpur Abu Road Concession Agreement by the Concessionaire or due to force majeure:

- i. NHAI commits a material default in complying with any of the provisions of the Palanpur Abu Road Concession Agreement and such default has a material adverse effect on the Concessionaire; or
- ii. NHAI repudiates the Palanpur Abu Road Concession Agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be bound by the Palanpur Abu Road Concession Agreement.

Termination Payments

The termination payment pursuant to the Palanpur Abu Road Concession Agreement becomes due and payable to the Concessionaire by NHAI within 15 days of the Concessionaire furnishing to NHAI an NOC issued by the lenders/ lenders' representative recording/ effecting release/ vacation/ discharge of the charge on Palanpur Abu Road Project receivables (if any) created by Concessionaire for securing repayment of the debt. If NHAI fails to disburse the full termination payment within 15 days, NHAI shall pay interest at a rate equal to 3% above the bank rate on the amount of termination payment remaining unpaid.

Upon termination of the Palanpur Abu Road Concession Agreement by the NHAI on account of occurrence of a Concessionaire Default, the NHAI shall pay the Concessionaire by way of termination payment 70% of the Unexpired Cash Flow.

Upon termination of the Palanpur Abu Road Concession Agreement by the Concessionaire on account of occurrence of an NHAI Default, the Concessionaire shall be entitled to receive from NHAI by way of termination payment a sum equal to 105% of the Unexpired Cash Flow.

Technical Clarifications on the Concession Agreements

For details in relation to the technical clarifications received from NHAI in relation to the Concession Agreements, please refer to “Annexure D - Technical clarifications on the Concession Agreements” on page 6670.

INFORMATION CONCERNING THE UNITS

Unit holding of the Trust

Particulars	Number of Units
Units issued and outstanding prior to this Offer	10,051,485
Units issued and outstanding after this Offer	595,200,000*

**Subject to finalization of Basis of Allotment and allotment of Units to Sponsor*

Unitholders holding more than 5% of the Units

Sr. No.	Name of Unit Holders	Pre-Offer		Post-Offer	
		Number of Units	Percentage of holding (%)	Number of Units**	Percentage of holding (%)
1.	The Sponsor	10,051,485	100.00	95,600,000	16.06
2.	2452991 Ontario Limited	-	-	148,800,000	25.00
3.	CPP Investment Board Private Holdings (4) Inc.	-	-	148,800,000	25.00
4.	SBI Retirement Benefit Fund - Aggressive Hybrid Plan*	-	-	59,400,000	9.98
5.	SBI Balanced Advantage Fund*	-	-		

** This represents the unitholding of SBI Retirement Benefit Fund – Aggressive Hybrid Plan and SBI Balanced Advantage Fund on the basis of the same PAN being assigned to both, SBI Retirement Benefit Fund – Aggressive Hybrid Plan and SBI Balanced Advantage Fund.*

*** Subject to finalization of Basis of Allotment*

Unitholding of the Sponsor, Investment Manager, Project Manager and Trustee

The Sponsor shall hold 95,600,000 Units, as disclosed above. The Trustee, Project Manager and the Investment Manager do not hold any Units and shall not acquire any Units in this Offer.

Unitholding of the directors of the Investment Manager

As on the date of this Final Placement Memorandum, none of the directors of the Investment Manager hold any Units or propose to hold any Units.

Sponsor lock-in

In terms of the InvIT Regulations, the Sponsor shall hold at least 15% of Units on a post-Offer basis, aggregating to 89,280,000 Units, which shall be locked-in for a period of three years from the date of listing of the Units, subject to the conditions specified in the InvIT Regulations. Further, the unitholding of the Sponsor, exceeding 15% on a post-Offer basis, aggregating to 6,320,000 Units*, shall be locked-in for a period of not less than one year from the date of listing of the Units.

USE OF PROCEEDS

The gross proceeds of the Offer are ₹ 50,459.60 million and the Net Proceeds are ₹ 50,274.58 million. The Net Proceeds will be utilised towards the following objects:

- Infusion of debt/equity into the Project SPV: The proceeds of the debt/equity infused into the Project SPV shall be utilized by the Project SPV for: (a) part payment of (i) initial estimated concession value to the Sponsor, in terms of the Concession Agreements; (ii) initial improvement cost; (iii) major maintenance cost; (iv) upfront fees to various agencies, as applicable; (b) creation and maintenance of debt service reserve account, if any; and/or (c) creation and maintenance of major maintenance reserve, if any; and/or any (d) any general corporate purposes; and
- General purposes.

The details of the Net Proceeds are set forth in the following table:

(In ₹ million)

Particulars	Estimated Amount
Gross proceeds of the Offer	50,459.60
Less: Offer related and other expenses to be borne by the Trust	185.04
Net Proceeds	50,274.56

Requirements of Funds

The Net Proceeds are proposed to be used in accordance with the details provided in the following table:

(In ₹ million)

Sr. No.	Particulars	Amount
1.	Infusion of debt/equity into to the Project SPV: The proceeds of the debt/equity infused into the Project SPV shall be utilized by the Project SPV for: (a) part payment of (i) initial estimated concession value to the Sponsor; (ii) initial improvement cost; (iii) major maintenance cost; (iv) upfront fees to various agencies, as applicable; (b) creation and maintenance of debt service reserve account, if any; and/or (c) creation and maintenance of major maintenance reserve, if any	50,059.60
2.	General purposes	214.96
	Total	50,274.56

We believe that the infusion of the funds into the Project SPV, in order to meet its obligations under the Concession Agreements, will enable the Project SPV to acquire the necessary rights under the Concession Agreements and make subsequent distributions to Unitholders. Accordingly, we believe that the proposed infusion of funds will be beneficial to the Trust and to Unitholders.

The fund requirements mentioned above and the proposed deployment are based on the estimates of the Investment Manager and have not been appraised by any bank, financial institution or any other external agency. The fund requirements may vary due to factors beyond the Investment Manager's control, such as market conditions and competitive environment. Consequently, the fund requirements are subject to revisions in the future at the discretion of the Investment Manager. In the event of any shortfall of funds for the activities proposed to be financed out of the Net Proceeds as stated above, the Investment Manager may re-allocate the Net Proceeds to the activities where such shortfall has arisen, subject to compliance with applicable law.

Details of Utilisation of Net Proceeds

The details of utilisation of the Net Proceeds are set forth herein below:

Infusion of debt/equity into to the Project SPV

The Trust proposes to utilise an estimated aggregate amount of ₹ 50,059.60 million from the Net Proceeds to provide loans ("**Project SPV Facilities**") to the Project SPV in terms of the Project SPV Facility Agreements. In

accordance with applicable law, and the authorization of the Board of Directors of the Investment Manager, the Trust may additionally utilise a portion of the Net Proceeds towards infusion of equity into the Project SPV. The actual amount to be invested into the Project SPV by way of equity infusion, if any, may be decided by the IM Board in their discretion.

Additionally, the Trust has also entered into a loan agreement dated September 29, 2021, with certain lenders for availing loans amounting to approximately ₹ 20,000.00 million (“**Trust Loans**”). For details in relation to the terms of the Trust Loans, including its purpose, please see the section entitled “*Financial Indebtedness and Deferred Payments*” on page 226.

The Project SPV will utilize the funds raised through the Project SPV Facilities towards (a) payment of (i) initial estimated concession value to the Sponsor, in terms of the Concession Agreements; (ii) initial improvement cost; (iii) major maintenance cost; (iv) upfront fees to various agencies, as applicable; (b) creation and maintenance of debt service reserve account, if any; and/or (c) creation and maintenance of major maintenance reserve, if any, and/or (d) any general corporate purposes. For details of the Concession Agreements, please see the section entitled “*Summary of the Concession Agreements*” on page 194.

General Purposes

In terms of the InvIT Regulations, the Investment Manager shall, at its discretion, deploy the balance Net Proceeds aggregating to ₹ 214.96 million towards general expenses for the operation of the Trust, subject to such utilization not exceeding 10% of the Net Proceeds, in compliance with the InvIT Regulations. The general purposes for which the Trust proposes to utilize Offer Proceeds include meeting exigencies and expenses incurred, by way of the Trust in the ordinary course of business. In addition, the Trust may utilize the Offer Proceeds towards other expenditure (in the ordinary course of business) considered expedient and as approved by the Investment Manager or the Trustee, as the case may be, subject to compliance with applicable law.

In case of a shortfall in Net Proceeds, the Investment Manager may, in compliance with the InvIT Regulations, have the flexibility to meet such shortfall including, by utilising the Trust’s internal accruals or availing facilities from lenders. The Investment Manager will have flexibility in utilizing the proceeds earmarked for general purposes. The Investment Manager, in accordance with the investment objectives of the Trust, policies of its board of directors and the InvIT Regulations, will have flexibility in utilising any surplus amounts.

Offer Expenses

The total expenses of this Offer are estimated to be approximately ₹ 185.04 million. The Offer expenses consist of fee and commissions payable to the Lead Managers, fee payable to legal counsels, fee payable to Escrow Collection Bank and Registrar to the Offer, printing and stationery expenses, and all other incidental and miscellaneous expenses for listing the Units on the Stock Exchanges. All remaining expenses in relation to the Offer (other than the aforementioned Offer expenses which shall be borne by the Trust) shall be borne by the Sponsor. For ease of operations, if required, the expenses of the in relation to the Offer as stated above, at the outset, may be borne by the Sponsors on behalf of the Trust, and the Investment Manager (on behalf of the Trust) agrees that it will reimburse the Sponsor for all such expenses as may be incurred by the Sponsor. The break-up for the Offer expenses is as follows:

(In ₹ million)

Activity	Estimated expenses	As a % of the total estimated Offer expenses	As a % of the total Offer size
Fee and commission to advisors to this Offer (including GST)	123.84	66.93%	0.24%
Fee payable to others (including GST)	61.20	33.07%	0.12%
Total estimated Offer expenses	185.04	100.00%	0.36%

FINANCIAL INDEBTEDNESS AND DEFERRED PAYMENTS

As on the date of this Final Placement Memorandum, except as stated below, the Trust or the Project SPV does not have any outstanding or sanctioned fund-based facilities. However, as on date of this Final Placement Memorandum, the Trust has not drawn down any amounts pursuant to any loan arrangement.

Status of lender consents

As on date of this Final Placement Memorandum, neither the Trust nor the Project SPV has availed any borrowings. As a result, the requirement to obtain consents from lenders in relation to this Offer does not arise.

Borrowings of the Trust

The Trust has entered into a loan agreement dated September 29, 2021, with certain lenders for availing loans amounting to approximately ₹ 20,000.00 million (“**Trust Loans**”). The principal terms of the Trust Loans to be availed by the Trust are as follows:

Parameter	Description
Borrower	National Highways Infra Trust (“ Trust ”)
Sponsor	National Highways Authority of India
Project Manager	National Highways Invit Project Managers Private Limited
Investment Manager	National Highways Infra Investment Managers Private Limited
Project SPV	National Highways Infra Projects Private Limited
Lenders	State Bank of India, Axis Bank Limited and Bank of Maharashtra
Facility Agent	State Bank of India
Security Trustee	SBICAP Trustee Company Limited
Obligors	(a) the Trust; (b) the Project SPV; and (c) any other person who provides any Security, or guarantee or any other contractual comfort in terms of the Finance Documents.
Facilities	collectively, Facility A, Facility B and the Working Capital Facilities, for an aggregate principal amount not exceeding INR 2000,00,00,000 (Indian Rupees Two Thousand Crores only)
Facility A	Rupee facility for an aggregate principal amount not exceeding INR 1480,00,00,000 (Indian Rupees One Thousand Four Hundred and Eighty Crores only) to be availed by the Trust from the Lenders.
Facility B	Rupee facility for an aggregate principal amount not exceeding INR 520,00,00,000 (Indian Rupees Five Hundred and Twenty Crores only) to be availed by the Trust from Axis Bank Limited and Bank of Maharashtra with the Working Capital Facilities, as its sub-limits.
Working Capital Facilities	collectively, the BG Facility and the LC Facility.
LC/BG Facility	the letter of credit/ bank guarantee facility aggregating up to INR 20,00,00,000 (Indian Rupees Twenty Crores only) being extended as a sub-limit of Facility B.
Facility Agreement	The facility agreement dated September 29, 2021 executed between the Trust, the Facility Agent and the Lenders with respect to the Facilities.
Facility Agreement Date	September 29, 2021

Parameter	Description
Availability Period of Facilities	<p>(a) with respect to Facility A, unless extended by the respective Lenders, the period commencing from the Facility Agreement Date and terminating on the earlier of:</p> <ul style="list-style-type: none"> (i) 30 September 2021, or such other extended date as may be extended in writing by the respective Lenders; or (ii) the date on which Facility A is fully drawn down/utilised; or (iii) the date on which Facility A is cancelled or terminated in accordance with the provisions of the Facility Agreement. <p>(b) with respect to Facility B, unless extended by the respective Lender, the period commencing from the first drawdown date of Facility A and terminating on the earlier of:</p> <ul style="list-style-type: none"> (i) 24 (twenty four) months from the date of first drawdown date of Facility A, or such other extended date as may be extended in writing by the respective Lenders; or (ii) the date on which Facility B is fully drawn down; or (iii) the date on which Facility B is cancelled or terminated in accordance with the provisions of the Facility Agreement. <p>(c) with respect to the Working Capital Facilities, the dates or timelines as specified in the agreement(s) to be entered into between the Trust and the Working Capital Facility Lender, prior to availing any of the Working Capital Facilities (“WC Product Schedule”), and as may be renewed from time to time pursuant to the same being mutually agreed in writing between the Trust and the Working Capital Facility Lender.</p>
Maturity Date	Earlier of (i) the date falling 19 years 6 months from the first drawdown date; and (ii) March 31, 2041.
Repayment	In 78 (seventy eight) structured quarterly instalments
Project(s)	<p>Following projects housed by the Project SPV:</p> <ul style="list-style-type: none"> (a) Maharashtra – Karnataka Border to Belgaum section of the National Highway no. 48 (old National Highway no. 4) from 515.00 kms to 592.705 kms (total 77.705 kms) in the state of Karnataka; (b) Palanpur – Abu Road section of the National Highway no. 27 from 601.000 kms to 646.000 kms (total 45.000 kms) in the states of Gujarat/Rajasthan; (c) Abu Road – Swaroopganj section of the National Highway no. 27 from 646.000 kms to 676.000 (total 31.000 kms) in the state of Rajasthan; (d) Chittorgarh – Kota and Chittorgarh Bypass section of the National Highway no. 27 from 891.929 kms to 1052.429 kms (total 160.500 kms) in the state of Rajasthan; and (e) Kothakota Bypass – Kurnool section of the National Highway no. 44 from 135.469 kms to 211.000 kms (total 74.622 kms) in the state of Telangana.
Lenders’ Consultants	The Lenders shall have the right to appoint Lenders’ traffic consultant (if any), Lenders’ independent engineer, the Lenders’ insurance advisor, Lenders’ environment consultant and the Lenders’ legal counsel and any other consultant as may be required by the Lenders during the currency of the Facilities. Any costs and expenses, fees and other moneys that are payable in relation to such appointment will be required to be borne by the Trust.
Escrow Bank for the Project SPV	State Bank of India
Escrow Bank for the Trust	State Bank of India

Parameter	Description
Trust Escrow Account	Account(s) maintained with the Trust Escrow Bank where all amounts received from the Project SPV shall be deposited.
Purpose	<p>The Facilities shall be utilized by the Trust in the following manner:</p> <ul style="list-style-type: none"> (a) Facility A shall be utilised by the Trust for on lending to the Project SPV. (b) Facility B shall be utilised by the Trust for the following purposes: <ul style="list-style-type: none"> (i) towards initial capital expenditure incurred by the Trust; (ii) towards providing loans and advances to the Project SPV; (iii) towards funding the major maintenance reserve and for on lending to the Project SPV which the Project SPV shall utilise towards any expenses that it may incur other expenses that may be incurred by the Project SPV; (iv) towards funding the DSRA required to be maintained by the Trust in terms of the Facility Agreement; and (v) towards meeting the transaction related expenses. (c) BG Facility being provided by the Working Capital Facility Lender shall be utilised by the Trust towards any performance bank guarantee. (d) LC Facility being provided by the Working Capital Facility Lender shall be utilised by the Trust towards any letter of credit requirements for purchase of equipment (such as toll equipment) for the purpose of the Projects and any other requirements as per the Concession Agreements.
Interest	Effective rate of interest of 7.20% p.a. linked to the MCLR of respective Lenders plus spread, with monthly rests
Security	<p>The obligations of the Trust under the Facilities, all interest and other monies in respect thereof shall be secured on a <i>pari-passu</i> basis, amongst the Lenders participating in the Facilities, by a first ranking security interest including, but not limited to following:</p> <ul style="list-style-type: none"> (a) a first ranking <i>pari passu</i> charge over the Trust's immovable assets (if any), both present and future; (b) a first ranking <i>pari passu</i> charge over: (i) all tangible movable assets of the Trust, including moveable plant and machinery, machinery spares, tools and accessories, furniture, fixtures, vehicles, all other movable assets, inventories, securities, equipment, book debts, operating cash flows, scheduled and unscheduled receivables and revenues, commissions, revenues of whatsoever nature and wherever arising both present and future; (ii) all receivables of the Trust, both present and future; (iii) the intellectual property rights of the Trust, both present and future; (iv) all rights, titles, interests, benefits, claims and demands, whatsoever of the Trust in any real estate and leasehold rights held by the Trust, both present and future; (v) all rights, title, interest, benefits, claims and demands whatsoever of the Trust under all insurance contracts and insurance proceeds, both present and future; (vi) all rights, titles, interests, benefits, claims and demands, whatsoever of the Trust in respect of the escrow account and all sub-accounts thereunder, and all other assets, and securities which represent amounts lying in or to be credited in such accounts / sub-accounts and any amounts lying therein; (vii) all rights, titles, interest, benefits, claims and demands, whatsoever of the Trust against the Project SPV and/or the Projects including in all facilities to be granted by the Trust to the Project SPV (including the interest and principal repayments

Parameter	Description
	<p>thereof) and the rights of substitution and termination available to the Trust in relation to the Projects; and</p> <p>(c) a first ranking <i>pari passu</i> charge over the equity shares held by the Trust in the Project SPV, subject to compliance of Sections 19(2) and (3) of the Banking Regulations Act, 1949</p>
Undertakings from the Trust	<p>The Trust is required to undertake, <i>inter alia</i>, the following:</p> <p>(a) save and except for any sale or disposal of any assets of the Project SPV as permitted under the Finance Documents, the Trust shall neither sell, assign, mortgage or otherwise dispose of any of the assets of the Trust without the prior approval from the Lenders;</p> <p>(b) the Trust shall create and perfect (if required) the Security Interest over the Security in accordance with the timelines stipulated under the Facility Agreement;</p> <p>(c) the Trust shall not effect any change in the shareholding and exercise direct control over the Project SPV;</p> <p>(d) the Trust shall not create any Security Interest (save and except for any permitted security interest) over its assets nor provide any guarantee without the prior written approval of the Lenders. Provided that the Trust may provide guarantees for securing any financial indebtedness availed by any new project SPV that it may acquire in compliance with the terms of the Finance Documents, without any recourse to the cash flows of the Trust and/or the Project SPV, the secured assets, the Project SPV secured assets and the Projects;</p> <p>(e) the Trust shall ensure that its cash flows (including all receivables) shall be exclusively deposited in the Trust escrow account in accordance with the terms of the Trust escrow agreement and the Trust shall ensure that the cash flows of Project SPV shall be deposited in the Project SPV escrow account(s) in accordance with the terms of the escrow agreements;</p> <p>(f) it shall ensure that the Project SPV shall not abandon the Projects during the subsistence of the Facilities;</p> <p>(g) upon any default by the Project SPV leading to a termination or substitution in relation to any or all of the Projects as per the provisions of the relevant Concession Agreement(s), the Trust in its capacity as the 'lenders' representative' (<i>as defined in the respective Concession Agreement</i>) shall act on the instructions of the Lenders or any trustee or agent acting for and on behalf of the Lenders) for exercising rights of termination or substitution as available to it as a lender of the Project SPV, in accordance with the Project SPV Financing Agreements, subject to the terms of the respective Concession Agreement;</p> <p>(h) for undertaking any withdrawals from the Trust Escrow Account, the Trust shall comply with the waterfall mechanism as set out in the Trust escrow agreement;</p> <p>(i) except as may be provided in the terms of the Finance Documents, no Person has any security interest over the assets and/or the cash flows of the Project SPV other than the Trust or its agent, trustee or nominee under the Project SPV Facility Agreements;</p> <p>(j) unless otherwise expressly permitted by the Facility Agent in writing, the Trust shall not make any restricted payments at any time, unless each of the restricted payment conditions (as set out in the Finance Documents) are complied with to the satisfaction of the Facility Agent and in the manner set out in the Finance Documents;</p> <p>(k) the debt cap shall not be more than 49% (forty nine percent);</p> <p>(l) the Trust shall comply with the provisions of the InvIT Regulations in accordance with the timelines stipulated thereunder;</p>

Parameter	Description
	<p>(m) the Trust shall not undertake a change of the Project Manager, the Investment Manager, the Trustee and/or the Sponsor without the prior written approval of the Lenders;</p> <p>(n) the Trust shall appoint the Lenders' Consultants as per the scope of services approved by the Lenders. All costs and expenses will be borne by the Trust;</p> <p>(o) the Trust shall and shall ensure that the Obligors comply with their obligations under the Finance Documents;</p> <p>(p) the Trust shall not exercise any right to call an event of default in relation to the Project SPV Facilities extended by it;</p> <p>(q) the Trust shall not file and/or initiate any recovery suit, insolvency proceeding, liquidation proceeding, resolution process or any other similar process under the IBC or any other Law, against itself, until the Final Settlement Date;</p> <p>(r) the Trust shall immediately (unless otherwise provided under the Facility Agreement) provide the Lenders such information, certification and data as may be required by the Lenders or any agency appointed by the Lenders;</p> <p>(s) the Trust shall not make any modifications/alterations to the Trust Documents which are inconsistent with the terms of the Finance Documents and may adversely affect the rights of the Lenders;</p> <p>(t) save and except as set out in the Base Case Business Plan, the Trust shall not and shall ensure that the Project SPV does not undertake any expansion of any of the Projects without the prior approval of the Lenders;</p> <p>(u) the Trust shall open and maintain the DSRA with the Trust Escrow Bank in accordance with the Finance Documents;</p> <p>(v) the Trust shall not undertake any acquisition of any new project and/or new project SPV, if such proposed acquisition is not in compliance with the acquisition conditions set out in the Finance Documents. Further, any permitted indebtedness required to be incurred for undertaking any such acquisition shall be in compliance with the conditions set out in the Finance Documents;</p> <p>(w) the Trust shall ensure that no person whose name appears in the list of wilful defaulters (in accordance with the extant guidelines issued by the RBI or any credit information companies) shall be inducted on the governing board of the Trust, and if such a person is found on the governing board, the Trust shall take expeditious and effective steps for removal of the person from its governing board. Notwithstanding anything contained herein, Clause 7.6(y) shall not apply to any nominee director appointed by the Lenders in accordance with the terms of the Finance Documents;</p> <p>(x) upon the occurrence of default under the Project SPV Facility Agreements, such that the said default results in an event of default, the Trust agrees that the Lenders shall have the right to instruct the Trust to enforce the Security Interest (if any) created pursuant to such Project SPV Facility Agreements and the Trust agrees to act in accordance with the instructions given by the Lenders in this regard;</p> <p>(y) the Trust shall ensure that any financial obligation of the Trust associated with the Project which is payable in foreign currency in any form at present or in future shall at all times be fully hedged;</p> <p>(z) the Trust shall ensure that the Project SPV secured assets shall be held exclusively for the benefit of the Lenders and it shall not enforce the security interest created over the Project SPV secured assets, unless expressly requested by the Lenders and any enforcement proceeds received in relation thereto shall be held by the Trust in trust for the benefit of the Lenders; and</p> <p>(aa) the Trust shall ensure, among other things, that:</p>

Parameter	Description
	<ul style="list-style-type: none"> (A) the Sponsor shall continue to act as the sponsor as per Regulation 2(zz) of the InvIT Regulations and that there shall be no change in the Sponsor, without the prior approval of the Lenders; (B) the Sponsor shall continue to hold at least 51% (fifty one percent) of the shareholding in the Investment Manager; (C) the Sponsor and the Project SPV do not abandon the Projects; (D) any liability (including in relation to any group contribution) of the Trust and/or the Project SPV towards the Sponsor or any other Unit Holders shall be subordinated to the Facilities; and (E) the Project SPV shall enter into requisite EPC Contracts, operations and maintenance agreements and major maintenance agreements as required pursuant to the Concession Agreements.
Undertakings from the Project SPV	<p>The Project SPV is required to undertake, <i>inter alia</i>, the following:</p> <ul style="list-style-type: none"> (a) To open the Escrow Account with the Project SPV account bank prior to the first Drawdown Date; (b) To not incur any financial indebtedness (without the prior approval of the Lenders) except the indebtedness permitted under the Finance Documents and any bank guarantee facilities to be issued in favour of a telecom authority or as performance security in favour of the Sponsor, and any letter(s) of credit to be issued for the purchase of any toll equipment; (c) To ensure that the Project SPV Escrow Bank transfers the amounts from the Project SPV escrow account(s) to the Trust's escrow account on the terms set out in the Finance Documents. (d) To ensure that the prior approval of the Lenders is procured before undertaking any amendment to the Project Documents, which results in (A) a material amendment or material modification to the Project Documents; (B) non-compliance with the Base Case Business Plan; (C) affects the ability of the Obligors to perform their obligations and/or or enforce any right, benefit, privilege or remedy under the Finance Documents and / or Project Documents, to which they are a party; or (D) affects the ability of any Secured Party to exercise its rights or enforce any remedies available to it under any of the Finance Documents; (e) The Project SPV Facility Agreements entered into between the Trust and the Project SPVs shall have a definite repayment schedule. (f) Upon the occurrence of any default by the Project SPV leading to a termination or substitution in relation to any or all of the Projects as per the provisions of the relevant Concession Agreement(s), the Trust in its capacity as the 'lenders' representative' (as defined in the respective Concession Agreement)) shall act on the instructions of the Lenders or any trustee or agent acting for and on behalf of the Lenders) for exercising rights of termination or substitution as available to it as a lender of the Project SPV, in accordance with the financing documents executed by, inter alios, the Project SPV; (g) The amount of Project SPV Facilities lent by the Trust to the Project SPV in its capacity as a 'lender' (as defined under the Concession Agreements) shall be higher than the Secured Obligations payable by the Trust in relation to the Facilities; and (h) The Project SPV escrow agreements to be executed by all parties (except NHAI) prior to the first Drawdown Date of Facility A. The Project SPV shall ensure that the Substitution Agreements are executed within 90 (ninety) days from the first Drawdown Date of Facility A. Further, the Project SPV shall ensure that NHAI shall execute the

Parameter	Description
	Escrow Agreements within 90 (ninety) days from the first drawdown date of Facility A.
Base Case Business Plan	The consolidated business plan of the Trust (including the cash flows from the Project SPV) setting out, <i>inter alia</i> , the Trust's assumptions for the Project SPV, updated from time to time in accordance with the Facility Agreement, which shall be in line with the requirements under the Project Documents and mutually agreed between the Trust and the Facility Agent.
Project Documents	collectively, the following documents: <ul style="list-style-type: none"> (a) the concession agreements of the Project SPV; (b) the substitution agreements executed between the Project SPV, the Sponsor and the Trust; (c) the escrow agreements executed between the Project SPV, the Sponsor and the Project SPV Escrow Bank; (d) all the insurance contracts of the Project SPV in relation to the respective Projects; (e) documents of title in relation to the Projects, if any; (f) engineering, procurement and construction contracts in relation to the Projects; (g) all authorisations in relation to the Projects; (h) operation and maintenance agreements and major maintenance agreements for routine as well as periodic maintenance, if any; (i) any bonds, guarantees, letters of credit or any other security issued in relation to any of the Project Documents set out in points (a)-(h) above; (j) any other agreements, documents or instruments entered into by the Project SPV or by any person in its favour in respect of the Projects and mutually designated as "Project Documents" by the Facility Agent and the Trust.
Trust Documents	collectively, the following: <ul style="list-style-type: none"> (a) the trust deed dated October 19, 2020 executed between the Sponsor and IDBI Trusteeship Services Limited ("Trustee"), as amended and modified from time to time ("Trust Deed"); (b) the investment management agreement dated October 21, 2020 executed between, <i>inter alios</i>, the Trustee and the Investment Manager, as amended and modified from time to time; (c) the project implementation agreement dated March 30, 2021 entered into by the Trustee (on behalf of the Trust), the Investment Manager and the Project Manager, with the Project SPV, which sets out the obligations of the Project Manager with respect to operation, maintenance, implementation and management of the Project SPV, as may be amended, modified and/or supplemented from time to time; and (d) such other documents as may be required to be executed by the Trust from time to time and mutually designated as such by the Lenders and the Trust.
Finance Documents	collectively, the following: <ul style="list-style-type: none"> (a) the Facility Agreement; (b) the Security trustee agreement for appointment of the Security Trustee; (c) the Security documents in relation to the Security mentioned in the Security clause of this termsheet; (d) agreement for assignment; (e) the escrow agreement to be executed by the Trust;

Parameter	Description
	<ul style="list-style-type: none"> (f) the Trust's confirmation to the inter-creditor agreement of the Lenders, if any; (g) the undertaking from Investment Manager; (h) the undertaking from the Project SPV; (i) the negative lien undertaking from the Project SPV; (j) the corporate guarantee to be issued by the Project SPV; (k) any assignment / novation deed; (l) the WC Product Schedule; and (m) any other document designated as "Finance Document" under the Facility Agreement and/or mutually designated as such by the Facility Agent and the Trust.
Transaction Documents	collectively, the Project Documents, the Trust Documents and the Finance Documents.
Voluntary Prepayment	<ul style="list-style-type: none"> (a) The Trust shall be entitled to prepay the outstandings with respect to the Facilities, in full or in part, at any time during the term of the Facilities, subject to prior written notice of at least 30 (Thirty) days being provided to the Lenders. Prepayment premium at the rate of 0.5% (zero point five percent) shall be payable on such voluntary prepayment. (b) If the increase in the spread in accordance with the terms of the Facility Agreement is not acceptable to the Trust, the Trust shall be entitled to prepay the outstanding Facilities without any prepayment premium provided the Trust has issued an irrevocable notice (within 30 (thirty) days from the date on which the Spread was increased) to prepay the loan within 180 (One Hundred and Eighty) days commencing from the date on which the spread was increased. (c) No prepayment premium will be payable if prepayment is made out of the cash accruals of the Project SPV, provided the Trust has issued an irrevocable notice (of at least 15 (fifteen) days prior to the date of such prepayment) to prepay the loans. (d) The Trust may prepay the outstandings in full or in part, without being required to pay any prepayment premium, if the same is being made at the instance of the Lenders. (e) The Trust may prepay the outstandings in full or in part, without being required to pay any prepayment premium, if the same is being made from any internal accruals of the Trust or from the funds of the Unit Holders, provided the Trust has issued an irrevocable notice (of at least 30 (thirty) days from the date of such prepayment) to prepay the loans. (f) If any Lender does not consent to the sharing of the Security with the lenders of any Permitted Indebtedness (except for the Facilities) that may be availed by the Borrower in compliance with the terms of this Agreement and the Permitted Indebtedness Conditions, then the Borrower may prepay the Loans of such Lender in full, without being required to pay any Prepayment Premium provided the Borrower has issued an irrevocable notice (of at least 30 (thirty) days prior to the date of such prepayment) to prepay such Loans. <p>Any amounts prepaid in the manner above (other than pursuant to (b) and (c) above shall be paid to all the Lenders on a pro rata basis, except that if any particular Lender entitled to a prepayment specifically notifies the Trust waiving such right of prepayment ("Waiving Lender"), then the Trust shall not be required to make any prepayment to such Lender and the Trust will be required to prepay only such amounts to the other Lenders, which would have been payable to them had the Waiving Lender not waived its right of prepayment otherwise provided under the terms of this Agreement.</p>

Parameter	Description
	Any amounts pursuant to above shall be paid to the relevant Lenders shall be applied in inverse order of maturity.
Mandatory Prepayment	<p>The Trust shall be required to mandatorily prepay the outstanding Facilities (in full or part, as the context may require), without being required to pay any prepayment premium , immediately upon receipt of the following amounts received by and on behalf of the Project SPV, and/or the Trust, and in any case no later than within 15 (fifteen) days from the occurrence of the events set out below, including in accordance with the Trust escrow agreement:</p> <ul style="list-style-type: none"> (a) any insurance proceeds received by the Project SPV pursuant to the insurance contracts, and if such insurance proceeds are of an amount which is in excess of INR 1,00,00,000 (Indian Rupees One Crore only) (and as certified by an independent practicing chartered accountant) and which are not utilized towards the repair, renovation, restoration or reinstatement of the affected Project assets; (b) any proceeds from the disposal of any assets of the Project SPV (such disposal being subject to the terms of the Finance Documents or upon the Trust obtaining the prior written consent from the Lenders), if such proceeds, whether in aggregate in the Financial Year or individually, are in an amount which is in excess of INR 1,00,00,000 (Indian Rupees One Crore only) and which are not utilized for replacement of such assets of the Project SPV pursuant to which they were received; (c) amounts in the nature of liquidated damages or penalties received by the Project SPV under any Project Documents after adjusting for the additional interest payable to the Lenders, liquidated damages required to be paid under any Project Documents to the extent that such amounts are not applied for meeting any performance rectification arising on account of non-performance by various contractors under the Project Documents; (d) the proceeds resulting from an arbitral award or judicial order in connection with any of the Project Documents and the Trust Documents; (e) any proceeds in connection with a breach of warranty or guarantee under any Project Document to the extent not applied to repair or defect that is the subject of such warranty; (f) any proceeds resulting from the expiration, termination or revocation of any authorisation under the Project Documents or from any termination payments received from the Sponsor under the Project Documents; (g) any proceeds from nationalisation, compulsory acquisition, expropriation, , seizure or other similar events with respect to any part of the Projects or the Project assets, unless the Lenders approve that such proceeds shall be utilised towards the reinstatement of such part of the Projects. <p>Any amounts prepaid in the manner above (other than pursuant to (i) above shall be paid to all the Lenders on a pro rata basis, except that if any particular Lender entitled to a prepayment specifically notifies the Trust waiving such right of prepayment (“Waiving Lender”), then the Trust shall not be required to make any prepayment to such Lender and the Trust will be required to prepay only such amounts to the other Lenders, which would have been payable to them had the Waiving Lender not waived its right of prepayment otherwise provided under the terms of this Agreement.</p> <p>Any amounts pursuant to above shall be applied in the inverse order of maturity.</p>

Parameter	Description
Restricted Payment	<p>The following have been identified as restricted payments in the Facility Agreement:</p> <ul style="list-style-type: none"> (a) the authorisation, declaration or payment of any distributions including dividends, interest, pass through income to a Unit Holder or any other form of cash flows on share capital, shareholder units, inter-corporate deposits, quasi equity availed from the Sponsor, Unit Holders, associate companies and/or any strategic investors; and (b) capital reduction, <p>all of which may, in any event, be made on a quarterly basis on an RPC Compliance Date, in accordance with and subject to the provisions of the Facility Agreement and the Trust escrow agreement, as the case may be. Provided however that any payment in relation to the Project SPV Facilities, or payment of any fees payable to the Investment Manager and/or the Security Trustee shall be permitted and not fall within the definition of Restricted Payments.</p> <p>The above-mentioned restricted payments shall be permitted on a quarterly basis subject to compliance with certain restricted payment conditions which include the following:</p> <ul style="list-style-type: none"> (a) the Trust has paid the interest and/or repayment instalments and/or other charges due and payable under the Finance Documents; (b) the Trust has demonstrated the availability of liquidity equivalent for major maintenance funding requirements for all Projects being operated by the Project SPV, either in the form of earmarked cash or availability on credit facilities for the said amounts as mandated in cash flow waterfall mechanism set out in the Project SPV escrow agreement; (c) all reserves, including the DSRA Amount and the major maintenance reserve (in accordance with the Base Case Business Plan) as required on the immediately succeeding due date, are maintained and replenished in accordance with the Finance Documents and the Trust escrow agreement, to the satisfaction of the Lenders; (d) no Event of Default has occurred and is continuing or will be caused due to the making of the relevant Restricted Payment. (e) no Material Adverse Effect in respect of the Project SPV has occurred or continuing or will be cause due to making of the relevant Restricted Payment; (f) no breach of Financial Covenants has occurred or is continuing or will be caused due to making of the relevant Restricted Payment; (g) the relevant Restricted Payment is permitted by Law; and (h) the cash sweep pursuant to the occurrence of any Cash Sweep Trigger Event has been completed in accordance with the Finance Documents prior to the payment of the relevant Restricted Payment. <p>Any payment in relation to the Project SPV Facilities, or payment of any fees payable to the Investment Manager and/or the Security Trustee shall be permitted and not fall within the definition of Restricted Payments.</p>
Events of Default	<p>The occurrence of, <i>inter alia</i>, any one of the following events shall constitute an event of default:</p> <ul style="list-style-type: none"> (a) Any default by the Trust in the payment of the principal amounts on any due date, subject to a cure period of 3 days in case such default is due to a technical issue.

Parameter	Description
	<ul style="list-style-type: none"> (b) Breach or default by the Obligors in the performance or observance of material terms and covenants of the Finance Documents, subject to a cure period of 30 days. (c) Occurrence of any material event or circumstance that is prejudicial to or materially imperils or materially depreciates or jeopardizes the Security created or to be created in favour of the Lenders, subject to a cure period of 30 days. (d) Any breach or default in the performance and/or observation of a financial covenant for 2 consecutive years. (e) Any downgrade in the Trust's credit rating to below AA- by any credit rating agency, where such downgrade if capable of being cured is not cured within a period of 180 (one hundred and eighty) days. (f) The Trust fails to obtain the final initial credit rating in relation to the Facilities and the proposed exposure within 6 months from the first drawdown date. (g) Any material misrepresentation, warranty or statement made by any Obligor in connection with any Finance Document to which it is party or in any other document delivered by or on behalf of or if under or in connection with any Finance Document, is or proves to have been substantially incorrect, untrue or misleading when made or deemed to be made, subject to a cure period of 30 days. (h) Any execution or distress being enforced or levied against whole or substantial part of the Trust's assets and any order obtained in relation thereto is not discharged, vacated or stayed within 30 days from the date of such enforcement or levy. (i) Abandonment of material activities being carried out by the Project SPV or abandonment of the Projects which materially impacts the obligation of the Trust under the Finance Documents. (j) Change in material activities being carried out by the Project SPV or a seizure of, or a change in, the Projects which materially impact the obligation of the Trust under the Finance Documents. (k) Occurrence of any event or circumstance which has or is likely to have a Material Adverse Effect, subject to a cure period of 30 days.
Consequences of Event of Default	<p>On and at any time after the occurrence of an Event of Default, the Lenders will be entitled to one or all of, including but not limited to, the following rights:</p> <ul style="list-style-type: none"> (a) declare all or any part of the outstandings to be immediately due and payable; (b) cancel the commitments (in part or in full) and accelerate all or a part of the payment obligations of the Trust under the Facility Agreement; (c) exercise their right to reset the spread, in addition to the right available to reset the spread on the relevant reset date under the terms of the Facility Agreement; (d) sue for creditor's process and/or exercise all or any rights (including the right to substitute/terminate assigned in their favour or the rights available to secured creditors or their agents and trustees under the Securitisation Act) in accordance with the Finance Documents,

Parameter	Description
	<p>including any enforcement of any Security towards repayment of the outstandings;</p> <p>(e) exercise any or all of its rights, remedies, powers or discretions under the Finance Documents, the inter-creditor agreement, Law or equity (including pursuant to any guidelines which may be stipulated by the RBI from time to time);</p> <p>(f) subject to laws (including the InvIT Regulations), convert the outstanding outstandings into Units of the Trust. The Trust shall facilitate the Lenders (including by way of obtaining the requisite consent of the unit holders);</p> <p>(g) take all such actions as may be provided in the RBI's restructuring circulars.</p> <p>(h) appoint 1 (one) Nominee Director on the board of directors of the Project SPV (subject to Laws and the terms of the Concession Agreements) or appoint a nominee on the board of directors of the Trust (subject to Laws) to protect the interests of the Lenders, till the event of default is cured, on the terms and conditions as more particularly set out under the Facility Agreement.</p> <p>(i) instruct the Trust to enforce the security interest created over the Project SPV secured assets in case of any default in the Project SPV Facilities.</p>
Conditions Precedent to Execution of the Facility Agreement	<p>The following conditions, <i>inter alia</i>, are required to be fulfilled by the Trust prior to execution of the Facility Agreement:</p> <p>(a) The Trust shall have provided certified true copies of the Trust Documents, certificate of registration as an InvIT.</p> <p>(b) The Trust shall have provided constitutional documents of the Investment Manager, certified true copy of the board resolution and specimen signatures of authorised signatories.</p> <p>(c) The Trust shall have provided constitutional documents of the Trustee, certified true copy of the board resolution and specimen signatures of authorised signatories.</p> <p>(d) The Trust shall have provided the credit rating letter issued by the credit rating agency along with a copy of the cover letter in relation thereto evidencing Trust's acceptance of the provisional initial credit rating.</p> <p>(e) The Trust shall have provided evidence that of tying up the envisaged loan requirements.</p>
Conditions Precedent to first Drawdown of Facility A and Facility B	<p>The following conditions, <i>inter alia</i>, are required to be fulfilled by the Trust prior to drawdown of Facility A and Facility B:</p> <p>(a) The Obligors shall have submitted all documents required as per the 'know your customer' policy of the Lenders.</p> <p>(b) The Trust and the Project SPV shall have provided certificates from their respective authorised signatory, statutory auditor, independent chartered accountant, company secretary, key managerial personnel in the manner stipulated in the Facility Agreement.</p> <p>(c) The Finance Documents (other than the documents required to be executed subsequently) shall have been executed.</p> <p>(d) A legal opinion from the Lenders' legal counsel addressed shall have been issued on the validity and enforceability of the Finance Documents.</p> <p>(e) Documents evidencing security creation and perfection (if any) shall have been submitted.</p>

Parameter	Description
	<ul style="list-style-type: none"> (f) The Trust shall have provided a certified copy of the comments / deemed approval obtained from the Sponsor for creation of the Corporate Guarantee, Negative Lien Undertaking and Project SPV Undertaking. (g) The Trust shall have paid all necessary fees, costs and expenses payable pursuant to the Finance Documents. (h) The Trust shall have provided evidence that all Concession Agreements in relation to the Projects shall have been executed. (i) The Trust and Project SPV escrow accounts shall have been opened and the Unit Holders shall have deposited funds for their total commitment (in full) for an amount not less than INR 5870,00,00,000 (Indian Rupees Five Thousand Eight Hundred Seventy Crores only) into the Trust escrow account in accordance with the Trust escrow agreement. (j) The Lenders shall have carried out a pre-disbursement visit of the Trust's premises. (k) Modifications required by the Lenders' legal counsel to the Project SPV Facility Agreements shall have been carried out. (l) The Trust shall have submitted an acknowledged copy of the application letter for certificate under Section 281 of the Income Tax Act, 1961 for itself and the Project SPV. (m) Certified true copy of the resolution passed by the unit holders of the Trust pursuant to Regulation 20, Regulation 22 and the other applicable regulations of the InvIT Regulations with respect to the Facilities and the Finance Documents
Additional Conditions Precedent to Drawdown of Facility B	<p>The following additional conditions, <i>inter alia</i>, are required to be fulfilled by the Trust prior to drawdown of Facility B:</p> <ul style="list-style-type: none"> (a) Appointment of the Lenders' consultants (other than the lenders' legal counsel) in consultation with the Lenders for such scope of work as may be decided by the Lenders. (b) Due diligence reports from the Lenders' independent engineer, Lenders' insurance advisor, the Lenders' environment consultant and the Lenders' legal counsel shall have been submitted by the Trust and all issues/concerns raised in such reports shall have been addressed to the satisfaction of the Lenders. (c) Evidence that all actions as per the environmental and social management system (ESMS) guidelines have been completed. (d) Certificate obtained from the Lenders' independent engineer validating the reasonableness of the operations and maintenance and the major maintenance assumptions made in relation to the Base Case Business Plan. (e) Evidence that the EPC Contracts and operations and maintenance contracts as required by the Lenders have been entered into between the Project SPV and the contractors.
Conditions Subsequent	<p>The Trust shall fulfil certain conditions including but not limited to the following:</p> <ul style="list-style-type: none"> (a) Execution of the share pledge agreement and the power of attorney in relation thereto within 90 (ninety) days from the first drawdown date.

Parameter	Description
	<ul style="list-style-type: none"> (b) Execution of the corporate guarantee and the substitution agreements, within 90 (ninety) days from the first drawdown date. (c) Execution of the escrow agreement by NHAI within 90 (ninety) days from the first drawdown date. (d) To obtain the final initial credit rating within 30 (ninety) days from the first drawdown date. (e) Provide a certified true copy of the no-objection certificate/permission of the assessing officer granted to the Trust under Section 281(1) of the Income Tax Act, 1961, immediately upon receipt thereof. (f) Evidence of the major maintenance reserve having been created as per the Base Case Business Plan and the Finance Documents.
End Use Certificate	The Trust shall furnish an end use certificate from the statutory auditor to the Facility Agent confirming that the proceeds have been utilised solely in accordance with the Purpose, no later than 30 (thirty) days from the respective drawdown.
Unconditional Cancellability Clause	<p>The Lenders will have the absolute and the unconditional right to cancel the undrawn, unavailed and the unused commitments under the Facilities, in whole or in part, at any time during the Availability Period, without giving any prior notice to the Trust, for any reason whatsoever, including but not limited to, on the occurrence of:</p> <ul style="list-style-type: none"> (a) in case of deterioration in the creditworthiness of the loan accounts of the Trust in any manner whatsoever; (b) in case the Facilities are not utilised by the Trust (in part or in full) within the Availability Period; and (c) in case of any non-compliance of any terms and conditions of the Finance Documents.
Governing Law and Jurisdiction	The Finance Documents shall be governed by the laws of India. Courts of Delhi shall have exclusive jurisdiction.
Increased Costs	The Trust is required to pay the Lenders, within 15 (fifteen) days of a demand made by the Lenders, unless required to be paid immediately by the Laws, any increased costs arising due to the implementation or imposition of any new reserve requirements or other measures by Government Agencies, including any change in capital adequacy norms, save and except for any change which is not otherwise factored in the applicable interest rate revised pursuant to the Facility Agreement.
Documentation	In addition to the terms and conditions contained in this termsheet, the final documentation will contain other customary/ additional stipulation/ clauses including but not limited to representations and warranties, affirmative covenants, negative covenants by the Obligors, indemnity, Security related clauses, assignability / transferability, illegality, taxations, costs and expenses, material adverse effect, mechanism for drawdown, appointment of Lenders' Consultants, etc.
Business Opportunity	State Bank of India, Axis Bank Limited and Bank of Maharashtra to be given preference (on a first right of offer basis) at least <i>pro rata</i> business relating, <i>inter alia</i> , to deposit, to undertake remittances, non-fund based transactions including any letters of credit/BGs, bills/cheque purchase, forex transactions and any interest rate or currency hedging business, merchant banking, any banking related business related to an IPO or an FPO, or other capital market transactions, services in relation cash management products, and availing of loans in relation to motor vehicles.

Borrowing Policy

The Investment Manager shall ensure that all funds borrowed in relation to the Trust are in compliance with the InvIT Regulations. Accordingly, the Investment Manager has formulated the borrowing policy to outline the process for borrowing monies in relation to the Trust. The key terms of the Borrowing Policy include the following:

1. The Investment Manager shall ensure that all funds borrowed in relation to the Trust are in compliance with the InvIT Regulations.
2. The Trust may raise debt and avail borrowings and deferred payments from time to time, including through issuance of debt securities and availing loans from banks and financial institutions in accordance with applicable law (including the InvIT Regulations). The Trust may issue debt securities in the manner specified by the SEBI, and in accordance with applicable law. In the event the aggregate consolidated borrowings and deferred payments (net of cash and cash equivalents) of the Trust, any holding company and the Project SPVs, exceed any thresholds prescribed under the InvIT Regulations in this regard, any further borrowings by the Trust shall be availed in accordance with the requirements prescribed under the InvIT Regulations, including any approval from Unitholders under Regulation 22 of the InvIT Regulations.
3. The Investment Manager shall ensure that if the value of funds borrowed from related parties in a financial year, exceeds 5% of the total consolidated borrowings of the Trust, any holding company and the Project SPV, approval from the Unitholders shall be obtained prior to entering into any such subsequent transaction with any related party, in accordance with Regulation 22 of the InvIT Regulations.
4. The Trust shall be permitted to borrow monies through any permitted means, by any instrument, in Indian or foreign currency, as permitted by applicable law, including as prescribed by the Reserve Bank of India. The Investment Manager and the Trustee (both on behalf of the Trust) shall be permitted to borrow monies in relation to the Trust, subject to the approval of its board of directors and such other committee of the board of directors of the Investment Manager as may be constituted in this regard.
5. The Trust also has the power to create, mortgage or secure any of its assets or provide guarantees in order to borrow funds. However, the Investment Manager shall not be allowed to create any obligation which would allow the liabilities to extend beyond the assets held by the Trust and/or the Project SPVs.
6. Except with prior approval of the Unitholders and obtaining any other approvals required under applicable law (including InvIT Regulations), any such obligation will not allow the Investment Manager to make the liabilities of the Trust or its Unitholders unlimited.
7. In addition to the above, any borrowing by any holding company or the Project SPV, incorporated under the Companies Act, 1956 or the Companies Act, 2013, will be in accordance with the conditions prescribed therein.
8. Any variation of this Policy shall be only with the approval of the Unitholders of the Trust and in accordance with the InvIT Regulations.
9. In case of any discrepancy, the provisions of applicable law shall prevail over the provisions of this Policy. Notwithstanding the above, this Policy will stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the Unitholders of the Trust.
10. *Disclosure and reporting:*
 - i. The Investment Manager shall disclose to the designated stock exchange(s) any additional borrowing, at level of Project SPV or the Trust, as per the requirements prescribed under the InvIT Regulations.

- ii. Details of changes during the year pertaining to borrowings or repayment of borrowings (standalone and consolidated) shall be disclosed in the annual report of the Trust as per the requirements prescribed under the InvIT Regulations.
- iii. Details of outstanding borrowings and deferred payments of InvIT including any credit rating(s), debt maturity profile, gearing ratios of the Trust on a consolidated and standalone basis shall be disclosed in the annual report of the Trust as per the requirements prescribed under the InvIT Regulations.

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FACTORS BY THE DIRECTORS OF THE INVESTMENT MANAGER AFFECTING THE FINANCIAL CONDITION, RESULTS OF OPERATIONS AND CASH FLOWS

Due to the nature of the Project SPV and the InvIT Assets, there is limited financial information available in respect of us which can be presented in this Final Placement Memorandum. Since our registration, we have not had any corporate activity and therefore do not believe that a discussion of our results of operations would be meaningful. No separate financial information, including actual revenue data for the InvIT Assets, are currently available, which could be used to clearly assess financial information, including revenue and expenses, in respect of each of the InvIT Assets. Accordingly, in lieu of combined financial statements of the Trust, the InvIT Assets and/or Project SPV, the revenue data that NHAI has historically collected through toll collection and maintenance contracts has been included in the section entitled "Asset Revenue Information" on page 313.

Furthermore, this limited historical revenue data available in respect of the InvIT Assets may not reflect their operation in the future and are not indicative of our expected future financial condition, results of operations or cash flows. Investors are cautioned that the lack of financial information in this Final Placement Memorandum may make it difficult to assess our financial position or future prospects or results of operations.

The following discussion is intended to convey management's perspective on our expected financial condition and results of operations.

This discussion contains forward-looking statements and reflects our current views with respect to future events and financial performance that involve risks and uncertainties. Actual results may differ materially from those discussed in or implied by any of the forward-looking statements as a result of various factors, including those listed under "Risk Factors" and "Forward-Looking Statements".

Overview of the Trust and Project SPV

The Sponsor settled the Trust on October 19, 2020, as a contributory irrevocable trust, pursuant to the Trust Deed, under the provisions of the Indian Trusts Act, 1882. The Trust was registered with SEBI on October 28, 2020, as an infrastructure investment trust under Regulation 3(1) of the InvIT Regulations having registration number IN/InvIT/20-21/0014.

The investment objectives of the Trust are to carry on the activity of and to make investments as an infrastructure investment trust as permissible in terms of the InvIT Regulations. The investment of the Trust shall only be in any manner permissible under, and in accordance with, the InvIT Regulations and applicable law, including in such holding companies and/or special purpose vehicles and/or infrastructure projects and/or securities in India as permitted under the InvIT Regulations.

The Project SPV was incorporated on July 23, 2020 for the purpose of entering into the Concession Agreements to acquire tolling rights from the Sponsor have been transferred to the Trust. The Trust has acquired ownership of the Project SPV. From the Appointed Date under each of the Concession Agreements, the Trust will take over the tolling operation of the following toll road assets (the "**Toll Roads**"):

- Palanpur/Khemana – Abu Road Project ("**Asset 1**"): Abu Road section of NH 27 with a total length of 45 kms, connecting the states of Gujarat and Rajasthan;
- Abu Road – Swaroopganj Project ("**Asset 2**"): Swaroopganj section of NH 27 with a total length of 31 kms, in the state of Rajasthan;
- Maharashtra Border – Belgaum Project ("**Asset 3**"): Belgaum – Kagal section of NH 48 with a total length of 77.7 kms, connecting the states of Karnataka and Maharashtra;
- Chittorgarh – Kota & Chittorgarh Bypass Project ("**Asset 4**"): Chittorgarh – Kota section of NH 27 with a total length of 160.50 kms, in the state of Rajasthan; and
- Kothakota Bypass – Kurnool Highway Project ("**Asset 5**"): Kothakota bypass – Kurnool of NH 44 with a total length of 74.6 kms, connecting the states of Telangana to Andhra Pradesh.

The Sponsor, Project Manager and the Project SPV have entered into a transitional support agreement for the purpose of the Sponsor providing the transitional support to (i) the Project Manager in respect of its obligations under the Project Implementation and Management Agreement, and (ii) the Project SPV in respect of its O&M obligations and tolling obligations (as provided under the Concession Agreements). The terms and conditions of

the transitional support agreement shall, in respect of each Concession Agreement and the Project Implementation and Management Agreement, be effective and binding on the Parties for a period of 6 (six) months commencing from the appointed date of the respective Concession Agreements, unless terminated earlier by mutual consent. Furthermore, the maintenance obligations of Asset 1 and Asset 2 would not be the obligation of the Trust until March 2024 and the maintenance obligations of the Trust for Asset 5 would start only after September 2026.

The Investment Manager has confirmed that the Trust shall have the ability to meet its working capital requirements for at least 12 months from the date of listing of the Units.

For more information, please see sections headed “*Formation Transactions in Relation to the Trust*” and “*Parties to the Trust – The Sponsor*” on pages 26 and 94 of this Final Placement Memorandum.

SEBI Exemptions

For the purposes of the Offer, our Sponsor requested SEBI for an exemption dated January 13, 2021 to allow for the relaxation of strict application of financial disclosure rules per the InvIT Regulations for the Sponsor and the Investment Manager (“**SEBI Exemption Request**”). The SEBI Exemption Request was made on the basis that (i) the Sponsor is incorporated under the NHAI Act and no historical consolidated financials are available for presentation in the Final Placement Memorandum and (ii) the Investment Manager has only recently been incorporated and hence no historical financial information is available in respect of the Investment Manager. SEBI accepted the request and granted an exemption through its letter dated February 12, 2021.

In addition, our Sponsor requested additional exemptions from SEBI in relation to a relaxation of the strict application of certain financial and operational disclosure requirements per the InvIT Regulations on the basis that no separate financial information, including actual revenue data for the InvIT Assets, are currently available, which could be used to clearly ascertain financial information including revenue and expenses in respect of each of the InvIT Assets. Pursuant to a SEBI exemption letter dated March 17, 2021, SEBI granted a number of additional exemptions, including in relation to the disclosure of cash flow and revenue figures for our assets, the disclosure of our full financial statements, and in relation to a discussion and analysis of the historical financial information pertaining to our assets.

Accordingly, only the following information is presented in this Final Placement Memorandum:

- The audited standalone financial information of the Trust for the period from its date of settlement, i.e. October 19, 2020, up to March 31, 2021, and for the three months period ended June 30, 2021;
- Projections of Revenue from Operations and Cash Flow from Operating Activities on page 349 of this Final Placement Memorandum;
- Summary financial information of the Sponsor, as of and for the financial years ended March 31, 2019, March 31, 2018 and March 31, 2017, derived from the audited standalone financial statements of the Sponsor for the respective years. Further, the unaudited limited review standalone financial results of the Sponsor for the financial year ended March 31, 2020, and the unaudited limited review standalone financial results of the Sponsor for the six months ended September 30, 2020, the unaudited limited review standalone financial results of the Sponsor for the financial year ended March 31, 2021, and the unaudited limited review standalone financial results of the Sponsor for the three months ended June 30, 2021, has been included. For further details, please see the sections entitled “*Summary Financial Information of the Sponsor*” on page 29;
- Summary financial information of the Investment Manager, as of and for the financial year ended March 31, 2021, derived from the audited standalone financial statements of the Investment Manager for the financial year ended March 31, 2021, and
- In lieu of the combined financial statements, of the Trust along with the InvIT Assets and/or SPV, the revenue data that NHAI has historically been collecting through toll collection and maintenance contracts, has been included in the section entitled “*Asset Revenue Information*” on page 313. This revenue data has been provided from April 1, 2018 till August 31, 2021, separately for each InvIT Asset, to the extent that such data is available for such InvIT Asset. The said amounts being collected are at times intermittent on account of gaps in tolling contract periods and would not be a true reflection of the revenue that these InvIT Assets are actually generating. Please refer to “*Risk Factors - We have no operating history and limited*

historical financial information and, as such, there are limited financial statements presented in this Final Placement Memorandum.” on page 61 in this regard.

The absence of meaningful historical operating data or financial statements may make it difficult for investors to evaluate our ability to operate, manage and maintain the Toll Roads and assess our financial position or future prospects or results of operations.

Recent Developments

The second wave of Covid-19 in India was accompanied by various local and state level curfews and lockdowns between April and June 2021. Although the second wave had a higher infection rates, the movement of traffic and goods was not impacted by the same magnitude as the first wave in 2020. In particular, because industrial and agricultural activities continued to operate, truck traffic did not fall as steeply as it did in the previous wave of the pandemic.

In August 2021, the Traffic Consultants were engaged to prepare updated reports assessing the impact of the second wave of COVID-19 on the Tolls Roads, including on certain of their traffic and revenue projections included in Annexure C.

With regard to Asset 1 and Asset 2, Steer Davies Gleave India Private Limited noted that April and May 2021 were negatively impacted across all vehicle categories, but the most significant impact was on personal vehicle categories. Between June and August 2021, both roads saw a strong recovery. Asset 3 was more negatively impacted, in particular at the Kognoli plaza which is closer to the Maharashtra-Karnataka border, due to stricter border crossing restrictions. Similar to Assets 1 and 2, car traffic was more severely impacted at Asset 3 compared to commercial traffic. Between June and August 2021, both toll plazas of Asset 3 saw a strong recovery, particularly for commercial vehicles. However, car traffic volumes continued to lag due to the border crossing restrictions that remained for personal movements. On the basis of the updated traffic observations following the second wave of the pandemic, and estimating the impact of a potential third wave, the projections of traffic and revenue for FY 23 for Assets 1, 2 and 3 were re-assessed by Steer Davies Gleave India Private Limited and determined to still be in line those set out in Annexure C.

In respect of Asset 4, Ramboll India Private Limited noted that traffic and revenue was negatively impacted in April and June 2021 due to state-wide lockdowns and curfews imposed following the second wave of the pandemic. In July and the first parts of August, passenger traffic recovered although freight traffic did not, potentially because of the closure of mines in the surrounding region due to rainy season and mine flooding. Asset 5 was similarly affected through June 2021, showing a strong recovery in both passenger and freight traffic in July 2021, likely reflecting pent-up demand after the relaxation of lockdowns. On the basis of these observations, Ramboll India Private Limited concluded that its projections of traffic and revenue for FY 23 for Assets 4 and 5 were still in line with those set out in Annexure C.

Significant Factors Affecting Our Results of Operations

We expect our results of operations, financial condition and liquidity to be influenced by the following events, facts, developments and market characteristics.

The terms of the Concession Agreements and traffic volumes

Toll fees are typically pre-determined with the relevant government entity and cannot be modified to reflect prevailing circumstances, other than annual adjustments to account for inflation as specified in the Concession Agreements. Accordingly, our profitability is largely a function of how effectively we manage costs during the concession period. Significant costs during the concession period include operating and maintenance expenses such as periodic maintenance which is required to be performed as specified in the Concession Agreement. Periodic maintenance involves the repair of wear and tear of the roads and highways, including overlaying the surface of the roads and highways, if required. For further details on the maintenance requirements for each of our projects, see the section headed “*Our Business*” in this Final Placement Memorandum. Our inability to effectively manage such operating and maintenance expenses during the concession period may have a material adverse effect on our profitability, financial condition and results of operations.

We are substantially dependent on the accuracy of the traffic volume forecasts for the respective Toll Road projects. Projects undertaken on a BOT basis involve Concession Agreements that are long-term in nature, usually

between 20 to 30 years. The agreed consideration for the Toll Road projects is based on, amongst other factors, forecasts of traffic volumes and expected revenues over the concession period. Any material shortfall between the actual traffic volume and the forecast traffic volume for a project could have a material adverse effect on our cash flows, results of operations and financial condition.

Our projects involve agreements that are long-term in nature. All long-term projects have inherent risks associated with them and involve variables that may not necessarily be within our control. Accordingly, we may be exposed to a variety of operation and maintenance and other risks, including unanticipated cost increases and overruns, inability to negotiate satisfactory arrangements with third parties, and disagreements with third parties. In addition, the long-term nature of our contracts may expose us to increased risk of unforeseen business and industry changes and developments which could have a material adverse effect on their business, financial condition and results of operations.

Toll revenues

The operation of toll roads principally involves collection of tolls and maintenance. Revenues from the Toll Roads will substantially comprise receipts collected at toll plazas from vehicles passing through the Toll Roads. Toll revenues generated by each of the Toll Roads will be subject to a number of factors, including traffic volume by vehicle categories, weight of the vehicle, applicable toll rates and distance travelled. The volume can vary with the location of the asset and the period of operation, as well as seasonal effects. Meanwhile, toll rates are ultimately determined by the Indian government in accordance with certain national laws and regulations. We anticipate a continuing increase in toll rates for the Toll Roads given the annual inflation-linked adjustment.

Operation and maintenance costs

We will be responsible for the operation and maintenance of the Toll Roads upon commencement of the respective concession. We expect to take over the operation and maintenance of the Chittorgarh – Kota & Chittorgarh Bypass Project and the Maharashtra Border – Belgaum Project immediately upon commencement of the Concession Period. However, with respect to the Palanpur/Khemana – Abu Road Project, Abu Road – Swaroopganj Project and the Kothakota Bypass – Kurnool Highway Project we will take over the operation and maintenance of these Toll Roads upon expiration of their existing BOT concessions on March 24, 2024, March 24, 2024, and September 15, 2026 respectively. Pursuant to each of the Concession Agreements, we will be required to ensure that the relevant Toll Road conforms to the maintenance requirements set forth in the Concession Agreements. For each Toll Road, we will be required to prepare an annual program of preventive, urgent and other scheduled maintenance to comply with the standards and requirements set out in the Concession Agreements.

Local state economies

We expect our financial results from the Toll Road to be dependent upon growth in the local state economies in which they are operated, namely Rajasthan, Gujarat, Telangana and Karnataka. We expect trends in the economic development and population growth of each of these states to have a direct impact on the traffic utilizing the Toll Road.

Access to and cost of financing

Our ability to obtain financing, as well as the cost of such financing, affects our business. Our ability to access such additional financing is subject to a variety of factors, including interest rates and other funding costs and market conditions. Any lack of access or higher costs in relation to additional financing that may be required by us could negatively impact our results of operations.

Arrangement with respect to future assets

We plan to make significant investments in toll road assets so as to expand our portfolio over the next several years. In accordance with the approval granted by the Chairman of NHAI, by way of communication dated March 29, 2021, the Sponsor will offer around 1,500 km of roads in three years to the Trust (“**Future Assets**”).

The process of identification of Future Assets, offer of Future Assets to Trust and completion of transfer of Future Assets to the Trust including valuation mechanism may be refined and/or modified in line with the internal policies of NHAI. Furthermore, the success of our portfolio expansion is limited by the availability of, and competition for, suitable projects, by our financial resources, including our available cash and borrowing capacity, by our

ability to integrate such acquired projects into our business and by other factors, some of which may be beyond our control. For more details, please see the section headed “*Risk Factors—The Sponsor is under no obligation to provide the Trust with access to future assets, and the Trust may be unable to bid effectively for them*” in this Final Placement Memorandum.

Competition

We operate in a competitive environment. The competition for toll road and other infrastructure projects varies depending on the size, nature and complexity of the project and on the geographical region in which the project is to be executed. Some of our competitors have greater financial resources, economies of scale and operating efficiencies than we do. There can be no assurance that we can effectively compete with its competitors in the future, and this failure to compete effectively may have a material adverse effect on our financial condition and results of operations.

Exchange rate fluctuations

Financial information disclosed in this Final Placement Memorandum and the Asset Revenue Information will be presented in Rupees, and our functional currency is Rupees. However, while we generate revenue in Rupees, we may purchase our equipment in both Rupees and foreign currency, including U.S. dollars. Additionally, if we incur external borrowings in currencies other than Rupees, we will be exposed to foreign currency exchange risk and, depending on the cross-currency issues of these foreign currencies and the Rupee, our combined financial statements may include distorted figures of expenses and, consequentially, profits or loss. Accordingly, our results of operations will be impacted by the strength of the U.S. dollar and other currencies as measured against the Rupee due to translational effect. To the extent that the Rupee strengthens or weakens against the U.S. dollar, or other currencies in which we interact, our combined results of operations will be affected.

Impact of COVID-19 on Toll Road projects

Following the lockdown as per Ministry of Home Affairs (MHA) guidelines, the Ministry of Road Transportation and Highways (MORTH) had suspended tolling on all national highways for a 21-day period that ended on April 14, 2020. The constrained vehicular movement in the run up to the lockdown due to Covid-19 followed by suspension of tolling pushed the toll collections into negative territory for financial year ended 2020. According to the Traffic Consultants, the performance of Toll Road projects declined during the nine months period ended December 31, 2020, owing to the dual impact of revision in axle load norms and the general slowdown in economy. As India faces the second wave of the pandemic, and the impact is not yet fully ascertainable, potential lockdowns across States in India, may constrain vehicular movements that will negatively impact toll collections at the Toll Roads.

Liquidity and Capital Resources

Pursuant to the Concession Agreements, we are required to pay certain concession fees and make certain improvement works to each of the Toll Road relating to overlay activities and construction of additional toll lanes, among other things. We expect to finance our operations for the next 12 months primarily from cash flow from the operation of the Toll Roads. We may also from time to time seek other sources of funding, which may include debt or equity financings, depending on our financing needs and market conditions.

Qualitative Disclosures About Market Risk

Market risk is the risk of loss arising from adverse changes in market rates and prices, such as foreign currency exchange rates and commodity prices. We do not hold or issue financial instruments for trading purposes and does not enter into derivative transactions that would be considered speculative positions. We intend to minimize our exposure to currency risk by minimizing our non-Rupee borrowings.

Interest Rate Risk

As the infrastructure development and construction business is capital intensive, we are exposed to interest rate risk. We expect the bulk of our borrowings to be at fixed rates of interest. Our borrowings are exposed to market risk relating to changes in interest rates upon any refinancing or additional financing. The debt financing proposed to be provided by the Trust to the Project SPV will be classified as senior debt under the Concession Agreement. This exposure to debt by the Project SPV could further lead to an increase in interest expense and could have an

adverse effect on the results of operations and financial condition. Although from time to time, we may exercise any rights available to us under these financing arrangements to terminate the existing debt financing arrangement on the respective reset dates and enter into new financing arrangements, there can be no assurance that we will be able to do so on commercially reasonable terms, that our counterparties will perform their obligations, or that these agreements, if entered into, will protect us adequately against interest rate risks.

Foreign currency exchange rate risk

Our foreign exchange risk primarily arises from movements of the Rupee against the U.S. dollar. Approximately 100% of our capital expenditures are denominated in Rupees. In addition, 100% of our borrowings are denominated in Rupees, with the remaining 0% denominated in U.S. dollars. Accordingly, our operating and financial results would be negatively affected when the Rupee depreciates against the U.S. dollar and interest rates in U.S. dollar increase. In addition, we may in the future enter into financing arrangements for foreign currency borrowings. We cannot assure you that we will be able to effectively mitigate the adverse impact of currency fluctuations and increases in international interest rates on our results of operation.

Liquidity Risk

We may not have sufficient cash flows to meet our operation and maintenance expense requirements and our financing obligations when they come due. We manage liquidity risks by forecasting projected cash flows. Management closely monitors our future and contingent obligations and set up required cash reserves as necessary in accordance with internal requirements.

DISTRIBUTION

Statements contained in this section entitled “Distribution” that are not historical facts are forward-looking statements. Such statements are subject to certain risks and uncertainties that could cause actual results to differ materially from those that may be projected. Under no circumstances should the inclusion of such information herein be regarded as a representation, warranty or prediction with respect to the accuracy of the underlying assumptions by the Trust, the Trustee, the Sponsor, the Investment Manager, the Lead Managers or any other person. Bidders are cautioned not to place undue reliance on these forward-looking statements that are stated only as at the date of this Final Placement Memorandum. For details, please see the section entitled “Forward-Looking Statements” on page 20. For details on the risks relating to distribution, please see the section entitled “Risk Factors” on page 61.

A. Preamble

The Distribution Policy (the “**Policy**”), aims to outline the process and procedure for distribution in relation to the Trust.

- B. The net distributable cash flows of the Trust (the “**Distributable Income**”) shall be based on the cash flows generated from the underlying operations undertaken by the Project SPV (being National Highways Infra Projects Private Limited) held by the Trust.
- C. Distributions may be made from the monies received by the Trust, in accordance with the provisions of the InvIT documents and applicable law.
- D. In terms of the InvIT Regulations, the Project SPV shall distribute not less than 90% of the net distributable cash flows to the Trust in the proportion of its holding in the Project SPV, subject to applicable provisions of the Companies Act, 2013 or Limited Liability Partnership Act, 2008, each as amended.
- E. In the event any infrastructure assets is sold by the Trust or any Project SPV or if the equity shares or interest in any Project SPV is sold by the Trust, then in accordance with the InvIT Regulations:
 - if the Trust proposes to re-invest the sales proceeds into any other infrastructure asset, it shall not be required to distribute any sales proceeds to the Unitholders or the Trust; and
 - if the Trust proposes not to invest the sales proceeds into any other infrastructure asset within a period of one year, it shall be required to distribute the same in accordance with the InvIT Regulations.
- F. The Trust shall distribute at least 90% of the Distributable Income to its unitholders (“**Unitholders**”). Such distribution shall be declared and made such that the time period between any two declarations of distribution shall not exceed one year. In accordance with the InvIT Regulations, distributions by the Trust shall be made no later than 15 days from the date of such declarations. The distribution, when made, shall be made in Indian Rupees.
- G. All distributions to the Unitholders shall be made in compliance with the InvIT Regulations, Income-tax Act, 1961 (“**IT Act**”) and other applicable laws.
- H. The Distributable Income and the net distributable cash flows of any Project SPV shall be calculated in accordance with the InvIT Regulations. The indicative method of calculating net distributable cash flows for the Project SPV and the Trust is provided below:

Calculation of net distributable cash flows at any HoldCo and/or SPV level: -

Profit after tax as per profit and loss account (standalone) (A)
Add: Depreciation, impairment and amortisation as per profit and loss account. In case of impairment reversal, same needs to be deducted from profit and loss.
Add/Less: Decrease/(increase) in working capital as per Ind AS 7
Add: Interest paid on loan/non-convertible debentures issued to Trust
Add/less: Loss/gain on sale of infrastructure assets
Add: NHAI Interest and NHAI Premium Provision
Add: Proceeds from sale of infrastructure assets adjusted for the following:

<ul style="list-style-type: none"> related debts settled or due to be settled from sale proceeds; directly attributable transaction costs; proceeds reinvested or planned to be reinvested as per Regulation 18(7)(a) of the InvIT Regulations
Add: Proceeds from sale of infrastructure assets not distributed pursuant to an earlier plan to re-invest, if such proceeds are not intended to be invested subsequently, net of any profit / (loss) recognised in profit and loss account
Less: Capital expenditure, if any
Add/less: Any other item of non-cash expense / non cash income (net of actual cash flows for these items), including but not limited to <ul style="list-style-type: none"> any decrease/increase in carrying amount of an asset or a liability recognised in profit and loss account on measurement of the asset or the liability at fair value; interest cost as per effective interest rate method (difference between accrued and actual paid); deferred tax; unwinding of Interest cost on interest free loan or other debentures; portion reserve for major maintenance which has not been accounted for in profit and loss statement; reserve for debenture/ loan redemption (Excluding any reserve required by any law or as per lender's agreement)
Less: Reserve for debentures / loans / capex expenditure in the intervening period till next proposed distribution if deemed necessary by the Investment Manager invested in permitted investments
Less: Repayment of external debt (principal) / redeemable preference shares / debentures, etc. (Excluding refinancing) / net cash set aside to comply with DSRA requirement under loan agreements
Less: Total NHAI Premium including interest and principal payment
Less: Cash Strap / Reserves requirements by Lenders / Rating Agencies
Total Adjustments (B)
Net Distributable Cash Flows (C)=(A+B)

Calculation of net distributable cash flows at the consolidated Trust level

Cash flows received from the Portfolio Assets in the form of interest
Cash flows declared /received from the Portfolio Assets in the form of dividend
Any other income accruing at the Trust level and not captured above, including but not limited to interest/return on surplus cash invested by Trust
Cash flows received from the Portfolio Assets towards the repayment of the debt issued to the Portfolio Assets by Trust
Proceeds from the Portfolio Assets for a capital reduction by way of a buy back or any other means as permitted, subject to applicable law
Proceeds from sale of assets of the Portfolio Asset not distributed pursuant to an earlier plan to re-invest, or if such proceeds are not intended to be invested subsequently
Total cash inflow at the Trust level (A)
Less: Any payment of fees, interest and expense incurred at the Trust level, including but not limited to the fees of the Investment Manager and Trustee
Less: Net cash set aside to comply with DSRA requirement under loan agreements
Less: Costs/retention associated with sale of assets of the Portfolio Assets: <ul style="list-style-type: none"> relate debts settled or due to be settled from sale proceeds of Portfolio Assets; transaction costs paid on sale of the assets of the Portfolio Assets; and capital gains taxes on sale of assets/ shares in Portfolio Assets/ other investments.
Less: Proceeds reinvested or planned to be reinvested in accordance with Regulation 18 (7) (a) of the InvIT Regulations
Less: Repayment of external debt at the Trust level and at the level of any of the underlying portfolio assets/special purpose vehicles (Excluding refinancing)
Less: Amount invested in any of the Portfolio Assets for service of debt or interest
Less: Reserve for debentures / loans / capex expenditure in the intervening period till next proposed distribution if deemed necessary by the Investment Manager invested in permitted investments
Less: Repair work in relation to the projects undertaken by any of the Portfolio Assets
Less: Income Tax (if applicable) at the standalone Trust level

Add/Less: Decrease/(increase) in working capital as per Ind AS 7
Less: Cash Strap / Reserves requirements by Lenders / Rating Agencies
Total cash outflows / retention at the Trust level (B)
Net Distributable Cash Flows (C) = (A+B)

- I. For the purposes of the IT Act, any income distributed by the Trust to the Unitholders shall be deemed to be of the same nature and in the same proportion in the hands of the Unitholder as it had been received by, or accrued to, the Trust. Accordingly, the Trust may follow either the receipt approach or the accrual approach subject to the provisions of the IT Act and applicable accounting standards, however, the same shall be followed since the beginning and on a consistent basis.
- J. In terms of the InvIT Regulations, if the distribution is not made within 15 days of declaration, the Investment Manager shall be liable to pay interest to the Unitholders at the rate of 15% per annum or such other rate as may be specified under applicable law, until the distribution is made. Such interest shall not be recovered in the form of fees or any other form payable to the Investment Manager by the Trust.
- K. Notwithstanding the above, this Policy will stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the Unitholders of the Trust.
- L. ***In-specie Distribution:*** Subject to the approval of the Unitholders, in accordance with the Trust Deed and provisions of applicable law, the Trustee, in consultation with the Investment Manager, may at any time during the life of the InvIT make in-specie distributions of the assets of the Trust on such terms and conditions and in such manner that is in accordance with the Trust Deed, the Investment Management Agreement, the project implementation and management agreement and other documents for the purpose of the Trust (including the offer documents) and applicable law.

RELATED PARTY TRANSACTIONS

In terms of Regulation 2(1)(zv) of the InvIT Regulations, related party shall be as defined as under the Companies Act, 2013 or under the applicable accounting standards and shall also include: (i) Parties to the Trust; and (ii) promoters, directors, and partners of the Parties to the Trust. For further details in relation to related party transactions, please see the section entitled “*Audited Financial Information*” on page 323. The Parties to the Trust, may, from time to time, enter into related party transactions, in accordance with applicable law.

Procedure for dealing with Related Party Transactions

The board of directors of the Investment Manager has adopted the policy on related party transactions of the Trust (the “**RPT Policy**”) pursuant to its resolution dated February 3, 2021.

The key terms of the RPT Policy are provided below:

- (i). In accordance with the InvIT Regulations, the Investment Manager will ensure that all future Related Party Transactions shall be:
 - (a). on an arm’s length basis;
 - (b). in accordance with the relevant accounting standards;
 - (c). in the best interest of the Unitholders;
 - (d). consistent with the strategy and investment objectives of the Trust; and
 - (e). compliant with applicable law.
- (ii). Review and approval of Related Party Transactions:
 - (a). Each transaction which is identified as a Related Party Transaction shall be pre-approved by the Audit Committee prior to entering into such transaction, (b) The Audit Committee shall grant omnibus approval for Related Party Transactions. Each such omnibus approval shall be valid for a period not exceeding one year from the date of such approval, and Related Party Transactions undertaken after the expiry of such period shall require fresh approval of the Audit Committee. The Audit Committee shall review, on a quarterly basis, the details of Related Party Transactions entered into by the Trust pursuant to the omnibus approval.
- (iii). The Investment Manager will establish an internal control system so as to ensure that all future Related Party Transactions are compliant with the InvIT Regulations and applicable accounting standards. Further, the Investment Manager shall convene meetings of the Unitholders in accordance with Regulation 22 of the InvIT Regulations, and maintain records pertaining to such meetings in the manner prescribed. The Investment Manager shall also ensure compliance with any additional guidelines issued in this regard by Securities and Exchange Board of India and other relevant regulatory, statutory or governmental authorities from time to time.
- (iv). In addition to any other requirement that may be prescribed in terms of the InvIT Regulations or other applicable laws, all Related Party Transactions to be entered into in the future will be decided by the Board after the examination of the nature of the transaction and its supporting documents, as available, or such other data as may be deemed necessary by the Board.
- (v). The Investment Manager will ensure that if the value of funds borrowed from Related Parties in a financial year exceeds 5% of the total consolidated borrowings of the Trust, any holding company and the SPVs, or any other threshold prescribed by the InvIT Regulations, approval from the Unitholders shall be obtained prior to entering into any such subsequent transaction with any Related Party, in accordance with Regulation 22 of the InvIT Regulations.
- (vi). The Investment Manager will ensure that if the total value of all the Related Party Transactions in a financial year pertaining to acquisition or sale of assets, whether directly or through a holding company or SPV, or investments into securities, exceeds 5% of the value of the assets of the Trust or any other threshold prescribed by the InvIT Regulations, approval from the Unitholders shall be obtained prior to entering into any such subsequent transaction with any Related Party, in accordance with Regulation 22 of the InvIT Regulations.

- (vii). As a general rule, the Investment Manager must demonstrate to the Board that future Related Party Transactions satisfy the criteria set out in Paragraph D(i) at the time of recommending the same for the approval of the Board.
- (viii). The Investment Manager will maintain a register to record all Related Party Transactions entered into by the Trust and the basis on which they are entered into.
- (ix). The Investment Manager will also incorporate into its internal audit plan a review of all Related Party Transactions entered into by the Trust during each financial year, including a review of the implementation of the agreements.
- (x). The Board shall review at least quarterly in each financial year the Related Party Transactions entered into during such quarter to ascertain that the guidelines and procedures established to monitor the Related Party Transactions have been complied with.
- (xi). The review by the Board will include the examination of the nature of the transaction and its supporting documents or such other data as may be deemed necessary by the Board.
- (xii). The Investment Manager shall ensure that all the incomes and expenses from Related Party Transactions have arisen from legitimate business transactions.
- (xiii). While considering a Related Party Transaction, any director on the Board who has a potential interest in any Related Party Transaction will recuse himself or herself and abstain from discussion, review and voting on the Related Party Transaction.

Potential Conflict of Interest

- (i). Subject to applicable law and this Policy, all resolutions in writing of the Board in relation to matters concerning related party transactions of the Trust must be approved by a majority of the Directors.
- (ii). Where matters concerning the Trust relate to transactions entered into or to be entered into by the Investment Manager for and on behalf of Trust with a Related Party, the Board is required to consider the terms of the transactions to satisfy itself that the transactions are conducted in accordance with the parameters set out in paragraph D(i).
- (iii). While acquiring assets in the future from the Sponsor, the Investment Manager will maintain a register of all opportunities and transactions arising from the implementation of agreements to acquire assets from the Sponsor.
- (iv). The Investment Manager will incorporate in its internal audit plan, a review of the implementation of the agreements to acquire assets from the Sponsor.
- (v). As part of its review of the internal audit reports at least quarterly in each financial year, the Board will review the internal audit reports of the implementation of the agreements to acquire assets from the Sponsor to ensure compliance. The review will include an examination of supporting documents and such other data deemed necessary to the Board. If a director on the Board has an interest in a transaction arising from the implementation of the agreements to acquire assets from the Sponsor, he or she is to abstain from participating in the review and approval process in relation to that transaction.

Disclosure and Reporting

- (i). The Investment Manager shall submit to the Trustee, quarterly reports on the activities of the Trust, including the status of compliance with the requirements specified under the InvIT Regulations in relation to Related Party Transactions, within such time as may be prescribed in the InvIT Regulations and applicable law.
- (ii). Related Party Transactions shall be disclosed: (a) in the offer document with respect to any such transactions entered into prior to the offer of units and any such proposed transactions subsequent to the

offer; and (b) to the stock exchanges and the Unitholders periodically, in accordance with the InvIT Regulations and the agreements to be entered into with the stock exchanges in relation to the listing of the Units. The Investment Manager shall adequately disclose the details of any fees or commissions received or to be received by such related party(ies) to the stock exchanges.

- (iii). In terms of the InvIT Regulations, the annual report to be submitted by the Investment Manager to all Unitholders, electronically or by physical copies, shall contain, *inter alia*, details of all related party transactions, including acquisitions or disposal of any projects, directly or through SPVs during the year, the value of which exceeded five percent of value of the assets of the Trust.

Related Party Transactions

Present and On-going Related Party Transactions

Related Party Transactions of the Trust in relation to the setting up of the Trust and this Offer

A number of present and on-going transactions with certain related parties have been, or will be, entered into in relation to the setting up of the Trust. The Trustee and the Investment Manager confirm that the following related party transactions have been, or shall be, entered into, on an arm's length basis in accordance with the relevant accounting standards, in the best interest of the Unitholders, consistent with:

(A) Share Purchase Agreement

Please see the section entitled “– *Acquisition of the Project SPV by the Trust – Share Purchase Agreement*” on page 254 for a description of the terms of the Share Purchase Agreement.

(B) Trust Deed

Please see the section entitled “*Parties to the Trust – Key Terms of the Trust Deed*” on page 95 for a description of the terms of the Trust Deed.

(C) Investment Management Agreement

Please see the section entitled “*Parties to the Trust – Key Terms of the Investment Management Agreement*” on page 106 for a description of the terms of the Investment Management Agreement.

(D) Project Implementation and Management Agreement

Please see the section entitled “*Parties to the Trust – Key terms of the Project Implementation and Management Agreement*” on page 117 for a description of the terms of the Project Implementation and Management Agreement.

(E) Concession Agreements

Please see the section entitled “*Summary of the Concession Agreements*” on page 194 for a description of the terms of the Concession Agreements.

(F) Trademark license Agreement

Our Trustee (on our behalf) have entered into a trademark license agreement dated March 30, 2021 with our Sponsor (the “**Trademark License Agreement**”). As per the terms of the Trademark License Agreement, our Sponsor has granted us a non-exclusive, non-transferable, royalty-free and non – assignable license (without the right of sub-license) to use the trademarks of the Sponsor in relation to our business throughout India and the rest of the world, including for the purposes of our logos. The license granted to the Trust in terms of the Trademark License Agreement shall be for a term of 1 (one) year from the date of such agreement, or such shorter period as may be mutually agreed to between the parties.

(G) Transitional Support Agreement

The Sponsor, Project Manager and the Project SPV have entered into a transitional support agreement dated March 30, 2021, for the purpose of the Sponsor providing the transitional support to (i) the Project Manager in respect of its obligations under the Project Implementation and Management Agreement, and (ii) the

Project SPV in respect of its O&M obligations and tolling obligations (as provided under the Concession Agreements). The terms and conditions of the transitional support agreement shall, in respect of each Concession Agreement and the Project Implementation and Management Agreement, be effective and binding on the Parties for a period of 6 (six) months commencing from the appointed date of the respective Concession Agreements, unless terminated earlier by mutual consent. As per the transitional support agreement dated March 30, 2021, the Sponsor's fee for the services provided under the transitional support agreement shall be such amount as may be mutually agreed amongst Sponsor, Project Manager and the Project SPV. Subsequently, the Sponsor and the Project SPV mutually agreed upon the fee to be paid for transitional support services, pursuant to (i) the letter dated September 24, 2021, from the Project SPV to the Sponsor, and (ii) the letter dated September 28, 2021, from the Sponsor to the Project SPV.

Acquisition of the Project SPV by the Trust

Share Purchase Agreement

In connection with the Offer, the Trust (acting through the Trustee) ("**Buyer**") has acquired the entire equity share capital of the Project SPV from the Sponsor (Sponsor being the "**Seller**") on the closing date in accordance with the terms of the share purchase agreement dated September 30, 2021 ("**Share Purchase Agreement**").

Under the terms of the Share Purchase Agreement, the aggregate consideration payable by the Buyer to the Seller for purchase of the shares of the Project SPV is ₹ 1,015.20 million, which shall be paid by the Buyer to the Seller through allotment of such number of Units (the "**Consideration Units**") determined in the following manner:
Consideration Units = ₹ 1,015.20 million / Issue Price per Unit

Accordingly, approximately 10,051,485 Units have been allotted to the Sponsor.

Pursuant to the purchase of the Shares by the Buyer as aforesaid, the shareholding pattern of the Project SPV as of the Closing Date is as follows:

Name of Shareholder	Number of Shares held	Percentage of shareholding in the Project SPV
National Highways Infra Trust (represented by the Trustee)	99,999	99.99%
Nominee of National Highways Infra Trust	1	Negligible
Total	100,000	100%

Under the Share Purchase Agreement, the Sponsor has provided various representations and warranties (subject to some of the disclosures in the Final Placement Memorandum) in relation to the Project SPV, which include those related to:

- certain fundamental aspects, such as: (a) due incorporation of the Sponsor and Project SPV, (b) enforceability of the Share Purchase Agreement, (c) absence of any pre-emptive rights in relation to the equity shares of the Project SPV, (d) validity, and compliance with the requirements, of approvals, licenses, permits, authorizations, consents and licenses, (e) relevant concession agreement being in full force and effect and no subsisting event of default thereunder;
- corporate records, financial statements, intellectual property and insurance;
- compliance with applicable laws, including environmental and anti-corruption laws;
- validity of applicable approvals, licenses, permits and authorizations; and
- litigations and taxation.

The Seller ("**Indemnifying Party**") shall agree to indemnify, defend and hold harmless any of the Buyer and the Investment Manager (each, an "**Indemnified Party**") promptly upon demand at any time and from time to time, from and against Losses which relate to or arise from: (i) actual or alleged breach of or inaccuracies or misrepresentations in any of the Seller Warranties or breach of any covenant of the Seller herein; or (ii) any pending or threatened claims against the Project SPV from the period prior to and including the closing date. Any claim for indemnity shall be made by the Indemnified Party by notice in writing to the Indemnifying Party within the Claim Period, and the obligation of the Indemnifying Party to indemnify the Indemnified Party shall be subject to the Claim being made within the Claim Period.

The Share Purchase Agreement may be terminated (i) by mutual consent of the parties to the Share Purchase Agreement in writing; (ii) by either of the parties to the Share Purchase Agreement by notice in writing to the other parties to the Share Purchase Agreement if closing does not occur by December 31, 2021 or such other date as may be mutually agreed by the parties to the Share Purchase Agreement in writing, or (iii) at the option of the Buyer, with notice to the other Parties, upon occurrence of a material adverse effect.

Project SPV Facility Agreements

Please see the section entitled “*Formation Transactions in relation to the Trust – Utilisation of Net Proceeds*” on page 27 for a description of the terms of the Project SPV Facility Agreements.

Arrangement with respect to future assets

In accordance with the approval granted by the Chairman of NHAI, by way of communication dated March 29, 2021, the Sponsor will offer around 1,500 km of roads in three years to the Trust (“**Future Assets**”).

The process of identification of Future Assets, offer of Future Assets to Trust and completion of transfer of Future Assets to the Trust including valuation mechanism may be refined and/or modified in line with the internal policies of NHAI.

Borrowings from Related Parties

No borrowings were availed by the Trust or Project SPV from any of its related parties.

Potential Conflicts of Interest

The Investment Manager has established certain procedures to deal with conflict-of-interest issues. For further details on management of potential conflicts of interest, please see the section entitled “– *Procedure for dealing with Related Party Transactions*” on page 251.

DILUTION

Dilution is the amount by which the Offer Price exceeds the net asset value (“NAV”) per Unit, immediately after the completion of this Offer (net of Offer expenses). NAV per Unit is determined by subtracting the total liabilities of the Trust from the total assets of the Trust and dividing by the number of Units issued and outstanding immediately before this Offer.

Pursuant to the Offer, the Trust will issue 499,600,000* Units at an Offer Price of ₹ 101 for each Unit, resulting in a combined NAV of the Trust of approximately ₹ 50,459.60 million or ₹ 101 per Unit based on the total number of Units outstanding after the completion of this Offer. This represents an immediate dilution in combined NAV of approximately Nil per Unit to the Sponsor and an immediate dilution in combined NAV of approximately Nil per Unit to other Unitholders, subscribing in this Offer.

* *Subject to finalization of Basis of Allotment*

The following provides the per Unit dilution as on March 31, 2021:

Combined NAV per Unit before this Offer	N.A.
Combined NAV per Unit after this Offer	₹ 101
Dilution in NAV per Unit to the Sponsor attributable to the Sponsor	Nil
Dilution in NAV per Unit to Unitholders (other than the Sponsor)	Nil
Dilution to Unitholders (other than the Sponsor) as a percentage of the Offer Price	Nil

REGULATIONS AND POLICIES

The following description is a summary of certain sector specific laws currently in force in India, which are applicable to the Trust. The information detailed in this chapter has been obtained from publications available in the public domain. The description of the regulations set out below may not be exhaustive, and is only intended to provide general information to Bidders, and is neither designed as, nor intended to substitute, professional legal advice. Judicial and administrative interpretations are subject to modification or clarification by subsequent legislative, judicial or administrative decisions.

Provided below are certain significant legislations, regulations and policies that generally govern the road infrastructure sector in which the Project SPV operates.

Regulatory Framework on Road Infrastructure

The regulatory framework in India in the road sector mainly derives its source from the primary legislations of National Highways Authority of India Act, 1988, as amended (the “**NHAI Act**”) and the National Highways Act, 1956 (the “**NH Act**”) enacted by the Indian parliament.

The National Highways Act, 1956

The policy of the MoRTH, in implementing the NH Act, is to vest the Ministry with the power to declare a national highway and for acquisition of land for this purpose. The GoI by notification can declare the intention to acquire any land for a public purpose as envisaged by the law and such land can be used for the purposes of building, maintenance and operation of the declared national highways throughout the country. The NH Act vests MoRTH with the power to appoint a competent authority for the effective implementation of the NH Act and its policies. The said appointed authority retains the right and power to survey, make any inspection, valuation or enquiry;(b) take levels;(c) dig or bore into sub-soil;(d) set out boundaries and intended lines of work;(e) mark such levels, boundaries and lines placing marks and cutting trenches; or (f) do such other acts or things as may be laid down by rules made in this behalf by that government.

All the notified national highways shall vest in the name of the Union and for the purposes, shall include all lands appurtenant thereto and all the bridges, culverts, tunnels and other enlisted constructions under the said NH Act. The Central Government shall assume the responsibility of maintaining and construction of national highways in proper condition in accordance to the law. The Central Government also retains the right to levy fees over the services and benefits rendered in relation to the use of such national highways.

The National Highways (Amendment) Act, 2017, entails the competent authority to issue reports to the Central Government in respect of any land with incorrect revenue record or not required due to change in geometry or alignment of the construction in order for the de-notification of such land from the acquisition pool. In pursuance of the above policy of law, the National Highways Rules, 1957, have been amended to ensure the exercise of the power under the NH Act. These rules provide for periodic regulatory compliance and reporting standards to be followed by the competent authority in reporting to the Central Government.

The National Highways Authority of India Act, 1988 (“NHAI Act”)

The NHAI Act was enacted in pursuance of the powers by the Central Government in appointing an competent authority under the NH Act and provides for the constitution of an authority for the development, maintenance and management of national highways and for matters connected therewith or incidental thereto. NHAI's objective is to ensure that all contract awards and procurements conform to the best industry practices with regard to transparency of process, adoption of bid criteria to ensure healthy competition in award of contracts. Implementation of projects conforms to best quality requirements and the highway system is maintained to ensure best user comfort and convenience. NHAI has a three-tier structure. The headquarters (HQ), the regional offices (ROs) and the project implementation units (PIUs). The PIUs, headed by project directors, are responsible for implementation of projects assigned to them and ROs, headed by a CGM level officer, have been set-up in various parts of the country for decentralizing and strengthening the field level operations in NHAI. The HQ is responsible for overall supervision of the works assigned to NHAI. Pursuant to the NHAI Act, NHAI is competent to enter into and perform any contract necessary for the discharge of its functions.

In view of the challenging task of construction, development, and management of national highways being undertaken by NHAI, the Committee on Public Undertakings selected the subject “National Highways Authority

of India (NHAI)” for comprehensive examination and report. The National Highways Authority of India (Amendment) Act, 2013, received the assent of the President of India on September 10, 2013, and aimed at increasing the institutional capacity of NHAI to help execute the powers delegated to it. National Highways Development Project (“**NHDP**”) was launched in 1998 with the objective of developing roads of international standards which facilitate smooth flow of traffic. The NHDP envisages creation of roads with enhanced safety features, better riding surface, grade separator and other salient features. The GoI, under the Central Road Fund Act, 2000 created a dedicated fund which is required to be utilized for the development and maintenance of national highways. Certain sources for financing the NHDP are through securitisation of cess as well as involving the private sector by encouraging public-private partnership.

Applicable Rules

As per the NH Act and the NHAI Act, the Central Government is empowered to make rules in order to further the objects of NH Act and NHAI Act. In exercise of such power, the Central Government has framed certain rules which are as follows:

- The National Highways Rules, 1957;
- The National Highways (Temporary Bridges) Rules, 1964;
- National Highways Authority of India (Budget, Accounts Audit, Investment of Funds and Powers to enter Premises) Rules, 1990;
- The National Highways (Collection of Fees by any person for the use of Section of National Highways/Permanent Bridges/Temporary bridge on National Highways) Rules, 1997;
- The National Highways (Rate of Fee) Rules, 1997;
- The National Highways (Fees for the use of National Highways Section and Permanent Bridge – Public Funded Project) Rules, 1997;
- The National Highways (Manner of Depositing the Amount by the Central Government with Competent Authority for Acquisition of Land) Rules, 1998;
- The National Highways Tribunal (Procedure for Appointment as Presiding Officer of the Tribunal) Rules, 2003;
- The National Highways Tribunal (Procedure) Rules 2003;
- National Highways Authority of India (the term of office and other conditions of service of Members) Rules, 2003, as amended;
- The Central Road Fund (State Roads) Rules, 2007;
- The National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended;
- The National Highways Authority of India (Budget, Accounts, Audit, Investment of Funds, and power to enter premises) Rules, 1990, as amended;
- The National Highways Tribunal (Financial and Administrative Powers) Rules, 2004;
- The Highways Administration Rules, 2004; and
- The National Highways Tribunal (Procedure for Investigation of Misbehaviour or incapacity of Presiding Officer) Rules, 2003.

Environmental Compliances and Regulations

The major statutes in India which seek to regulate and protect the environment against pollution related activities include the Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act, 1981 and the Environment Protection Act, 1986 (the “**Environment Protection Act**”). The basic purpose of these statutes is to control, abate and prevent pollution. In order to achieve these objectives, Pollution Control Boards (“**PCBs**”), which are vested with diverse powers to deal with water and air pollution, have been set up in each state. PCBs are responsible for setting the standards for maintenance of clean air and water, directing the installation of pollution control devices in industries and undertaking inspection to ensure that industries are functioning in compliance with the standards prescribed. These authorities issue consent to establish and consent to operate which are to be required to be renewed periodically. These authorities also have the power of search, seizure and investigation if the authorities are aware of or suspect violation of such regulations.

In accordance with the Forest (Conservation) Act, 1980, state governments are not permitted to make any order directing the use of forest land for a non-forest purpose, or assignment of any forest land through lease or otherwise to any private person or corporation without the approval of the GoI. The Ministry of Environment and Forests (“**MoEF**”) mandates the Environment Impact Assessment (“**EIA**”) must be conducted for specified projects. In the process, the MoEF receives proposals or the setting up of projects and assesses their impact on the environment

before granting clearances to the projects.

Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, impose an obligation and duty on the owners and operators of any facility or industry with a capability to create hazardous materials to safely dispose of such material in transport and other means of collecting and storing. Each occupier and operator of any facility generating hazardous waste is required to obtain an approval from the relevant state pollution control board for collecting, storing and treating the hazardous waste.

Public Liability Insurance Act, 1991

The Public Liability Insurance Act, 1991 (the “**Public Liability Act**”), imposes liability on the owner or controller of hazardous substances for any damage arising out of an accident involving such hazardous substances. A list of ‘hazardous substances’ covered by the legislation has been enumerated by the GoI by way of a notification. The owner or handler is also required to take out an insurance policy insuring against liability under the legislation. The rules made under the Public Liability Act mandate that the employer has to contribute towards the Environment Relief Fund, a sum equal to the premium paid on the insurance policies. This amount is payable to the insurer.

Labour Laws and Other Regulations

The laws and regulations to employment that may be applicable to the Trust, the Investment Manager and the project SPV include the following:

- The Employees Provident Fund & Miscellaneous Provisions Act, 1952;
- The Employees' State Insurance Act, 1948;
- The Payment of Gratuity Act, 1972; and
- The Maternity Benefit Act, 1961.

Further, the Code on Wages, 2019, Code on Social Security, 2020, Occupational Safety, Health and Working Conditions Code, 2020 and the Industrial Relations Code, 2020, have been published in the official gazette by the Government of India. These will come into effect on dates as notified by the Government of India in the official gazette.

In addition to the above, various state shops and commercial establishments acts are also applicable to the Trust.

Other Related Regulations

The NHAI as a statutory body established by the Central government, is regulated with a distinct set of regulations including:

- National Highways Authority of India (Recruitment, Seniority and Promotion) Regulations, 1996;
- National Highways Authority of India (House Rent Allowance and Leased Accommodation) Regulations, 1997;
- National Highways Authority of India (Joining Time) Regulations, 1996;
- National Highways Authority of India (Incentive) Regulations, 1996;
- National Highways Authority of India (Travelling Allowance and Daily Allowance) Regulations, 1997;
- National Highways Authority of India (Leave) Regulations, 1997;
- National Highways Authority of India (Conduct Discipline and Appeal) Regulations, 1997;
- National Highways Authority of India (Leave Travel Concession) Regulations, 1997;
- National Highways Authority of India (Medical Attendance and Treatment) Regulations, 1997;
- National Highways Authority of India (Transaction of Business) Regulations, 1997;
- National Highways Authority of India (Transaction of Business Amendment) Regulations, 2001; and
- National Highways Authority of India (Medical Attendance and Treatment) Regulations, 1997.

Other applicable law

The Motor Vehicles Act, 1988

The development, maintenance and management as well as control of the National Highways are regulated by the NH Act and the NHAI Act. Under the Motor Vehicles Act, 1988, some powers have been delegated to the Transport Department of the State Governments.

Section 138 of the Motor Vehicles Act, 1988 further empowers the State Governments to make rules for the control of traffic, including for the purpose of the removal and the safe custody of vehicles including their loads which have broken down or which have been left standing or have been abandoned on roads; the installation and use of weighing devices; the maintenance and management of wayside amenities complexes; the exemption from all or any of the provisions of relating to fire brigade vehicles, ambulances and other special classes or descriptions of vehicle, subject to such conditions as may be prescribed; the maintenance and management of parking places and stands and the fees, if any, which may be charged for their use; prohibiting the taking hold of or mounting of a motor vehicle in motion; prohibiting the use of foot-paths or pavements by motor vehicles, generally, the prevention of danger, injury or annoyance to the public or any person, or of danger or injury to property or of obstruction to traffic.

Motor Vehicles (Amendment) Act, 2019

The Motor Vehicles (Amendment) Act, 2019 is targeted towards bringing changes in the transport sector to encourage safer driving practices among Indian motor vehicle drivers. The draft for the amendment was put forward in the lower house of the Parliament, with a proposal to impose strict fines on the violators of traffic rules. The Act proposes to create a National Road Safety Board to be created by the central government through a notification. The Board will advise the central and state governments on all aspects of road safety and traffic management.

Indian Trusts Act, 1882

The Indian Trusts Act, 1882 (“**Trusts Act**”) governs all private trusts in India.

The Trusts Act sets out the purpose for which private trusts can be established, the manner in which they may be created, executed and extinguished. The person creating a trust under the Trusts Act is the author of such trust, the person to whom the author grants the power and authority to regulate the trust is the trustee and the persons for whose benefit such trust has been created are the beneficiaries of such trust. The Trust Act sets out the rights, duties, liabilities and powers of the trustees and the beneficiaries vis-a-vis the trust. The Trust has been settled in accordance with the provisions of the Trusts Act.

Control of National Highways (Land and Traffic) Act, 2002

The Control of National Highways (Land and Traffic) Act, 2002 (the “**Control of NH Act**”) provides for control of land within national highways, right of way and traffic moving on national highways and also for removal of unauthorised occupation thereon.

In accordance with the provisions of the Control of NH Act, the Central Government has established Highway Administrations. Under the Control of NH Act, all land that forms part of a highway which vests in the Central Government, or that which does not already vest in the Central Government but has been acquired for the purpose of highways shall be deemed to be the property of the Central Government. The Control of NH Act prohibits any person from occupying any highway land or discharging any material through on such land without the permission of the Highway Administration or any officer authorised by such administration. The Control of NH Act permits the grant of lease and license for use of highway land for temporary use.

Indian Tolls Act, 1851

In accordance with the Indian Tolls Act, 1851 (the “**Tolls Act**”), the state governments have been vested with the power to levy tolls at such rates as they deem fit, to be levied upon any road or bridge, made or repaired at the expense of the Central or any state government. The tolls levied under the Tolls Act, are deemed to be ‘public revenue’ and the collection of tolls can be placed under any person the state governments’ deem fit. Such persons are enjoined with the same responsibilities as if they were employed in the collection of land revenue. Further, all police officers are bound to assist the toll collectors when required in the implementation of the Tolls Act. The Tolls Act further gives power for recovery of toll and exempts certain category of people from payment of toll.

National Highways Fee (Determination of Rates and Collection) Rules, 2008

The National Highways Fee (Determination of Rates and Collection) Rules, 2008 (the “**NH Fee Rules**”), regulates the collection of fee for the use of national highways. In accordance with the NH Fee Rules, the GoI may, by a notification, levy fee for use of any section of a national highway, permanent bridge, bypass or tunnel forming part of a national highway, as the case may be. However, the GoI may, by notification, exempt any section of a national highway, permanent bridge, bypass or tunnel constructed through a public funded project from levy of such fee.

The NH Fee Rules supersede the National Highways (Temporary Bridges) Rules, 1964, the National Highways (Collection of Fees by any Person for the Use of Section of National Highways/ Permanent Bridge/ Temporary Bridge on National Highways) Rules, 1997, the National Highways (Fees for the use of National Highways Section and Permanent Bridges - Public Funded Project) Rules, 1997 and the National Highways (Rate of Fees) Rules, 1997 other than in respect of things done or omitted to be done under such rules prior to supersession.

The NH Fee Rules do not apply to agreements and contracts executed or bids invited prior to the publication of such rules i.e. prior to December 5, 2008. The collection of fee in case of a public funded project shall commence within 45 days from the date of completion of the project. The NH Fee Rules further provide for the base rate of fees applicable for the use of a section of the national highway for different categories of vehicles.

REGULATORY APPROVALS

The Trust and the Project SPV are required to obtain consents, licenses, registrations, permissions and approvals for carrying out their present business activities which include, approvals for registration as an infrastructure investment trust and for carrying out its present business, as applicable. Other than as stated in this section, the Trust and the Project SPV have obtained necessary consents, licenses, permissions, registrations and approvals from various governmental, statutory and regulatory authorities, required for the registration as an infrastructure investment trust and for carrying out its present business, as applicable. In view of the approvals listed below, the Trust can undertake the Offer as well as its current business, as applicable, and no further major approvals from any governmental or regulatory authority or any other entity are required to undertake the Offer or to continue its business, as applicable. Unless otherwise stated, these approvals are all valid as on date of the Final Placement Memorandum. For details in connection with the regulatory and legal framework within which we operate, please refer to the section entitled "Regulations and Policies" on page 256.

I. Approvals in relation to the Offer

1. In-principle approval from the NSE dated April 13, 2021, read along with the extension letters dated July 12, 2021, and September 29, 2021, issued by NSE; and
2. In-principle approval from the BSE dated August 25, 2021.

II. Approvals for the Trust

1. Certificate of registration bearing number IN/InvIT/20-21/0014 dated October 28, 2020, with SEBI as an infrastructure investment trust.

III. Approvals received in respect of the InvIT Assets

Kothakota to Kurnool (Andhra Pradesh)

- Provisional completion certificate dated September 30, 2009 issued by M/s Aarvee Associates Architects Engineers & Consultants Private Limited, acting as Independent Consultant, certifying that km 135.469 to km 211.000 of NH-7 can be placed in commercial operations.
- Environmental clearance dated May 19, 2006, issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Kothakota to Kurnool section for upgrading of existing two lane to four lane divided carriageway configuration of NH-7 from 135.469 km to 211.000 km undertaken by NHAI.

Palanpur to Abu Road (Gujarat) to Swaroopgunj (Gujarat)

- Completion certificate dated September 22, 2009 issued by M/s Aarvee Associates Architects Engineers & Consultants Private Limited, acting as Independent Consultant, certifying the completion and successful testing in respect of 340.00 km to 264.00 km on Palanpur to Swaroopgunj section of NH-14.
- Provisional completion certificate dated May 19, 2009 issued by M/s Aarvee Associates Architects Engineers & Consultants Private Limited, acting as Independent Consultant, certifying that 340.00 km to 264.00 km on Palanpur to Swaroopgunj section of NH-14 can be placed in commercial operations.
- Environmental clearance dated April 17, 2006 issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Palanpur to Swaroopgunj section for rehabilitation and upgrading of existing NH-14 from 264.00 km to 340.00 km and NH-76 from 0/000 to 110/000 undertaken by NHAI.

Maharashtra Border – Belgaum (Karnataka)

- Completion certificate dated April 12, 2005 issued by Sir Owen Williams Innvestment and Frischmann Prabhu (India) Private Limited, acting as Independent Engineer, certifying the completion in respect of 515 km to 592 km Belgaum Maharashtra Border section of NH-4.
- Provisional completion certificate dated July 19, 2004 issued by Sir Owen Williams Innvestment and Frischmann Prabhu (India) Private Limited, acting as Independent Engineer, certifying that 515 km to 592 km Belgaum Maharashtra Border section of NH-4 can be placed in commercial operations.
- Environmental clearance dated May 14, 2002 issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Belgaum Maharashtra Border for four laning and strengthening of NH-4 515 km to 592 km undertaken by NHAI.

Chittorgarh Kota (Rajasthan)

- Environmental clearance dated February 2, 2006 issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Chittorgarh to Kota in Rajasthan section for upgrading of NH-76 of east west corridors undertaken by NHAI.
- Defects liability certificate dated May 17, 2010, issued by M/s Stanley Consultants Inc. in joint venture with M/s RITES Limited certifying completion of all works on April 27, 2010, in respect of Chittorgarh to Kota section in Rajasthan for upgrading of NH-76 of east west corridors undertaken by NHAI.

IV. Approvals applied for but not yet received

As on the date of the Final Placement Memorandum, there are no approvals required to be obtained by National Highways Infra Trust and the Project SPV, for which applications have been made, but approvals have not been received.

V. Approvals for which applications are yet to be made

As on the date of the Final Placement Memorandum, there are no approvals required to be obtained by National Highways Infra Trust and the Project SPV, for which applications are yet to be made.

LEGAL AND OTHER INFORMATION

Except as stated in this section, there are no material litigations and actions by regulatory authorities, in each case against the Trust, the Project SPV, the Sponsor, the Investment Manager, the Project Manager or any of their respective Associates and the Trustee as on the date of the Final Placement Memorandum.

For the purpose of this section, details of all regulatory actions and criminal matters involving the Trust, the Project SPV, the Sponsor, the Investment Manager, the Project Manager and each of their Associates, and the Trustee, that are currently pending, have been disclosed. Further, any matter involving an amount equivalent to, or more than, the amount as disclosed below, in respect of the Trust, the Sponsor, the Investment Manager, the Project Manager and each of their Associates, and the Trustee has been disclosed.

In respect of the Sponsor and its Associates (which includes the Associates of the Project Manager, Investment Manager and Project SPV), all outstanding civil matters which involve an amount exceeding ₹ 5,000 million, have been considered material. All cases where the amount is not ascertainable, but considered material, have been disclosed.

For the Investment Manager, all outstanding civil matters which involve an amount exceeding ₹ 10 million, have been considered material. However, the Investment Manager does not have any outstanding litigation.

For the Project Manager, all outstanding civil matters which involve an amount exceeding ₹ 1 million, have been considered material. However, the Project Manager does not have any outstanding litigation.

In relation to the Project SPV, all outstanding civil matters which involve an amount equal to, or more than one per cent of the net worth of the Trust as of December 31, 2020, has been considered material for disclosure. However, the Project SPV does not have any outstanding litigation.

For the Trustee, all outstanding cases involving the Trustee have been disclosed.

Further, all pending cases, where the amount is not ascertainable but considered material by the Trust, the Sponsor, the Investment Manager, the Project Manager or any of their Associates and the Trustee as on the date of the Final Placement Memorandum have been disclosed. Also, in cases where outcome of one litigation impacts one or more other litigations, which individually are below materiality threshold, but collective above, such cases have also been disclosed.

I. Litigation involving the Trust

There are no pending criminal, regulatory or other material litigations involving the Trust as on the date of the Final Placement Memorandum.

II. Litigation involving Associates of the Trust

As on the date of the Final Placement Memorandum, the Trust does not have any Associate.

III. Litigations involving the Project SPV

There are no pending criminal, regulatory or other material litigations involving the Project SPV as on the date of the Final Placement Memorandum.

IV. Litigations involving the Associates of the Project SPV

Please see the section entitled “ – Litigations involving the Associates of the Sponsor” below.

V. Litigations involving the Sponsor

Criminal matters

There are no pending criminal litigations involving the Sponsor as on the date of the Final Placement Memorandum

Regulatory matters

1. An application was filed by Amresh Singh against Union of India and others including NHAI before the National Green Tribunal (“**Tribunal**”) alleging the rampant dumping of soil by NHAI contractors directly in the river Chenab and Tawi without prior environmental clearance. After considering all the documents placed on record, while referring the report of Monitoring Committee, the Tribunal was not satisfied with the actions taken by NHAI, and accepted the recommendations of the Monitoring Committee and directed the J&K Pollution Control Board to take appropriate actions in consultation with CPCB against the names mentioned in the report of the Monitoring Committee. The Bench also directed NHAI to take strict actions against the non-compliant contractors and sub-contractors at the HQ level. The matter is currently pending.
2. An application was filed before the National Green Tribunal Principal Bench, New Delhi regarding the Ghazipur Dump Site and the environmental problems that are caused due to the unsegregated, un-recycled large mountain of dump. The Sponsor was not a party to these proceedings till 2017 and East Delhi Municipal Corporation (“**EDMC**”) had been exploring the implementation of a project to undertake the removal and processing of the municipal solid waste dumped at the site. In view of the same, the EDMC held discussions with the Sponsor for use of solid waste for construction of embankments in the expansion of NH-24 or other National Highway projects undertaken by the Sponsor. In view of our role, we were impleaded in the case in 2017. The matter is currently pending.

Material civil matters

The following material civil cases are initiated by Contractors/Concessionaires (hereinafter mentioned as the “**Claimant**”) against the Sponsor in relation to various projects across India:

Arbitrations

1. Ircon Soma Tollway Private Limited has initiated arbitration proceedings against the Sponsor in relation to the “improvement, operation and maintenance, rehabilitation and strengthening of existing 2-lane road and widening to 4-lane divided highway from km 380.000 to km 265.000 of NH-3 (Pimpalgaon-Dhule Section) in the state of Maharashtra”. The claims relate to delay in handing over of existing right of way, payment made during the course of the project of Central Railways to expedite construction of road over bridge near Dhule Railway Station, financial implication on the project cost due to non-maintenance of the existing road and late award of the contract by the Sponsor and non-payment of outstanding O&M grants. The claim raised by Claimant amounts to ₹ 9425.202 million. The said matter is currently pending.
2. Abhijeet Angul Sambalpur Toll Road Limited has initiated arbitration proceedings against the Sponsor in relation to the rehabilitation and up-gradation of four laning of the Angul-Sambalpur section of NH-42 in the State of Odisha. The claims raised relate to the compensation for losses suffered by the Claimant on account of delay in procurement of site and necessary approvals, wrongful termination of the concession agreement and debarment from participation in bidding for future projects of the Sponsor. The claims raised by the Claimant amount to ₹ 2,0000 million. The Sponsor has also filed counter claim for ₹ 1,282,720 million. The matter is currently pending.
3. M/s Bhubaneshwar Expressway Private Limited has initiated arbitration proceedings against the Sponsor in relation to 4-laning of Bhubaneswar-Puri Section of NH-203 (Km 0.00 to Km 59.00) in the State of Odisha to be executed as BOT (Toll) basis on DBFOT pattern under NHDP- III. The claims were filed by the Claimant for termination payment, pre-reference interest on termination payment, pendente lite and future interest on termination payment: at 18% per annum and arbitration cost on actual basis. The Claimant has raised a claim for ₹ 7421.10 Million. The Sponsor has also filed counter claims against the Claimant for ₹ 757.10 million. The matter is currently pending.
4. Madhucon Projects Ltd. (Barasat Krishnagar Expressway Limited) has initiated arbitration proceedings against the Sponsor in relation to Barasat-Krishnagar Section BOT (Annuity) in the State of West Bengal. The claims filed by the Claimant for loss due to interest on debt, loss due to interest on equity infused into the project, losses due to idling/underutilisation of machinery and equipment, losses due to idling/underutilisation of manpower, losses due to miscellaneous expenditure incurred at site, compensation due to delay in handing over of site, losses due to price escalation on the works already executed, losses due to expenses incurred on the works executed, loss of overheads and profit and total termination payment. The Claimant has raised a claim for ₹ 2,1398.90 million. The Sponsor has also filed

counter claims against the Claimant for ₹ 10,606.80 Million. The matter is currently pending.

5. Raiganj-Dalkhola Highways Limited has initiated arbitration proceedings against the Sponsor in relation to the “Four-Lanning of NH-34 in the Raiganj-Dalkhola Section from km 398 to km 452.750 in the State of West Bengal under NHDP Phase-III”. The Claimant has sought compensation along with interest aggregating to ₹ 8,365.10 million and cost for arbitration for wrongful termination of the concession agreement. The Sponsor has also filed a counter claim against the Claimant for ₹ 8,542.90 million. The matter is currently pending.
6. M/s BSCPL Aurang Tollway Limited has initiated arbitration proceedings against the Sponsor in relation to four laning of Orissa Border-Aurang Section from Km 88.000 to Km 239.000 of NH-6 in the State of Chhattisgarh to be executed as BOT(Toll) on DBFOT pattern under NHDP Phase-IV. The claims filed by the Claimant were for delay in achievement of the provisional completion including project milestones, change of scope and change in law. The Claimant has raised a claim for ₹ 8,523.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 7,320.30 million. The matter is currently pending.
7. M/s Raipur Expressway Limited has initiated arbitration proceedings against the Sponsor in relation to improvement, operation, maintenance and strengthening of existing 2-lane road and widening to 4-lane divided highway from Km 239.000 to Km 281.000 of NH-6 (Raipur- Aurung Section) in the state of Chhattisgarh on BOT basis. The claims were filed by the Claimant for compensation due to delay in declaration of appointed date, compensation due to extension of time for project completion, damages for delay in providing right of way (ROW), claim on account of change of scope, claim for interest on delayed payments by the respondent, claim for loss of bonus due to arbitrary withdrawal of provisional completion certificate, claim on account of delay in releasing bank guarantees for retention money and claim for expenses and loss of profit due to delay in release of performance security. The Claimant has raised a claim for ₹ 10,121.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 4,231.70 million. The matter is currently pending.
8. M/s Ashoka Highway (Durg) Limited has initiated arbitration proceedings against the Sponsor in relation to design, engineering, finance, construction, operation & maintenance of end of Durg Bypass-Chhattisgarh/Maharashtra Border from Km 324.400 to Km 405.000 of NH-6 under NHDP. The Claimant has raised a claim for ₹ 5660.80 million. The matter is currently pending before arbitral tribunal. However, as both the parties want to settle the disputes, the matter has now been referred to conciliation committee (CCIE), with the consent of the parties, in terms of the policy circular dated June 2, 2017.
9. Jetpur Somnath Tollways Limited has initiated arbitration proceedings against the Sponsor in relation to Jetpur Somnath Section BOT (Toll). The claims filed by the Claimant for damages under the respective concession agreement for delay in non-fulfilment of all conditions precedent set forth in the concession agreement, Compensation for additional costs incurred by the Claimant towards deployment of plants, machineries and equipment during the extended construction period from October 1, 2014, up to November 10, 2016, compensation for additional cost incurred on account of inflation/price escalation of major input costs during the extended construction period from October 1, 2014, up to November 10, 2016, additional interest liability towards lenders (IDC) during construction period on account of extended construction period, compensation for additional cost incurred on account of EPC overheads during the extended construction period from October 1, 2014, up to November 10, 2016, additional compensation for delay (as per actuals/anticipated in the financial model) for the project period till September, 2016 on account of inability to collect toll fee for the entire stretch resulting from various material defaults by respondent, additional SPV incorporation charges resulting due to infusion of increased equity by the shareholders on account of material defaults by the respondent and interest cost on such shareholder’s equity (unsecured debt from shareholders). The Claimant had raised a claim for ₹ 13,096.00 million. The Sponsor had also filed counter claims against the Claimant for ₹ 8,472.10 million. An award of ₹ 12,130 million in favour of the Claimant in the matter has been passed on July 31, 2021. The matter is currently pending.
10. M/s L&T Samakhiali Gandhidham Tollway Limited has initiated arbitration proceedings against the Sponsor in relation to 6-laning of Samakhiali-Gandhidham Section of NH-8A from Km 306.00 to Km 362.160 in the state of Gujarat to be executed as BOT (Toll) on Design, Build, Finance, Operate and Transfer (DBFOT) under NHDP Phase-V. The claims filed by the Claimant for cost claim arising on account of change in law in terms of the relevant concession agreement, amount claimed under the relevant state support agreement (“SSA”) for breach of obligations by us Government of Gujarat under the SSA, non-payment of compensation for absence of state support from the Sponsor from COD up to February 11,

2016, and cost claim due to delay in COD. The Claimant has raised a claim for ₹ 8,050.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 18,324.70 million. The matter is currently pending.

11. M/s IRB Ahmedabad Vadodara Super Express Tollway Private Limited has initiated arbitration proceedings against the Sponsor in relation to six laning of Ahmedabad to Vadodara Section of NH-8 from Km 6.400 to Km 108.700 (Length 102.300) in the State of Gujarat and improvement of Ahmedabad-Vadodara Expressway from Km 0.000 to Km 93.302 in the State of Gujarat (Length DBFOT) toll basis. The claims filed by the Claimant for competing road and premium not being payable, Illegal Demand of Additional Premium and Interest By The Respondent, Illegal Retention of Performance Bank Guarantee by the Respondent, Wrongful retention of Bank Guarantees and compensation towards loss of interest and bank commission charge and Cost of Arbitration. The Claimant has raised a claim for ₹ 5,571.10 million. The Sponsor has also filed counter claims against the Claimant for ₹ 4,231.70 million. The matter is currently pending.
12. Gwalior Jhansi Expressways Limited has initiated an arbitration proceeding against the Sponsor in relation to the designing, development and maintenance of certain sections of NH-75 in the States of Uttar Pradesh and Madhya Pradesh. The claims relate to compensation for non-payment of annuities and interest, for additional direct costs incurred by the Claimant due to material breach of the concession agreement and additional costs incurred by the Claimant in respect of interest payments during the construction period beyond the scheduled project completion date. The claims raised by the Claimant amount to ₹ 20,611.5 million. The Sponsor has also filed a counter claim against the Claimant for the failure relating to compliance of the maintenance obligation, reimbursement of one-half of remuneration, costs and expenses of the independent consultant, delayed cost due to time overrun and also on account of loss of toll revenue due to delay. The counter claim is for an amount of ₹ 17,024.00 million. The said matter is currently pending.
13. M/s Indore Dewas Tollways Limited. has initiated arbitration proceedings against the Sponsor in relation to 6-laning of Indore-Dewas Section of Nh-3 from Km 577.550 to Km 610.000 and Km 0.000 to Km 12.600 (approx. length 45.05Km) in the State of Madhya Pradesh under NHDP Phase-V to be executed as BOT(Toll) project on DBFOT pattern. The claims filed by the Claimant for claim for utilization of resources beyond the scheduled 6-laning date, as envisaged in the respective concession agreement, compensation for Claimant's loss towards additional interest during construction, compensation towards Claimants loss of toll revenue attributable to respondents misrepresentation and subsequent default in maintaining feeder roads, refund of additional concession fee/premium paid by the Claimant, compensation/indemnification towards loss of profit claimants EPC contractor. The Claimant has raised a claim for ₹ 9,158.10 million. The Sponsor has also filed counter claims against the Claimant for ₹ 1,700.00 million. The matter is currently pending.
14. GVK Shivpuri Dewas Expressway Private Limited has initiated arbitration proceedings against the Sponsor in relation to the designing, development and maintenance of the Shivpuri-Dewas Section of NH-3 in the State of Madhya Pradesh. The claims raised by the Claimant relate to the return of the performance bank guarantee upon termination of the contract by us and compensation for the losses suffered by the Claimant due to delay in receiving environmental clearances. The claims raised by the Claimant amount to ₹ 5,521.40 million. The Sponsor has also filed a counter claim against the Claimant for amounts incurred on account of maintenance and management of the existing stretch, estimated expenses on account of retendering and on account of loss of premium. The counter claim is for an amount of ₹ 10,761.00 million. The matter is currently pending.
15. M/s GVK Deoli Kota Expressway Private Limited has initiated arbitration proceedings against the Sponsor in relation to design, construction, development, finance, operation and maintenance of four laning of Deoli- Kota Section of NH-12 from Km 165.000 to Junction of NH-76 on Kota Bypass (approx. length 83.04 Kms) in the State of Rajasthan on BOT(Toll) project on DBFOT pattern under NHDP phase-II. The claims filed by the Claimant for claim on account of prolongation costs and extended stay at the site, loss suffered on account of additional overhead and loss of profit, loss of toll revenue, claim on account of increase in cost of the project due additional works done by the Claimant owing to the change of scope, claim on account of additional expenses incurred by the Claimant towards tunnel work, claim on account of excessive repair and prolonged maintenance duration of existing road, claim on account of the Respondent in making the termination payment and claim on account of future loss to Claimant. The Claimant has raised a claim for ₹ 16,000.00 Million . The Sponsor has also filed counter claims against the

Claimant for ₹ 5,657.60 million. The matter is currently pending.

16. Soma Isolux Kishangarh-Beawar Tollway Private Limited has initiated arbitration proceedings against the Sponsor in relation to the “improvement, operation and maintenance, rehabilitation and strengthening of the existing 2 lane road and widening it to six-lane divided highway from km 364.125 to km 58.245 (approximately 93.56 km) on the Krishangarh-Ajmer-Beawar section of National Highway”. The claim relates to compensation for increase in overheads due to extended construction period, for additional cost due to loss of productivity, idling and under-utilization of plant & equipment during the extended period and for costs incurred towards interest payments on debt during the extended construction period. The claims raised by Claimant amounts to ₹ 11,968.00 million. The Sponsor has also filed counter claims against Claimant for ₹ 3,109.5 million. The matter is currently pending.
17. Soma Isolux NH One Tollway Private Limited has initiated arbitration proceedings against the Sponsor in relation to six laning of Panipat-Jalandhar section of NH-1 (km 96.00 to km 387.100) in the state of Haryana and Punjab. The claims filed by the Claimant were in relation to delay in finalization of toll plaza and commencement of toll operations at approved locations, loss of fee revenue on account of defaults, extension of project completion schedule and change in scope and other claims. The Claimant has raised a claim for ₹ 70,359.00 million. The Sponsor has also filed counter claims against Claimant for ₹ 32,847.00 million. The matter is currently pending.
18. M/s. Shapoorji Pallonji & Company Private Limited has initiated arbitration proceedings against the Sponsor in relation to Jammu-Udhampur section BOT (Annuity). The claims filed by the Claimant in relation to declaration of provisional completion certificate date as June 1, 2014 with consequential reliefs of bonus for the period from January 7, 2014 to May 31, 2014, determination of appointed date and payment of bonus from July 5, 2014, compensation for additional cost arising out of change in methodology of rock excavation due from July 10, 2014, and compensation for additional cost arising out of change in methodology of tunnel rock excavation from October 17, 2014. The Claimant has raised a claim for ₹ 9,383.40 million. The Sponsor has also filed counter claims against the Claimant for ₹ 14,940.00 million. The matter is currently pending.
19. M/s Bareilly Highways Project Limited has initiated arbitration proceedings against the Sponsor in relation to four laning of Bareilly-Sitapur section of NH-24 from Km 262.000 to Km 413.200 (approx. 151.200km) in the State of Uttar Pradesh under NHDP Phase-III of DBFOT basis. The claims filed by the Claimant were in relation to claim for additional interest on debt beyond SPCD (i.e. between August 23, 2013 to January 31, 2019), interest for additional interest on debt beyond SPCD, claim for interest due on additional promoters contribution infused in the project, claim for interest due on delay release of grant, claim for expenses incurred by SPV company beyond SPCD, claim for interest for cost of land compensation, claim for net revenue loss from SPCD till January 31, 2019, interest for net revenue loss from SPCD till January 31, 2019, claim for interest on excess 50% independent engineering cost debit by the Sponsor, claim for reimbursement of GST on regular EPC invoices-change of law, claim for interest on claim of GST on change of scope & utility shifting, claim for direct expenses incurred by EPC contractor beyond SPCD, claim for plant and machinery rental/rehandling for extended period, claim for interest for plant and machinery/rental/rehandling for extended period, claim for price escalation during the extended period, claim for interest for price escalation during the extended period, claim for expenses incurred on change of scope/variation items, claim for interest for change of scope/variation items, claim for additional transportation cost due to ban in local mining at sites, claim for interest for additional transportation cost due to ban in local mining at sites. The Claimant has raised a claim for ₹ 37,211.40 million. The Sponsor has also filed counter claims against the Claimant for ₹ 3,54,211.00 million. The matter is currently pending.
20. M/s Lucknow-Sitapur Expressways Limited has initiated arbitration proceedings against the Sponsor in relation to improvement, operation and maintenance including strengthening and widening of existing two lane road to four lane dual carriageway from km 488.270 – Km. 413.200 of NH -24 (Lucknow Sitapur Section) in the State of Uttar Pradesh on BOT basis. The claims filed by the Claimant for revenue loss, revenue loss due to delay in COD, revenue loss from start of toll collection, EPC escalation, EPC additional overhead, EPC overstay of plant and equipment, additional maintenance cost of EPC, loss of profit earning capacity, extra cost IDC, revenue loss due to overloading and claims for underpasses. The Claimant has raised a claim for ₹ 7,470 million . The Sponsor has also filed counter claims against the Claimant for ₹ 3,370.00 million. The matter is currently pending.

21. M/s PNC Kanpur Highways Limited has initiated arbitration proceedings against the Sponsor in relation to two-laning with paved shoulder of Kanpur to Kabrai Section of NH-86 from Km 7.430 to Km 130.100 in the State of Uttar Pradesh on DBFOT basis. The claims filed by the Claimant were in relation to demand for increased overheads due to delay in appointed date, demand against additional cost suffered due to idling of plants and equipment due to delayed appointed date, damages for delay in handing over site as per provisions of the relevant concession agreement, demand against additional costs suffered on account of inflation/price escalation on cost of major inputs/resources due to delayed appointed date and extended construction period, demand for compensation against overheads due to extended stay than planned stay, demand for additional cost suffered due to extended stay of plants and equipment than planned duration, demand for additional interest liability suffered during construction period on account of extended construction period, demand for loss of revenue suffered due to non-realization of user fee collection from July 14, 2014 to May 5, 2015, demand for loss of revenue suffered due to suspension of collection of user fee at toll plazas on NHs due to demonetization of ₹ 500 and ₹1,000 currency notes, demand for loss of earning capacity and profit suffered due to extension of construction period, demand for loss suffered on equity due to delayed return on investment on account of delayed realization of toll revenues due to delay in declaration of appointed date, extended construction period and delay in PCOD, demand in lieu of interest on amounts raised under the various claims as above in accordance with the respective due dates of payment, the contractual provisions and the law. The Claimant had raised a claim for ₹ 6,180.00 million. An award of ₹ 2,503.90 million in the matter has been passed on April 23, 2021 in favour of the Claimant. The matter is currently pending.
22. M/s Tania Raxaul Private Limited has initiated arbitration proceedings against the Sponsor in relation to two laning with paved shoulder of Piopraakothi to Raxaul Section of NH-28A from Km 0.600 to Km 62.064 in the state of Bihar. The claims filed by the Claimant were in relation to claim for termination payment for default of respondent, claim for non-finalisation of location and correct notification for toll plaza (along with interest at the rate of 18%), claim for delay in handover for land/ right of way/ site (along with interest at the rate of 18%), claim for additional interest during construction on account of extended construction period, claim for increased distance/lead for stone aggregate, claim for inflation/ price escalation (along with interest at the rate of 18%), claim for additional cost of maintenance, claim for increased overheads of concessionaire (along with interest at the rate of 18%), claim for increased overheads of EPC contractor (along with interest at the rate of 18%), claim for idling/underutilisation of plant, machinery & equipment, and claim for loss of profits of EPC contractor. The Claimant has raised a claim for ₹ 9,010.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 2,873.60 million. The matter is currently pending.
23. M/s Haridwar Highways Project Limited has initiated arbitration proceedings against the Sponsor in relation to the four laning of Muzaffarnagar-Haridwar Section from Km 131.00 to Km 211.000 of NH-28 in the state of UP and Uttarakhand under NHDP Phase-II as BOT (Toll) on DBFOT pattern. The claims filed by the Claimant were in relation to financial expenses incurred by the Claimant beyond the scheduled commercial operation date till February 2019, interest payable on compensation for delay in handing over of the land form from appointed date till February, 2019, interest due on delay towards release of grant from February 7, 2013, up to February, 2019, claim for reimbursement of GST on regular bills/invoices of the Claimant from July, 2016, claims for expenses incurred by the Claimant on rentals of plants and machinery beyond SCOD, claims for expenses incurred by the Claimant on rentals of plants and machinery beyond SCOD till February 2019, claim for expenses incurred by the Claimant due to price escalation beyond the SCOD up to February 2019, additional transportation cost due to ban on mining at sites, claim for direct expenses incurred beyond SCOD up to February 2019, expenses incurred on existing road maintenance beyond SCOD and claim on account of amount recovered for Dehradun Highway Project Limited. The Claimant has raised a claim for ₹ 22,060.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 22,260.00 million. The matter is currently pending.
24. Madhucon (Madurai-Tuticorin Expressways Limited) has initiated arbitration proceedings against the Sponsor in relation to the "Design, Engineering, Finance, Construction, Operation and Maintenance of Madurai-Tuticorin Section from km 138.800 to km 264.50 of NH-45B in the State of Tamil Nadu under NHDP Phase IIIA". The claims relate to compensation payable due to prolongation of the project, refund of liquidated damages, change of scope of work, loss of business opportunity, loss on account of shortfall in revenue from the project and amount payable on account of price escalation during the extended period of construction. The claim raised by Claimant amounts to ₹ 81,993.10 million. The Sponsor has also filed counter claims against the Claimant for ₹ 2,902.60 million. The said matter is currently pending.

25. M/s Chennai Elevated Toll Way Limited has initiated arbitration proceedings against the Sponsor in relation to the new four lanes elevated road from Chennai Port to Maduravoyal (NH-4) in the State of Tamil Nadu under NHDP Phase-VII on BOT(Toll) basis. The claims filed by the Claimant were in relation to termination payment, claims payable to the EPC contractor, claim for additional cost due to idling/ underutilization/ prolongation of plants & equipment, loss of profit payable to the EPC contractor due to delay and termination of the contract, loss of opportunity to the EPC contractor due to delay and termination of the contract, claims for infructuous expenditure for setting up camps, site approach, road development etc. The Claimant has raised a claim for ₹ 41,071.80 million. The Sponsor has also filed counter claims against the Claimant for ₹ 21,632.70 million. The matter is currently pending.
26. Trichy Thanjavur Expressways Limited has initiated arbitration proceedings against the Sponsor in relation to the “design engineering, financing, construction, operation and maintenance of Thanjavur-Trichy Section from km 80.000 to km 135.750 of NH-67 in the State of Tamil Nadu”. The claims relate to the compensation payable on account of losses due to prolongation of the project, change in scope, losses on account of shortfall in revenue and loss of business opportunity and profit. The claims raised by the Claimant amounts to ₹ 29,906.70 million. The matter is currently pending.
27. M/s SU Toll Road Private Limited. has initiated arbitration proceedings against the Sponsor in relation to Salem-Ulundurpet Section from Km. 0.313 km 136.670 of NH – 68 in the State of Tamil Nadu under NHDP Phase – IIIA on Build, Operate and Transfer (BOT) basis. The claims filed by the Claimant for compensation were in relation to additional expenses incurred on account of extended stay of plant and equipment at the site, compensation for additional overheads in the extended construction period, compensation on account of the loss of opportunity to earn profits due to extended construction period, interest paid to the lenders due to delay in completion of project as per the original schedule and compensation for revenue loss due to delay in issuance of COD. The Claimant has raised a claim for ₹ 14,623.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 2,261.90 million. The matter is currently pending.
28. M/s T K Toll Road Private Limited. has initiated arbitration proceedings against the Sponsor in relation to design, engineering, finance, construction, operation and maintenance of Trichy to Karur Section of NH-67 from Km 135.800 to Km 218.028 (excluding Lalaper ROB) in the state of Tamil Nadu under NHDP Phase-IIIA on BOT basis. The claims filed by the Claimant were in relation to extended stay of plant and equipment from July 15, 2010 to February 23, 2014, increase in cost of input materials, fuel and labour expenses incurred in the extended period from July 15, 2010 to February 23, 2014, loss of revenue due to delay in provisional completion certificate from July 15, 2010, to February 23, 2014, overhead cost for the extended in the extended construction period, reimbursement of cost incurred for works executed in Trichy bypass (Km 135.800 to 154.400) on account of deletion of stretch from the purview of the relevant concession agreement, compensation for delay in payment of grant by the respondent, additional cost incurred on account of interest paid at higher rate of interest to lenders due to extended construction period from July 15, 2010 to February 23, 2014. The Claimant has raised a claim for ₹ 11,177.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 210.00 million. The matter is currently pending.
29. M/s MEP Chennai Bypass Toll Road Private Limited has initiated arbitration proceedings against the Sponsor in relation to operation and maintenance of Chennai Bypass section from Km 0.000 to Km 32.600 of NH-4 & 5 in the State of Tamil Nadu on OMT basis. The claims filed by the Claimant were in relation to amount due towards concession fee (up to April 8, 2016), damages for non-completion of project facilities calculated up to April 8, 2016, amount due towards non-fulfilment of condition precedent and damages for non-maintenance of project highway calculated up to April 8, 2016. The Claimant has raised a claim for ₹ 5,033.00 million. The Sponsor has also filed counter claims against the Claimant for ₹ 8,704.30 million. The matter is currently pending.
30. M/s Suncon-Soma (JV) has initiated arbitration proceedings against the Sponsor in relation to four lane national highway connectivity to ICTT at Vallarpadam, Cochin, in the State of Kerala (17.200 km). The claims filed by the Claimant were in relation to compensation for additional expenditure incurred for transporting materials through extra distance to the construction sites due to non-handing over of land, payment of price variation/adjustment for utility shifting works, compensation of price variation/adjustment for utility shifting works, compensation payable consequent to prolongation of the contract and for costs of arbitration. The Claimant has raised a claim for ₹ 5,312.00 million. The Sponsor has also filed counter claims against Claimant for ₹ 1,027.30 million. The matter is currently pending.

31. M/s Kurukshetra Expressway Private Limited has initiated arbitration proceedings against the Sponsor in relation to four laning of Rohtak-Bawal section of NH-352 (Old NH-71) from Km 363.300 (Design Km. 363.300) to Km 450.800 (Design Km 445.553) under NHDP-III in the State of Haryana on DBFOT basis. The claims were raised under the terms of the relevant concession agreement. The Claimant has raised a claim for ₹ 9,150.00 million. The matter is currently pending.
32. M/s JSR Mulbagal Tollways Private Limited has initiated arbitration proceedings against the Sponsor in relation to 4-laning of Mulbagal-AP/Karnataka Border Section of NH-75 (Old NH-4) from Km 216.912 to Km 239.100 in the state of Karnataka to be executed on design, build, finance, operate and transfer (DBFOT/BOT) basis in BOT (Toll) mode under NHDP Phase-III. The claims filed by the Claimant are in relation to the amount payable to the Claimant in the event of termination by concessionaire and / or by the authority, the interest on the capital/equity of the concessionaire, loss for underutilization / idle of resources deployed in the way of man power, towards machineries, plant and equipment beyond the date of completion for about 29 months, loss of profit, loss of return envisaged by the concessionaire as a result of default of the authority, amount spent towards the short fall of subsistence revenue, losses due to price escalation, revenue that might have generated by the Claimant through advertisements and loss due COVID-19. The Claimant has raised a claim for ₹ 21,332.50 million. The Sponsor has also filed counter claims against the Claimant for ₹ 119.30 million. The matter is currently pending.
33. The Sponsor has initiated arbitration proceedings against M/s Transstroy Hoskote-Dobbaspeth Tollway Private Limited in relation to the four laning of Hoskote-Dobbaspeth section of NH-207 from Km 58.300 to Km 138.320 in the State of Karnataka under NHDP, Phase-IV to be executed on DBFOT (Toll) basis. The claims filed by the Sponsor were in relation to damages on account of non-achievement of prescribed milestones, claim and recovery towards escalation in price and additional cost of the project, compensation for loss of goodwill and reputation, special repair to damaged portion of bypass portion of existing road of Hoskote-Dobbaspeth section of NH-207 from Km 58+300 to Km 138+320 by a third party, routine maintenance and special repair to existing road of Hoskote – Dobbaspeth section of NH-207 other than the bypass portion by M/s. Nikhil Infra Projects Private Limited. The Sponsor has raised a claim for ₹ 35,410.00 million. M/s Transstroy Hoskote-Dobbaspeth Tollway Private Limited has also filed counter claims against the Claimant for ₹ 4,231.70 million. The matter is currently pending.
34. M/s Rohtak Panipat Tollway Private Limited has initiated arbitration proceedings against the Sponsor in relation to the four laning of Rohtak-Panipat Section of NH-71A from Km 0.00 (Km 63.300) of NH-10 to Km 80.58 (Km 83.500 of NH-1) in the State of Haryana on DBFOT basis under NHDP Phase-III. The claims filed by the Claimant were raised in terms of the relevant concession agreement. The Claimant has raised a claim for ₹ 11,510.00 million. The matter is currently pending.
35. M/s Ranchi Expressway Limited has initiated arbitration proceedings against the Sponsor in relation to the four laning of Ranchi- Rargaon-Jamshedpur Section from Km 114.00 to Km 277.500 of NH-33 in the State of Jharkhand on BOT(Annuity) basis under NHDP Phase-II. The claims filed by the Claimant were in relation to payment towards value of work done, amount payable towards maintenance of existing road, refund of amount expended on interest during construction, compensation payable due to delay in handling over of land, extra expenditure due to escalation of cost of work done, loss incurred due to idling of machinery due to prolongation of project, loss of overheads due to prolongation of project, loss of overheads and profits on value of work done due to illegal termination and claim for amount of revenue loss (loss of annuity). The Claimant has raised a claim for ₹ 80,172.80 million. The Sponsor has also filed counter claims against the Claimant for ₹ 3,628.10 million. The matter is currently pending.

Material civil matters filed by the Sponsor

36. Essel Walajahpet Poonamalle Toll Road Private Limited has filed a petition before the High Court of Delhi (challenging the award of the arbitral tribunal). The claims challenged are for compensation for adjusted equity as termination payments, compensation for repayment of the debt borrowed from the lenders/creditors, compensation for loss of profit payable to EPC contractor, compensation for internal rate of return and mobilisation and de-mobilisation. The amount challenged before the High Court of Delhi is ₹ 65,32.90 million. The matter is currently pending.
37. The Sponsor has filed a petition before the High Court of Delhi (challenging the award of the arbitral tribunal) against Oriental Nagpur Betul Highways Limited. The claims challenged are for date of PCOD to

be declared as January 7, 2014, and grant bonus of additional 91 days including 9th instalment of annuity payment. The amount challenged before the High Court of Delhi is ₹ 5,524.00 million. The matter is currently pending.

38. The Sponsor has filed a petition before the High Court of Delhi (challenging the award of the arbitral tribunal) against West Haryana Highway Private Limited. The claims challenged are interest due on additional promoter contribution infused in the project, price escalation during the extended period, plant and machinery idling/rental/rehandling for extended period and interest on plant and machinery idling/rental. The amount challenged before the High Court of Delhi is ₹ 5,478.90 million. The matter is currently pending.
39. The Sponsor has filed a petition before the High Court of Delhi (challenging the award of the arbitral tribunal) against Gwalior Bypass Project Limited. The claims challenged are claim for interest on delayed release of annuity amount along with interest due to delayed payment of regular annuity, claim for interest on debt after COD till December 31, 2016 and interest incurred on price escalation from PCOD till October 31, 2016. The amount challenged before the High Court of Delhi is ₹ 5,328.10 million. The matter is currently pending.

Other material litigation

Considering the business and purpose of the Sponsor, it is imperative for the Sponsor to have an effective mechanism for the acquisition of land for building roads. Taking this need of the Sponsor into account, the parliament has enacted the NH Act, a special enactment which overrides the Land Acquisition Act, 1894 in cases where the land is acquired for the purposes of building National Highways. The Parliament has enacted the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, which is applicable to land acquisitions under NH Act with effect from January 1, 2015 (i.e. one year from the date of commencement of the Act, subject to notification by Central Government). The process of acquiring land is a very cumbersome process and it leads to a large number of disputes. At present there are approximately 72,000 land acquisition cases pending before various Courts/Tribunals/Competent Authorities for adjudication.

VI. Litigations involving the Associates of the Sponsor

Except as disclosed below, as on the date of the Final Placement Memorandum, there are no pending criminal or material litigations or regulatory actions involving the Associates of the Sponsor.

Sr. No	Name of Associate	Number of proceedings outstanding	Amount involved (₹ in million)
<i>Direct Tax</i>			
1.	Paradip Port Road Company Limited	5	7.74
2.	Tuticorin Port Road Company Limited	3	1.97
3.	Vishakhapatnam Port Road Company Limited	3	1.73
4.	Calcutta Haldia Port Road Company Limited	3	-
5.	Mumbai JNPT Port Road Company Limited	2	-
6.	New Mangalore Port Road Company Limited	2	-
7.	Chennai Ennore Port Road Company Limited	1	-
8.	Ahmedabad Vadodara Expressway Company Limited	7	112.14

VII. Litigations involving the Project Manager

There are no pending criminal, regulatory or other material litigations involving the Project Manager as on the date of the Final Placement Memorandum.

VIII. Litigations involving the Associates of the Project Manager

Please see the section entitled “ – *Litigations involving the Associates of the Sponsor*” above.

IX. Litigations involving the Investment Manager

There are no pending criminal, regulatory or other material litigations involving the Investment Manager as on the date of the Final Placement Memorandum.

X. Litigations involving the Associates of the Investment Manager

As the President of India is the Promoter of the Investment Manager, persons or entities that may be classified as 'associates' of the Investment Manager in terms of Regulation 2(1)(b)(ii) and Regulation 2(1)(b)(iii) of the InvIT Regulations, have not been identified as 'associates' of the Investment Manager. Consequently, information or disclosures required to be included with respect to such persons or entities pursuant to the InvIT Regulations has not been included in the Final Placement Memorandum.

XI. Litigations involving the Trustee

1. Hubtown Limited (the “**Plaintiff**”) had filed a case before the High Court of Bombay against the Trustee and its directors (the “**Defendants**”) for having informed the bankers of the Plaintiff regarding the defaults committed by the Plaintiff. The Trustee has stated that the Plaintiff is a guarantor for the debt for which the Trustee is acting as a debenture trustee and in case of defaults, the relevant documents authorize the Trustee to share information about such default to CIBIL/RBI and other creditors. The aggregate amount claimed is ₹ 3,000 million. The matter is currently pending in the Court for settlement.
2. SBI Cap Trustee (the “**Plaintiff**”) had filed a suit before the City Civil Court, Bangalore against the Trustee and others (the “**Defendants**”) requiring sale of pledged shares for a particular price by SREI Fund/Investors, for whom the Trustee was acting as the share pledge trustee. The Plaintiff was acting for a consortium of lenders and has residual interest. The aggregate claim amount is Rs. 1,550.3 million. The Branch Manager of SBI along with their counsel submitted to the Court that they are willing to explore settlement. The Court referred the matter for pre-conciliation efforts. The Plaintiff informed the Conciliator that if certain details of the loan transaction and a statement of accounts in relation to the same were provided, the dispute could be resolved quickly. The matter is pending.
3. Balmer Lawrie and Company Limited and another (the “**Plaintiffs**”) had filed a petition before the Calcutta High Court against the Trustee and certain others (the “**Defendants**”) challenging the validity of the sale transaction of 1,48,20,000 shares in Transafe Services Limited by the Defendant to the Plaintiff. The Plaintiffs have inter alia sought (a) the recovery of consideration received by the Defendants for the allegedly void contract being ₹ 237.12 million and (b) interest at the rate of 18% per annum on the decretal amount. The matter is currently pending.
4. Loancore Servicing Solutions Private Limited (the “**Petitioner**”) had filed a Company petition no. 293/59/ND/2019 before the National Company Law Tribunal (“**NCLT**”), Principal Bench at New Delhi against the Religare Enterprise Limited and others including the Trustee (the “**Respondents**”) alleging that the Respondents sold the shares of the Religare Enterprise Limited under the dominion and control of the Petitioners to Respondent no. 3-5. It is further alleged that the Trustee appropriated the shares and had transferred them to the Respondents nos. 3 to 5. It is furthermore alleged that the pledged shares had been sold to consciously deprive the Petitioner of its rights and to facilitate an illegal takeover of Respondent no. 1 by the Trustee through Respondent no.5 acting in concert. The alleged damages claim amount is ₹ 700 million is against the Respondent nos. 2 to 5. The NCLT has refused to pass any interim orders as asked by the Petitioner. The Petitioners has failed to produce any evidence or otherwise establish that it has any form of contractual privity or other relationship of any manner with the Trustee and therefore has absolutely no locus to make any claims against the Trustee. The success of the Petitioner against the Trustee in the instant petition being agitated is remote. However, the petition is pending before the NCLT, Delhi.
5. Future Corporate Resources Limited (FCRL) In the matter of FCRL ESOP Trust, SEBI Adjudicating Officer has passed an order dated the February 3, 2021, on the ground of insider trading against eight

persons including FCRL Employees Trust of which ITSL is a trustee. FCRL along with FCRL Employee Welfare Trust has been jointly and severally directed to disgorge an amount of ₹ 2, 75, 68,650/-. ITSL has submitted that ITSL as a trustee has acted on the instructions of the committee and not liable for insider trading and has not gained or received any amount. ITSL and FCRL Employee Welfare Trust are separate. All the said persons have filed an appeal before SAT against the said SEBI Order dated the February 3, 2021. SAT has given the next date of hearing in the month of November on November 9, 2021. The matter is sub-judice.

SECURITIES MARKET OF INDIA

The information in this section has been extracted from documents available on the website of SEBI and the stock Exchange and has not been prepared or independently verified by the Parties to the InvIT or the Lead Managers or any of their respective affiliates or advisors.

The Indian Securities Market

India has a long history of organized securities trading. In 1875, the first stock exchange was established in Mumbai. BSE and NSE together hold a dominant position among the stock exchanges in terms of the number of listed companies, market capitalisation and trading activity.

Stock Exchange Regulation

Indian stock exchanges are regulated primarily by SEBI, as well as by the Government acting through the Ministry of Finance, Capital Markets Division, under the SCRA and the SCRR. SEBI, in exercise of its powers under the SCRA and the SEBI Act, notified Securities Contract (Regulation) (Stock Exchanges and clearing Corporations) Regulations, 2018 (the “**SCR (SECC) Regulations**”), which regulate *inter alia* the recognition, ownership and internal governance of stock exchanges and clearing corporations in India together with providing for minimum capitalisation requirements for stock exchanges. The SCRA, the SCRR and the SCR (SECC) Regulations along with various rules, bye-laws and regulations of the respective stock exchanges, regulate the recognition of stock exchanges, the qualifications for membership thereof and the manner, in which contracts are entered into, settled and enforced between members of the stock exchanges.

The SEBI Act empowers SEBI to regulate the Indian securities markets, including stock exchanges and intermediaries in the capital markets, promote and monitor self-regulatory organisations and prohibit fraudulent and unfair trade practices. Regulations concerning minimum disclosure requirements by public companies, rules and regulations concerning investor protection, insider trading, substantial acquisitions of shares and takeover of companies, buy-backs of securities, employee stock option schemes, stockbrokers, merchant bankers, underwriters, mutual funds, foreign institutional investors, credit rating agencies and other capital market participants have been notified by the relevant regulatory authority.

Listing and Delisting of Securities

The InvIT Regulations provide for listing and delisting of units of InvITs on and from the stock exchanges.

BSE

Established in 1875, it is the oldest stock exchange in India. In 1956, it became the first stock exchange in India to obtain permanent recognition from the Government under the SCRA. It has evolved over the years into its present status as one of the premier stock exchanges of India. Pursuant to the BSE (Corporatization and Demutualization) Scheme 2005 of SEBI, with effect from August 19, 2005, BSE was incorporated as a company under the Companies Act, 1956. The equity shares of BSE were listed on NSE on February 3, 2017.

NSE

NSE was established by financial institutions and banks to provide nationwide online, satellite-linked, screen-based trading facilities with market-makers and electronic clearing and settlement for securities including government securities, debentures, public sector bonds and units. It has evolved over the years into its present status as one of the premier stock exchanges of India. NSE was recognised as a stock exchange under the SCRA in April 1993 and commenced operations in the wholesale debt market segment in June 1994. The capital market (equities) segment commenced operations in November 1994 and operations in the derivatives segment commenced in June 2000.

Internet-based Securities Trading and Services

Internet trading takes place through order routing systems, which route client orders to exchange trading systems for execution. Stockbrokers interested in providing this service are required to apply for permission to the relevant stock exchange and also have to comply with certain minimum conditions stipulated by SEBI. NSE became the

first exchange to grant approval to its members for providing internet-based trading services. Internet trading is possible on both the “equities” as well as the “derivatives” segments of NSE.

Trading Hours

Trading on both NSE and BSE occurs from Monday to Friday, between 9:15 a.m. and 3:30 p.m. IST (excluding the 15 minutes pre-open session from 9:00 a.m. to 9:15 a.m. that has been introduced recently). BSE and NSE are closed on public holidays. The recognised stock exchanges have been permitted to set their own trading hours (in the cash and derivatives segments) subject to the condition that (i) the trading hours are between 9.00 a.m. and 5.00 p.m.; and (ii) the stock exchange has in place a risk management system and infrastructure commensurate to the trading hours.

Trading Procedure

This totally automated screen based trading in securities was put into practice nationwide. This has enhanced transparency in dealings and has assisted considerably in smoothening settlement cycles and improving efficiency in back-office work. In the year 2004, BSE introduced its new generation trading platform, BOLT Plus.

NSE has introduced a fully automated trading system called National Exchange for Automated Trading (“NEAT”), which operates on strict time/price priority besides enabling efficient trade. NEAT has provided depth in the market by enabling large number of members all over India to trade simultaneously, narrowing the spreads.

Depositories

The Depositories Act provides a legal framework for the establishment of depositories to record ownership details and effect transfer in book-entry form. Further, SEBI framed regulations in relation to the registration of such depositories, the registration of participants as well as the rights and obligations of the depositories, participants, companies and beneficial owners. The depository system has significantly improved the operation of the Indian securities markets.

SELLING AND TRANSFER RESTRICTIONS

The distribution of the Placement Memorandum and this Final Placement Memorandum and the offer, sale or delivery of the Units is restricted by law in certain jurisdictions. Persons who may come into possession of the Placement Memorandum and this Final Placement Memorandum are advised to consult with their own legal advisors as to what restrictions may be applicable to them and to observe such restrictions. The Placement Memorandum and this Final Placement Memorandum may not be used for the purpose of an offer or invitation in any circumstances in which such offer or invitation is not authorized. Due to the following restrictions, investors are advised to consult legal counsel prior to purchasing Units or making any resale, pledge or transfer of the Units.

Each purchaser of the Units in this Offer will be deemed to have made acknowledgments and agreements as described under “Notice to Investors – Representations by Eligible Investors” on page 2 of this Final Placement Memorandum.

Republic of India

The Placement Memorandum and this Final Placement Memorandum may not be distributed directly or indirectly in India or to residents of India and any Units may not be offered or sold directly or indirectly in India to, or for the account or benefit of, any resident of India except as permitted by applicable Indian laws and regulations, under which an offer is strictly on a private and confidential basis and is limited to Eligible Investors and is not an offer to the public. The Placement Memorandum and this Final Placement Memorandum is neither a public issue nor a prospectus under the Companies Act, 2013 or an advertisement and should not be circulated to any person other than to whom this Offer is made. The Placement Memorandum and this Final Placement Memorandum has not been and will not be registered as a prospectus with any Registrar of Companies in India.

No action has been taken or will be taken by National Highways Infra Trust, the Investment Manager or the Lead Managers that would permit a public offering of the Units to occur in any jurisdiction, or the possession, circulation or distribution of the Placement Memorandum and this Final Placement Memorandum or any other material relating to National Highways Infra Trust or the Units in any jurisdiction where action for such purpose is required. Accordingly, the Units may not be offered or sold, directly or indirectly, and none of the Placement Memorandum or this Final Placement Memorandum, any offering materials and any advertisements in connection with the offering of the Units may be distributed or published in or from any country or jurisdiction except under circumstances that will result in compliance with any applicable rules and regulations of any such country or jurisdiction. The Offer will be made in compliance with the applicable InvIT Regulations. Each purchaser of the Units in this Offer will be deemed to have made acknowledgments and agreements as described under “Notice to Investors” on page 1, “Notice to Investors - Representations by Eligible Investors” on page 2 and these Selling and Transfer Restrictions.

Australia

This Final Placement Memorandum does not constitute a prospectus or other disclosure document under the Corporations Act 2001 (Cth) (“**Australian Corporations Act**”) and does not purport to include the information required of a prospectus or disclosure document under the Australian Corporations Act. This Final Placement Memorandum has not been lodged with the Australian Securities and Investments Commission (“**ASIC**”) and no steps have been taken to lodge it with ASIC. No offer will be made under this Final Placement Memorandum to any person to whom disclosure is required to be made under Chapter 6D of the Australian Corporations Act. Any offer in Australia of the Units under this Final Placement Memorandum may only be made to persons who are “sophisticated investors” (within the meaning of section 708(8) of the Australian Corporations Act), “professional investors” (within the meaning of section 708(11) of the Australian Corporations Act) or otherwise pursuant to one or more exemptions under section 708 of the Australian Corporations Act which permit the offer of the Units without disclosure under Part 6D.2 of the Australian Corporations Act.

As any offer of Units under this Final Placement Memorandum will be made without disclosure in Australia under Chapter 6D.2 of the Australian Corporations Act, the offer of those securities for resale in Australia within 12 months may, under section 707 of the Australian Corporations Act, require disclosure to investors under Chapter 6D.2 if none of the exemptions in section 708 applies to that resale. By applying for the Units you undertake to the Issuer that you will not, for a period of 12 months from the date of issue of the Units, offer, transfer, assign or otherwise alienate those securities to any person in Australia except in circumstances where disclosure to such person is not required under Chapter 6D.2 of the Australian Corporations Act or where a compliant disclosure

document is prepared and lodged with ASIC.

Canada

Prospective Canadian investors are advised that the information contained within this Final Placement Memorandum has not been prepared with regard to matters that may be of particular concern to Canadian investors. Accordingly, prospective Canadian investors should consult with their own legal, financial and tax advisers concerning the information contained within this Final Placement Memorandum and as to the suitability of an investment in the Units in their particular circumstances.

The Units may be sold only to purchasers purchasing, or deemed to be purchasing, as principal that are both accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions or subsection 73.3(1) of the Securities Act (Ontario), and permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of the Units must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this Final Placement Memorandum (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser's province or territory for particulars of these rights or consult with a legal advisor. Pursuant to section 3A.3 of National Instrument 33-105 Underwriting Conflicts ("**NI 33-105**"), the Lead Managers are not required to comply with the disclosure requirements of NI 33-105 regarding underwriter conflicts of interest in connection with this Offer.

Upon receipt of this Final Placement Memorandum, each Canadian purchaser hereby confirms that it has expressly requested that all documents evidencing or relating in any way to the sale of the securities described herein (including for greater certainty any purchase confirmation or any notice) be drawn up in the English language only.

Cayman Islands

No offer or invitation to subscribe for Units may be made to the public in the Cayman Islands to subscribe for any of the Units but an invitation or offer may be made to sophisticated persons (as defined in the Cayman Islands Securities Investment Business Law (the "**SIBL**"), high net worth persons (as defined in the SIBL) or otherwise in accordance with the SIBL.

The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this document nor taken steps to verify the information set out in it and has no responsibility for it. The Units to which this Final Placement Memorandum relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the Units offered should conduct their own due diligence on the Units.

Dubai International Financial Centre

This Final Placement Memorandum relates to an Exempt Offer in accordance with the Markets Rules Module of the Dubai Financial Services Authority (the "**DFSA**") Rulebook. This Final Placement Memorandum is intended for distribution only to Professional Clients who are not natural persons. It must not be delivered to, or relied on by, any other person.

European Economic Area

In relation to each member state of the European Economic Area and the United Kingdom (each, a "**Relevant State**"), no Units have been offered or will be offered pursuant to the Offer to the public in that Relevant State prior to the publication of a prospectus in relation to the Units that has been approved by the competent authority in that Relevant State or, where appropriate, approved in another Relevant State and notified to the competent authority in that Relevant State, all in accordance with the Prospectus Regulation, except that offers of the Units may be made to the public in that Relevant State at any time under the following exemptions under the Prospectus Regulation.

- (a) to any legal entity which is a qualified investor as defined under the Prospectus Regulation;
- (b) to fewer than 150 natural or legal persons (other than qualified investors as defined under the Prospectus Regulation), subject to obtaining the prior consent of the Book Running Lead Managers and the Syndicate Members for any such offer; or
- (c) in any other circumstances falling within Article 1(4) of the Prospectus Regulation,

provided that no such offer of the Units shall require the Trust or any manager to publish a prospectus pursuant to article 3 of the Prospectus Regulation or supplement a prospectus pursuant to article 23 of the Prospectus Regulation.

For the purposes of this provision, the expression “**offer to the public**” in relation to any Units in any Relevant State means the communication in any form and by any means of sufficient information on the terms of the offer and any Units to be offered so as to enable an investor to decide to purchase or subscribe for any Units and the expression “**Prospectus Regulation**” means Regulation (EU) 2017/1129.

Hong Kong

The Units have not been offered or sold and will not be offered or sold in Hong Kong, by means of any document, other than (a) to “professional investors” as defined in the Securities and Futures Ordinance (Chapter 571 of the Laws of Hong Kong) (the “**SFO**”) and any rules made under the SFO; or (b) in other circumstances which do not result in the document being a “prospectus” as defined in the Companies (Winding Up and Miscellaneous Provisions) Ordinance (Cap. 32) of Hong Kong (the “**C(WUMP)O**”) or which do not constitute an offer to the public within the meaning of the C(WUMP)O.

No advertisement, invitation or document relating to the Units, which is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to Units which are or are intended to be disposed of only to persons outside Hong Kong or only to “professional investors” as defined in the SFO and any rules made under the SFO has been or will be issued, whether in Hong Kong or elsewhere.

Luxembourg

The Units may not be offered or sold in the Grandduchy of Luxembourg, except where offered in circumstances that do not require the approval of a prospectus by the Luxembourg Financial Regulatory Authority in accordance with the Law of July 12, 2005 on prospectuses for securities. This Final Placement Memorandum shall be non-public and strictly confidential and shall only be disclosed to a limited number of professional investors for their consideration in connection with the private offering of the Units, in all cases under circumstances designed to preclude a distribution that would be other than a private placement. For the avoidance of doubt, the offering or sale of Units to professional investors in Luxembourg has been duly notified to the Luxembourg Financial Regulatory Authority in accordance with (i) Article 45 of the Law of July 12, 2013 on AIFMDs and (ii) the Luxembourg regulator's current practice and guidelines. This Final Placement Memorandum may not be reproduced or used for any purpose, or provided to any person other than those to whom copies have been sent. The recipient will keep permanently confidential all information contained in this Final Placement Memorandum not already in the public domain and will use the Placement Memorandum for the sole purpose of evaluating a possible investment in National Highways Infra Trust.

Mauritius

The public of the republic of Mauritius is not invited to subscribe for the interests offered hereby. This Final Placement Memorandum relates to a private placement and does not constitute an offer to the public in Mauritius to subscribe for the interests offered hereby. The interests are only being offered to a limited number of sophisticated investors meeting the eligibility criteria. No regulatory approval has been sought for the Offer in Mauritius and it must be distinctly understood that the Mauritius Financial Services Commission does not accept any responsibility for the financial soundness of or any representations made in connection with the Offer. The Final Placement Memorandum is for the use only of the named addressee and should not be given or shown to any other person.

Saudi Arabia

This Final Placement Memorandum may not be distributed in the Kingdom of Saudi Arabia except to such persons as are permitted under the Rules on the Offer of Securities and Continuing Obligations issued by the Capital Market Authority (“CMA”). The CMA does not make any representation as to the accuracy or completeness of this Final Placement Memorandum and expressly disclaims any liability whatsoever for any loss arising from, or incurred in reliance upon, any part of the Placement Memorandum. Prospective purchasers of the Units offered hereby should conduct their own due diligence on the accuracy of the information relating to the Units. If you do not understand the contents of this Final Placement Memorandum, you should consult an authorised financial adviser.

Singapore

The Final Placement Memorandum has not been and will not be registered as a prospectus with the Monetary Authority of Singapore, and the Units will be offered pursuant to exemptions under the Securities and Futures Act (Chapter 289) of Singapore, as modified or amended from time to time (the “SFA”). Accordingly, the Units may not be offered or sold or made the subject of an invitation for subscription or purchase nor may the Final Placement Memorandum or any other document or material in connection with the offer or sale or invitation for subscription or purchase of the Units be circulated or distributed, whether directly or indirectly, to any person in Singapore other than (i) to an institutional investor (as defined in Section 4A of the SFA) pursuant to Section 274 of the SFA, (ii) to a relevant person (as defined in Section 275(2) of the SFA) pursuant to Section 275(1) of the SFA, or any person pursuant to Section 275(1A) of the SFA, and in accordance with the conditions specified in Section 275 of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA.

Where Units are subscribed or purchased under Section 275 of the SFA by a relevant person which is:

- (a) a corporation (which is not an accredited investor (as defined in Section 4A of the SFA)) the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or
- (b) a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor,

securities or securities-based derivatives contracts (each term as defined in Section 2(1) of the SFA) of that corporation or the beneficiaries’ rights and interest (howsoever described) in that trust shall not be transferred within six (6) months after that corporation or that trust has acquired the Units pursuant to an offer made under Section 275 of the SFA except:

- (i) to an institutional investor or to a relevant person, or to any person arising from an offer referred to in Section 275(1A) or Section 276(4)(i)(B) of the SFA;
- (ii) where no consideration is or will be given for the transfer;
- (iii) where the transfer is by operation of law;
- (iv) as specified in Section 276(7) of the SFA; or
- (v) as specified in Regulation 37A of the Securities and Futures (Offers of Investments) (Securities and Securities-based Derivatives Contracts) Regulations 2018.

United Arab Emirates (“UAE”)

The Units have not been, are not being, and will not be publicly offered, sold, promoted or advertised in the United Arab Emirates other than in compliance with the laws of the United Arab Emirates governing the issue, offering and sale of securities. Further, this Final Placement Memorandum does not constitute a public offer of securities in the United Arab Emirates and is not intended to be a public offer. This Final Placement Memorandum has not been approved by or filed with the Central Bank of the United Arab Emirates, the Securities and Commodities

Authority or any other relevant licensing authorities or governmental agencies in the United Arab Emirates. This Final Placement Memorandum is strictly private and confidential and has not been reviewed, deposited or registered with any licensing authority or governmental agency in the United Arab Emirates.

This Final Placement Memorandum must not be shown, made available or provided to any person other than the original recipient and may not be reproduced or used for any other purpose. The Units may not be offered or sold directly or indirectly to the public in the United Arab Emirates. If you do not understand the contents of this Prospectus, you should consult an authorized financial adviser.

United Arab Emirates (Excluding the Dubai International Finance Centre)

This Final Placement Memorandum is strictly private and confidential and is being distributed to a limited number of investors and must not be provided to any person other than the original recipient, and may not be reproduced or used for any other purpose. If you are in any doubt about the contents of this document, you should consult an authorised financial adviser.

By receiving this Final Placement Memorandum, the person or entity to whom it has been issued understands, acknowledges and agrees that this Final Placement Memorandum has not been approved by or filed with the UAE Central Bank, the UAE Securities and Commodities Authority (the “SCA”) or any other authorities in the UAE (outside of the financial free zones established pursuant to UAE Federal Law No. 8 of 2004), nor have the JLMs received authorisation or licencing from the UAE Central Bank, SCA or any other authorities in the UAE to market or sell securities or other investments within the UAE. It should not be assumed that any of the JLMs is a licenced broker, dealer or investment adviser under the laws applicable in the UAE, or that any of them advise individuals resident in the UAE as to the appropriateness of investing in or purchasing or selling securities or other financial products.

No marketing of any financial products or services has been or will be made from within the UAE other than in compliance with the laws of the UAE and no subscription to the Units or other investments may or will be consummated within the UAE. The Units are not intended for circulation or distribution in or into the UAE, other than to persons who are “Qualified Investors” within the meaning of the SCA’s Board of Directors Decision No. 3 of 2017 Concerning the Organisation of Promotion and Introduction to whom the materials may lawfully be communicated. This does not constitute a public offer of securities in the UAE under the SCA Chairman of the Board Resolution No. 11/R.M of 2016 on the Regulations for Issuing and Offering Shares of Public Joint Stock Companies, or otherwise.

Nothing contained in this Final Placement Memorandum is intended to constitute investment, legal, tax, accounting or other professional advice. This Final Placement Memorandum is for your information only and nothing in this document is intended to endorse or recommend a particular course of action. Any person considering acquiring securities should consult with an appropriate professional for specific advice rendered based on their respective situation.

United Kingdom

The Final Placement Memorandum is only directed at, and will only be provided to, persons to whom interests may lawfully be promoted pursuant to section 21 of the Financial Services and Markets Act 2000 (the “FSMA”). In particular, this Final Placement Memorandum is only directed at, and will only be provided to, investment professionals (“**Relevant Persons**”) within the meaning of article 19 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (“FPO”). Any investment or investment activity to which the Placement Memorandum relates is available only to Relevant Persons and dealings hereunder will be made only with Relevant Persons. Persons who are not investment professionals within the meaning of article 19 of the FPO should not rely on the Placement Memorandum.

The Placement Memorandum has not been delivered for approval to the United Kingdom Financial Conduct Authority in the United Kingdom or to an authorized person within the meaning of the FSMA. No approved prospectus within the meaning of section 85 of the FSMA or of the Prospectus Regulation has been published or is intended to be published in relation to the Offer. The Final Placement Memorandum does not constitute a prospectus for the purposes of the FSMA or the Prospectus Regulation.

United States of America

Each purchaser or subscriber of Units in the United States will be deemed to have represented and agreed that it has received a copy of this Final Placement Memorandum and such other information as it deems necessary to make an investment decision and that:

- (i) it is (A) a U.S. QIB, (B) acquiring the Units for its own account or for the account of one or more U.S. QIBs with respect to whom it has the authority to make, and does make, the representations and warranties set forth in this paragraph, (C) acquiring the Units for investment purposes, and not with a view to further distribution of such Units and (D) aware, and each beneficial owner of the Units has been advised, that the sale of the Units to it is being made in reliance on an exemption from, or in a transaction not subject to, the registration requirements of the Securities Act;
- (ii) it understands and agrees that the Units have not been and will not be registered under the Securities Act or with any securities regulatory authority of any state, territory or other jurisdiction of the United States and may not be offered, resold, pledged or otherwise transferred, except (A)(1) to a person whom the purchaser and any person acting on its behalf reasonably believes is a U.S. QIB purchasing for its own account or for the account of a U.S. QIB in a transaction meeting the requirements of Rule 144A, (2) in an offshore transaction complying with Rule 903 or Rule 904 of Regulation S, (3) pursuant to an exemption from the registration requirements of the Securities Act provided by Rule 144 thereunder (if available) or (4) pursuant to an effective registration statement under the Securities Act and (B) in accordance with all applicable securities laws of any state, territory or other jurisdiction of the United States;
- (iii) it acknowledges that the Units are “restricted securities” within the meaning of Rule 144(a)(3) under the Securities Act, that the Units are being offered and sold in a transaction not involving any public offering in the United States within the meaning of the Securities Act and that no representation is made as to the availability of the exemption provided by Rule 144 for resales of the Units;
- (iv) it understands that in the event Units are held in certificated form, such certificated Units will bear a legend substantially to the following effect:

“THE SECURITY EVIDENCED HEREBY HAS NOT BEEN AND WILL NOT BE REGISTERED UNDER THE UNITED STATES SECURITIES ACT OF 1933, AS AMENDED (THE “SECURITIES ACT”), ANY STATE SECURITIES LAWS IN THE UNITED STATES OR THE SECURITIES LAWS OF ANY OTHER JURISDICTION AND MAY NOT BE OFFERED, SOLD, PLEDGED OR OTHERWISE TRANSFERRED, EXCEPT: (A) IN A TRANSACTION IN ACCORDANCE WITH RULE 144A UNDER THE SECURITIES ACT TO A PERSON THAT THE HOLDER AND ANY PERSON ACTING ON ITS BEHALF REASONABLY BELIEVES IS A QUALIFIED INSTITUTIONAL BUYER; (B) IN AN OFFSHORE TRANSACTION IN ACCORDANCE WITH RULE 903 OR RULE 904 OF REGULATION S UNDER THE SECURITIES ACT; (C) PURSUANT TO AN EXEMPTION FROM THE REGISTRATION REQUIREMENTS OF THE SECURITIES ACT PROVIDED BY RULE 144 (IF AVAILABLE); OR (D) PURSUANT TO AN EFFECTIVE REGISTRATION STATEMENT UNDER THE SECURITIES ACT, IN EACH CASE IN ACCORDANCE WITH ANY APPLICABLE SECURITIES LAWS OF ANY STATE OF THE UNITED STATES. NO REPRESENTATION CAN BE MADE AS TO THE AVAILABILITY OF THE EXEMPTION PROVIDED BY RULE 144 UNDER THE SECURITIES ACT FOR RESALES OF THIS SECURITY. EACH PURCHASER OF THIS SECURITY IS HEREBY NOTIFIED THAT THE SELLER OF THIS SECURITY MAY BE RELYING ON THE EXEMPTION FROM THE PROVISIONS OF SECTION 5 OF THE SECURITIES ACT PROVIDED BY RULE 144A THEREUNDER AND EACH PURCHASER WILL, AND EACH SUBSEQUENT HOLDER IS REQUIRED TO, NOTIFY ANY PURCHASER OF THIS SECURITY FROM IT OF THE RESALE RESTRICTIONS REFERRED TO ABOVE. EACH HOLDER, BY ITS ACCEPTANCE OF THIS SECURITY, REPRESENTS THAT IT UNDERSTANDS AND AGREES TO THE FOREGOING RESTRICTIONS”;

- (v) notwithstanding anything to the contrary in the foregoing, it understands that Units may not be deposited

into an unrestricted depository receipt facility in respect of Units established or maintained by a depository bank unless and until such time as such Units are no longer “restricted securities” within the meaning of Rule 144(a)(3) under the Securities Act;

- (vi) any resale made other than in compliance with the above stated restrictions shall not be recognised by the Trust;
- (vii) it agrees that it will give to each person to whom it transfers Units notice of any restrictions on transfer of such Units; and
- (viii) it acknowledges that the Trust, the Sponsor and the Joint Lead Managers and others will rely upon the truth and accuracy of the foregoing acknowledgements, representations and agreements and agrees that, if any of such acknowledgements, representations or agreements deemed to have been made by virtue of its purchase of Units are no longer accurate, it will promptly notify the Trust, the Sponsor and the Joint Lead Managers, and if it is acquiring any Units as a fiduciary or agent for one or more U.S. QIBs, it represents that it has sole investment discretion with respect to each such account and that it has full power to make the foregoing acknowledgements, representations and agreements on behalf of each such account.

Other Jurisdictions

The distribution of this Final Placement Memorandum and the offer and sale of the Units may be restricted by law in certain jurisdictions. Persons into whose possession this Final Placement Memorandum comes are required to inform themselves about, and to observe, any such restrictions to the extent applicable.

RIGHTS OF UNITHOLDERS

The rights and interests of Unitholders are contained in this Final Placement Memorandum and the InvIT Regulations. Under the Trust Deed and the Investment Management Agreement, these rights and interests are safeguarded by the Trustee and the Investment Manager. Any rights and interests of Unitholders as specified in the Final Placement Memorandum would be deemed to be amended to the extent of any amendment to the InvIT Regulations.

Beneficial Interest

Each Unit represents an undivided beneficial interest in the Trust. A Unitholder has no equitable or proprietary interest in the InvIT Assets of the Trust and is not entitled to transfer of the InvIT Assets (or any part thereof) or any interest in the InvIT Assets (or any part thereof) of the Trust. A Unitholder's right is limited to the right to require due administration of the Trust in accordance with the provisions of the Trust Deed and the Investment Management Agreement.

Ranking

No Unitholder of the Trust shall enjoy superior voting or any other rights over another Unitholder. Further, there shall not be multiple classes of Units. However, in accordance with InvIT Regulations, the Trust may issue subordinate units of the Trust only to the Sponsor and its Associates, where such subordinate units shall carry only inferior voting or any other rights compared to other Units.

Redressal of grievances

The Trustee shall periodically review the status of Unitholders' complaints and their redressal undertaken by the Investment Manager. The stakeholders' relationship committee of the Investment Manager shall monitor the status of complaints and their redressal. For details, please see the section entitled "*Corporate Governance*" on page 122.

Distribution

The Unitholders shall have the right to receive distribution in accordance with the InvIT Regulations and in the manner set forth in this Final Placement Memorandum. For details, please see the section entitled "*Distribution*" on page 248.

Meeting of Unitholders

Meetings of Unitholders will be conducted in accordance with the InvIT Regulations.

Passing of resolutions

1. With respect to any matter requiring approval of the Unitholders:
 - (i) a resolution shall be considered as passed when the votes cast by Unitholders, so entitled and voting, in favour of the resolution exceed a certain percentage as specified in the InvIT Regulations, of votes cast against;
 - (ii) the voting may be done by postal ballot or electronic mode;
 - (iii) a notice of not less than 21 days shall be provided to the Unitholders;
 - (iv) voting by any Unitholder (including, the Sponsor in its capacity as a Unitholder), who is a related party in such transaction, as well as associates of such Unitholder(s) shall not be considered on the specific issue; and
 - (v) the Investment Manager shall be responsible for all the activities pertaining to conducting of meeting of the Unitholder, subject to overseeing by the Trustee.

Provided that for issues pertaining to the Investment Manager, including a change in Investment Manager, removal of Investment Manager or change in control of Investment Manager; the Trustee shall convene and handle all activities pertaining to conduct of the meetings. Provided further that, for issues

pertaining to the Trustee, including change in Trustee, the Trustee shall not be involved in any manner in the conduct of the meeting.

2. Further, with respect to the Trust:

- (i) an annual meeting of all Unitholders shall be held not less than once a year within stipulated time from the end of each financial year and the time between two meetings shall not exceed 15 months;
- (ii) with respect to the annual meeting of Unitholders,
 - (a) any information that is required to be disclosed to the Unitholders and any issue that, in the ordinary course of business, may require approval of the Unitholders may be taken up in the meeting including:
 - latest annual accounts and performance of the Trust;
 - approval of auditor and fee of such auditor, as may be required;
 - latest valuation reports;
 - appointment of valuer, as may be required; and
 - any other issue; and
 - (b) for any issue taken up in such meetings which require approval from the unit holders other than as specified in Regulation 22(6) of the InvIT Regulations, votes cast in favour of the resolution shall be more than the votes cast against the resolution.

3. In case of the following, approval from Unitholders shall be required where votes cast in favour of the resolution shall be more than the votes cast against the resolution:

- (i) any approval from Unitholders required in terms of Regulation 18 (*Investment conditions and dividend policy*), Regulation 19 (*Related party transactions*) and Regulation 21 (*Valuation of assets*) of the InvIT Regulations;
- (ii) any transaction, other than any borrowing, the value of which is equal to or greater than 25% of the assets of the Trust;
- (iii) any borrowing in excess of specified limit as required under Regulation 20(3)(a) of the InvIT Regulations;
- (iv) any issue of Units after initial offer by the Trust, in whatever form, other than any issue of Units which may be considered by SEBI, under Regulation 22(5) of the InvIT Regulations;
- (v) increasing period for compliance with investment conditions to one year in accordance with Regulation 18(5)(c) of the InvIT Regulations;
- (vi) any issue, in the ordinary course of business, which in the opinion of the Sponsor or Trustee or Investment Manager, is material and requires approval of the Unitholders, if any; and
- (vii) any issue for which SEBI or the designated stock exchanges requires approval.

4. In case of the following, approval from Unitholders shall be required where votes cast in favour of the resolution shall not be less than one and a half times the votes cast against the resolution:

- (i) any change in the Investment Manager, including removal of the Investment Manager or change in control of the Investment Manager;
- (ii) any material change in investment strategy or any change in the management fee of the Trust;
- (iii) the trustee and Investment Manager proposing to seek delisting of units of the Trust;
- (iv) any issue, not in the ordinary course of business, which in the opinion of the Sponsor or Investment

Manager or Trustee requires approval of the Unitholders;

- (v) any issue for which SEBI or the designated stock exchanges requires approval;
- (vi) any issue taken up on request of the Unitholders including:
 - (a) removal of the Investment Manager and appointment of another investment manager to the Trust;
 - (b) removal of the auditor and appointment of another auditor to the Trust;
 - (c) removal of the valuer and appointment of another valuer to the Trust;
 - (d) delisting of the Trust, if the Unitholders have sufficient reason to believe that such delisting would act in the interest of the Unitholders;
 - (e) any issue which the Unitholders have sufficient reason to believe that is detrimental to the interest of the Unitholders; and
 - (f) change in the Trustee if the Unitholders have sufficient reason to believe that acts of such Trustee is detrimental to the interest of the Unitholders.

With respect to the right(s) of the Unitholders under clauses 4(vi) above:

- (a) not less than 25% of the Unitholders by value, other than any party related to the transactions and its associates, shall apply, in writing, to the Trustee for the purpose;
 - (b) on receipt of such application, the Trustee shall require, with the Investment Manager to place the issue for voting in the manner as specified in the InvIT Regulations; and
 - (c) with respect to clause 4(vi)(f) above, not less than 60% of the Unitholders by value shall apply, in writing, to the trustee for the purpose.
5. In case of any borrowing by the Trust in terms of the limit specified in the InvIT Regulations, approval from 75% of the Unitholders by value shall be obtained.
6. For delisting of units of the Trust in terms of the InvIT Regulations, approval from not less than 90% of the Unitholders by value shall be required and exit shall be provided to dissenting Unitholders.

Information rights

The Investment Manager, on behalf of the Trust, shall also submit such information to the Stock Exchanges and Unitholders on a periodical basis, as may be required under the InvIT Regulations and the Listing Agreement. The Investment Manager (on behalf of the Trust) shall disclose to the Stock Exchanges, Unitholders and SEBI, all such information and in such manner as specified by SEBI, including under the InvIT Regulations and the SEBI circular no. CIR/IMD/DF/127/2016 dated November 29, 2016. The Investment Manager, on behalf of the Trust, shall also provide disclosures or reports specific to the sector or sub-sector in which the Trust has invested or proposes to invest, in the manner as may be specified by SEBI.

Buyback and Delisting of Units

Any buyback or delisting of Units, will be in accordance with the InvIT Regulations.

For further details about the rights of the Unitholders, please see the sections entitled “*Parties to the Trust*” and “*Corporate Governance*” on pages 94 and 122, respectively.

OFFER STRUCTURE

Initial offer through a private placement of 499,600,000* Units by way of a fresh issue, for cash at price of ₹ 101 per Unit aggregating up to ₹ 50,459.60* million by the Trust. This Offer constitutes at least 10.00% of the total outstanding Units on a post-Offer basis.

* Subject to finalisation of Basis of Allotment

Particulars	Details
Number of Units available for Allotment/allocation	499,600,000 Units^
Basis of Allotment/ allocation	Discretionary*
Floor Price	100**
Cap Price	101**
Maximum Bid	Such number of Units (in multiples of 200,000 Units) not exceeding the size of this Offer, subject to applicable limits ⁽¹⁾
Mode of Allotment	Compulsorily in dematerialised form
Bid Lot/ Minimum Bid Size	A minimum of 2,600,000 Units, and in multiples of 200,000 Units thereafter
Allotment Lot	A minimum of 2,600,000 Units, and in multiples of 200,000 Units thereafter
Trading Lot ⁽²⁾	Upon listing, such number of Units, the value of which is, or exceeds, ₹ 20 million
Who can apply ⁽³⁾	(i) Institutional Investors; and (ii) Bodies Corporate
Terms of Payment	Entire Bid Amount shall be payable at the time of submission of the Application Form ⁽¹⁾

* Subject to such conditions and in such manner as may be determined by the Investment Manager in consultation with the Sponsor.

** Bids were required to be made for Units at a price within the price band, that is at or above the floor price and at or below the cap price. Please note that Bids outside the price band were liable to be rejected.

^ Subject to finalisation of Basis of Allotment.

(1) In case of joint Bids, the Application Form was required to contain only the name of the First Bidder whose name should also appear as the first holder of the beneficiary account held in joint names. The signature of only the First Bidder would be required in the Application Form and such First Bidder would be deemed to have signed on behalf of the joint holders. Bidders were advised to consult their own advisors with respect to any restrictions or limitations that may be applicable to them, including any restrictions or limitations in relation to their ability to invest in the Units. By making a Bid (including any revision thereof), the Bidder will be deemed to have represented to the Investment Manager, the Trustee, the Lead Managers and the Lead Managers that it was eligible to participate in the Offer and be Allotted Units under applicable law.

(2) The trading lot post-listing of the Units may be modified in accordance with the InvIT Regulations and other applicable law.

Indicative Offer Timeline

Event	Indicative Date
Bid/Offer Opening Date	October 29, 2021
Bidders to submit completed Application Forms	Bid/Offer Period
Bid/Offer Closing Date	November 2, 2021
Dispatch of CANs to successful Bidders	November 3, 2021
Closing Date	On or about November 3, 2021
Designated Date	On or about November 8, 2021
Initiation of refunds, if any, in excess of the amount which was required to be paid by such Bidder pursuant to the Units Allocated to such Bidder	On or about November 9, 2021
Listing Date	On or about November 10, 2021

The above timetable is indicative and does not constitute any obligation or liability on the Trust, the Investment Manager, the Trustee or the Lead Managers.

While the Investment Manager shall ensure that all steps for the completion of the necessary formalities for the listing and the commencement of trading of the Units on the Stock Exchanges are completed within 30 Working Days from the date of Allotment, the timetable may change due to various factors, such as, any

extension of the Bid/Offer Period by the Investment Manager or any delay in receiving the final listing and trading approvals from the Stock Exchanges. The commencement of trading of the Units will be entirely at the discretion of the Stock Exchanges and in accordance with applicable law.

OFFER INFORMATION

Below is a summary, intended to provide a general outline of the procedures for the bidding, application, payment, Allocation and Allotment.

Eligible Investors are advised to inform themselves of any restrictions or limitations that may be applicable to them under applicable law to which they are subject, and should consult their respective advisors in this regard. Eligible Investors that apply in this Offer will be required to confirm, and will be deemed to have represented to the Trustee, the Investment Manager, the Sponsor, the Lead Managers and their respective directors, officers, agents, affiliates and representatives, that they are eligible under all applicable laws, rules, regulations, guidelines and approvals to acquire the Units. The Investment Manager, the Sponsor and the Lead Managers and their respective directors, officers, agents, affiliates and representatives accept no responsibility or liability for advising any investor on whether such investor is eligible to acquire the Units.

Authority for the Offer

The Trust is making this Offer in accordance with Regulation 14(2) of the InvIT Regulations. The Offer was authorised and approved by the board of directors of the Investment Manager on March 22, 2021. Regulation 14(2)(e) of the InvIT Regulations requires that a placement memorandum be filed at least five days prior to the opening of the Offer. SEBI, *vide* its letter dated October 25, 2021, bearing reference number SEBI/HO/DDHS/DDHS_3/P/OW/2021/29917/1, to the Investment Manager, has granted a relaxation in respect of compliance with the aforesaid requirement.

The Trust has received the in-principle approvals of NSE and BSE pursuant to letters dated April 13, 2021 (read along with the extension letters dated July 12, 2021, and September 29, 2021, issued by NSE) and August 25, 2021, respectively, for the listing of the Units.

The Investment Manager has filed a copy of the Draft Placement Memorandum and the Placement Memorandum, and will file a copy of this Final Placement Memorandum, with SEBI and the Stock Exchanges.

The Units have not been and will not be registered, listed or otherwise qualified in any jurisdiction outside India and may not be offered or sold, and Bids may not be made by persons in any such jurisdiction, except in compliance with the applicable law of such jurisdiction. The Units shall not be offered or sold where such offer or sale would require registration, qualification or listing.

Eligible Investors should note that Allotment to successful Bidders will only be in the dematerialized form. Application Forms which do not have the details of the Bidders' demat accounts including DP ID, PAN and Client ID will be treated as incomplete and rejected. Bidders will not have the option of receiving Allotment in physical form. On Allotment, the Units will be traded only on the dematerialized segment of NSE and BSE.

Offer Procedure

1. The Lead Managers, in consultation with the Investment Manager, has electronically circulated serially numbered copies of the Placement Memorandum and the Application Form to Eligible Investors. The Application Form has been specifically addressed to each Eligible Investor. The list of Eligible Investors to whom the serially numbered copies of the Placement Memorandum and the Application Form have been circulated, has been determined by the Investment Manager, in consultation with the Lead Managers.
2. **Unless a serially numbered Placement Memorandum along with an Application Form is addressed to a particular Eligible Investor, no invitation to subscribe shall be deemed to have been made to such Eligible Investor.** Even if such documentation were to come into the possession of any person other than the intended recipient, no offer or invitation to offer shall be deemed to have been made to such person and such person shall not be eligible to participate in the Offer.
3. Bidders were required to submit an Application Form to the Lead Managers, only during the Bid/Offer Period and not later than the Bid/Offer Closing Date.
4. Bidders were required to submit a Bid at or above the floor price set out in the Placement Memorandum or at or below the cap price set out in the Placement Memorandum, if any. Please note that Bids below the floor price and above the cap price, if any, were liable to be rejected.

5. Bidders were required *inter alia*, to indicate the following in the Application Form:

- a representation that it is outside the United States acquiring the Units in an offshore transaction under Regulation S and it has agreed to certain other representations set forth in “*Notice to Investors – Representations by Eligible Investors*” on page 2 and “*Selling and Transfer Restrictions*” on page 277 and certain other representations made in the Application Form;
- name of the Bidder to whom the Units are to be Allotted;
- number of Units Bid for;
- Bid price;
- details of the Bid Amount deposited by the Bidder into the Cash Escrow Account;
- details of the demat accounts to which the Units should be credited;
- a representation that such person is an “Institutional Investor” or a “Body Corporate” in terms of the InvIT Regulations;
- the details of Bidder’s bank account along with fund transfer details, in case of any refund; and
- any other information which may be relevant to the Bid.

Note: The Bids made by asset management companies or custodians of Mutual Funds, if permitted under applicable law, shall specifically state the names of the concerned schemes for which the Bids are made. In case of a Mutual Fund, a separate Bid can be made in respect of each scheme of the Mutual Fund registered with SEBI and such Bids in respect of more than one scheme of the Mutual Fund will not be treated as multiple Bids provided that the Bids clearly indicate the scheme for which the Bid has been made. Bidders are advised to ensure that any single Bid from them does not exceed the investment limits or maximum number of Units that can be held by them under applicable law.

6. Each Bidder was required to make payment of the entire Bid Amount for the Units, only through electronic transfer to the Cash Escrow Account during the Bid/Offer Period, along with the completed Application Form.
7. No payment was to be made by Bidders in cash. Please note that any payment of Bid Amount for Units was required to be made from the bank account of the relevant Bidder applying for Units, and the Lead Managers, on behalf of the Investment Manager, shall keep a record of the bank account from where such Bid Amounts have been received. The Bid Amount payable on Units to be held by joint holders shall be paid from the bank account of the person whose name appears first in the completed Application Form. Pending listing, all Bid Amounts received from Bidders shall be kept by in a separate bank account with a scheduled bank (i.e. the Cash Escrow Account).
8. Once a duly completed Application Form was submitted by a Bidder on the basis of disclosures in the Placement Memorandum, such Application Form constituted an irrevocable offer and could not have been withdrawn.
9. Upon receipt of the completed Application Form and the receipt of the Bid Amount in the Cash Escrow Account, the Investment Manager, after Bid/Offer Closing Date, determined the number of the Units to be Allocated pursuant to the Offer, in consultation with the Lead Managers and the Sponsor.
10. The Lead Managers, on behalf of the Investment Manager, have sent or will send the CANs, along with serially numbered Final Placement Memorandum, to the Bidders who have been Allocated Units. The dispatch of a CAN shall be deemed a valid, binding and irrevocable contract in respect of the number of Units Allocated to the Bidder. **Please note that the Allocation and Allotment will be at the absolute discretion of the Investment Manager, and will be based on the recommendation of the Lead Managers.**

11. Upon the dispatch of CAN to successful Bidders, the Investment Manager shall Allot Units of the Trust as per the details in the CAN sent to successful Bidders. The Investment Manager will intimate the Stock Exchanges about the details of the Allotment and apply for approval of the Units for listing and trading of the Units on the Stock Exchanges after the credit of Units into the demat accounts of the successful Bidders.
12. Allottees are advised to instruct their respective Depository Participant to accept the Units that may be Allotted to them pursuant to the Offer into their respective demat accounts.
13. In the event Investment Manager is unable to Allot the Units, in full or part or upon cancellation of the Offer or upon Allotment at less than the Bid price or if refunds are required to be made in accordance with applicable law, the Investment Manager shall be liable to refund the Bid Amounts with interest to the Bidders in accordance with applicable law. For each Bidder to whom any amounts are to be refunded, the refund shall be made to the same bank account from which the Bid Amount was remitted by such Bidder.
14. The Units that have been credited to the demat accounts of the Bidders shall be eligible for trading on the Stock Exchanges only upon the receipt of final listing and trading approvals from the Stock Exchanges. Bidders are advised to apprise themselves of the status of the receipt of the permissions from the Stock Exchanges or the Investment Manager.
15. The Bid Amount will be transferred to the accounts of the Trust from the Cash Escrow Account only after receipt of the final listing and trading approvals for the Units from the Stock Exchanges.

Who can Bid?

Each Bidder was required to check if it was eligible to Bid under applicable law. Furthermore, certain categories of Bidders may not have been permitted to Bid in the Offer or hold Units in excess of the limits specified under applicable law.

Only Institutional Investors and Bodies Corporate were eligible to participate in this Offer.

An Institutional Investor is defined in Regulation 2(1)(ya) of the InvIT Regulations.

A Body Corporate is defined in Section 2(11) of the Companies Act, 2013, to include a company incorporated outside India, but does not include (i) a co-operative society registered under any law relating to co-operative societies; and (ii) any other body corporate (not being a company as defined in the Companies Act, 2013) which the Central Government may, by notification, specify in this regard.

Bodies Corporate incorporated outside India were permitted to participate in the Offer subject to compliance with Schedule VIII of the Foreign Exchange Management (Non-debt Instruments) Rules, 2019.

The Trustee, the Valuer and the employees of the Valuer who were involved in the valuation of the Trust were not permitted to Bid in this Offer.

Bids by FPIs

Foreign Portfolio Investors (other than individuals, corporate bodies and family offices) were permitted to participate in the Offer subject to compliance with Schedule VIII of Foreign Exchange Management (Non-debt Instruments) Rules, 2019. In case of Bids by FPIs, the payment were required to be paid as inward remittance from abroad through banking channels or out of funds held in NRE, SNRR or FCNR(B) account maintained in accordance with the Foreign Exchange Management (Deposit) Regulations, 2016, along with documentary evidence in support of the remittance. In case of Bids made by FPIs, a verified true copy of the certificate of registration issued by the designated depository participant under the SEBI FPI Regulations was required to be attached along with the Application Form, failing which the Investment Manager, in consultation with the Lead Managers, reserved the right to reject the Bid.

Bids by SEBI registered VCFs and AIFs

The SEBI VCF Regulations prescribe, amongst others, the investment restrictions on VCFs registered with SEBI. Further, the SEBI AIF Regulations prescribe, amongst others, the investment restrictions on AIFs. Further, VCFs which have not re-registered as an AIF under the SEBI AIF Regulations shall continue to be regulated by the

SEBI VCF Regulations until the existing fund or scheme managed by the fund is wound up and such funds shall not launch any new scheme after the notification of the SEBI AIF Regulations. Additionally, VCFs and AIFs are subject to certain investment restrictions, including with respect to the percentage of investible funds held in each investee entity. Allotments made in respect of Bids by VCFs and AIFs in this Offer shall be subject to the rules and regulations that are applicable to each of them respectively.

Bids by Banking Companies

Bids could be made by banks as permitted by the RBI and was subject to conditions specified in the Prudential Guidelines – Banks’ investment in units of REITs and InvITs dated April 18, 2017. In case of Bids made by banking companies registered with the RBI, certified copies of (i) the certificate of registration issued by the RBI, and (ii) the approval of such banking company’s investment committee were required to be attached to the Application Form. Failing this, any such Bid was liable to be rejected.

Bids by Provident Funds/Pension Funds

On March 2, 2015, the Ministry of Finance issued a notification allowing investments by non-government provident funds, pension funds, superannuation funds and gratuity funds up to 5% in infrastructure investment trusts, as specified. On May 29, 2015, the Ministry of Labour and Employment issued a notification allowing investments by provident funds up to 5% in infrastructure investment trusts, as specified. However, such investments by provident funds, pension funds, superannuation funds and gratuity funds will be subject to, amongst others, the sponsor entity of the InvIT having a minimum of AA or equivalent rating in the applicable rating scale from at least two credit rating agencies registered with SEBI. In case of Bids made by provident funds/pension funds, subject to applicable laws, with minimum corpus of ₹ 250 million, a certified copy of certificate from a chartered accountant certifying the corpus of the provident fund/pension fund was required to be attached to the Application Form. Failing this, any such Bid was liable to be rejected.

Bids by NPS Schemes

The Pension Fund Regulatory and Development Authority issued circulars dated June 3, 2015 and September 2, 2015, respectively, allowing investments by national pension fund schemes (“NPS Schemes”) up to 5% in infrastructure investment trusts, as specified. However, in accordance with the circular dated May 4, 2017 (effective from May 8, 2017), as amended by the circular dated May 8, 2018, issued by PFRDA, such investments by NPS Schemes will be subject to, amongst others, such securities having a minimum of A or equivalent rating in the applicable rating scale from at least two credit rating agencies registered with SEBI, subject to the maximum permissible amount of investments in securities rated between A- and AA. In case of Bids made by NPS Schemes, with minimum corpus of ₹ 250 million, a certified copy of certificate from a chartered accountant certifying the corpus of the provident fund/pension fund was required to be attached to the Application Form. Failing this, any such Bid is liable to be rejected.

Bids by Mutual Funds

Bids could be made by mutual funds under all its schemes, existing and future, subject to the investment conditions and other restrictions prescribed under the Securities and Exchange Board of India (Mutual Funds) Regulations, 1996 (including, the circular on mutual funds dated February 28, 2017 and any other circulars, notifications and guidelines issued thereunder).

Bids by Insurance Companies

Bids could be made by insurance companies as permitted by the Insurance Regulatory and Development Authority of India in terms of the Master Circular – Investments, 2016 and the circular issued by the IRDAI entitled, Investment in Units of Real Estate Investment Trusts (REIT) & Infrastructure Investment Trusts (InvIT), dated March 14, 2017.

Bids under Power of Attorney

In case of Bids made pursuant to a power of attorney by Institutional Investors or bodies corporate, a certified copy of the power of attorney or the relevant resolution or authority, as the case may be, along with a certified copy of the memorandum of association and articles of association and/or bye laws was required to be submitted along with the Application Form. Failing this, any such Bid was liable to be rejected. The Investment Manager,

in consultation with the Lead Managers, in its absolute discretion, reserved the right to relax the above condition of simultaneous lodging of the power of attorney along with the Application Form.

Allotments, if any, made to FVCIs in the Offer are subject to the respective rules and regulations that are applicable to each of them.

The Parties to the Trust and the Lead Managers are not liable for any amendment or modification or change to applicable law or regulations, which may occur after the date of the Placement Memorandum. Eligible Investors were advised to make their independent investigations and satisfy themselves that they were eligible to apply in this Offer. Eligible Investors were advised to ensure that any single application from them does not exceed the investment limits or maximum number of Units that can be held by them under applicable law or regulation or as specified in the Placement Memorandum.

Note: Affiliates or associates of the Lead Managers who are Eligible Investors could participate in the Offer in compliance with applicable law.

Maximum and Minimum Bid Size

- *Each Bidder was required to Bid for a minimum of 2,600,000 Units and in multiples of 200,000 Units thereafter.*
- *No Bidder could Bid for such number of Units that exceeded the Offer size.*
- *No Bidder could place a Bid below the floor price or above the cap price mentioned in the Placement Memorandum.*

Application Process

Application Form

Bidders were required to only use the Application Forms provided by the Investment Manager electronically, for the purpose of making a Bid in terms of the Placement Memorandum.

By making a Bid for the Units through Application Forms, Bidders were deemed to have made the following representations and warranties, respectively:

- (a) The Bidder confirmed that it is an Institutional Investor or a Body Corporate, and was eligible to participate in the Offer;
- (b) The Bidder had deposited the Bid Amount in the Cash Escrow Account;
- (c) The Bidder had made a Bid above the floor price and below the cap price;
- (d) The Bidder had no right to withdraw its Bid once such Bid was submitted to the Lead Managers;
- (e) Revised Bids, if any, shall have been submitted during the Bid/Offer Period, at and above the floor price and below the cap price;
- (f) The Bidder confirmed that it was eligible to apply for, and hold, any Units that may be Allotted to the Bidder pursuant to the Offer. The Bidder further confirmed that any such Allotment of Units to, and the holding of Units by, the Bidder does not, and shall not, exceed the level permissible as per any law applicable to the Bidder; and
- (g) The Bidder confirmed that it is either (i) inside the United States, and is a U.S. QIB, or (ii) outside the United States and was purchasing the Units in an “offshore transaction” as defined Regulation S under the Securities Act, and in either cases was not our affiliate or a person acting on behalf of such an affiliate.

ELIGIBLE INVESTORS WERE REQUIRED TO PROVIDE THEIR DEMAT ACCOUNT DETAILS, THEIR DEPOSITORY PARTICIPANT’S NAME, DEPOSITORY PARTICIPANT IDENTIFICATION NUMBER, BENEFICIARY ACCOUNT NUMBER AND BANK ACCOUNT DETAILS IN THE

APPLICATION FORM. ELIGIBLE INVESTORS WERE REQUIRED TO ENSURE THAT THE NAME GIVEN IN THE APPLICATION FORM IS EXACTLY THE SAME AS THE NAME IN WHICH THE DEMAT ACCOUNT IS HELD.

Demographic details such as address and bank account details will be obtained from the Depositories as per the demat account details given in the Application Form.

Instructions for completing the Application Form

Bidders may note that Application Forms not filled completely or correctly as per instructions provided in the Placement Memorandum and the Application Form were liable to be rejected. The Bids had to adhere to the following:

- (a) Bids were required to be made only in the prescribed Application Form;
- (b) Application Form must have been completed in full, in BLOCK LETTERS in ENGLISH and in accordance with the instructions contained in the Placement Memorandum and in the Application Form. Incomplete Application Forms were liable to be rejected. Bidders were required to provide details of valid and active DP ID, Client ID and PAN clearly and without error. Invalid accounts, suspended accounts, or where such account was classified as invalid or suspended were not considered for Allotment. Bidders should note that the Lead Managers, Registrar and the Investment Manager will not be liable for errors in data entry due to incomplete or illegible Application Forms; and
- (c) Bidders were required to sign the Application Form. Bidders should have ensured that the thumb impressions and signatures other than in the languages specified in the Eighth Schedule to the Constitution of India, were attested by a Magistrate or a Notary Public or a Special Executive Magistrate under official seal.

Submission of Application Form

All Application Forms were required to be duly completed with information including the name of the Bidder, the number of the Units applied for, the Bid Amount and details of the bank account from which payment of the Bid Amount was made. The Application Form were required to be submitted to the Lead Managers through electronic form and followed-up with physical delivery of the Application Form at the following address:

SBI Capital Markets Limited

202, Maker Tower 'E'
Cuffe Parade, Mumbai 400 005
Maharashtra, India
Tel: +91 22 2217 8300
Fax: +91 22 2218 8332
Email: nhaiinvit@sbicaps.com
Website: www.sbicaps.com
Investor Grievance Email: investor.relations@sbicaps.com
Contact person: Mandeep Singh
SEBI Registration No: INM000003531

ICICI Securities Limited

ICICI Venture House,
Appasaheb Marathe Marg,
Prabhadevi, Mumbai - 400 025
Maharashtra, India
Tel: +91 22 6807 7100
Fax: +91 22 6807 7801
Email: nhaiinvit@icicisecurities.com
Investor Grievance E-mail: customercare@icicisecurities.com
Contact person: Rupesh Khant
SEBI Registration No: INM000011179

Kotak Mahindra Capital Company Limited

1st Floor, 27 BKC, Plot No. 27, 'G' Block,

Bandra Kurla Complex, Bandra (East),

Mumbai 400 051, Maharashtra, India

Tel: +91 22 4336 0000

Fax: +91 22 67132445

E-mail: nhai.invit@kotak.com

Investor Grievance E-mail: kmccredressal@kotak.com

Contact Person: Ganesh Rane

Website: www.investmentbank.kotak.com

SEBI Registration No.: INM000008704

The Lead Managers were not required to provide any written acknowledgement of the Application Form.

PAN

Each Eligible Investor was required to mention its Permanent Account Number ("PAN") allotted under the IT Act. Each Eligible Investor was required to submit a copy of its PAN card along with the Application Form. Applications without this information were to be considered incomplete and were liable to be rejected. Eligible Investors must have not submitted the general index registrar number ("GIR") instead of the PAN as the Application Form was liable to be rejected on this ground.

Price Band

Each Bidder was required to make a Bid at or above the floor price or within the price band but at or below the cap price. Bids below the floor price and above the cap price specified, were liable to be rejected.

Bank Account for Payment of Bid Amount

The Investment Manager has opened the Cash Escrow Account with Axis Bank Limited, acting as the Escrow Collection Bank in terms of the arrangement among the Trust, the Investment Manager, the Lead Managers and the Escrow Collection Bank. Bidders were required to deposit the entire Bid Amount during the Bid/Offer Period, together with the completed Application Form, in favour of "*NATIONAL HIGHWAYS INFRA TRUST – CASH ESCROW ACCOUNT*".

If the payment of the Bid Amount was not made favouring the Cash Escrow Account within the Bid/Offer Period, the Application Form of the Bidder was liable to be rejected.

The Trustee and the Investment Manager shall utilize the amount deposited in the Cash Escrow Account only for the purposes of: (i) adjustment against Allotment; or (ii) refund of application monies. For further details, please see the section entitled "*Offer Information – Refunds*" on page 297.

Payment Instructions

The payment of Bid Amount were required to be made by the Bidders in the name of the Cash Escrow Account as per the payment instructions provided in the Placement Memorandum and the Application Form.

Payments were required to be made only through electronic fund transfer. Payments through cheques or cash or any mode other than electronic mode were liable to be rejected.

Price Discovery

- (a) Based on the Bids received and demand generated at various price levels, the Investment Manager in consultation with the Lead Managers, has finalized the Offer Price.
- (b) Allocation to Investors was at the discretion of the Investment Manager in consultation with the Lead Managers, subject to compliance with the InvIT Regulations, the SEBI Guidelines and other Applicable Laws.
- (c) Allocation to Non-Residents, including Eligible NRIs and FPIs was subject to applicable law.

- (d) The Investment Manager in consultation with the Lead Managers reserves the right to withdraw the Offer any time after the Bid/Offer Opening Date but before the Allotment, without assigning any reasons whatsoever.
- (e) No Bidder can withdraw or lower their Bids at any time.

Allocation

The Bidders were required to submit their Bids for the Units within the Bid/Offer Period to the Lead Managers. The Registrar was required to provide a schedule of Bids received which shall indicate the Bid Price received in respect of each Bid (based on a schedule to be provided by the Escrow Collection Bank to the Registrar), to the Lead Managers.

Method of Allocation

The Investment Manager has determined the Allocation in consultation with the Lead Managers and the Sponsor on a discretionary basis, subject to such conditions and in such manner determined by the Investment Managers in consultation with the Sponsor. After finalization of the Allocation, the Investment Manager has updated the Placement Memorandum with the Offer details and shall file the Final Placement Memorandum with SEBI and the Stock Exchanges, and dispatch the CAN, together with a serially numbered Final Placement Memorandum to each successful Bidder.

THE DECISION OF THE INVESTMENT MANAGER, IN CONSULTATION WITH THE LEAD MANAGERS AND THE SPONSOR IN RESPECT OF ALLOCATION SHALL BE FINAL AND BINDING ON ALL BIDDERS. BIDDERS MAY NOTE THAT ALLOCATION OF THE UNITS IS AT THE SOLE AND ABSOLUTE DISCRETION OF THE INVESTMENT MANAGER, IN CONSULTATION WITH THE LEAD MANAGERS AND THE SPONSOR, AND BIDDERS MAY NOT RECEIVE ANY ALLOCATION EVEN IF THEY HAVE SUBMITTED VALID APPLICATION FORMS AND DEPOSITIED BID AMOUNTS. NONE OF THE INVESTMENT MANAGER AND LEAD MANAGERS ARE OBLIGED TO ASSIGN ANY REASON FOR ANY SUCH NONALLOCATION.

Confirmation of Allocation Note or CAN

Based on the Application Forms and the Bid Amounts received from Bidders, the Investment Manager, in consultation with the Lead Managers and the Sponsor, in their sole and absolute discretion, have decided the Bidders to whom the serially numbered CANs have been or shall be sent, pursuant to which the details of Units Allocated to them have been or shall be notified to such Bidders. Additionally, the CAN includes the probable designated date, being the date of credit of the Units to the respective Bidder's demat account ("**Designated Date**").

Bidders who have been Allocated Units would also be sent a serially numbered Final Placement Memorandum either in electronic form or by physical delivery along with the serially numbered CAN. The dispatch of the serially numbered Final Placement Memorandum and the CAN to Bidders shall be deemed a valid, binding and irrevocable contract in respect of the number of Units Allocated to each successful Bidder.

Bidders are advised to instruct their Depository Participant to accept the Units that may be Allotted to them pursuant to the Offer.

Bidders' Demat Account and Bank Account Details

Bidders should note that the Bidders' PAN, DP ID, Client ID, address and bank account details provided by them in the Application Form (the "**Demographic Details**"), will be used for giving refunds (including through direct credit, NACH, NECS, NEFT and RTGS) to the Bidders. It was required to mandatorily provide the bank account details in the space provided in the Application Form and Application Forms that did not contain such details were liable to be rejected. Hence, Bidders are advised to immediately update their bank account details, PAN and Demographic Details as appearing in the records of the Depository Participant and ensure that they are true and correct. Failure to do so could result in delays in credit of refunds to Bidders at their sole risk and none of the Lead Managers, the Registrar, the Escrow Collection Bank, the Investment Manager or the Trustee will have any responsibility or undertake any liability for this. Accordingly, Bidders should have carefully filled in their demat account details in the Application Form.

Closing Date and Allotment of the Units'

The Trustee and the Investment Manager will endeavour to complete the Allotment by the Closing Date.

In accordance with the InvIT Regulations, the Units will be issued and Allotment shall be made only in dematerialised form to the Allottees. The Investment Manager, through its constituted attorneys (on behalf of the Trust) and the Registrar have entered into:

1. Agreement dated March 24, 2021, with NSDL; and
2. Agreement dated March 19, 2021, with CDSL.

The Trustee and/or the Investment Manager, at their discretion, reserve the right to cancel the Offer at any time prior to the issuance of CAN, without assigning any reason whatsoever.

Following the Allotment of the Units, the Investment Manager will apply for final listing and trading approvals from the Stock Exchanges.

Refunds

In the event Investment Manager is unable to Allot the Units, in full or part or upon cancellation of the Offer or upon Allotment at less than the Bid Price or if refunds are required to be made in accordance with Applicable Law, the Investment Manager shall be liable to refund the Bid Amounts with interest to the Bidders in accordance with applicable law. For each Bidder to whom any amounts are to be refunded, the refund shall be made to the same bank account from which the Bid Amount was remitted by such Bidder. In the event of non-receipt of listing permission from the Stock Exchanges, the Units shall not be eligible for listing and the Trust shall be liable to refund the Bid Amounts to the Allottees immediately along with interest at the rate of 15% per annum, from the date of Allotment until such time prescribed under, and in compliance with, the InvIT Regulations.

Other Instructions

Right to Reject Applications

The Investment Manager, in consultation with the Lead Managers, could reject Bids, in part or in full, without assigning any reason whatsoever. The decision of the Investment Manager and the Lead Managers in relation to the rejection of Bids shall be final and binding.

Units in Dematerialised form with NSDL or CDSL

The Allotment shall be only in dematerialised form (i.e., not in physical certificates but represented by the statement issued through the electronic mode).

A Bidder applying for the Units to be issued pursuant to the Offer was required to have at least one beneficiary account with a Depository Participant of NSDL or CDSL prior to making the Bid. Allotment to a successful Bidder will be credited in electronic form directly to the beneficiary account (with the Depository Participant) of such Bidder.

Units in electronic form can be traded only on the Stock Exchanges having electronic connectivity with NSDL and CDSL. The Stock Exchanges have electronic connectivity with NSDL and CDSL. The trading of the Units would be in dematerialised form only for all Unitholders in the respective demat segment of the Stock Exchanges. For details in respect of the Trading Lot, please see the section entitled "*Offer Structure*" on page 287.

The Trustee, the Sponsor, the Investment Manager or the Lead Managers, will not be responsible or liable for the delay in the credit of the Units to be issued and transferred pursuant to the Offer due to errors in the Application Form, delay in payment of Bid Amount or otherwise on part of the Bidders.

Undertakings of the Investment Manager:

- a. There shall be only one denomination for the Units of the Trust; and
- b. it shall comply with such disclosure and accounting norms specified by the SEBI from time to time.

TAXATION

STATEMENT OF POSSIBLE TAX BENEFITS AVAILABLE TO THE TRUST AND ITS UNITHOLDERS UNDER THE APPLICABLE LAWS IN INDIA

September 28, 2021

To

National Highways Infra Trust

G-5 & 6, Sector – 10,
Dwarka,
New Delhi 110 075

National Highways Infra Investment Managers Private Limited

G-5 & 6, Sector – 10
Dwarka
New Delhi 110 075

IDBI Trusteeship Services Limited

Asian Building Ground Floor,
17 R Kamani Marg,
Ballard Estate, Mumbai, 400001

Sub: Statement of possible tax benefits available to National Highways Infra Trust and its Unitholders

Dear Sirs,

We refer to the proposed initial offer of the units of the National Highways Infra Trust (“**the Trust**”). With reference to the captioned subject, given below is a statement and the Annexure herewith, of the applicable sections of the Income Tax Act, 1961, (“**Income Tax Act**”) relating to tax benefits available to the Trust and its Unitholders. These benefits are typically dependent on Trust or its unitholders fulfilling the conditions prescribed under the relevant provisions of the Act.

The benefits discussed in the enclosed Annexure are not exhaustive but illustrative. The information contained in the Annexure is only intended to provide general information to the investors and hence is neither designed nor intended to be a substitute for professional tax advice. In view of the individual tax consequences and the changing tax laws, it is advisable to consult a tax consultant with respect to the specific tax implications arising out of the participation in the issue.

Our confirmation is based on the information, explanations and representations obtained from the Investment Manager and on the basis of our understanding of the business activities and operations of Trust.

We do not express an opinion or provide any assurance as to whether:

- Trust or its unitholders will continue to obtain these benefits in future.
- The conditions prescribed for availing the benefits, where applicable have been/would be met with.
- The revenue authorities/courts will concur with the views expressed herein.

Limitations

Our views expressed in the statement and as enclosed in the Annexure are based on the facts and assumptions indicated above. No assurance is given that the revenue authorities/ courts will concur with the views expressed herein. Our views are based on the existing provisions of law and its interpretation, which are subject to change from time to time. We do not assume responsibility to update the views consequent to such changes.

We hereby give our consent to include this statement and the Annexure attached herewith, regarding possible tax benefits available to the Trust and to its Unitholders in the draft placement memorandum and placement memorandum in connection with the initial offer of the units of the Trust which is intended to be filed with Securities and Exchange Board of India, relevant stock exchanges and any regulatory authority, as may be required under applicable law.

For A.R. & Co.,
Chartered Accountants
FRN – 002744C

CA. Rajat Dasgupta
Partner
MRN – 051989
UDIN: 21051989AAAAAT8570
Date: 28.09.2021
Place: New Delhi

ANNEXURE TO STATEMENT OF POSSIBLE TAX BENEFITS AVAILABLE TO THE TRUST AND ITS UNITHOLDERS UNDER THE APPLICABLE LAWS IN INDIA

The Income-tax Act, 1961 (“Act”) has set-out a special regime for taxation of income arising to the Trust and its unitholders under Chapter XII FA of the Act.

We have summarised below relevant income-tax provisions as applicable to the Trust and its unitholders, under the Act. The income tax provisions listed below are available to the Trust and its unitholders subject to compliance with the applicable provisions and/or the conditions laid out in the Act and the regulations as prescribed under the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, made under the Securities and Exchange Board of India Act, 1992 (15 of 1992) or the International Financial Services Centres Authority under the International Financial Services Centres Authority Act 2019 (50 of 2019) (‘InvIT Regulations’), as the case may be.

1. Tax provisions applicable to the Trust

1.1. Definition of business trust under the Act

Prior to Finance Act, 2020, a ‘business trust’ was defined under section 2(13A) of the Act to mean a trust registered as an infrastructure investment trust (“InvIT”) under the InvIT Regulations or a Real Estate Investment Trusts (REIT) under the REIT Regulations, units of which, are required to be listed on a recognised stock exchange in accordance with the InvIT Regulations or REIT Regulations, as the case may be.

The Finance Act 2020 has amended the definition of ‘business trust’ which earlier recognised only listed InvITs and REITs registered with SEBI to now include unlisted InvITs registered with SEBI as well. This amendment came to effect from 1 April 2020.

1.2. Taxability of the Trust

1.2.1. Income received from the Special Purpose Vehicle(s) (‘SPVs’)

a. Interest and Dividend

Interest/Dividend received or receivable by the Trust from an Indian company in which the Trust holds a controlling interest and any specific percentage of shareholding or interest as required under the InvIT Regulations (‘SPV’) should be exempt from tax under section 10(23FC) of the Act.

As per section 194 of the Act, the dividend income distributed to business trust by the SPV is not subject to withholding tax. As per section 194A(3)(xi) of the Act, any income by way of interest (other than ‘interest on securities’) received/receivable by the Trust from SPV is not subject to withholding tax. Further, any income by way of interest on securities received/receivable by the Trust from SPV is subject to withholding tax at the rate of 10% as per section 193 of the Act; however, no withholding tax applicable on interest payable on security issued by a company, where such security is listed on recognized stock exchange.

b. Income from buy-back of share

As per section 115QA of the Act, domestic companies are required to pay additional tax at the rate of 20%⁺⁺ of the distributed income on buy-back of shares (‘Buyback Distribution Tax’). Distributed income means the consideration paid by the domestic company on buy back of shares as reduced by the amount received by the company for the issue of such shares, determined as per Rule 40BB of the Income-tax Rules, 1962 (‘the Rules’). Income arising from buy-back of shares on which Buyback Distribution Tax has been paid shall not be taxable⁷ in the hands of the Trust.

^{6 ++} excluding applicable surcharge and cess

⁷ Section 10(34A) of the Act

Further, in view of the provisions of section 14A of the Act, any expenditure incurred in relation to earning the exempt income under 1.2.1(a) and 1.2.1(b) above shall not be tax deductible. In case the tax authorities are not satisfied by the disallowance considered by the Trust, the quantum of disallowance shall be computed in accordance with the provisions of section 14A read with Rule 8D of the Rules.

1.2.2. Income other than the income distributed by the SPVs

a. Income by way of dividend/interest

Dividend/interest income received by the Trust from listed securities, liquid funds, etc. shall be subject to tax at the maximum marginal rate in force ('MMR') as per section 115UA of the Act.

As per section 57 of the Act, no deduction shall be allowable against dividend income other than deduction on account of interest expense and such interest expense shall not exceed 20% of the gross dividend income for that year, without deduction under section 57 of the Act.

b. Income by way of capital gains and other income

In terms of section 115UA(2) of the Act, the total taxable income of the Trust shall be chargeable to tax at MMR except for income arising on transfer of short-term capital assets and long-term capital assets⁸ under section 111A and section 112 of the Act.

As per the provisions of section 111A of the Act, any income arising from transfer of short-term capital asset being an equity share in a company or a unit of an equity oriented fund or a unit of a business trust, transacted through a recognized stock exchange and subject to STT, should be taxable at a concessional rate of 15%⁺⁺. However, the condition of subject to STT is not applicable if the transaction is undertaken on a recognized stock exchange located in any International Financial Services Centre ('IFSC') and where the consideration for such transaction is received or receivable in foreign currency.

As per the provisions of section 112 of the Act, gains arising on the transfer of long-term capital assets shall be chargeable to tax in the hands of the Trust at the rate of 20%⁺⁺. However, the tax arising on transfer of long-term capital asset, being listed securities (other than a unit) or zero-coupon bond, shall be lower of the following:

- a. 10%⁺⁺ without indexation benefit, or
- b. 20%⁺⁺ with indexation benefit

Section 48 of the Act prescribes the mode of computation of capital gains and provides for deduction of cost of acquisition/ improvement and expenses incurred in connection with the transfer of a capital asset, from the sale consideration to arrive at the amount of capital gains. However, in respect of long-term capital gains, section 48 of the Act provides for substitution of cost of acquisition/improvement with indexed cost of acquisition/improvement, which adjusts the cost of acquisition/improvement by a cost inflation index as prescribed from time to time. Such indexation benefit would not be available on bonds and debentures.

The Act⁹ allows short-term capital loss arising during a financial year to be set off against income, if any, from capital gains (short-term or long-term), arising in the same financial year. However, long-term capital loss arising during a financial year is allowed to be set-off only against long-term capital gains. Balance loss, if any, is allowed to be carried forward and set-off against income from capital gains, arising during subsequent eight assessment years, as follows: (i) balance short-term capital loss can be carried forward and set-off against capital gains (short-term or long-term); and (ii) balance long-term capital loss can be carried forward and set-off only against long-term capital gains.

⁸ As per section 2(42A), a short-term capital asset means: (i) for unlisted shares – period of holding is less than or equal to 24 months; (ii) for unlisted securities (other than unlisted shares) - period of holding is less than or equal to 36 months; (iii) Immovable property being land and/or building - period of holding is less than or equal to 24 months; (iv) listed equity shares or units of an equity-oriented fund – period of holding less than or equal to 12 months. As per section 2(29A), a capital asset which is not a short-term capital asset is regarded as a long-term capital asset.

⁹ Section 70 read with section 74 of the Act

2. **Taxability of unitholders**

2.1. **Income by way of dividend and interest**

- a. As per the provisions of section 115UA(1) of the Act, the income distributed by the Trust is taxable in the hands of the unitholders in the same manner and in the same proportion as the underlying income received by or accrued to the Trust.
- b. As per the provisions of section 10(23FD), any income referred to in section 115UA(1) of the Act and distributed by the Trust shall not be included in the total income of the unitholders, except for the following income:
 - (i) Interest income from SPV [referred to in section 10(23FC)];
 - (ii) Dividend Income from SPV [referred to in section 10(23FC)], i.e., if the SPV has opted for concessional tax regime under section 115BAA;

The above income would be taxable in the hands of the unitholders under section 115UA(3) of the Act.

- c. Taxability of dividend income distributed by the Trust to unitholders is dependent on the taxation regime adopted by the SPV(s), which distributes the dividend to the Trust. If the SPV(s) has not opted for a concessional corporate tax rate under section 115BAA of the Act ('Qualifying SPV'), dividend distributed by such Qualifying SPV ('Qualified Dividend') and distributed by the Trust is exempt in the hands of the unitholders. Any dividend other than Qualified Dividend distributed by the Trust ('Disqualified Dividend') is taxable in the hands of the unitholders.
- d. Further, where the dividend, interest, or any other income received by the Trust is chargeable to tax in the hands of the Trust, such income shall be exempt in the hands of the unitholders on distribution by the Trust under section 10(23FD) of the Act. Further, any expenditure incurred for earning such exempt income shall not be deductible in the hands of the unitholders under the provisions of section 14A of the Act.
- e. Deductions from income in the hands of unitholders
A domestic company is allowed deduction of dividend income received by it from another domestic company or the Trust subject to certain conditions. Therefore, if the unitholder is a domestic company, it should be able to claim the deduction under section 80M where the prescribed conditions mentioned under section 80M have been complied with.

Further, as per section 57 of the Act, no deduction shall be allowable against the dividend income other than deduction on account of interest expense and such interest expense shall not exceed 20% of the gross dividend income for that year, without deduction under section 57 of the Act.

2.2. **Income by way of capital gains**

2.2.1. **For resident unitholder**

- a. Where the gains arising on the transfer of units of the Trust by the unitholder are included in the business income of an assessee assessable under the head 'Profits and Gains from Business or Profession' and on which STT has been charged, such STT shall be a deductible expense from business income as per the provisions of section 36(1)(xv) of the Act.
- b. Where the gains on transfer of the units of the Trust are characterized as capital gains, and if such units are long-term capital assets¹⁰ and such transaction is chargeable to STT, income arising on

¹⁰ Capital asset being units of a business trust would be classified as long-term capital asset if the period of holding is more than 36 months immediately preceding the date of its transfer..

transfer of units of the Trust (over and above INR 0.1 million) will be taxable at a concessional tax rate of 10%⁺⁺ subject to conditions as per section 112A. However, the condition of transaction being chargeable to STT is not required if the transaction is undertaken on a recognised stock exchange located in IFSC and where the consideration for such transaction is received or receivable in foreign currency. Further, in case of long-term capital gain on transfer of units of the Trust, which are not subject to STT, shall be taxable in the hands of the unitholders at the tax rate of 20%⁺⁺ under section 112 of the Act.

- c. Short-term capital gains arising on transfer of the units of the Trust will be chargeable to tax at the rate of 15%⁺⁺ as per the provisions of section 111A of the Act, provided such transaction is subject to STT. The condition of STT is not required to be followed if the transaction is undertaken on a recognised stock exchange located in IFSC and where the consideration for such transaction is received or receivable in foreign currency.
- d. In case of a unitholder being an individual or HUF, where the total taxable income as reduced by short-term capital gains is below the basic exemption limit, the short-term capital gains will be reduced to the extent of the shortfall and only the balance short-term capital gains will be subjected to such tax in accordance with the proviso to sub-section (1) of section 111A of the Act. Short-term capital gains on transfer of units of the business trust, not transacted through a recognized stock exchange and not subject to STT shall be taxable at the applicable rate of tax for respective unitholders.
- e. In case of unitholder, being a domestic company that are liable to pay MAT under provisions of section 115JB of the Act, the gains arising, if any, on sale of units of the Trust are to be included as part of book profits for the purposes of computing MAT liability. MAT paid by such companies should be available as credit for set off against future tax liability, provided such companies do not opt to be governed by the concessional tax rate under section 115BAA of the Act.

2.2.2. For non-resident unitholder (other than Foreign Portfolio Investors ('FPIs')):

- a. Where the gains arising on the transfer of shares of the unitholder are included in the business income of an assessee assessable under the head 'Profits and Gains from Business or Profession' and on which STT has been charged, such STT shall be a deductible expense from business income as per the provisions of section 36(1)(xv) of the Act. Such business income should not be taxable in India unless that the non-resident has a taxable presence in India.
- b. Where the gains on transfer of the units are characterized as capital gains, if such units are long-term capital assets and such transaction is chargeable to STT, income arising on transfer of units of the Trust (over and above INR 0.1 million) will be taxable at a concessional tax rate of 10%⁺⁺ subject to conditions as per Section 112A. However, the condition of STT is not required to be followed if the transaction is undertaken on a recognised stock exchange located in IFSC and where the consideration for such transaction is received or receivable in foreign currency. Further, in case of long-term capital gain on transfer of units of the Trust, which are not subject to STT, shall be taxable in the hands of the unitholders at the tax rate of 20%⁺⁺ under section 112 of the Act.
- c. Short-term capital gains arising on transfer of the units of the Trust will be chargeable to tax at the rate of 15%⁺⁺ as per the provisions of section 111A of the Act if such transaction is chargeable to STT. However, the condition of STT is not required to be followed if the transaction is undertaken on a recognised stock exchange located in IFSC and where the consideration for such transaction is received or receivable in foreign currency.

- d. Short-term capital gains on transfer of units of the business trust, not transacted through a recognized stock exchange and not subject to STT shall be taxable at the applicable rate of tax for respective unitholders.
- e. As per section 47 of the Act read with Notification no. 16/2020, any capital gain arising on transfer of capital asset being unit of a business trust listed on a recognised stock exchange located in any IFSC where the consideration is received or receivable in foreign currency, would not be regarded as a transfer and therefore, would not be subject to any capital gain tax implications.
- f. Under the provisions of section 90(2) of the Act, in case of non-resident unitholders, beneficial tax regime under a Double Taxation Avoidance Agreement ('DTAA') entered into between India and the country in which the non-resident Investor is resident, if any, shall be available and can be explored. Please do note that the same shall be subject to conditions prescribed under the Act (obtaining and furnish a certificate of tax residency in a country outside India etc).
- g. As per explanation 4 to section 115JB(2), the provisions of section 115JB shall not be applicable to a foreign company if the foreign company is a resident of a country having DTAA with India and such foreign company does not have a permanent establishment within the definition of the term in the relevant DTAA, or the foreign company is a resident of a country which does not have a DTAA with India and such foreign company is not required to seek registration under the legislation covering companies in India.

2.2.3. For unitholders who are FPIs:

- a. As per section 2(14) of the Act, any securities held by a FPI, which were invested in accordance with the regulations made under the Securities and Exchange Board of India Act, 1992 shall be deemed to be capital assets. Hence the income from the transfer of such securities shall be deemed to be treated as capital gains.
- b. If units of the Trust are long-term capital assets and such transaction is chargeable to STT, income arising on their transfer (over and above INR 0.1 million) will be taxable at a concessional tax rate of 10%⁺⁺ subject to conditions as per section 112A read with section 115AD. Further, in case of long-term capital gain on transfer of units of the Trust, which are not subject to STT, shall be taxable in the hands of the unitholders at the tax rate of 10%⁺⁺, without any indexation benefit as per section 115AD.
- c. Short-term capital gains arising on transfer of the units of the Trust will be chargeable to tax at the rate of 15%⁺⁺ as per the provisions of section 111A of the Act read with section 115AD, if such transaction is chargeable to STT. Short-term capital gains on transfer of units of the Trust, not transacted through a recognized stock exchange and not subject to STT shall be taxable at 30%⁺⁺ under section 115AD of the Act. The condition of payment of STT is not required to be followed if the transaction is undertaken on a recognised stock exchange located in IFSC and where the consideration for such transaction is received or receivable in foreign currency.

2.2.4. For unitholders who are notified Sovereign Wealth Fund and Pension Funds:

As per section 10(23FE) of the Act, any income by way of dividend, interest, or long-term capital gain arising from investment made in units of the Trust on or after 1 April 2020 and before 31 March 2024 and held for at least three years shall be exempt for notified Sovereign Wealth Fund and Pension Funds, subject to satisfaction of stipulated conditions.

- 2.2.5. The Act allows short-term capital loss arising during a financial year to be set off against income, if any, from capital gains (short-term or long-term), arising in the same financial year. However, long-term capital loss arising during a financial year is allowed to be set-off only against long-term capital gains.

Balance loss, if any, is allowed to be carried forward and set-off against income from capital gains, arising during subsequent eight assessment years, as follows: (i) balance short-term capital loss can be carried forward and set-off against capital gains (short-term or long-term); and (ii) balance long-term capital loss can be carried forward and set-off only against long-term capital gains.

2.3. **Tax deduction at source by the Trust**

Section 194LBA – Certain income from units of the Trust

- a. As per section 194LBA of the Act, taxes shall be required to be deducted at source at the time of payment/ credit (whichever is earlier) from following income distributions by the Trust to its unitholders:

Income recipient	Nature of income	Applicable tax rates
• Resident unitholders	Interest income - Section 194LBA(1) Disqualified Dividend income - Section 194LBA(1) Qualified Dividend income - Section 194LBA(2A)	10% 10% Not subject to withholding tax
• Non-resident unitholders [#]	Interest income - Section 194LBA(2) Disqualified Dividend income [^] - Section 194LBA (2) Qualified Dividend income - Section 194LBA(2A)	5% ⁺⁺ 10% ⁺⁺ Not subject to withholding tax
• Category I & II Alternative Investment Funds • Mutual Funds	Any distribution	Not subject to withholding tax

[^] If the Act provides withholding tax rate for any specific category of non-resident unitholders, then the same needs to be considered.

[#] Non-resident unitholders may seek to avail any beneficial provisions under applicable DTAA that India may have entered into with its country of residence.

- b. Provisions of section 206AA of the Act

As per section 206AA of the Act, where a tax payer does not possess a Permanent Account Number ('PAN'), taxes have to be withheld on payment of income to the tax payer (where chargeable to tax) at higher of the following:

- at the rate specified in the Act; or
- at the rate or rates in force; or
- at the rate of twenty per cent

The Finance Act, 2016 amended the aforementioned provision to provide an exemption to non-residents, subject to compliance of such conditions as may be prescribed by the CBDT. In furtherance of the amended provision, the CBDT issued a notification prescribing the rules (Rule 37BC of the Rules) for relaxation from withholding of tax at higher rates in the absence of PAN in the case of non-resident deductee and laid down the information and alternative documents required to claim such relaxation.

Finance Act 2021 has inserted section 206AB which *inter alia* stipulates that where tax is required to be withheld by a person on payment or credit to a *specified person*¹¹, the tax shall be deducted at the higher of the following rates:

- (i) at twice the rate specified in the relevant provision of the Act; or
- (ii) at twice the rate or rates in force; or

¹¹ A 'specified person' is a person (excluding non-residents who do not have a permanent establishment in India) who has not filed income-tax return for the two preceding years and aggregate of TDS and TCS in his case is INR 0.05 million or more in each year.

(iii) at the rate of five per cent.

If the provisions of section 206AA is applicable to a specified person, in addition to the provision of section 206AB, the tax shall be deducted at higher of the two rates provided in section 206AB and in section 206AA.

U.S. Federal Income Tax Considerations

The following is a summary of certain U.S. federal income tax consequences of the acquisition, ownership and disposition of Units by a U.S. Holder (as defined below). This summary deals only with initial purchasers of Units that are U.S. Holders and that will hold the Units as capital assets.

The discussion does not cover all aspects of U.S. federal income taxation that may be relevant to, or the actual tax effect that any of the matters described herein will have on, the acquisition, ownership or disposition Units by particular investors (including consequences under the alternative minimum tax or net investment income tax), and does not address state, local, non-U.S. or other tax laws (such as estate or gift tax laws). This summary also does not address tax considerations applicable to investors that own (directly, indirectly or by attribution) 10 per cent. or more of the Units of the Trust by vote or value, nor does this summary discuss all of the tax considerations that may be relevant to certain types of investors subject to special treatment under the U.S. federal income tax laws (such as financial institutions, insurance companies, individual retirement accounts and other tax-deferred accounts, tax-exempt organisations, dealers in securities or currencies, investors that will hold the Units as part of straddles, hedging transactions or conversion transactions for U.S. federal income tax purposes, persons that have ceased to be U.S. citizens or lawful permanent residents of the United States, investors holding the Units in connection with a trade or business conducted outside of the United States, U.S. citizens or lawful permanent residents living abroad or investors whose functional currency is not the U.S. dollar).

As used herein, the term “U.S. Holder” means a beneficial owner of Units that is, for U.S. federal income tax purposes, (i) an individual citizen or resident of the United States, (ii) a corporation created or organised under the laws of the United States, any state thereof or the District of Columbia, (iii) an estate the income of which is subject to U.S. federal income tax without regard to its source or (iv) a trust if a court within the United States is able to exercise primary supervision over the administration of the trust and one or more U.S. persons have the authority to control all substantial decisions of the trust, or the trust has validly elected to be treated as a domestic trust for U.S. federal income tax purposes.

The U.S. federal income tax treatment of a partner in an entity or arrangement treated as a partnership for U.S. federal income tax purposes that holds Units will depend on the status of the partner and the activities of the partnership. Prospective purchasers that are entities or arrangements treated as partnerships for U.S. federal income tax purposes should consult their tax advisers concerning the U.S. federal income tax consequences to them and their partners of the acquisition, ownership and disposition of Units by the partnership.

This summary is based on the tax laws of the United States, including the Internal Revenue Code of 1986, as amended, its legislative history, existing and proposed regulations thereunder, published rulings and court decisions, as well as on the income tax treaty between the United States and India (the “**Treaty**”), all as of the date hereof and all subject to change at any time, possibly with retroactive effect.

THE SUMMARY OF U.S. FEDERAL INCOME TAX CONSEQUENCES SET OUT BELOW IS FOR GENERAL INFORMATION ONLY. ALL PROSPECTIVE PURCHASERS SHOULD CONSULT THEIR TAX ADVISERS AS TO THE PARTICULAR TAX CONSEQUENCES TO THEM OF ACQUIRING, OWNING, AND DISPOSING OF THE UNITS, INCLUDING THEIR ELIGIBILITY FOR THE BENEFITS OF THE TREATY, THE APPLICABILITY AND EFFECT OF STATE, LOCAL, NON-U.S. AND OTHER TAX LAWS AND POSSIBLE CHANGES IN TAX LAW.

Characterization of the Trust for U.S. Federal Income Tax Purposes

The U.S. tax classification of the Trust will depend on whether the Trust is considered to be an ordinary trust or a business trust. An arrangement generally will be treated as an ordinary trust for U.S. tax purposes if it can be shown that its purpose is to vest in trustees responsibility for the protection and conservation of property for beneficiaries who cannot share in the discharge of this responsibility and, therefore, are not associates in a joint enterprise for the conduct of business for profit. However, a trust that engages in business activities generally will be considered a business trust and, in the case of a non-U.S. trust, generally will be treated as a corporation for U.S. federal income tax purposes. Although the issue is not free from doubt, the Trust intends to take the position that the Trust is properly treated as a corporation for U.S. federal income tax purposes and the Units are properly treated as equity in a corporation for U.S. federal income tax purposes. However, the Trust’s position is not binding on the U.S. Internal Revenue Service (the “IRS”) or the courts and there can be no assurance that this characterization will be accepted by the IRS or a court. If the Trust is properly characterized as an ordinary trust

for U.S. federal income tax purposes U.S. Holders would be subject to certain information reporting applicable to non-U.S. trusts and U.S. investors generally would be required to take account of income and expenses incurred at the level of the Trust. U.S. Holders that fail to comply with applicable information reporting requirements in a timely manner could be subject to significant penalties. Each prospective investor should consult its own tax advisor about the proper characterization of the Trust and the Units for U.S. federal income tax purposes and the consequences of acquiring, owning or disposing of Units if the Trust is treated as an ordinary trust for U.S. federal income tax purposes. The remainder of this summary assumes that the Trust is properly characterized as a corporation for U.S. federal income tax purposes and that the Units are properly characterized as equity in a corporation for U.S. federal income tax purposes.

Passive Foreign Investment Company Rules

A non-U.S. corporation will be a passive foreign investment company (“PFIC”) in any taxable year in which, after taking into account the income and assets of the corporation and certain subsidiaries pursuant to applicable “look-through rules,” either (i) at least 75 per cent. of its gross income is “passive income” or (ii) at least 50 per cent. of the average value of its assets is attributable to assets which produce passive income or are held for the production of passive income. The Trust has not made, and does not expect to make, any determination as to its potential classification as a PFIC during any taxable year.

If the Trust is a PFIC in any year during which a U.S. Holder owns Units, and the U.S. Holder has not made a mark to market or qualified electing fund election (each as described below), the U.S. Holder generally will be subject to special rules (regardless of whether the Trust continues to be a PFIC) with respect to (i) any “excess distribution” (generally, any distributions received by the U.S. Holder on the Units in a taxable year that are greater than 125 per cent. of the average annual distributions received by the U.S. Holder in the three preceding taxable years or, if shorter, the U.S. Holder’s holding period for the Units) and (ii) any gain realised on the sale or other disposition of Units. Under these rules (a) the excess distribution or gain will be allocated rateably over the U.S. Holder’s holding period, (b) the amount allocated to the current taxable year and any taxable year prior to the first taxable year in which the Trust is a PFIC will be taxed as ordinary income, and (c) the amount allocated to each of the other taxable years will be subject to tax at the highest rate of tax in effect for the applicable class of taxpayer for that year and an interest charge for the deemed deferral benefit will be imposed with respect to the resulting tax attributable to each such other taxable year. If the Trust is a PFIC, a U.S. Holder of Units generally will be subject to similar rules with respect to distributions to the Trust by, and dispositions by the Trust of the stock of, any direct or indirect subsidiaries of the Trust that are also PFICs. If the Trust ceases to be a PFIC, a U.S. Holder may make an election (a “deemed sale election”) to be treated for U.S. federal income tax purposes as having sold its Units on the last day of the last taxable year of the Trust during which it was a PFIC. A U.S. Holder that makes a deemed sale election will cease to be treated as owning stock in a PFIC. However, gain recognised by a U.S. Holder as a result of making the deemed sale election will be subject to the rules described above.

U.S. Holders can avoid the interest charge by making a mark to market election with respect to the Units, provided that the Units are “marketable”. Units will be marketable if they are regularly traded on a non-U.S. stock exchange if (i) the exchange is regulated or supervised by a governmental authority of the country in which the exchange is located; (ii) the exchange has trading volume, listing, financial disclosure, surveillance and other requirements designed to prevent fraudulent and manipulative acts and practices, remove impediments to, and perfect the mechanism of, a free and open, fair and orderly, market, and to protect investors; (iii) the laws of the country in which the exchange is located and the rules of the exchange ensure that these requirements are actually enforced; and (iv) the rules of the exchange ensure active trading of listed stocks. For these purposes, the Units will be considered regularly traded during any calendar year during which they are traded, other than in de minimis quantities, on at least 15 days during each calendar quarter. Any trades that have as their principal purpose meeting this requirement will be disregarded.

A U.S. Holder that makes a mark to market election must include in ordinary income for each year an amount equal to the excess, if any, of the fair market value of the Units at the close of the taxable year over the U.S. Holder’s adjusted basis in the Units. An electing holder may also claim an ordinary loss deduction for the excess, if any, of the U.S. Holder’s adjusted basis in the Units over the fair market value of the Units at the close of the taxable year, but this deduction is allowable only to the extent of any net mark to market gains for prior years. Gains from an actual sale or other disposition of the Units will be treated as ordinary income, and any losses incurred on a sale or other disposition of the Units will be treated as an ordinary loss to the extent of any net mark to market gains for prior years. Once made, the election cannot be revoked without the consent of the IRS unless the Units cease to be marketable. If the Trust is a PFIC for any year in which the U.S. Holder owns the Units but

before a mark to market election is made, the interest charge rules described above will apply to any mark to market gain recognised in the year the election is made.

In some cases, a shareholder of a PFIC can avoid the interest charge and the other adverse PFIC consequences described above by making a “qualified electing fund” (“QEF”) election to be taxed currently on its share of the PFIC’s undistributed income. The Trust does not, however, expect to provide to U.S. Holders the information regarding this income that would be necessary in order for a U.S. Holder to make a QEF election with respect to its Units.

A U.S. Holder who owns, or who is treated as owning, PFIC stock during any taxable year in which the Trust is classified as a PFIC may be required to file IRS Form 8621. Prospective purchasers should consult their tax advisers regarding the requirement to file IRS Form 8621 and the potential application of the PFIC regime.

Distributions

Subject to the PFIC rules discussed above, distributions paid by the Trust out of current or accumulated earnings and profits (as determined for U.S. federal income tax purposes), before reduction for any Indian withholding tax paid by the Trust with respect thereto, generally will be taxable to a U.S. Holder as dividend income, and will not be eligible for the dividends received deduction allowed to corporations. Distributions in excess of current and accumulated earnings and profits will be treated as a non-taxable return of capital to the extent of the U.S. Holder’s basis in the Units and thereafter as capital gain. However, the Trust does not maintain calculations of its earnings and profits in accordance with U.S. federal income tax accounting principles. U.S. Holders should therefore assume that any distribution by the Trust with respect to Units will be reported as ordinary dividend income. U.S. Holders should consult their own tax advisers with respect to the appropriate U.S. federal income tax treatment of any distribution received from the Trust.

Dividends paid in Rupees will be included in income in a U.S. dollar amount calculated by reference to the exchange rate in effect on the day the dividends are received by the U.S. Holder, regardless of whether the Rupees are converted into U.S. dollars at that time. If dividends received in Rupees are converted into U.S. dollars on the day they are received, the U.S. Holder generally will not be required to recognise foreign currency gain or loss in respect of the dividend income.

A U.S. Holder generally will be entitled, subject to certain limitations, to a credit against its U.S. federal income tax liability, or a deduction in computing its U.S. federal taxable income, for Indian income taxes withheld from distributions by the Trust. Distributions generally will constitute “passive category income” for purposes of the foreign tax credit. The rules governing foreign tax credits are complex. Prospective purchasers should consult their tax advisers concerning the foreign tax credit implications of Indian withholding taxes.

Sale or Other Disposition

Subject to the PFIC rules discussed above, upon a sale or other disposition of Units, a U.S. Holder generally will recognise capital gain or loss for U.S. federal income tax purposes equal to the difference, if any, between the amount realised on the sale or other disposition and the U.S. Holder’s adjusted tax basis in the Units, in each case as determined in U.S. dollars. U.S. Holders should consult their own tax advisors about how to account for proceeds received on the sale or other disposition of Units that are not paid in U.S. dollars. This capital gain or loss will be long-term capital gain or loss if the U.S. Holder’s holding period in the Units exceeds one year. The deductibility of capital losses is subject to limitations.

Any gain or loss generally will be U.S. source. Therefore, a U.S. Holder may have insufficient foreign source income to utilise foreign tax credits attributable to any Indian withholding tax imposed on a sale or disposition. Prospective purchasers should consult their tax advisers as to the availability of and limitations on any foreign tax credit attributable to this Indian withholding tax.

Backup Withholding and Information Reporting

Distributions and proceeds from the sale or other disposition of Units paid by a U.S. paying agent or other U.S. intermediary will be reported to the IRS and to the U.S. Holder as may be required under applicable regulations. Backup withholding may apply to these payments if the U.S. Holder fails to provide an accurate taxpayer

identification number or certification of exempt status or fails to comply with applicable certification requirements. Certain U.S. Holders are not subject to backup withholding. U.S. Holders should consult their tax advisers as to their qualification for exemption from backup withholding and about these rules and any other reporting obligations that may apply to the ownership or disposition of Units, including requirements related to the holding of certain “specified foreign financial assets”.

LEGAL MATTERS

Each of J. Sagar Associates, Cyril Amarchand Mangaldas and Linklaters Singapore Pte. Ltd. do not make, or purport to make, any statement in this Final Placement Memorandum and is not aware of any statement in this Final Placement Memorandum which purports to be based on a statement made by any of them, and it makes no representation, express or implied, regarding, and to the extent permitted by law takes no responsibility for, any statement in or omission from this Final Placement Memorandum.

INDEPENDENT ACCOUNTANTS

The Audited Financial Information have been prepared in accordance with the accounting principles generally accepted in India. The Audited Financial Information included in this Final Placement Memorandum have been audited by A.R. & Co., Chartered Accountants, the statutory auditors of the Trust, as stated in their audit reports dated August 18, 2021, and September 27, 2021, included in this Final Placement Memorandum. The Auditors have examined the Projections of Revenue from Operations and Cash Flow from Operating Activities, and their report in relation to such Projections of Revenue from Operations and Cash Flow from Operating Activities dated September 28, 2021, has been included in this Final Placement Memorandum.

ASSET REVENUE INFORMATION

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Ref: NHAI/13013/547/C0/2020-21/InvIT/46

Date: 24.08.2021

To,
MD&CEO NHIIMPL,
NHAI Corporate Office,
G-5 & 6, Dwarka Sector 10,
New Delhi — 110075

Subject: Submission of Information related to monetization of projects through Invit.

Dear Sir,

With reference to your letter dated 19.08.2021 wherein you have requested certain information as the same is required as part of the process of setting up of InvIT. In this regard it is submitted that the information given below has been attached as follows:

- a) Actual monthly revenue of last three financial years (FY19, FY20 & FY21) paid by tolling agency to NHAI for 5 projects. (Annexure I)
- b) Updated tolling contract and revenue details. (Annexure-II)
- c) Copy of the tolling contracts awarded/executed after March 1st, 2021 relating to these 5 projects. (Google drive link in mail dated 24.08.21)
- d) As Built drawings of 5 no. Projects allocated for InvIT. (Google drive link in mail dated 24.08.21)
- e) Copy of approvals relating to environmental clearances.(Google drive link in mail dated 24.08.21)
- f) State Support Agreement (SSA) with Telangana, Rajasthan, Gujarat and Karnataka. (Google drive link in mail dated 24.08.21)

Encl- 8 No Sheets

This is issued with the approval of competent authority.

Yours Faithfully

(R.K.Rathee)
GM(T)-InvIT

List of existing tolling contracts as on 18th August 2021

Project Name	Toll Plaza	Contractor Name	Contract Value (Rs. crore / annum)	Valid Upto
Abu Road – Palanpur	Khemana	Riddhi Siddhi Associates	71.35	16/12/2021
Abu Road – Swaroopganj	Undavariya	M/s Ashirwad Smart Infra-link Pvt. Ltd.	60.15	08/05/2022
Kothakota – Kurnool	Pullur	Sri Sai enterprises	127.53	08/03/2022
Chittorgarh – Kota	Bassi, Aroli, Dhaneshwar	Ashirwad Smart Infra-link Pvt. Ltd.	87.08	23.04.2022
Belgaum – Kagal	Kognoli	Sahakar Global	81.54	17/12/2021
Belgaum – Kagal	Hattargi	Sri Sai Enterprises	33.33	18/12/2021

Contracted revenues for the 5 Project assets for the period mentioned below:

Sl. No.	Project Stretch	Toll plaza	Period	Equivalent annualised Amount (Rs cr/ annum) unless mentioned
1	Swaroopganj To Abu Road	UNDVARIYA	08.05.2021 to 08.05.2022	60.15
			04.03.2021 – 07.05.2021	59.06
			19.01.2020 – 04.03.2021	44.01
			22.12.2018 – 19.01.2020	37.45
			04.11.2017 – 22.12.2018	34.82
			15.10.2017 to 04.11.2017	1.77 Cr. For the stated period
			15.07.2017 to 15.10.2017	8.12 Cr. For the stated period
			01.04.2017 to 15.07.2017	9.89 Cr. For the stated period
2	Abu Road To Palanpur	KHEMANA	16.12.2020 TO 16.12.2021	71.35
			05.09.2020 TO 16.12.2020	66.36
			16.06.2019 TO 05.09.2020	62.37
			13.04.2018 TO 16.06.2019	55.55
			07.04.2017 TO 13.04.2018	48.61
			01.04.2017 to 07.04.2017	0.76 Cr. For the stated period
3	Chittorgarh – Kota & Chittorgarh Bypass	BASSI , AROLI , DHANESWAR	23.04.2021 to 23.04.2022	87.08
			23.01.2021 TO 23.04.2021	88.65
			22.09.2020 TO 22.12.2020	77.52
			11.08.2020 TO 22.09.2020	70.5
			04.05.2019 TO 04.08.2020	84.87
			02.02.2019 TO 02.05.2019	82.16
			23.12.2017 TO 01.02.2019	75.92

Sl. No.	Project Stretch	Toll plaza	Period	Equivalent annualised Amount (Rs cr/ annum) unless mentioned
			01.04.2017-23.12.2017	37.74 Cr. For the stated period*
4	Maharashtra Karnataka Border to Belgaum	KOGNOLI	17.12.2020-17.12.2021	81.54
			22.09.2020-17.12.2020	11.67 for the stated period
			08.08.2020 to 22.09.2020	5.07 For the stated period
			22.02.2020 to 08.08.2020	29.74 For the stated period
			23.01.2020 to 22.02.2020	5.00 For the stated period
			23.10.2019 to 23.01.2020	15.02 For the stated period
			16.06.2019-23.10.2019	4.30 For the stated period
			16.06.2019 to 16.09.2019	12.91 For the stated period
			16.03.2019 to 16.06.2019	16.74 For the stated period
			16.03.2018 to 16.03.2019	67.87
			03.03.2017 to 03.03.2018	59.01
		HATTARGI	18.12.2020 - 18.12.2021	33.33
			22.09.2020 - 18.12.2020	6.54 for the stated period
			05.08.2020- 22.09.2020	2.53 Cr for the stated period
			05.03.2020 to 05.08.2020	11.43 for the stated period
			05.12.2019 – 05.03.2020	6.86 for the stated period
			05.11.2019 to 05.12.2019	2.56 for the stated period
			05.08.2019 to 05.11.2019	7.69 for the stated period
			05.05.2019 to 05.08.2019	7.92 for the stated period
			05.05.2018 to 05.05.2019	32.13
			05.05.2017 to 05.05.2018	28.40
			09.03.2017 – 05.05.2017	4.12 Cr. For the stated period
5	Kothakota Bypass To Kurnool	PULLUR	08.03.2021 - 08.03.2022	127.53
			07.12.2019 - 07.12.2020	120.33
			07.09.2018 - 07.12.2019	117.36
			04.08.2017 - 04.08.2018	105.16
			21.07.2016 to 04.08.2017	92.26

Revenue Details (Monthly) of Last 3 Years (Paid by Tolling Agency to Authority)

Pertaining Month	Remittance as per Tolling Contract (Daily/Weekly)	Remittance as per Tolling Contract during pertaining month	Remittance paid by tolling Agency to Authority during Month	Default (If any)		Force Majeure Case (If applicable)	
				Default Amount	Action taken	Effect of Force Majeure	Steps taken by authority to mitigate the effect of force majeure
April-18	Weekly	65,566,984	65,566,984	-	-	NIL	NIL
May-18	Weekly	67,752,550	67,752,550	-	-	NIL	NIL
June-18	Weekly	65,566,984	65,566,984	-	-	NIL	NIL
July-18	Weekly	67,752,550	67,752,550	-	-	NIL	NIL
August-18	Weekly	67,752,550	67,752,550	-	-	NIL	NIL
September-18	Weekly	65,566,984	65,566,984	-	-	NIL	NIL
October-18	Weekly	67,752,550	67,752,550	-	-	NIL	NIL
November-18	Weekly	65,566,984	65,566,984	-	-	NIL	NIL
December-18	Weekly	64,712,766	64,712,766	-	-	NIL	NIL
January-19	Weekly	57,282,181	57,282,181	-	-	NIL	NIL
February	Daily	62,503,750	62,503,750	-	-	NIL	NIL
March-19	Daily	69,796,500	69,796,500	-	-	NIL	NIL
April-19	Daily	70,585,050	70,585,050	-	-	NIL	NIL
May-19	Daily/ Weekly	74,890,954	74,890,954	-	-	NIL	NIL
June-19	Weekly	72,702,836	72,702,836	-	-	NIL	NIL
July-19	Weekly	75,126,264	75,126,264	-	-	NIL	NIL
August-19	Weekly	75,126,264	75,126,264	-	-	NIL	NIL
September-19	Weekly	72,702,836	72,702,836	-	-	NIL	NIL
October-19	Weekly	75,126,264	75,126,264	-	-	NIL	NIL
November-19	Weekly	72,702,836	72,702,836	-	-	NIL	NIL
December-19	Weekly	75,126,264	75,126,264	-	-	NIL	NIL
January-20	Weekly	75,126,264	75,126,264	-	-	NIL	NIL
February-20	Weekly	70,279,408	70,279,408	-	-	NIL	NIL
March-20	Weekly	53,406,500	39,173,428	31,395,161	Amount recovered from the Performance Security of the Toll Agency	26.03.2021 to 04.06.2020	The FM Claim as per the provision of CA and actual collection has been submitted to Competent Authority for approval. However, the toll collection has filed petition before the Hon'ble High Court New Delhi, which is subjudice
April-20	Weekly	6,781,680	9,212,519				
May-20	Weekly	50,656,988	52,049,533				
June-20	Weekly	74,703,367	67,919,433				
July-20	Weekly	77,623,225	89,296,094				
August-20	Weekly/ Daily	65,792,054	39,917,646				
September-20	Daily	59,613,312	59,613,312	-	-	NIL	NIL
October-20	Daily	65,844,000	65,844,000	-	-	NIL	NIL
November-20	Daily	63,720,000	63,720,000	-	-	NIL	NIL
December-20	Daily	65,844,000	65,844,000	-	-	NIL	NIL
January-21	Daily	68,557,479	68,557,479	-	-	NIL	NIL
February-21	Daily	68,006,008	68,006,008	-	-	NIL	NIL
March-21	Daily	75,292,366	75,292,366	-	-	NIL	NIL

PIU-Dharwad - Hattargi Toll plaza

Revenue Details (Monthly) of Last 3 Years (Paid by Tolling Agency to Authority)

Pertaining Month	Remittance as per Tolling Contract (Daily/Weekly)	Remittance as per Tolling Contract during pertaining month	Remittance paid by tolling Agency to Authority during Month	Default (If any)		Force Majure Case (If applicable)	
				Default Amount	Action taken	Effect of Force Majure	Steps taken by authority to mitigate the effect of force majure
April-18	Weekly	16,997,664	16,997,664	-	-	NIL	NIL
May-18	Weekly	30,344,344	30,344,344	-	-	NIL	NIL
June-18	Weekly	25,340,768	25,340,768	-	-	NIL	NIL
July-18	Weekly	31,675,960	31,675,960	-	-	NIL	NIL
August-18	Weekly	25,340,764	25,340,764	-	-	NIL	NIL
September-18	Weekly	25,340,764	25,340,764	-	-	NIL	NIL
October-18	Weekly	31,675,960	31,675,960	-	-	NIL	NIL
November-18	Weekly	25,340,764	25,340,764	-	-	NIL	NIL
December-18	Weekly	25,340,764	25,340,764	-	-	NIL	NIL
January-19	Weekly	31,675,960	31,675,960	-	-	NIL	NIL
February-19	Weekly	25,340,764	25,340,764	-	-	NIL	NIL
March-19	Weekly	31,675,960	31,675,960	-	-	NIL	NIL
April-19	Weekly	26,476,032	26,476,032	-	-	NIL	NIL
May-19	Weekly	26,476,032	26,476,032	-	-	NIL	NIL
June-19	Weekly	26,476,032	26,476,032	-	-	NIL	NIL
July-19	Weekly	33,095,040	33,095,040	-	-	NIL	NIL
August-19	Weekly	6,934,199	6,934,199	-	-	NIL	NIL
August-19	Daily	22,800,000	15,960,000	6,840,000	FMC due to Flood	From 06.08.2019 to 13.08.2019	FMC amount approved by Competent Authority RO, Bangalore
September-19	Daily	25,650,000	25,650,000	-	-	NIL	NIL
October-19	Daily	26,505,000	26,505,000	-	-	NIL	NIL
November-19	Daily	25,650,000	25,650,000	-	-	NIL	NIL
December-19	Daily	24,608,280	24,608,280	-	-	NIL	NIL
January-20	Daily	23,637,438	23,637,438	-	-	NIL	NIL
February-20	Daily	22,112,442	22,112,442	-	-	NIL	NIL
March-20	Daily	23,637,438	17,187,356	68,786,702	Amount recovered Rs. 7582078/- from the Performance Security of the Toll Agency	22.03.2020 to 20.08.2020	The FM Claim approved by Competent Authority and release the Performance Bank Guarantee amount after recovered Rs. 7582078/-
April-20	Daily	24,187,950	1,825,000				
May-20	Daily	24,994,215	11,170,000				
June-20	Daily	24,187,950	17,808,085				
July-20	Daily	24,994,215	17,616,330				
August-20	Daily	24,456,705	12,065,000				
August-20	Daily	6,171,433	6,171,433	-	-	NIL	NIL
September-20	Daily	17,585,097	17,585,097	-	-	NIL	NIL
October-20	Daily	22,535,295	22,535,295	-	-	NIL	NIL
November-20	Daily	21,808,350	21,808,350	-	-	NIL	NIL
December-20	Daily & Weekly	21,428,404	21,428,404	-	-	NIL	NIL
January-21	Weekly	25,570,828	25,570,828	-	-	NIL	NIL
February-21	Weekly	25,570,828	25,570,828	-	-	NIL	NIL
March-21	Weekly	29,223,803	29,223,803	-	-	NIL	NIL

PIU-Dharwad -Kognolli Toll plaza

Revenue Details (Monthly) of Last 3 Years (Paid by Tolling Agency to Authority)

Pertaining Month	Remittance as per Tolling Contract (Daily/Weekly)	Remittance as per Tolling Contract during pertaining month	Remittance paid by tolling Agency to Authority during Month	Default (If any)		Force Majeure Case (If applicable)	
				Default Amount	Action taken	Effect of Force Majeure	Steps taken by authority to mitigate the effect of force majeure
April-18	Weekly	43,051,451	43,051,451	-	-	NIL	NIL
May-18	Weekly	68,490,945	68,490,945	-	-	NIL	NIL
June-18	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
July-18	Weekly	68,490,945	61,354,933	7,136,012	FMC due to Transportors Strikes	From 23.07.2018 to 29.07.2018	FMC amount approved by Competent Authority RO, Bangalore
August-18	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
September-18	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
October-18	Weekly	68,490,945	68,490,945	-	-	NIL	NIL
November-18	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
December-18	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
January-19	Weekly	68,490,945	68,490,945	-	-	NIL	NIL
February	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
March-19	Weekly	54,792,756	54,792,756	-	-	NIL	NIL
April-19	Weekly	70,956,621	70,956,621	-	-	NIL	NIL
May-19	Weekly	57,258,432	57,258,432	-	-	NIL	NIL
June-19	Weekly & Daily	62,610,200	62,610,200	-	-	NIL	NIL
July-19	Daily	44,450,559	44,450,559	-	-	NIL	NIL
August-19	Daily	44,450,559	36,921,900	7,528,659	FMC due to Flood	From 08.08.2019 to 13.08.2019	FMC amount approved by Competent Authority RO, Bangalore
September-19	Daily	43,016,670	43,016,670	-	-	NIL	NIL
October-19	Daily	46,487,919	46,487,919	-	-	NIL	NIL
November-19	Daily	50,069,070	50,069,070	-	-	NIL	NIL
December-19	Daily	51,738,039	51,738,039	-	-	NIL	NIL
January-20	Daily	51,738,039	51,738,039	-	-	NIL	NIL
February-20	Daily	49,266,672	49,266,672	-	-	NIL	NIL
March-20	Daily	55,242,000	34,235,755	197,783,825	Amount recovered will be from the Performance Security of the Toll Agency	22.03.2020 to 08.08.2020	The FM Claim approved by Competent Authority RO, Bangalore and amount is yet to be recovered from tolling agency the same was sent to HQ for approval . However, the toll collection has filed petition before the Hon'ble High Court New Delhi,
April-20	Daily	55,977,960	5,234,407				
May-20	Daily	57,843,892	29,812,501				
June-20	Daily	55,977,960	28,229,647				
July-20	Daily	57,843,892	32,215,597				
August-20	Daily	57,843,892	13,217,864	-	-	NIL	NIL
August-20	Daily	26,719,406	26,719,406	-	-	NIL	NIL
September-20	Daily	35,845,549	35,845,549	-	-	NIL	NIL
October-20	Daily	42,066,225	42,066,225	-	-	NIL	NIL
November-20	Daily	40,709,250	40,709,250	-	-	NIL	NIL
December-20	Daily & Weekly	45,992,966	45,992,966	-	-	NIL	NIL
January-21	Weekly	62,551,232	62,551,232	-	-	NIL	NIL
February-21	Weekly	62,551,232	62,551,232	-	-	NIL	NIL
March-21	Weekly	69,253,150	69,253,150	-	-	NIL	NIL

Revenue Details (Monthly) of Last 3 Years (Paid by Tolling Agency to Authority)

Pertaining Month	Remittance as per Tolling Contract (Daily/Weekly)	Remittance as per Tolling Contract during pertaining month	Remittance paid by tolling Agency to Authority during Month	Default (if any)		Force Majure Case (If applicable)	
				Default Amount	Action taken	Effect of Force Majure	Steps taken by authority to mitigate the effect of force majeure
April-18	20,839,608.00	82,781,106.00	82,781,106.00	0.00			
May-18	20,839,608.00	104,198,040.00	104,198,040.00	0.00			
June-18	20,839,608.00	83,358,432.00	83,358,432.00	0.00			
July-18	20,839,608.00	104,198,040.00	104,198,040.00	0.00			
August-18	20,839,608.00	83,358,432.00	83,358,432.00	0.00			
September-18	20,839,608.00	88,046,607.00	88,046,607.00	0.00			
October-18	22,508,280.00	112,541,400.00	112,541,400.00	0.00			
November-18	22,508,280.00	90,033,120.00	90,033,120.00	0.00			
December-18	22,508,280.00	90,033,120.00	90,033,120.00	0.00			
January-19	22,508,280.00	90,033,120.00	90,033,120.00	0.00			
February-19	22,508,280.00	90,033,120.00	90,033,120.00	0.00			
March-19	22,508,280.00	90,033,120.00	90,033,120.00	0.00			
April-19	23,413,114.00	115,260,404.00	115,260,404.00	0.00			
May-19	23,413,114.00	93,652,456.00	93,652,456.00	0.00			
June-19	23,413,114.00	93,652,456.00	93,652,456.00	0.00			
July-19	23,413,114.00	117,065,570.00	117,065,570.00	0.00			
August-19	23,413,114.00	93,652,456.00	93,652,456.00	0.00			
September-19	23,413,114.00	93,652,456.00	93,652,456.00	0.00			
October-19	23,413,114.00	117,065,570.00	117,065,570.00	0.00			
November-19	23,413,114.00	90,033,120.00	90,033,120.00	0.00			
December-19	23,014,804.00	115,775,804.00	115,775,804.00	0.00			
January-20	23,014,804.00	92,059,216.00	92,059,216.00	0.00			
February-20	23,014,804.00	92,059,216.00	92,059,216.00	0.00			
March-20	23,014,804.00	115,074,020.00	92,059,216.00	23,014,804.00			
April-20	23,972,220.00	95478558.86	6,926,210.00	88,552,348.86			
May-20	23,972,220.00	95,888,880.00	41,981,363.00	53,907,517.00			
June-20	23,972,220.00	0.00	88,343,331.00	-88,343,331.00			
July-20	23,972,220.00	95,888,880.00	70,745,107.00	25,143,773.00			
August-20	23,972,220.00	95,888,880.00	78,977,271.00	16,911,609.00			
September-20	23,972,220.00	0.00	107,719,271.00	-107,719,271.00		Yes	Rs.20,92,98,357 relief has given under force Majeure and due amount Rs.5,90,42,323 (Including TCS and Penalty)recovered from Cash Performance security
October-20	23,972,220.00	95,888,880.00	95,888,880.00	0.00			
November-20	23,972,220.00	95,888,880.00	95,888,880.00	0.00			
December-20	23,972,220.00	0.00	119,861,100.00	-119,861,100.00			
January-21	23,972,220.00	95,888,880.00	95,888,880.00	0.00			
February-21	23,972,220.00	95,888,880.00	95,888,880.00	0.00			
March-21	24,457,809.00	121,294,743.00	121,294,743.00	0.00			

Revenue Details (Monthly) of Last 3 Years (Paid by Tolling Agency to Authority) Khemana							
Pertaining Month	Remittance as per Tolling Contract (Daily/Weekly)	Remittance as per Tolling Contract during pertaining month	Remittance paid by tolling Agency to Authority during Month	Default (If any)		Force Majure Case (If applicable)	
				Default Amount	Action taken	Effect of Force Majure	Steps taken by authority to mitigate the effect of force majeure
April-18	Weekly	45618049	45618049	-	-	Nil	
May-18	Weekly	48665607	48665607	-	-	Nil	
June-18	Weekly	47095749	47095749	-	-	Nil	
July-18	Weekly	48665607	43843896	4821711	Performance security	The amount recovered from 20.07.2018 to 27.07.2018	Force Majure relief given to tolling agency amount Rs.6301152
August-18	Weekly	48665607	48665607	-	-	Nil	
September-18	Weekly	47095749	47095749	-	-	Nil	
October-18	Weekly	48665607	48665607	-	-	Nil	
November-18	Weekly	47095749	47095749	-	-	Nil	
December-18	Weekly	48665607	48665607	-	-	Nil	
January-19	Weekly	48665607	48665607	-	-	Nil	
February-19	Weekly	45525890	45525890	-	-	Nil	
March-19	Weekly	48665607	48665607	-	-	Nil	
April-19	Weekly	49021963	49021963	-	-	Nil	
May-19	Weekly	50656028	50656028	-	-	Nil	
June-19	Weekly	50003224	50003224	-	-	Nil	
July-19	Weekly	52828823	52828823	-	-	Nil	
August-19	Weekly	52828823	52828823	-	-	Nil	
September-19	Weekly	51124667	51124667	-	-	Nil	
October-19	Weekly	52828823	52828823	-	-	Nil	
November-19	Weekly	51124667	51124667	-	-	Nil	
December-19	Weekly	52828823	52828823	-	-	Nil	
January-20	Weekly	52828823	52828823	-	-	Nil	
February-20	Weekly	47716356	47716356	-	-	Nil	
March-20	Weekly	44303044	38929867	11603587	Part of performance security withheld for necessary recovery	26.03.2021 to 07.06.2020	The FM claim is under settlement.Settlement cum closeout agreement not signed by tolling agency till date
April-20	Weekly	11601025	10397718				
May-20	Weekly	36450340	33806858				
June-20	Weekly	51696972	49313351				
July-20	Weekly	54968394	54968394	-	-	Nil	
August-20	Weekly	54968394	54968394	-	-	Nil	
September-20	daily	54340845	54340845	-	-	Nil	
October-20	daily	56388969	56388969	-	-	Nil	
November-20	daily	54569970	54569970	-	-	Nil	
December-20	daily	58430004	58430004	-	-	Nil	
January-21	Weekly	60607108	60607108			Nil	
February-21	Weekly	54741904	54741904			Nil	
March-21	Weekly	60607108	60607108			Nil	

Revenue Details (Monthly) of Last 3 Years (Paid by Tolling Agency to Authority) Undavriya							
Pertaining Month	Remittance as per Tolling Contract (Daily/Weekly)	Remittance as per Tolling Contract during pertaining month	Remittance paid by tolling Agency to Authority during Month	Default (If any)		Force Majure Case (If applicable)	
				Default Amount	Action taken	Effect of Force Majure	Steps taken by authority to mitigate the effect of force majeure
April-18	Weekly	29438533	29438533	-	-	Nil	
May-18	Weekly	30419817	30419817	-	-	Nil	
June-18	Weekly	29438533	29438533	-	-	Nil	
July-18	Weekly	30419817	30419817	-	-	Nil	
August-18	Weekly	30419817	30419817	-	-	Nil	
September-18	Weekly	29438533	29438533	-	-	Nil	
October-18	Weekly	30419817	30419817	-	-	Nil	
November-18	Weekly	29438533	29438533	-	-	Nil	
December-18	Weekly	30419817	30419817	-	-	Nil	
January-19	Weekly	31806000	31806000	-	-	Nil	
February-19	Weekly	28728000	28728000	-	-	Nil	
March-19	Weekly	31806000	31806000	-	-	Nil	
April-19	Weekly	32629877	32629877	-	-	Nil	
May-19	Weekly	33717540	33717540	-	-	Nil	
June-19	Weekly	32629877	32629877	-	-	Nil	
July-19	Weekly	33717540	33717540	-	-	Nil	
August-19	Weekly	33717540	33717540	-	-	Nil	
September-19	Weekly	32629877	32629877	-	-	Nil	
October-19	Weekly	33717540	33717540	-	-	Nil	
November-19	Weekly	32629877	32629877	-	-	Nil	
December-19	Weekly	33717540	33717540	-	-	Nil	
January-20	Weekly	35098047	35098047	-	-	Nil	
February-20	Weekly	34878440	34878440				
March-20	Weekly	34126750	31923576	3725603	Part of performance security withheld with NHAI for necessary recovery	23.03.2020 to 21.06.2020	The FM claim is under settlement.Settlement cum closeout agreement not signed by tolling agency till date
April-20	Weekly	7334675	7334675				
May-20	Weekly	23906860	23906860				
June-20	Weekly	30574196	29051767				
July-20	Weekly	38221874	38221874		-	Nil	
August-20	Weekly	38271874	38271874	-	-	Nil	
September-20	Weekly	37037297	37037297	-	-	Nil	
October-20	Weekly	38271874	38271874	-	-	Nil	
November-20	Weekly	37037297	37037297	-	-	Nil	
December-20	Weekly	38271874	38271874	-	-	Nil	
January-21	Weekly	38271874	38271874	-	-	Nil	
February-21	Weekly	34568144	34568144	-	-	Nil	
March-21	Weekly	49013582	35024180	13989402	Performance security is with	-	The toll agency has raised the FM claims due to COVID-19 (2nd Wave). So far no circular received regarding COVID-19 (2nd wave) mitigation.

AUDITED FINANCIAL INFORMATION

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A.R. & CO.
Chartered Accountants

Delhi Office:

A-403, Gayatri Apartment
Airlines Group Housing Society
Plot No 27, Sector -10,
Dwarka, New Delhi -110075
Cell No.9810195084, 9810444051
E-mail: ar_co1981@yahoo.co.in
pawankgoel1@gmail.com

Corporate and Correspondence Office:

C-1, II Floor, RDC, Raj Nagar
Ghaziabad- 201001 Delhi-NCR
National Capital region Of Delhi

Independent Auditor's Report

To,
The Trustees
NATIONAL HIGHWAYS INFRA TRUST
G - 5 & 6, Sector - 10, Dwarka,
New Delhi - 110 075.

Report on the Standalone Financial Statements

We have audited the accompanying standalone financial statements of **NATIONAL HIGHWAYS INFRA TRUST ("the Trust")** which comprises the Balance Sheet as at March 31, 2021, the Statement of Profit and Loss for the period from 19.10.2020 to 31.03.2021, the Statement of cash flows for the period from 19.10.2020 to 31.03.2021 and a summary of significant accounting policies and other explanatory information.

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid standalone financial statements give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India,

- (i) In the case of Balance Sheet, of the state of affairs of the Company as at March 31, 2021,
- (ii) In case of Statement of Profit & Loss, of the loss for the period from 19.10.2020 to 31.03.2021,
- (iii) the Statement of cash flows for the period from 19.10.2020 to 31.03.2021.
- (iv) the statement of changes in equity from 19.10.2020 to 31.03.2021

Basis for Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs). Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Trust in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India together with the ethical requirements that are relevant to our audit of the financial statements and we have fulfilled our other ethical responsibilities in accordance with these requirements and the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Management's Responsibility for the Standalone Financial Statements

The Trustees of the Trust/ (Management of the Trust) are/is responsible for the matters with respect to the preparation and presentation of these standalone interim financial statements that give a true and fair view of the financial position and financial performance of the Trust in accordance with the accounting principles generally accepted in India, including the Indian Accounting Standards and other accounting principles generally accepted in India. This responsibility also includes maintenance of adequate accounting records for safeguarding the assets of the Company and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent in the circumstances; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the interim financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these standalone financial statements based on our audit.

We have taken into account the provisions of the Act, the accounting and auditing standards and matters which are required to be included in the audit report under the provisions of the Act and the Rules made there under.

We conducted our audit in accordance with the Standards on Auditing. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and the disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal financial control relevant to the Trust's preparation of the financial statements that give a true and fair view in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on whether the Trust has in place an adequate internal financial controls system over financial reporting and the operating effectiveness of such controls. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by the Trust's Management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the standalone financial statements.

Report on Other Legal and Regulatory Requirements

As required by SEBI Circular number CIR/IMD/DF/114/2016 dated October 20, 2016 ("SEBI Circular"), we report that:

- (a) We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;
- (b) The Balance Sheets, Statements of Profit and Loss (including Other Comprehensive Income), Cash Flow Statements and Statements of Changes in Equity dealt with by this Report are in agreement with the books of account maintained
- (c) In our opinion, the aforesaid Financial Statements comply with the accounting principles generally accepted in India, including Indian Accounting Standards (hereinafter referred to as the 'Ind AS') and other accounting principles generally accepted in India.

For A. R. & Co.
Chartered Accountants
Firm Registration No. 002744C

(CA Aakansha Nigam)
Partner
Membership No: 416425
UDIN: 21416425AAAABE3018
Place: Ghaziabad
Date: 18.08.2021

NATIONAL HIGHWAYS INFRA TRUST		
Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075		
Standalone Balance Sheet as at March 31, 2021		
Particulars	Note No.	As at March 31, 2021
ASSETS		
Non-current assets		
a) Property, Plant and Equipment		-
b) Capital work-in-progress		-
c) Intangible assets		-
d) Intangible assets under development		-
e) Financial Assets - Other financial assets		-
f) Other non-current assets		-
	A	-
Current assets		
a) Financial Assets		-
i) Investments		-
ii) Cash and cash equivalents		-
iii) Loans		-
iv) Other financial assets	3	10,000.00
b) Current tax assets (net)		-
c) Other current assets		-
	B	10,000.00
TOTAL ASSETS	A+B	10,000.00
EQUITY AND LIABILITIES		
EQUITY		
a) Initial Settlement Amount	4	10,000.00
b) Equity Unit capital		-
c) Other Equity	5	(67,90,202.00)
	C	(67,80,202.00)
LIABILITIES		
Non-current liabilities		
a) Financial liabilities		
i) Borrowings		-
ii) Other financial liabilities		-
b) Provisions		-
c) Other non-current liabilities		-
	D	-
Current liabilities		
a) Financial liabilities		-
i) Borrowings		-
ii) Trade payables		-
iii) Other financial liabilities	6	67,83,699.00
b) Other current liabilities	7	6,503.00
c) Provisions		-
d) Current tax liabilities (net)		-
	E	67,90,202.00
TOTAL EQUITY AND LIABILITIES	(C+D+E)	10,000.00
Notes forming Part of Financial Statements 1 to 8		
For A. R. & Co. For and on behalf of NATIONAL HIGHWAYS INFRA TRUST		
Chartered Accountants By its Investment Manager,		
FRN :- 002744C National Highways Infra Investment Managers Private Limited		
CA Aakansha Nigam	Suresh Krishan Goyal	Alok
Partner	Director	Director
M. No. 416425	DIN:- 02721580	DIN:- 02600247
Mathew George	Gunjan Singh	
Chief Financial Officer	Company Secretary	
Place: New Delhi		
Date: Aug 18, 2021		

NATIONAL HIGHWAYS INFRA TRUST**Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075****Standalone Statement of Profit and Loss Account for the period ended on March 31, 2021**

Particulars	Note No.	For the period ended on March 31, 2021
INCOME		
Revenue from operations		-
Other income		-
TOTAL REVENUE (I)		-
EXPENSES		
Finance costs		-
Investment Manager Fees		-
Annual Listing Fees		-
Trustee Fees		4,21,260.00
Other Expenses	8	63,68,942.00
TOTAL EXPENSES (II)		67,90,202.00
Profit/ (Loss) before tax (I - II)		(67,90,202.00)
Tax expense		
Current tax expense		-
Adjustment of tax relating to earlier periods		-
		-
Profit/(Loss) after tax for the period	A	(67,90,202.00)
Other Comprehensive Income		-
Items which will not be reclassified to profit & loss (net of tax)		-
Items which will be reclassified to profit & loss (net of tax)		-
Total Comprehensive Income (loss) for the period	B	-
Total	(A+B)	(67,90,202.00)

For A. R. & Co.
Chartered Accountants
FRN :- 002744C

For and on behalf of NATIONAL HIGHWAYS INFRA TRUST
By its Investment Manager,
National Highways Infra Investment Managers Private Limited

CA Aakansha Nigam
Partner
M. No. 416425

Suresh Krishan Goyal
Director
DIN:- 02721580

Alok
Director
DIN:- 02600247

Mathew George
Chief Financial Officer

Gunjan Singh
Company Secretary

Place: New Delhi
Date: Aug 18, 2021

NATIONAL HIGHWAYS INFRA TRUST Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075 Standalone Statement of Cash flow for the period ended on March 31, 2021											
Particulars	For the period ended on March 31, 2021										
A. Cash flows from operating activities											
Net Profit/ (loss) before tax	(67,90,202.00)										
Adjustments for:											
Depreciation expense	-										
Interest expense	-										
Interest income	-										
Profit on sale of assets	-										
Provision for Gratuity and Leave encashment	-										
Capital work in progress written off	-										
Provision for doubtful debts and advances	-										
Liability no longer required written back	-										
Operating profit/(loss) before working capital changes	(67,90,202.00)										
Movements in working capital:											
(Increase) / Decrease in inventories	-										
(Increase) / Decrease in trade receivables	-										
(Increase) /Decrease in loans and advances and other financial assets	(10,000.00)										
Receipts from/ (Repayments to) related party liabilities	-										
Increase / (Decrease) in trade payables and liabilities	67,90,202.00										
Cash generated from operations	(10,000.00)										
Direct taxes paid (TDS receivable)	-										
Net cash (used in)/generated from operating activities (A)	(10,000.00)										
B. Cash flows from investing activities											
Sale /(Purchase) of tangible assets	-										
Margin money (deposited) /matured	-										
Interest received	-										
Net cash (used in)/generated investing activities (B)	-										
C. Cash flows from financing activities											
Receipt from Initial Settlement Amount	10,000.00										
Net Proceeds from /(repayment) of long/short term borrowings	-										
Interest paid	-										
Net cash (used in)/generated from financing activities (C)	10,000.00										
Net increase/(decrease) in cash and cash equivalents (A + B + C)	-										
Cash and cash equivalents at the beginning of the period	-										
Cash and cash equivalents at the end of the period	-										
<table> <tr> <td>For A. R. & Co. Chartered Accountants FRN :- 002744C</td><td>For and on behalf of NATIONAL HIGHWAYS INFRA TRUST By its Investment Manager, National Highways Infra Investment Managers Private Limited</td></tr> <tr> <td>CA Aakansha Nigam Partner M. No. 416425</td><td>Suresh Krishan Goyal Director DIN:- 02721580</td></tr> <tr> <td></td><td>Alok Director DIN:- 02600247</td></tr> <tr> <td></td><td>Mathew George Chief Financial Officer</td></tr> <tr> <td></td><td>Gunjan Singh Company Secretary</td></tr> </table>		For A. R. & Co. Chartered Accountants FRN :- 002744C	For and on behalf of NATIONAL HIGHWAYS INFRA TRUST By its Investment Manager, National Highways Infra Investment Managers Private Limited	CA Aakansha Nigam Partner M. No. 416425	Suresh Krishan Goyal Director DIN:- 02721580		Alok Director DIN:- 02600247		Mathew George Chief Financial Officer		Gunjan Singh Company Secretary
For A. R. & Co. Chartered Accountants FRN :- 002744C	For and on behalf of NATIONAL HIGHWAYS INFRA TRUST By its Investment Manager, National Highways Infra Investment Managers Private Limited										
CA Aakansha Nigam Partner M. No. 416425	Suresh Krishan Goyal Director DIN:- 02721580										
	Alok Director DIN:- 02600247										
	Mathew George Chief Financial Officer										
	Gunjan Singh Company Secretary										
Place: New Delhi Date: Aug 18, 2021											

NATIONAL HIGHWAYS INFRA TRUST

Notes forming part of the Financial Statements

1. Introduction

The Trust was settled by the Sponsor, National Highways Authority of India ("NHAI" or the "Sponsor"), an infrastructure development authority in India on 19.10.2020 as an irrevocable trust, pursuant to the Trust Deed, under the provisions of the Indian Trusts Act, 1882. The Trust was registered with SEBI on 28.10.2020 as an infrastructure investment trust under InvIT Regulations having registration number IN/InvIT/20-21/0014. The principal place of business of the Trust is situated at G - 5 & 6, Sector 10, Dwarka, New Delhi – 110 075.

The Trustee to the Fund is IDBI Trusteeship Services Limited (the "Trustee"). The Investment manager for the Trust is National Highways Infra Investment Managers Private Limited (the "Investment Manager"). The objectives of the Trust are to carry on the activity of and to make investments as an infrastructure investment trust as permissible in terms of the SEBI InvIT Regulations.

2. Significant Accounting Policies

2.1 Statement of Compliance

These Standalone financial statements of the Trust have been prepared in accordance with the accounting principles generally accepted in india, including Indian Accounting Standards (hereinafter referred to as the 'Ind AS') and other accounting principles generally accepted in india.

These Standalone Financial Statements comprise the Balance Sheet as on 31.03.2021, the statement of Profit & Loss for the year ended 31.03.2021, the Statement of Cash Flows for the year ended 31.03.2021, the statement of changes in equity for the year ended 31.03.2021 and notes to Accounts and other explanatory information.

2.2 Basis of Preparation

These financial Statements have been prepared on accrual basis and under the historical cost basis. The trust has determined its operating cycle as 12 months for the purpose of classification of its assets and liabilities as current and non-current.

2.3 Summary of Significant Accounting Policies

The financial statements have been prepared using the significant accounting policies and measurement basis summarized below:-

a) Current and Non-Current Classification

All assets and liabilities have been classified as current or non-current as per the normal operating cycle and other criteria set-out in Ind AS. Deferred tax assets and liabilities are classified as non-current assets and non-current liabilities, as the case may be.

b) Property, Plant and Equipment (PPE)

Property, Plant and Equipment is recognized when it is probable that future economic benefits associated with the item will flow to the trust and the cost can be measured reliably. PPE is stated at original cost net of tax / duty credits availed, if any, less accumulated depreciation and cumulative impairment.

Property, Plant and Equipment not ready for the intended use on the date of the Balance Sheet are disclosed as "Capital work-in-progress". Depreciation on Property, Plant and Equipment has been provided on a straight-line basis as per useful lives specified in the Schedule II of the Companies Act, 2013. Depreciation on additions / deductions is calculated pro-rata from / to the month of additions / deductions. The estimated residual value / scrap value of the project is estimated as 5% of the value of project. The Trust does not have any PPE as on 31.03.21.

c) Revenue Recognition

Revenue is recognised based on nature of activity when consideration can be reasonably measured and there exists reasonable certainty of its recovery. Revenue is measured at the fair value of the consideration received or receivable. The Trust has not started any activity yet and as on 31.03.21, the trust has nil income.

d) Taxes on Income

Current tax is determined on the basis of taxable income as per the provisions of Income Tax Act, 1961.

Deferred tax is recognised on temporary differences, being the differences between the tax bases of assets and liabilities and their carrying amount in the financial statements. As the Trust has nil income as on 31.03.21, there is no tax liability as on that date.

e) Financial Instruments

Financial assets and financial liabilities are recognized when the trust becomes a party to the contractual provisions of the instruments. Financial assets and financial liabilities are initially measured at fair value. Transaction costs that are directly attributable to the acquisition or issue of financial assets and financial

liabilities (other than financial assets and financial liabilities at fair value through profit or loss) are added to or deducted from the fair value of the financial assets or financial liabilities, as appropriate, on initial recognition.

f) Cash and Cash Equivalents

Cash and Cash Equivalents in the balance sheet comprise cash in hand and at banks and short term deposits with an original maturity of three months or less. For the purpose of the statement of cash flows, cash and cash equivalents consist of cash and short term deposits.

g) Related Party Disclosures as per Ind AS 23:-

i) List of Related Parties:-

1. Parties to the Trust:-

- NHAI (Sponsor)
- IDBI Trusteeship services Limited (Trustee)
 - **Directors** are :- (1) Padma Vinod Betai (2) Samuel Joseph Jebaraj (3) Ravishankar Gangadhar Shinde (4) Madhuri Jayant Kulkarni and (4) Satyajit Tripathy
- National Highways Infra Investment Managers Private Limited (Investment Manager of Trust)
 - **Directors** are :- (1) Alok (2) Suresh Krishan Goyal (3) Balasubramanyam Sriram and (4) Mahavir Parsad Sharma (5) Amit Kumar Ghosh (6) Shailendra Roy
- National Highways Infra Projects Private Limited (Project SPV)
 - **Directors** are :- (1) Akhilesh Kumar Srivastva (2) Muralidhara Rao Bugatha
- National Highways Invit Project Managers Private Limited (Project Manager)
 - **Directors** are :- (1) Ashish Asati (2) Muralidhara Rao Bugatha

2. Promoters of Parties to the the Trust

- **NHAI** - Government of India

- **National Highways Infra Investment Managers Private Limited – NHAI**
- **National Highways Invit Project Managers Private Limited – NHAI**
- **National Highways Infra Projects Private Limited – NHAI**
- **IDBI Trusteeship services Limited – IDBI Bank Ltd.**

ii) Transaction with Related Parties

Particulars	(Amount)
i) Trustee Fee paid by NHAI to Trustee	Rs. 4,21,260/-
ii) Set up Expenses including Initial Settlement amount introduced by NHAI	Rs. 62,92,242/-

iii) Outstanding Balance Payable to Related Party

Particulars	(Amount)
i) Set Up Expenses including Trustee fee and initial Settlement Amount paid by NHAI on behalf of Trust	Rs. 67,13,502/-

For A. R. & Co.
Chartered Accountants
FRN:- 002744C

For and on behalf of National Highways Infra Trust
By its Investment Manager
National Highways Infra Investment Managers Pvt. Ltd.

CA Aakansha Nigam
 Partner
 M. No.416425

Suresh Krishan Goyal
 Director
 DIN:- 02721580

Alok
 Director
 DIN:- 02600247

Mathew George
 Chief Financial Officer

Gunjan Singh
 Company Secretary

Place:- New Delhi
 Date :- 18.08.2021

NATIONAL HIGHWAYS INFRA TRUST

Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075

Notes Forming Part of Financial Statements

Statement of Changes in Unitholders Equity for the period ended March 31, 2021

Particulars	As at March 31, 2021
a) Initial Settlement Amount	
At the beginning of the period	-
Add:- Received during the period	10,000.00
At the end of the period	10,000.00
b) Unit Capital	
At the beginning of the period	-
Add:- Issued during the period	-
Less:- Capital Reduction during the period	-
At the end of the period	-
c) Other Equity	
Retained Earnings	
Profit/(Loss) for the period	(67,90,202.00)
At the end of the period	(67,90,202.00)

For A. R. & Co.
Chartered Accountants
FRN :- 002744C

For and on behalf of NATIONAL HIGHWAYS INFRA TRUST
By its Investment Manager,
National Highways Infra Investment Managers Private Limited

CA Aakansha Nigam
Partner
M. No. 416425

Suresh Krishan Goyal
Director
DIN:- 02721580

Alok
Director
DIN:- 02600247

Mathew George
Chief Financial Officer

Gunjan Singh
Company Secretary

Place: New Delhi
Date: Aug 18, 2021

NATIONAL HIGHWAYS INFRA TRUST**Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075****Notes Forming Part of Financial Statements****Note - 3 Other Financial Assets**

Particulars	As at March 31, 2021
IDBI Trusteeship Services Limited	10,000.00
Total	10,000.00

Note - 4 Equity - Initial Settlement Amount

Particulars	As at March 31, 2021
Initial Settlement Amount	10,000.00
Total	10,000.00

Note - 5 Equity - Other Equity

Particulars	As at March 31, 2021
Retained Earnings	
Profit/Loss for the Period	(67,90,202.00)
Total	(67,90,202.00)

Note - 6 Other financial Liabilities

Particulars	As at March 31, 2021
Current	
Audit Fee Payable	80,197.00
NHAI (Sponsor)	67,03,502.00
Total	67,83,699.00

Note - 7 Other Current Liabilities

Particulars	As at March 31, 2021
Current	
TDS Payable	6,503.00
Total	6,503.00

Note - 8 Other Expenses

Particulars	For the Period Ended March 31, 2021
Application Fees	1,06,030.00
Auditor Fees	86,700.00
Professional Fee	51,76,200.00
SEBI Registration Fee	10,00,012.00
Total	63,68,942.00

A.R. & CO.
Chartered Accountants

Delhi Office:

A-403, Gayatri Apartment
Airlines Group Housing Society
Plot No 27, Sector -10,
Dwarka, New Delhi -110075
Cell No.9810195084, 9810444051
E-mail: ar_co1981@yahoo.co.in
pawankgoel1@gmail.com

Corporate and Correspondence Office:

C-1, II Floor, RDC, Raj Nagar Ghaziabad-
201001 Delhi-NCR National Capital
region Of Delhi

Independent Auditor's Report

To,
The Trustees
NATIONAL HIGHWAYS INFRA TRUST
G - 5 & 6, Sector - 10, Dwarka,
New Delhi - 110 075.

Report on the Standalone Financial Statements

We have audited the accompanying standalone financial statements of **NATIONAL HIGHWAYS INFRA TRUST ("the Trust")** which comprises the Balance Sheet as at June 30, 2021, the Statement of Profit and Loss for the period from 01.04.2021 to 30.06.2021, the Statement of cash flows for the period from 01.04.2021 to 30.06.2021 and a summary of significant accounting policies and other explanatory information.

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid standalone financial statements give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India,

- (i) In the case of Balance Sheet, of the state of affairs of the Company as at June 30, 2021,
- (ii) In case of Statement of Profit & Loss, of the loss for the period from 01.04.2021 to 30.06.2021,
- (iii) The Statement of cash flows for the period from 01.04.2021 to 30.06.2021.
- (iv) the statement of changes in equity from 01.04.2021 to 30.06.2021

Basis for Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs). Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Trust in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India together with the ethical requirements that are relevant to our audit of the financial statements and we have fulfilled our other ethical responsibilities in accordance with these requirements and the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Management's Responsibility for the Standalone Financial Statements

The Trustees of the Trust/ (Management of the Trust) are/is responsible for the matters with respect to the preparation and presentation of these standalone interim financial statements that give a true and fair view of the financial position and financial performance of the Trust in accordance with the accounting principles generally accepted in India, including the Indian Accounting Standards and other accounting principles generally accepted in India. This responsibility also includes maintenance of adequate accounting records for safeguarding the assets of the Company and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent in the circumstances; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the interim financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these standalone financial statements based on our audit.

We have taken into account the provisions of the Act, the accounting and auditing standards and matters which are required to be included in the audit report under the provisions of the Act and the Rules made there under.

We conducted our audit in accordance with the Standards on Auditing. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and the disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal financial control relevant to the Trust's preparation of the financial statements that give a true and fair view in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on whether the Trust has in place an adequate internal financial controls system over financial reporting and the operating effectiveness of such controls. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by the Trust's Management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the standalone financial statements.

Report on Other Legal and Regulatory Requirements

As required by SEBI Circular number CIR/IMD/DF/114/2016 dated October 20, 2016 ("SEBI Circular"), we report that:

- (a) We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;
- (b) The Balance Sheets, Statements of Profit and Loss (including Other Comprehensive Income), Cash Flow Statements and Statements of Changes in Equity dealt with by this Report are in agreement with the books of account maintained
- (c) In our opinion, the aforesaid Financial Statements comply with the accounting principles generally accepted in India, including Indian Accounting Standards (hereinafter referred to as the 'Ind AS') and other accounting principles generally accepted in India.

For A. R. & Co.
Chartered Accountants
FRN. 002744C

(CA Rajat Dasgupta)
Partner
Membership No: 051989 UDIN:
21051989AAAAV3305
Place: Delhi
Date: 27.09.2021

NATIONAL HIGHWAYS INFRA TRUST
Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075
Standalone Balance Sheet as at June 30, 2021

			Amount in INR
		As at	As at
Particulars	Note No.	June 30, 2021	March 31, 2021
ASSETS			
Non-current assets			
a) Property, Plant and Equipment		-	-
b) Capital work-in-progress		-	-
c) Intangible assets		-	-
d) Intangible assets under development		-	-
e) Financial Assets - Other financial assets		-	-
f) Other non-current assets		-	-
Total non-current assets	A	-	-
Current assets			
a) Financial Assets		-	-
i) Investments		-	-
ii) Cash and cash equivalents		-	-
iii) Loans		-	-
iv) Other financial assets	3	10,000	10,000
b) Current tax assets (net)		-	-
c) Other current assets		-	-
Total current assets	B	10,000	10,000
TOTAL ASSETS	A+B	10,000	10,000
EQUITY AND LIABILITIES			
EQUITY			
a) Initial Settlement Amount	4	10,000	10,000
b) Equity Unit capital		-	-
c) Other Equity	5	(67,90,202)	(67,90,202)
Total equity	C	(67,80,202)	(67,80,202)
LIABILITIES			
Non-current liabilities			
a) Financial liabilities			
i) Borrowings		-	-
ii) Other financial liabilities		-	-
b) Provisions		-	-
c) Other non-current liabilities		-	-
Total non-current liabilities	D	-	-
Current liabilities			
a) Financial liabilities		-	-
i) Borrowings		-	-
ii) Trade payables		-	-
iii) Other financial liabilities	6	67,90,202	67,83,699
b) Other current liabilities	7	-	6,503
c) Provisions		-	-
d) Current tax liabilities (net)		-	-
Total current liabilities	E	67,90,202	67,90,202
TOTAL EQUITY AND LIABILITIES	(C+D+E)	10,000	10,000

Notes forming Part of Financial Statements

1 to 8

For A. R. & Co.
Chartered Accountants
FRN :- 002744C

For and on behalf of NATIONAL HIGHWAYS INFRA TRUST
By its Investment Manager,
National Highways Infra Investment Managers Private Limited

CA Rajat Dasgupta
Partner
Membership No. : 051989

Suresh Krishan Goyal
Director
DIN: 02721580

Alok
Director
DIN: 02600247

Place: New Delhi
Date: September 27, 2021

Mathew George
Chief Financial Officer

Gunjan Singh
Company Secretary

NATIONAL HIGHWAYS INFRA TRUST**Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075****Standalone Statement of Profit and Loss for the period ended on June 30, 2021**

		Amount in INR
<i>Particulars</i>	<i>Note No.</i>	<i>For the period ended on June 30, 2021</i>
INCOME		
Revenue from operations		-
Other income		-
TOTAL REVENUE (I)		-
EXPENSES		
Finance costs		-
Investment Manager Fees		-
Annual Listing Fees		-
Trustee Fees		-
Other Expenses		-
TOTAL EXPENSES (II)		-
Profit/ (Loss) before tax (I - II)		-
Tax expense		
Current tax expense		-
Profit/(Loss) after tax for the period	A	-
Other Comprehensive Income		
Items which will not be reclassified to profit & loss (net of tax)		-
Items which will be reclassified to profit & loss (net of tax)		-
Total Other Comprehensive Income / (loss) for the period	B	-
Total Comprehensive Income / (loss) for the period	(A+B)	-
Notes forming Part of Financial Statements	1 to 8	

For A. R. & Co.
Chartered Accountants
FRN : 002744C

For and on behalf of NATIONAL HIGHWAYS INFRA TRUST
By its Investment Manager,
National Highways Infra Investment Managers Private Limited

CA Rajat Dasgupta
 Partner
 Membership No. : 051989

Suresh Krishan Goyal
 Director
 DIN: 02721580

Alok
 Director
 DIN: 02600247

Mathew George
 Chief Financial Officer

Gunjan Singh
 Company Secretary

Place: New Delhi
Date: September 27, 2021

NATIONAL HIGHWAYS INFRA TRUST

Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075

Notes Forming Part of Standalone Financial Statements

Statement of Changes in Unitholders' Equity for the period ended June 30, 2021**Amount in INR**

<i>Particulars</i>	<i>As at June 30, 2021</i>	<i>As at March 31, 2021</i>
a) Initial Settlement Amount		
At the beginning of the period	10,000	-
Add:- Received during the period	-	10,000
At the end of the period	10,000	10,000
b) Unit Capital		
At the beginning of the period	-	-
Add:- Issued during the period	-	-
Less:- Capital Reduction during the period	-	-
At the end of the period	-	-
c) Other Equity		
Retained Earnings	(67,90,202)	-
Loss for the period	-	(67,90,202)
At the end of the period	(67,90,202)	(67,90,202)

Notes forming Part of Financial Statements

1 to 8

For A. R. & Co.
Chartered Accountants
FRN :- 002744C

For and on behalf of NATIONAL HIGHWAYS INFRA TRUST
By its Investment Manager,
National Highways Infra Investment Managers Private Limited

CA Rajat Dasgupta
Partner
Membership No. : 051989

Suresh Krishan Goyal
Director
DIN: 02721580

Alok
Director
DIN: 02600247

Mathew George
Chief Financial Officer

Gunjan Singh
Company Secretary

Place: New Delhi
Date: September 27, 2021

NATIONAL HIGHWAYS INFRA TRUST**Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075****Standalone Statement of Cash flow for the period ended on June 30, 2021**

		Amount in INR
<i>Particulars</i>		<i>For the period ended on June 30, 2021</i>
A. Cash flows from operating activities		
Net Profit/ (loss) before tax		-
Adjustments for:		
Depreciation expense		-
Interest expense		-
Interest income		-
Profit on sale of assets		-
Provision for Gratuity and Leave encashment		-
Capital work in progress written off		-
Provision for doubtful debts and advances		-
Liability no longer required written back		-
Operating profit/(loss) before working capital changes		-
Changes in working capital:		
(Increase) / Decrease in inventories		-
(Increase) / Decrease in trade receivables		-
(Increase) /Decrease in loans and advances and other financial assets		-
Increase / (Decrease) in trade payables and liabilities		-
Cash flows generated from operating activities		-
Direct taxes paid (TDS receivable)		-
Net cash (used in)/generated from operating activities (A)		-
B. Cash flows from investing activities		
Sale /(Purchase) of tangible assets		-
Margin money (deposited) /matured		-
Interest received		-
Net cash (used in)/generated from investing activities (B)		-
C. Cash flows from financing activities		
Receipt from Initial Settlement Amount		-
Net Proceeds from /(repayment) of long/short term borrowings		-
Interest paid		-
Net cash (used in)/generated from financing activities (C)		-
Net increase/(decrease) in cash and cash equivalents (A + B + C)		-
Cash and cash equivalents at the beginning of the period		-
Cash and cash equivalents at the end of the period		-

Notes forming Part of Financial Statements**1 to 8****For A. R. & Co.****For and on behalf of NATIONAL HIGHWAYS INFRA TRUST****Chartered Accountants****By its Investment Manager,****FRN :- 002744C****National Highways Infra Investment Managers Private Limited****CA Rajat Dasgupta****Suresh Krishan Goyal****Alok**

Partner

Director

Director

Membership No. : 051989

DIN:- 02721580

DIN:- 02600247**Mathew George****Gunjan Singh**

Chief Financial Officer

Company Secretary**Place: New Delhi****Date: September 27, 2021**

NATIONAL HIGHWAYS INFRA TRUST

Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075

Notes Forming Part of Standalone Financial Statements

1. Introduction

The Trust was settled by the Sponsor, National Highways Authority of India ("NHAI" or the "Sponsor"), an infrastructure development authority in India on 19.10.2020 as an irrevocable trust, pursuant to the Trust Deed, under the provisions of the Indian Trusts Act, 1882. The Trust was registered with SEBI on 28.10.2020 as an infrastructure investment trust under InvIT Regulations having registration number IN/InvIT/20-21/0014. The principal place of business of the Trust is situated at G - 5 & 6, Sector 10, Dwarka, New Delhi – 110 075.

The Trustee to the Fund is IDBI Trusteeship Services Limited (the "Trustee"). The Investment manager for the Trust is National Highways Infra Investment Managers Private Limited (the "Investment Manager"). The objectives of the Trust are to carry on the activity of and to make investments as an infrastructure investment trust as permissible in terms of the SEBI InvIT Regulations.

2. Basis of preparation and Significant Accounting Policies

2.1 Statement of Compliance

These Standalone financial statements of the Trust have been prepared in accordance with the accounting principles generally accepted in India, including Indian Accounting Standards (hereinafter referred to as the 'Ind AS') and other accounting principles generally accepted in India.

These Standalone Financial Statements comprise the Balance Sheet as on 30.06.2021, the statement of Profit & Loss for the period ended 30.06.2021, the Statement of Cash Flows for the period ended 30.06.2021, the statement of changes in equity for the period ended 30.06.2021 and notes to Accounts and other explanatory information.

2.2 Basis of Preparation

These financial Statements have been prepared on accrual basis and under the historical cost basis. The trust has determined its operating cycle as 12 months for the purpose of classification of its assets and liabilities as current and non-current.

2.3 Summary of Significant Accounting Policies

The financial statements have been prepared using the significant accounting policies and measurement basis

a) Current and Non-Current Classification

All assets and liabilities have been classified as current or non-current as per the normal operating cycle and other criteria set-out in Ind AS. Deferred tax assets and liabilities are classified as non-current assets and non-current liabilities, as the case may be.

b) Property, Plant and Equipment (PPE)

Property, Plant and Equipment is recognized when it is probable that future economic benefits associated with the item will flow to the trust and the cost can be measured reliably. PPE is stated at original cost net of tax /duty credits availed, if any, less accumulated depreciation and cumulative impairment.

Property, Plant and Equipment not ready for the intended use on the date of the Balance Sheet are disclosed as "Capital work-in-progress". Depreciation on Property, Plant and Equipment have been provided on straight-line basis as per useful lives specified in the Schedule II of the Companies Act, 2013. Depreciation on additions / deductions is calculated pro-rata from / to the month of additions / deductions. The estimated residual value /scrap value of the project is estimated as 5% of the value of project. The Trust does not have any PPE as on 30.06.21.

c) Revenue Recognition

Revenue is recognised based on nature of activity when consideration can be reasonably measured and there exists reasonable certainty of its recovery. Revenue is measured at the fair value of the consideration received or receivable. The Trust has not started any activity yet and as on 30.06.21, the trust has nil income.

d) Taxes on Income

Current tax is determined on the basis of taxable income as per the provisions of Income Tax Act, 1961.

Deferred tax is recognised on temporary differences, being the differences between the tax bases of assets and liabilities and their carrying amount in the financial statements. As the Trust has nil income as on 30.06.21, there is no tax liability as on that date.

NATIONAL HIGHWAYS INFRA TRUST**Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075****Notes Forming Part of Standalone Financial Statements****e) Financial Instruments**

Financial assets and financial liabilities are recognized when the trust becomes a party to the contractual provisions of the instruments. Financial assets and financial liabilities are initially measured at fair value. Transaction costs that are directly attributable to the acquisition or issue of financial assets and financial liabilities (other than financial assets and financial liabilities at fair value through profit or loss) are added to or deducted from the fair value of the financial assets or financial liabilities, as appropriate, on initial recognition.

f) Cash and Cash Equivalents

Cash and Cash Equivalents in the balance sheet comprise cash in hand and at banks and short term deposits with an original maturity of three months or less. For the purpose of the statement of cash flows, cash and cash equivalents consist of cash and short term deposits.

g) Related Party Disclosures as per Ind AS 23 :**i) List of Related Parties:-**

I. Parties to the Trust	
Sponsor	National Highways Authority of India
Project Manager	National Highways InVIT Project Managers Private Limited
Investment Manager	National Highways Infra Investment Managers Private Limited
Trustee	IDBI Trusteeship Services Limited
II. Promoters of Parties to the Trust specified in I above	
National Highways Authority of India	Government of India
National Highways InVIT Project Managers Private Limited	National Highways Authority of India
National Highways Infra Investment Managers Private Limited	National Highways Authority of India
IDBI Trusteeship Services Limited	IDBI Bank Limited
III. Directors of Parties to the Trust specified in I above	
National Highways Authority of India	N.A.
National Highways InVIT Project Managers Private Limited	Mr. Ashish Asati Mr. Muralidhara Rao Bugatha
National Highways Infra Investment Managers Private Limited	Mr. Balasubramanyam Sriram
	Mr. Shailendra Narain Roy
	Mr. Alok
	Mr. Suresh Krishan Goyal
IDBI Trusteeship Services Limited	Mr. Mahavir Parsad Sharma
	Shri J. Samuel Joesph
	Shri Ravishankar G. Shinde
	Smt. Madhuri J Kulkarni
	Shri Satyajit Tripathy
	Smt. Padma Betai

IV. Subsidiaries of National Highways Authority of India
Cochin Port Road Company Limited
Tuticorin Port Road Company Limited
Paradip Port Road Company Limited
Calcutta – Haldia Port Road Company Limited
New Mangalore Port Road Company Limited
Vishakhapatnam Port Road Company Limited
Ahmedabad Vadodara Expressway Company Limited
DME Development Limited
National Highways Infra Projects Private Limited
Chennai- Ennore Port Road Company Limited
Mormugao Port Road Company Limited
Mumbai- JNPT Port Road Company Limited

NATIONAL HIGHWAYS INFRA TRUST
Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075
Notes Forming Part of Standalone Financial Statements

Note - 3 Other Financial Assets

Particulars	Amount in INR	
	As at June 30, 2021	As at March 31, 2021
IDBI Trusteeship Services Limited	10,000	10,000
Total	10,000	10,000

Note - 4 Equity - Initial Settlement Amount

Particulars	As at June 30, 2021	As at March 31, 2021
Initial Settlement Amount		
Opening balance	10,000	-
Additions during the year	-	10,000
Closing balance	10,000	10,000

Note - 5 Equity - Other Equity

Particulars	As at June 30, 2021	As at March 31, 2021
Retained Earnings		
Opening balance	(67,90,202)	-
Loss for the Period	-	(67,90,202)
Closing balance	(67,90,202)	(67,90,202)

Note - 6 Other financial Liabilities

Particulars	As at June 30, 2021	As at March 31, 2021
Current		
Audit Fee Payable	80,197	80,197
Other payables	6,503	-
NHAI (Sponsor)	67,03,502	67,03,502
Total	67,90,202	67,83,699

Note - 7 Other Current Liabilities

Particulars	As at June 30, 2021	As at March 31, 2021
Current		
TDS Payable	-	6,503
Total	-	6,503

NATIONAL HIGHWAYS INFRA TRUST
Regd. Off.: - G-5 & 6, Sector -10, Dwarka, Delhi - 110075
Notes Forming Part of Standalone Financial Statements

Note - 8 Related Party Disclosures as per Ind AS 23 :

(A) List of Related parties

I. Parties to the Trust

Sponsor	National Highways Authority of India
Project Manager	National Highways InVIT Project Managers Private Limited
Investment Manager	National Highways Infra Investment Managers Private Limited
Trustee	IDBI Trusteeship Services Limited

II. Promoters of Parties to the Trust specified in I above

National Highways Authority of India	Government of India
National Highways InVIT Project Managers Private Limited	National Highways Authority of India
National Highways Infra Investment Managers Private Limited	National Highways Authority of India
IDBI Trusteeship Services Limited	IDBI Bank Limited

III. Directors of Parties to the Trust specified in I above

National Highways Authority of India	N.A.
National Highways InVIT Project Managers Private Limited	Mr. Ashish Asati
	Mr. Muralidhara Rao Bugatha
	Mr. Balasubramanyam Sriram
	Mr. Shailendra Narain Roy
National Highways Infra Investment Managers Private Limited	Mr. Alok
	Mr. Suresh Krishan Goyal
	Mr. Mahavir Parsad Sharma
	Shri J. Samuel Joesph
	Shri Ravishankar G. Shinde
IDBI Trusteeship Services Limited	Smt. Madhuri J Kulkarni
	Shri Satyajit Tripathy
	Smt. Padma Betai

IV. Subsidiaries of National Highways Authority of India

Cochin Port Road Company Limited
Tuticorin Port Road Company Limited
Paradip Port Road Company Limited
Calcutta – Haldia Port Road Company Limited
New Managalore Port Road Company Limited
Vishakhapatnam Port Road Company Limited
Ahmedabad Vadodara Expressway Company Limited
DME Development Limited
National Highways Infra Projects Private Limited
Chennai- Ennore Port Road Company Limited
Mormugao Port Road Company Limited
Mumbai- JNPT Port Road Company Limited

(B) Outstanding Balance Receivable / Payable to Related Parties :

Particulars	Amount in INR	
	As at June 30, 2021	As at March 31, 2021
Receivable balance :		
Trustee		
i) IDBI Trusteeship Services Limited	10,000	10,000
Payable balance :		
Sponsor		
ii) National Highways Authority of India	67,03,502	67,03,502

For A. R. & Co.
Chartered Accountants
FRN :- 002744C

For and on behalf of NATIONAL HIGHWAYS INFRA TRUST
By its Investment Manager,
National Highways Infra Investment Managers Private Limited

CA Rajat Dasgupta
Partner
Membership No. : 051989

Suresh Krishan Goyal
Director
DIN: 02721580

Alok
Director
DIN: 02600247

Place: New Delhi
Date: September 27, 2021

Mathew George
Chief Financial Officer

Gunjan Singh
Company Secretary

CAPITALIZATION STATEMENT

For the Trust on a standalone basis:

Particulars	Pre-Offer as at June 30, 2021 (in ₹)	As Adjusted for the Offer* (in ₹)
Unitholders' Funds		
Initial Contribution to the Trust	10,000.00	10,000.00
Unit Capital	-	6011,52,00,000.00
Reserve & Surplus	(67,90,202.00)	(67,90,202.00)
Total Unitholders' Funds (A)	(67,80,202.00)	6010,84,19,798.00
Long Term Borrowings	Nil	Nil
Short Term Borrowings	Nil	Nil
Other Borrowings (Current Maturity of Long Terms Borrowings)	Nil	Nil
Total Debt (B)	Nil	Nil
Total Capitalization (A+B)	Nil	Nil
Long Term Debt/Equity Ratio	Nil	Nil
Total Debt/ Equity Ratio	Nil	Nil

* As adjusted to reflect the number of Units to be issued pursuant to the Offer and proceeds from the Offer.

Note: Amount payable to National Highways Authority of India towards reimbursement of operational expenses amounting to ₹ 6,703,502/- does not form a part of borrowings hence not considered above.

**PROJECTIONS OF REVENUE FROM OPERATIONS AND CASH FLOW FROM OPERATING
ACTIVITIES**

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Delhi Office:

A-403, Gayatri Apartment
Airlines Group Housing Society
Plot No 27, Sector -10,
Dwarka, New Delhi -110075
Cell No.9810195084, 9810444051
E-mail: ar_co1981@yahoo.co.in
pawankgoel1@gmail.com

Corporate and Correspondence Office:

C-1, II Floor, RDC, Raj Nagar
Ghaziabad- 201001 Delhi-NCR
National Capital region Of Delhi

Independent Auditor's Report on the Projections

To,
The Trustees
NATIONAL HIGHWAYS INFRA TRUST
G - 5 & 6, Sector - 10, Dwarka,
New Delhi - 110 075.

We have examined the attached projected income statement, the projected cash flow of the National Highways Infra Trust (the "Trust") and the National Highways Infra Projects Private Limited (the "Project SPV") (defined below) for the years ended March 31, 2022, 2023 and 2024, the projected summary revenue from operations of the Project SPV (defined below), projected summary operating cash flow statement of the Trust and the Project SPV for the financial years ended March 31, 2022, 2023 and 2024 and the Basis and Notes to these projections (together referred to as "Projections") along with the significant assumptions underlying the Projections ("Projection Assumptions") (Project Assumptions together with the Projections referred to as "Revenue, Profit and Cash Flow Projections") of five stretches of National Highways Authority of India ("NHAI" or "Sponsor"), namely

- a) Abu Road - Palanpur
- b) Abu Road- Swaroopganj
- c) Kothakota Kurnool
- d) Belgaum Kagal
- e) Chittorgarh Kota

which are transferred from the Sponsor to the Project SPV in accordance with Standard on Assurance Engagement 3400, "The Examination of Prospective Financial Information", issued by the Institute of Chartered Accountants of India.

The Revenue, Profit and Cash Flow Projections have been prepared in relation to the proposed private placement of units of the Trust (the 'Issue'), under the SEBI (Infrastructure Investment Trust) Regulations, 2014, as amended from time to time, including pursuant to any circulars and guidelines issued thereunder, ("InvIT Regulations") using a set of assumptions that include hypothetical assumptions about future events and management's actions that are not necessarily expected to occur. Consequently, readers are cautioned that this projection may not be appropriate for purposes other than that described above.

The preparation and presentation of the Revenue, Profit and Cash Flow Projections

in accordance with the InvIT Regulations, is the responsibility of the Sponsor, the Project SPV and Investment Manager of Trust and has been approved by the Board of Directors of the Sponsor, Board of Directors of the Project SPV and Board of Directors of the Investment Manager of the Trust for inclusion in the draft placement memorandum in connection with the proposed private placement of units of the Trust ("private placement").

Our responsibility is to examine the evidence supporting the assumptions (excluding the hypothetical assumption) and other information in the Revenue, Profit and Cash Flow Projections. Our responsibility does not include verification of the accuracy of the Projections. Therefore, we do not vouch for the accuracy of the same. The assumptions used for the preparation of these Projections have been provided to us by the Investment Manager of the Trust and relied upon by us as certain matters included are of technical nature.

We have relied on the management estimates for Revenue, Profit and Cash Flow Projections.

Based on our reliance on the management estimates, nothing has come to our attention which causes us to believe that these Projection Assumptions do not provide a reasonable basis for the Projections assuming that actual outcome of hypothetical assumptions will not be materially different.

We have verified the arithmetical accuracy of the Projections and found them to be accurate and appropriate.

Further, in our opinion, the Projections are properly prepared on the basis of the assumptions as set forth in the basis and notes to Projections and are consistent with the accounting policies of the Trust and the Project SPV and the significant accounting policies adopted by the Project SPV is in line with the Indian Accounting Standard (Ind AS) as prescribed, read with relevant rules and other accounting principles generally accepted in India and the InvIT Regulations.

Attention is drawn to the, **"Basis for preparation of projections"** which states that the Projections contain forecasts and projections that relate to future events, which are, by their nature, subject to significant risks and uncertainties. Events and circumstances frequently do not occur as expected; even if the events anticipated under assumptions described herewith in attached documents occur, actual results are still likely to be different from the Projections since other anticipated events frequently do not occur as expected and the variation may be material. The actual results may therefore differ materially from those forecasted and projected, for the reasons set out above. Therefore, we do not express any opinion as to the possibility of achievement of the Projections.

Our work on the Projections does not constitute an audit. Our work has not been carried out in accordance with auditing or other standards and practices generally accepted in jurisdictions outside India, and accordingly should not be relied upon as if it had been carried out in accordance with those standards and practices. This report should not be relied upon by prospective investors outside India including the United States of America, including persons who are Qualified Institutional Buyers as defined under Rule 144A under the United States Securities Act of 1933 participating in the Issue. We accept no responsibility and deny any liability to any

person who seeks to rely on this report and who may seek to make a claim in connection with any offering of securities on the basis that they had acted in reliance on such information under the protections afforded by United States of America law and regulation.

This report is intended solely for inclusion in the placement memorandum in connection with the proposed private placement of the Units of the Trust and is not to be used, referred to or distributed for any other purpose without our prior written consent.

For A. R. & Co.
Chartered Accountants
Firm Registration No. 002744C

(CA Rajat DasGupta)
Partner
MRN – 051989
UDIN: 21051989AAAAAT8570
Date: 28.09.2021
Place: New Delhi

Annexure

Trust Income Statement

Year Start Year End	1-Oct-21 31-Mar-22	1-Apr-22 31-Mar-23	1-Apr-23 31-Mar-24
I Profit & Loss Account			
Income			
Interest Income	384.13	855.24	909.96
Interest on Surplus Funds		-	-
Dividend Income		-	-
Total Income	384.13	855.24	909.96
Expenditure			
IM Fees	20.48	9.68	6.93
Trust Expenses	0.45	0.97	1.04
DSRA Bank Charges	0.11	0.24	0.25
Total Expenses	21.04	10.88	8.22
EBITDA	363.10	844.36	901.74
Interest	62.87	148.88	147.66
Profit	300.23	695.48	754.08
Tax		-	-
Profit After Tax	300.23	695.48	754.08

Trust Cash Flow

Year Start	1-Oct-21	1-Apr-22	1-Apr-23
Year End	31-Mar-22	31-Mar-23	31-Mar-24
Cash from Operations			
Total Income	384.13	855.24	909.96
Less: Taxes	-	-	-
Less: Expenses	-20.93	-10.64	-7.97
Less: Net Interest accrued but not paid	-334.47	-670.60	-627.06
Cash from Operations	28.96	173.99	274.93

Project SPV Income Statement

Year Start	01-Oct-21	1-Apr-22	1-Apr-23
Year End	31-Mar-22	31-Mar-23	31-Mar-24
Profit & Loss Account			
Income			
Toll Revenues	236.08	522.77	566.61
Revenue from MM + ATMS Reserve Account		-	-
Other Income			
Total Revenue	236.08	522.77	566.61
Expenditure			
Operation Expenses	-	58.05	57.27
Routine Maintenance Expenses	6.80	21.15	21.89
PM Expenses	5.95	5.72	4.10
CSR Spend		-	-
Insurance Expenses	4.78	9.90	10.24
Other Office Expenses	12.26	26.35	28.33
Pre-Issuance Fees and Charges	38.00		
BG Expenses	0.15	0.30	0.30
Total Expenditure	67.94	121.47	122.13
EBITDA	168.14	401.31	444.48
EBITDA Margin %		77%	78%
Provision for MM and ATMS	3.90	9.37	15.98
Interest Expenses	413.89	855.24	909.96
Depreciation (Concession Fee and Initial Payment)	27.44	60.15	65.20
Depreciation (Capacity Augmentation)		-	-
Write-Off of Shareholder Loan		-	-
Total	445.23	924.76	991.14
Profit Before Tax	-277.09	-523.45	-546.66
Tax Payable		-	-
Profit After Tax	-277.09	-523.45	-546.66

Project SPV Cash Flow

Year Start	01-Oct-21	1-Apr-22	1-Apr-23
Year End	31-Mar-22	31-Mar-23	31-Mar-24
Cash Flow Statement			
<i>Cash flow from Operating Activities</i>			
EBITDA pre-MMR	168.14	401.31	444.48
less: MMR Expenses and MMRA transfer/drawal	-	-	-
Cash Flow from Operations	168.14	401.31	444.48
Taxes Paid	-	-	-
Net Cash from Operations	168.14	401.31	444.48

MATERIAL CONTRACTS AND DOCUMENTS FOR INSPECTION

The following contracts, which are or may be deemed material, have been entered into. These contracts and also the documents for inspection referred to hereunder, may be inspected at the principal place of business of the Trust, from 10:00 A.M. to 5:00 P.M., on all Working Days from the date of the Placement Memorandum until the date of listing of the Units pursuant to this Offer. Any of the contracts or documents mentioned in this Final Placement Memorandum may be amended or modified at any time if so required in the interest of the Trust or if required by the other parties, without reference to the Unitholder, subject to compliance with applicable law and InvIT Documents.

1. Trust deed dated October 19, 2020, entered between the Sponsor and the Trustee.
2. SEBI registration certificate for the Trust bearing number IN/InvIT/20-21/0014 dated October 28, 2020, to act as an infrastructure investment trust.
3. Investment management agreement dated October 21, 2020, entered between the Trustee and the Investment Manager.
4. Project implementation and management agreement dated March 30, 2021, entered amongst the Trustee, the Investment Manager, the Project Manager and Project SPV, as amended on September 29, 2021.
5. Share purchase agreement dated September 30, 2021, entered into among the Sponsor, the Trustee (on behalf of the Trust) and the Investment Manager, in respect of the equity shares of the Project SPV.
6. Placement agreement entered into amongst the Trust (acting through the Trustee), the Investment Manager, the Sponsor, the Project Manager and the Lead Managers, dated March 31, 2021.
7. Cash escrow agreement entered into amongst the Trust (acting through the Trustee), the Investment Manager, the Sponsor, the Lead Managers and the Escrow Collection Bank, dated September 24, 2021.
8. The concession agreements, each dated March 30, 2021, entered into by the Project SPV with NHAI.
9. Agreement dated March 24, 2021, between NSDL, the Trust (acting through the Investment Manager and its constituted attorneys) and the Registrar to the Offer.
10. Agreement dated March 19, 2021, between CDSL, the Trust (acting through the Investment Manager and its constituted attorneys) and the Registrar to the Offer.
11. Registrar agreement dated March 30, 2021, entered into among the Trustee (on behalf of the Trust), Investment Manager and the Registrar to the Offer.
12. The Project SPV Facility Agreements each dated September 30, 2021, entered into amongst the Trust (acting through the Trustee), the Investment Manager and the Project SPV.
13. Loan agreement dated September 29, 2021, entered into amongst the Trust, State Bank of India, Axis Bank Limited and Bank of Maharashtra.
14. Trademark license agreement dated March 30, 2021, entered into between the Sponsor and the Trustee (on behalf of the Trust).
15. Transitional support agreement dated March 30, 2021, entered into amongst the Sponsor, Project SPV and the Project Manager, read along with the letter dated September 28, 2021, from the Sponsor.
16. The Board resolution of the Investment Manager dated March 22, 2021, authorizing this Offer.
17. Approval of the CCEA *vide* communication dated December 13, 2019.
18. Approval of the Chairman of NHAI dated March 31, 2021, in relation to the Offer.
19. Certified copies of the updated Memorandum and Articles of Association of the Investment Manager as amended from time to time.
20. The consents from the (i) Lead Managers; (ii) Legal counsel to the Trust as to Indian law; (iii) Indian legal counsel to the Lead Managers; (iv) International legal counsel to the Trust and the Sponsor as to United States Federal Securities law; (v) Trustee, (vi) the Sponsor, (vii) the Investment Manager; (viii) Valuer; (ix) Traffic Consultants, (x) Technical Consultant, (xi) Registrar; (xii) Escrow Collection Bank; (xiii) Compliance Officer; and (xiv) statutory auditors of the Trust.
21. The Projections of Revenue from Operations and Cash Flow from Operating Activities and the report thereon.
22. Audited financial statements of the Sponsor for financial years ended March 31, 2019, March 31, 2018 and March 31, 2017.
23. Unaudited limited review standalone financial results of the Sponsor for the financial year ended March 31, 2020.

24. Unaudited limited review standalone financial results of the Sponsor for the six months ended September 30, 2020.
25. Unaudited limited review standalone financial results of the Sponsor for the financial year ended March 31, 2021.
26. The unaudited limited review standalone financial results of the Sponsor for the three months ended June 30, 2021,
27. The statement of possible tax benefits dated September 28, 2021, from the statutory auditors of the Trust.
28. In principle listing approval dated April 13, 2021, issued by NSE, read along with the extension letters dated July 12, 2021, and September 29, 2021, issued by NSE.
29. In principle listing approval dated August 25, 2021, issued by BSE.
30. Corporate governance policies adopted by the Investment Manager.
31. Due diligence certificate dated March 31, 2021, addressed to SEBI from the Lead Managers.
32. SEBI observation letter bearing number SEBI/HO/DDHS/P/OW/2021/9030/1 dated April 20, 2021.
33. Audited standalone financial statements of the Trust, for the period from the date of its settlement, that is October 19, 2020, till March 31, 2021, and for the three months period ended June 30, 2021.
34. Credit rating letter dated August 23, 2021, read along with the letter dated September 4, 2021, by CARE Ratings Limited assigning (a) a rating of “Provisional CARE AAA; Stable” in respect of the long term bank facilities proposed to be availed by the Trust, and (b) an issuer rating of “Provisional CARE AAA (Is); Stable”.
35. Credit rating letter dated August 20, 2021, by India Ratings and Research Private Limited assigning a (a) rating of “Provisional IND AAA/Stable”, in respect of the rupee term loan proposed to be availed by the Trust, and (b) long-term issuer rating of “Provisional IND AAA/Stable”.
36. Letter dated February 12, 2021, bearing reference number SEBI/HO/DDHS/DDHS/OW/MA/P/2021/4003/1 from SEBI granting us an exemption in terms of the InvIT Regulations and the SEBI Circular on Financial Disclosures. Letter dated March 17, 2021, bearing reference number SEBI/HO/DDHS/DDHS3/OW/MA/P/2021/6250/1 from SEBI granting us an exemption in terms of the InvIT Regulations and the SEBI Circular on Financial Disclosures.
37. SEBI Observation Letter dated October 5, 2021, bearing reference number SEBI/HO/DDHS/DDHS_Div3/P/ow/2021/27078/1.
38. Letter dated October 12, 2021, issued by the Ministry of Corporate Affairs, Government of India, bearing file number 7/29/2021-CL-I.
39. SEBI Observation Letter dated October 25, 2021, bearing reference number SEBI/HO/DDHS/DDHS_Div3/P/MA/OW/2021/29805/1.

DECLARATION

The Investment Manager declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

For National Highways Infra Investment Managers Private Limited

Shri B. Sriram
Chairman and Independent Director

Place: Chennai
Date: November 3, 2021

DECLARATION

The Investment Manager declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

For National Highways Infra Investment Managers Private Limited

Shri Suresh Goyal
Managing Director and Chief Executive Officer

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Investment Manager declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

For National Highways Infra Investment Managers Private Limited

Shri Alok

Sponsor Nominee Director

Place: New Delhi

Date: November 3, 2021

DECLARATION

The Investment Manager declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

For National Highways Infra Investment Managers Private Limited

Shri M.P. Sharma
Independent Director

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Investment Manager declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

For National Highways Infra Investment Managers Private Limited

Shri Shailendra Roy
Independent Director

Place: Mumbai
Date: November 3, 2021

DECLARATION

The Investment Manager declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

For National Highways Infra Investment Managers Private Limited

Shri Amit Kumar Ghosh
MoRTH Nominee Director

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri Giridhar Aramane, IAS and Secretary, Ministry of Road Transport & Highways
Chairman

Place: New Delhi

Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri Alok, IAS
Member (Admin)

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri R.K. Pandey
Member (Projects)

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri Mahabir Singh
Member (Technical)

Place: New Delhi
Date: November 3, 2021

DECLARATION

\ The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri Manoj Kumar
Member (Projects)

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri Amitabh Kant, IAS (Rtd.)
Chief Executive Officer, Niti Aayog

Place: New Delhi
Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Shri I.K. Pandey

DG (Road Development) & Special Secretary, Ministry of Road Transport and Highways

Place: New Delhi

Date: November 3, 2021

DECLARATION

The Sponsor declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the provisions of the InvIT Regulations, the SCRA, SEBI Act and all regulations and guidelines issued by the GoI or SEBI (as the case may be). The Sponsor further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make a well informed decision.

FOR NATIONAL HIGHWAYS AUTHORITY OF INDIA

Dr. T.V. Somanathan, IAS
Secretary, Department of Expenditure

Place: New Delhi
Date: November 3, 2021

ANNEXURE A

VALUATION REPORT

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Report on Enterprise Valuation of National Highways Infra Projects Private Limited proposed to be acquired by National Highways Infra Trust

RBSA Valuation Advisors LLP

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Private and Confidential

31 March 2021

Report Ref No: RVA2021DTFAREP064

National Highways Infra Investment Managers Private Limited
G-5 & 6, Sector-10, Dwarka
Delhi 110075

Sub: Enterprise Valuation of National Highways Infra Projects Private Limited, pursuant to SEBI (Infrastructure Investment Trusts) Regulations, 2014, as amended ("the SEBI InvIT Regulations")

Dear Sir,

We refer to our appointment letter dated 29th December 2020 wherein RBSA Valuation Advisors LLP ("RBSA") has been appointed by National Highways Infra Investment Managers Private Limited ("NHIIMPL"/ the "Investment Manager"), as an independent valuer, as per Regulation 2(zf) of the SEBI (Infrastructure Investment Trust) Regulations, 2014 ("SEBI InvIT Regulations"), for carrying out the Enterprise Valuation of National Highways Infra Projects Private Limited ("NHIPPL" or the "SPV"). NHIPPL is a wholly owned subsidiary of National Highway Authority of India ("NHAI" or the "Sponsor") and has been incorporated as a special purpose vehicle to encompass 5 Toll road projects ("Specified Projects"). NHIPPL has entered into a concession agreement with NHAI to operate, maintain and transfer the Specified Projects under the Toll, Operate and Transfer ("TOT") model. Specified Projects proposed to be held by NHIPPL are as follows:

1. Abu Road (Rajasthan) to Swaroopganj (Rajasthan) ("ABU-SWA")
2. Chittorgarh (Rajasthan) to Kota (Rajasthan) ("CHT-KOT")
3. Palanpur (Gujarat) to Abu Road (Rajasthan) ("PLN-ABU")
4. Kothakota Bypass (Telangana) to Kurnool (Andhra Pradesh) ("KOT-KUR")
5. Belgaum (Karnataka) to Kagal (Karnataka) ("BEL-KAG")

National Highways Infra Trust ("NHIT " or the "Trust" or "InvIT") is registered with the Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InvIT Regulations.

NHIIMPL is acting as Investment Manager to the Trust, NHAI is acting as Sponsor to the Trust, and IDBI Trusteeship Services Limited ("Trustee") is acting as Trustee to the Trust, within the meaning of the SEBI InvIT Regulations.

NHAI aims to monetize Specified Projects encompassed in the SPV through the InvIT (Infrastructure Investment Trust) route. Pursuant to this, NHIIMPL is evaluating a proposal for acquisition by the Trust of stake held by NHAI in NHIPPL ("Transaction").



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We have analyzed the information provided by/ on behalf of the Investment Manager through broad inquiry, analysis and review but have not carried out a due diligence or audit of such information. We have relied on the explanations and information provided by/ on behalf of the Investment Manager. We have no present or planned future interest in the Sponsor, the SPV or the Investment Manager except to the extent of our appointment as an independent valuer. Our professional fees for the valuation are not contingent upon the values reported herein. Our valuation analysis should not be construed as an investment advice specifically, we do not express any opinion on the suitability or otherwise of entering into any financial or other transaction with the Trust.

We enclose our valuation report (the "Report") providing our opinion on the fair enterprise valuation of NHIPPL as of 30th March 2021 ("Valuation Date"), on a 'going concern' premise. The attached Report details the valuation approach and methodologies, calculations, and conclusions with respect to this valuation.

Our valuation analysis must be considered as a whole. Selecting portions of our analysis or the factors we considered, without considering all factors and analysis together could create a misleading view of the process underlying the valuation conclusions. Valuation is a complex process and is not necessarily susceptible to partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.

Our valuation conclusion included herein, and Report complies with the SEBI InvIT Regulations and guidelines, circular or notification issued by SEBI there under.

Please note that the Report must be read in conjunction with the Assumptions and Limiting Conditions, which are contained in Section 3 of this Report. This letter, the Report and the summary of valuation included herein may be provided to the Trust's advisors, the Securities and Exchange Board of India, other regulatory and supervisory authority, as may be required in connection with the Transaction and can be reproduced and included in the draft placement memorandum and final placement memorandum proposed to be filed in connection with offering of the units of the Trust.

This letter should be read in conjunction with the attached Report.

For **RBSA Valuation Advisors LLP**,
(RVE No.: IBBI/RV-E/05/2019/110)



Name: Ravishu Vinod Shah

Designation: Partner

Asset Class: Securities or Financial Assets (RV No.: IBBI/RV/06/2020/12728)

Date: 31st March 2021

Place: Mumbai

RBSA Valuation Advisors LLP

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1. Executive Summary

National Highway Authority of India ("NHAI") was set up by an act of the Indian Parliament, NHAI Act, 1988. NHAI is set up with the primary objective of facilitating development, maintenance, and management of national highways in India. NHAI has been entrusted with National Highways Development Project, along with other minor projects. NHAI is vested in with a portfolio of 50,329 kms of National Highways ("NH") for development, maintenance, and management.

National Highways Infra Projects Private Limited ("NHIPPL" or "SPV") is a wholly owned subsidiary of NHAI, which has been incorporated as a special purpose vehicle to encompass five Toll road projects ("Specified Projects"). NHIPPL has entered into a concession agreement with NHAI to operate, maintain and transfer the Specified Projects under the Toll, Operate and Transfer ("TOT") model.

National Highways Infra Trust ("NHIT" or the "Trust" or "InvIT") is registered with the Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InvIT Regulations. National Highways Infra Investment Managers Private Limited ("NHIIMPL" or the "Investment Manager") is acting as Investment Manager to the Trust. National Highway Authority of India ("NHAI" or "Sponsor") is acting as Sponsor to the Trust, and IDBI Trusteeship Services Limited ("Trustee") is acting as the Trustee to the Trust, within the meaning of the SEBI InvIT Regulations.

NHAI aims to monetize Specified Projects encompassed in the SPV through the InvIT (Infrastructure Investment Trust) route. Pursuant to this, NHIIMPL is evaluating a proposal for acquisition by the Trust of stake held by NHAI in NHIPPL ("Transaction").

In this regard, RBSA Valuation Advisors LLP has been appointed by the Investment Manager, as an independent valuer, as per Regulation 2(zzf) of the SEBI InvIT Regulations, for the purpose of carrying out Enterprise Valuation of National Highways Infra Projects Private Limited which is proposed to be acquired by the Trust.

National Highways Infra Projects Private Limited comprises the following Specified Projects:

Sr. No.	Name of Section	NH	Total Length (Kms)	Toll Plaza	Start Kms	End Kms
1	Abu Road – Swaroopganj	NH-27	31.000	Undavariya	646.000	677.000
2	Chittorgarh – Kota & Chittorgarh Bypass	NH-27	160.500	Bassi, Aroli and Dhaneshwar	891.929	1052.429
3	Palanpur/Khemana – Abu Road	NH-27	45.000	Khemana	601.000	646.000
4	Kothakota Bypass - Kurnool Highway	NH-44	74.622	Pullur	135.469	211.000
5	Maharashtra / Karnataka Border (Kagal) Highway	NH-48	77.705	Hattargi and Kognoli	515.000	592.705

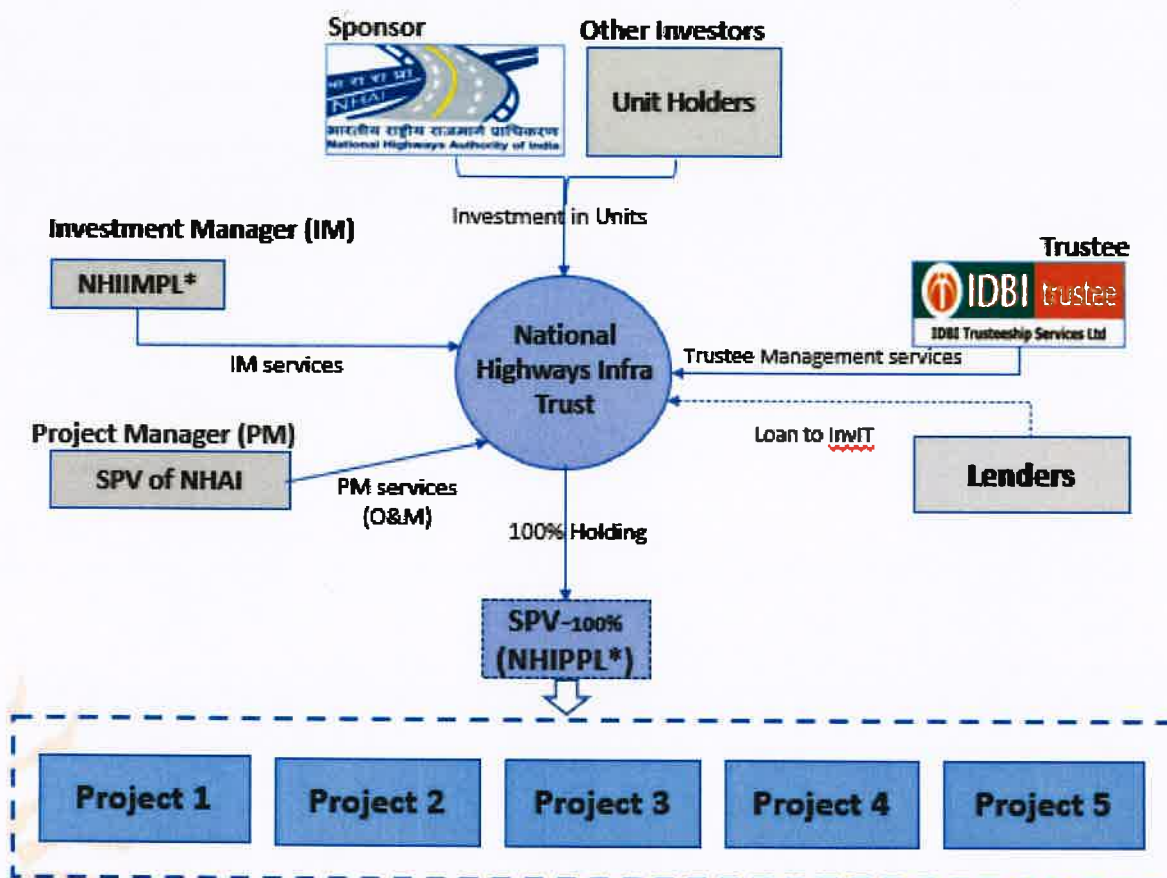


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Proposed National Highways Infra Trust Structure



*NHIPPL - National Highways Infra Projects Private Limited, NHIIMPL - National Highways Infra Investment Managers Private Limited

Valuation Analysis

The Discounted Cash Flow ("DCF") method under the Income Approach has been adopted for enterprise valuation of the SPV. Free Cash Flow to Firm method under DCF has been applied based on the projected financial statements of the SPV provided by the Management of NHIIMPL (the "Management"). The Enterprise Value has been computed by discounting the free cash flows to the firm (SPV) until the end of the concession period of 30 years beginning from 1st April 2021, using an appropriate Weighted Average Cost of Capital ("WACC").

The Investment Manager has appointed independent consultants to carry out Traffic study and estimation of toll revenue and Technical study for estimation of operating and maintenance expenses and major maintenance expenses, for each of the Specified Projects of the SPV over the concession period of 30 years ending on 31st March 2051. We have relied upon the Traffic Study reports and Technical reports provided by independent consultants on the Specified Projects of the SPV for the Enterprise valuation of NHIPPL.



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Valuation of a company/ business is not a precise science and the conclusions arrived at in many cases will be subjective and dependent on the exercise of individual judgment. There is, therefore, no indisputable single value and we normally express our opinion on the value as falling within a likely range. However, considering the nature of the engagement, we have provided a single point value estimate. While we have provided our opinion on the enterprise value of NHIPPL based on the information made available to us and within the scope and constraints of our engagement, others may have a different opinion. Accordingly, we expressly disclaim all liability for any loss or damage of whatever kind which may arise from any person acting on any information and estimates contained in this Report which are contrary to the stated purpose.

While our work has involved an analysis of financial and other information provided by/ on behalf of the Management, our engagement does not include an audit in accordance with generally accepted auditing standards of NHIPPL existing business records. We have not carried out any independent technical evaluation or appraisal or due diligence of the assets or liabilities of the NHIPPL. Accordingly, we assume no responsibility and make no representations with respect to the accuracy or completeness of any information provided by/ on behalf of the Management. Our Report is subject to the scope, assumptions and limitations detailed hereinafter. As such the Report is to be read in totality, and not in parts, in conjunction with the relevant documents referred to herein and in the context of the purpose for which it is made.

The outbreak of the Novel Coronavirus ("COVID-19"), declared by the World Health Organization as a "Global Pandemic" on 11th March 2020, has adversely affected the Global and Indian economy. Travel restrictions implemented by many countries has affected the economic activities. Governments have announced various measures to combat COVID 19 pandemic and to support the economic and business activities. The outbreak of COVID 19 Pandemic has led to significantly higher uncertainties in the near to medium term and its impact is evolving. Considering the unprecedented set of circumstances, Valuation analysis is reported on the basis of 'material valuation uncertainty' and accordingly, less certainty and a higher degree of caution should be attached to the Valuation analysis than would normally be the case. It may be noted that the estimated value may change significantly and unexpectedly over a relatively short period of time based on the evolving conditions/ uncertainties on account of COVID 19 pandemic.

Further, the Union Transport and Highway Minister informed the Lok Sabha (the Lower House of the Indian Parliament) on 18th March 2021, that all physical toll booths across the National Highways network will be removed and a GPS-based toll collection system will be rolled out within one year. In light of this announcement made by the Honorable Minister, we have been given to understand by the Management that due to lack of clarity on the implementation plan and related financial information, it is too early and difficult to assess the impact of implementation of GPS-based toll collection system on toll operations and maintenance expenses in future for the respective five projects and therefore, toll operations and maintenance expenses have been projected considering the existing toll collection system involving physical toll booths and FASTag.



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Enterprise Valuation of NHIPPL as of 30th March 2021 ("Valuation Date"), has been carried out considering *inter-alia* Traffic Study and Technical Reports of independent consultants, Business plan/ Projected financial statements of NHIPPL and other information provided by/ on behalf of the Management, industry analysis and other relevant factors.

The Valuation summary of NHIPPL as of 30th March 2021, is as follows:

SPV	WACC	Enterprise Value (INR Cr)
National Highways Infra Projects Pvt. Ltd. (NHIPPL)	10.4%	7,362.4

The project wise break-up of SPV's Enterprise Value is as follows:

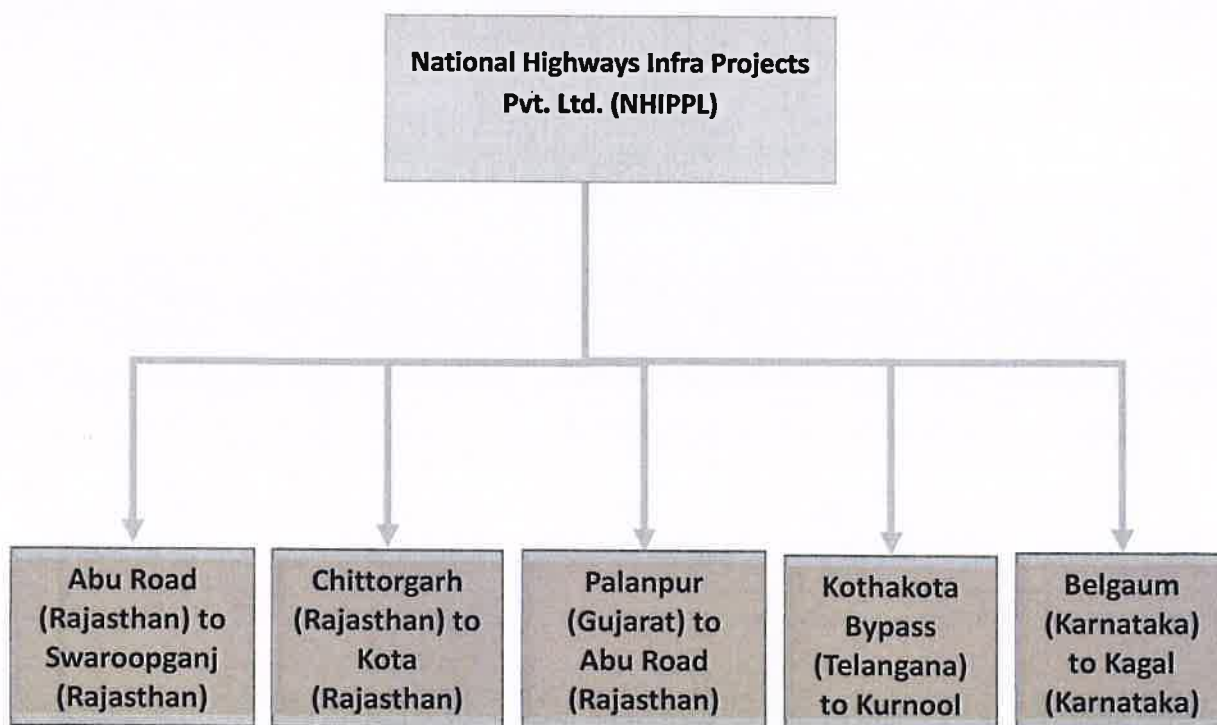
Project Name	Project EV (INR Cr)	Distribution
Abu Road-Palanpur	1,148.4	15.60%
Abu Road - Swaroopganj	742.9	10.09%
Kothakota Kurnool	1,943.2	26.39%
Belgaum Kagal	2,332.5	31.68%
Chittorgarh-Kota	1,195.3	16.24%
Total	7,362.3	100.00%
Add: Cash	0.1	
Total Enterprise Value	7,362.4	

Note: Project EV has been estimated considering *inter-alia* apportionment of common expenses and income taxes of the SPV to the Specified Projects and may not be representative of the Enterprise Value of each Specified Project on a 'standalone' basis



2. Engagement Overview

- National Highway Authority of India was set up by an act of the Indian Parliament, NHAI Act, 1988. NHAI is set up with the primary objective of facilitating development, maintenance, and management of national highways in India. NHAI has been entrusted with National Highways Development Project, along with other minor projects. NHAI is vested in with a portfolio of 50,329 kms of National Highways for development, maintenance, and management.
- National Highways Infra Projects Private Limited is a wholly owned subsidiary of NHAI, which has been incorporated as a special purpose vehicle to encompass five Toll road projects ("Specified Projects"). NHIPPL has entered into a concession agreement with NHAI to operate, maintain and transfer the Specified Projects under the Toll, Operate and Transfer (TOT) model.
- NHAI aims to monetize Specified Projects encompassed in the SPV through the InvIT (Infrastructure Investment Trust) route.
- National Highways Infra Projects Private Limited holds the following Specified Projects:



- National Highways Infra Trust is registered with the Securities and Exchange Board of India as an infrastructure investment trust under the SEBI InvIT Regulations. National Highway Authority of India is acting as Sponsor to the Trust, NHIIMPL is acting as Investment Manager to the Trust and IDBI Trusteeship Services Limited is acting as the Trustee to the Trust. NHIIMPL is evaluating a proposal to transfer equity shares in the SPV to National Highways Infra Trust.



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- In this regard, RBSA Valuation Advisors LLP has been appointed by the Investment Manager, as an independent valuer, as per Regulation 2(zzf) of the SEBI InvIT Regulations, for the purpose of carrying out the Enterprise Valuation of National Highways Infra Projects Private Limited which is proposed to be transferred to the Trust.
- RBSA Valuation Advisors LLP is a registered valuer entity under the Section 247 of the Companies Act, 2013 registered with the Insolvency and Bankruptcy Board of India having Registered Valuer Entity No. IBBI/RV-E/05/2019/110.
- We declare that:
 - We are competent to undertake the financial valuation in terms of the SEBI InvIT Regulations;
 - We are an independent registered valuer entity and have prepared the Report on a fair and unbiased basis; and
 - We have at least two partners/ directors having experience of 5 years each in the valuation of infrastructure assets.
- The Valuation Date considered for the Enterprise Valuation of SPV is 30th March 2021. Valuation analysis and results are specific to the Valuation date. A valuation of this nature involves consideration of various factors including the financial position of the SPV as at the Valuation Date, trends in the equity stock market and fixed income security market, macro-economic and industry trends, etc.
- We have carried out additional scope of work as per schedule V of SEBI InvIT Regulations (Refer para 10.1 for further details).
- This Report covers all the disclosures required as per the SEBI InvIT Regulations and the Valuation of the SPV is impartial, true and fair and in compliance with the SEBI InvIT Regulations.



3. Assumptions and Limiting Conditions

- 3.1. This Report, its contents and the results herein are specific to (i) the purpose of valuation agreed as per the terms of our engagement; (ii) the date of this Report; (iv) Traffic Study and Technical Reports for the Specified Projects by independent consultants, and (v) Business plan/ Projected financial statements of the SPV and other information provided by/ on behalf of the Management and information obtained from public domain/ subscribed databases till 30th March 2021.
- 3.2. While our work has involved an analysis of financial and other information provided by/ on behalf of the Management, our engagement does not include an audit in accordance with generally accepted auditing standards of the SPV existing business records. We have not carried out any independent technical evaluation or appraisal or due diligence of the assets or liabilities of the SPV. Accordingly, we assume no responsibility and make no representations with respect to the accuracy or completeness of any information provided by/ on behalf of the Management. Our Report is subject to the Scope, Assumptions and Limitations detailed hereinafter. As such the Report is to be read in totality, and not in parts, in conjunction with the relevant documents referred to herein and in the context of the purpose for which it is made.
- 3.3. The valuation of companies and businesses is not a precise science and the conclusions arrived at in many cases will be subjective and dependent on the exercise of individual judgment. There is, therefore, no indisputable single value and we normally express our opinion on the value as falling within a likely range, considering the purpose and requirement of this engagement, we have provided a single value. While we have provided our opinion on the fair value of the SPV based on the information made available to us and within the scope and constraints of our engagement, others may have a different opinion.
- 3.4. A valuation of this nature is necessarily based on stock market, financial, economic and other conditions in general and industry trends in particular prevailing as on the Valuation date and the information made available to us as of the date hereof. Events occurring after the Valuation date may affect this Report and the assumptions used in preparing it, and we do not assume any obligation to update, revise or reaffirm this Report.
- 3.5. In the course of valuation, we were provided with both written and verbal information as mentioned in the Section 4. We have analysed the information provided to us by/ on behalf of the Management through broad inquiry, analysis and review but have not carried out a due diligence or audit of the information provided for the purpose of this engagement. We have assumed that no information has been withheld that could have influenced the purpose of our Report.
- 3.6. Valuation may be based on estimates of future financial performance or opinions that represent reasonable expectations at a particular point in time. However, we do not provide assurance on the achievability of the results projected by the Management as events and circumstances do not occur as expected and differences between actual and expected results may be material. We express no

opinion as to how closely the actual results will correspond to those projected as the achievement of the projected results is inter-alia dependent on actions, plans and assumptions of the Management and macro-economic and other external factors which are beyond the control of the Management.

- 3.7. Our valuation is primarily from a business perspective and does not take into account various legal and other corporate structures beyond the limited information provided to us by the Investment Manager. The value conclusion is not intended to represent the value at any time other than the Valuation date that is specifically stated in the Report.
- 3.8. We have also relied on the data from external sources to conclude the valuation. These sources are believed to be reliable and therefore, we assume no liability for the truth or accuracy of any data, opinions or estimates furnished by others that have been used in this analysis. Where we have relied on data, opinions or estimates from external sources, reasonable care has been taken to ensure that such data has been correctly extracted from those sources and/ or reproduced in its proper form and context.
- 3.9. The actual price achieved in case of a transaction may be higher or lower than our estimate of value depending upon the circumstances and timing of the transaction, the nature of the business and other relevant factors. The knowledge, negotiating ability and motivation of the buyers and sellers and the applicability of a discount or premium for control will also affect actual market price achieved. Accordingly, our valuation conclusion will not necessarily be the price at which any agreement proceeds. The final transaction price is something on which the parties themselves have to agree considering *inter-alia* their own assessment of the Transaction and inputs from other advisors.
- 3.10. This Report has been prepared for the sole use by the Investment Manager / Trust / Sponsor in connection with the purpose stated herein. It is inappropriate to use this Report for any purpose other than the purpose mentioned herein. This restriction does not preclude the Investment Manager from providing a copy of the Report to its third-party advisors whose review would be consistent with the intended use. Our Report may be disclosed in connection with any statutory and regulatory filing in connection with the Transaction and in accordance with the provision of SEBI InvIT Regulations. Further, the Report and summary of valuation included herein can be reproduced and included in the Draft placement memorandum and final placement memorandum, which may be filed with the SEBI. We shall not assume any responsibility to any third party to whom the Report is disclosed or otherwise made available.
- 3.11. The Report assumes that the SPV complies fully with relevant laws and regulations applicable in its area of operations and usage unless otherwise stated, and that they will be managed in a competent and responsible manner. Further, unless specifically stated to the contrary, this Report has given no consideration to matters of a legal nature, including issues of legal title and compliance with local laws, and litigations and other contingent liabilities that are not recorded/ reflected in the financial statements provided to us.



- 3.12. It is clarified that this Report is not a fairness opinion under any of the stock exchange/ listing regulations. In case of any third-party having access to this Report, it should be noted that the Report is not a substitute for the third party's own due diligence/ appraisal/ enquiries/ independent advice that the third party should undertake for his purpose.
- 3.13. The outbreak of the Novel Coronavirus ("COVID-19"), declared by the World Health Organization as a "Global Pandemic" on March 11, 2020, has adversely affected the Global and Indian economy. Travel restrictions implemented by many countries has affected the economic activities. Governments have announced various measures to combat COVID 19 pandemic and to support the economic and business activities. The outbreak of COVID 19 Pandemic has led to significantly higher uncertainties in the near to medium term and its impact is evolving. Considering the unprecedented set of circumstances, Valuation analysis is reported on the basis of 'material valuation uncertainty' and accordingly less certainty and a higher degree of caution should be attached to the Valuation analysis than would normally be the case. It may be noted that the estimated value may change significantly and unexpectedly over a relatively short period of time based on the evolving conditions/ uncertainties on account of COVID 19 pandemic.
- 3.14. In the particular circumstances of this case, our liability (in contract or under statute or otherwise) for any economic loss or damage arising out of or in connection with this engagement, irrespective of the quantum of loss or damage caused, shall be limited to the amount of fees actually received by us from the Investment Manager, as laid out in the engagement letter, for such valuation work.
- 3.15. In rendering this Report, we have not provided any legal, regulatory, tax, accounting or actuarial advice and accordingly we do not assume any responsibility or liability in respect thereof.
- 3.16. This Report does not look into the business/ commercial reasons behind the Transaction nor the likely benefits arising out of the same. Similarly, it does not address the relative merits of investing in an infrastructure trust as compared with any other alternative business transaction, or other alternatives, or whether or not such alternatives could be achieved or are available.
- 3.17. We are not advisors with respect to legal tax and regulatory matters for the Transaction. No investigation of the SPV claim to title of assets has been made for the purpose of this Report and the SPV claim to such rights have been assumed to be valid. No consideration has been given to liens or encumbrances against the assets, beyond the loans is closed in the accounts. Therefore, no responsibility is assumed for matters of a legal nature.
- 3.18. The scope of work has been limited both in terms of the areas of the business and operations which have been reviewed. There may be matters, other than those noted in this report, which might be relevant in the context of the transaction and which a wider scope might uncover.



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- 3.19. RBSA is not aware of any contingent, commitment or material issue, besides the information disclosed in the audited financial statements and additionally provided by the Investment Manager / Management which has been presented in this Report, which could materially affect the SPV economic environment and future performance and therefore, the fair value of their businesses.
- 3.20. We have no present or planned future interest in the Trustee, Investment Manager, the Sponsor or the SPV and the fee for this Report is not contingent upon the values reported herein. Our valuation analysis should not be construed as investment advice; specifically, we do not express any opinion on the suitability or otherwise of entering into any financial or other transaction.
- 3.21. We have relied upon the representations of the Management in respect of the information provided by them. We shall not be liable for any loss, damages, cost or expenses arising from fraudulent acts, misrepresentations, or willful default on part of the Investment Manager, the SPV, their directors, employee or agents.
- **Limitation of Liabilities**
 - It is agreed that, having regard to RBSA's interest in limiting the personal liability and exposure to litigation of its personnel, the Investment Manager, the Sponsor, the Trust or the Trustee will not bring any claim in respect of any damage against any of RBSA's personnel.
 - In no circumstances, RBSA shall be responsible for any consequential, special, direct, indirect, punitive or incidental loss, damages or expenses (including loss of profits, data, business, opportunity cost, goodwill or indemnification) in connection with the performance of the Services whether such damages are based on breach of contract, tort, strict liability, breach of warranty, negligence, or otherwise) even if the Investment Manager had contemplated and communicated to RBSA the likelihood of such damages. Any decision to act upon the Report is to be made by the Investment Manager and no communication by RBSA should be treated as an invitation or inducement to engage the Investment Manager to act upon the Report.
 - In the particular circumstances of this case, our liability (in contract or under statute or otherwise) for any loss or damage caused, shall be limited to the amount of fees actually received by us, as laid out in the engagement letter, for such valuation work.
 - It is clarified that the Sponsor and the Trust will be solely responsible for any delays, additional costs, or other liabilities caused by or associated with any deficiencies in their responsibilities, misrepresentations, incorrect and incomplete information including information provided to determine the assumptions.
 - RBSA will not be liable if any loss arises due to the provision of false, misleading or incomplete information or documentation by the Investment Manager, the Sponsor, the Trust or the Trustee.



4. Sources of Information

For the purpose of undertaking this valuation exercise, we have relied on the following sources of information provided by/ on behalf of the Management:

- Audited financial statement of the SPV for the period ended 30 March 2021,
- Concession Agreements for the five projects between the SPV and NHAI for the Specified Projects;
- Reports of independent consultants appointed by the Investment Manager for Traffic study and estimation of toll revenue for the duration of the concession period for each of the Specified Projects of the SPV ("Traffic Study Reports");
- Reports of independent consultants appointed by the Investment Manager for Technical study for estimation of operating and maintenance expenses and major maintenance expenses for the duration of the concession period for each of the Specified Projects of the SPV ("Technical Reports");
- Projected financial statements of the SPV for the concession period from 1st April 2021 to 31st March 2051 (FY2022 – FY2051) which the Management expects to be their best estimate of the expected performance of the SPV encompassing yje Specified Projects ("Management Projections");
- Discussions with the Management to inter-alia understand expected future performance of the SPV, key value drivers and other factors affecting the business of the SPV;
- Management representation letter with respect to mandatory disclosures required by SEBI; and
- Capital IQ's database of publicly traded companies.

We have also obtained the explanations, information and representations, which we believed were reasonably necessary and relevant for our exercise from the Management.



5. Procedures

We have carried out the Enterprise Valuation of the SPV, to the extent applicable, in accordance with ICAI Valuation Standards, 2018 ("ICAI VS") issued by the Institute of Chartered Accountants of India.

We have adopted the following procedures for carrying out the valuation analysis:

- Considered the audited financial statement of the SPV for the period ended 30 March 2021;
- Considered the key terms of Concession Agreements;
- Analysis of the Management Projections;
- Considered the Traffic Study Reports and Technical Reports;
- Analysis of the key economic and industry factors which may affect the valuation of the SPV;
- Analysis of the information available in public domain/ subscribed databases in respect of the comparable companies/ comparable transactions, as considered relevant by us;
- Selection of valuation approach and valuation methodology/(ies), in accordance with ICAI VS, as considered appropriate and relevant by us;
- Analysis of other publicly available information, as considered relevant by us; and
- Determination of Enterprise Value of the SPV.



6. Industry Overview

Road Infrastructure in India

- India has the second largest road network in the world, spanning a total of ~ 5.9 million kilometers (kms). This comprises National Highways, Expressways, State Highways, Major District Roads, Other District Roads and Village Roads as under:

Particulars	In kms	% share
National Highways	132,500	2%
State Highways	156,694	3%
Other Roads	5,608,477	95%
Total	5,897,671	

Source: IBEF November 2020 Report

- This road network transports 64.5 per cent of all goods in the country and 90 per cent of India's total passenger traffic uses road network to commute. Road transportation has gradually increased over the years with improvement in connectivity between cities, towns, and villages in the country.

Strong momentum in expansion of roadways

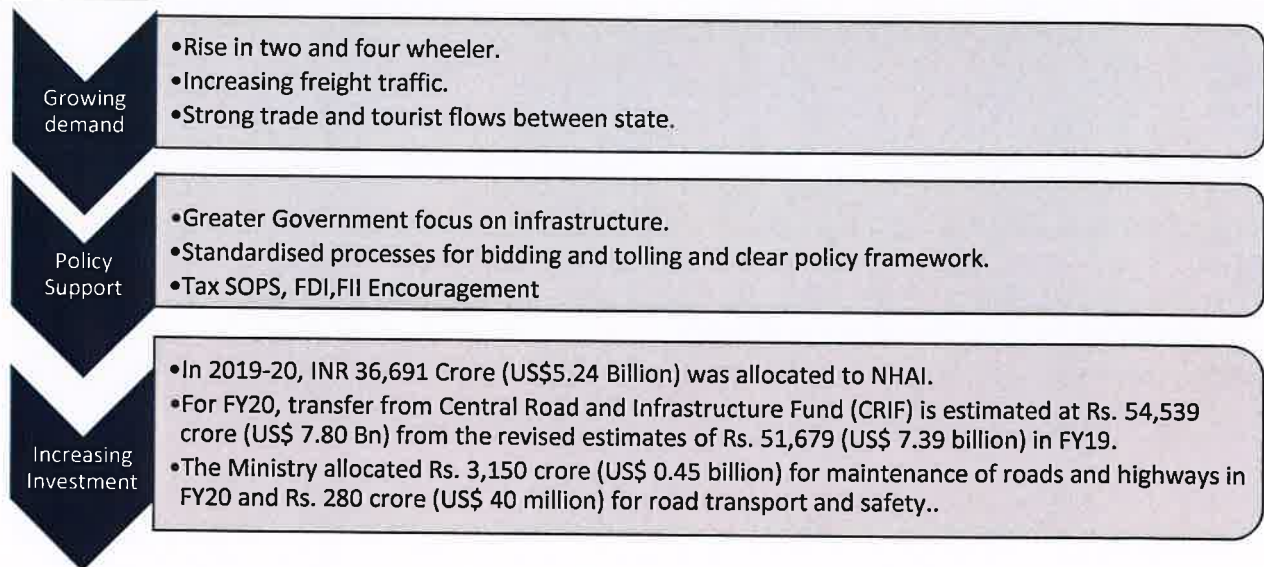
- Highway construction in India increased at 21.44% CAGR between FY16- FY19. In FY19, 10,855 km of highways were constructed. The Government aims to construct 65,000 km of national highways at a cost of Rs. 5.35 lakh crore (US\$ 741.51 billion) by 2022.
- In April 2020, the Government has set a target of constructing roads worth INR 15 lakh crore (US\$ 212.80 billion) over the next two years.
- In July 2020, foundation stones of various highway projects, part of a new economic corridor, worth around Rs 20,000 crore (US\$ 2.84 billion) were laid in Haryana.
- In October 2020, the foundation stone was established for nine National Highway projects—with a total length of ~262 km—worth more than INR 2,752 crore (US\$ 371.13 million) in Tripura.
- In October 2020, National Highway projects worth INR 19,800 crore (US\$ 2.67 billion) in Kerala have been initiated by the Ministry of Road Transport and Highways and are expected to be completed by 2024. 30 projects, with a length of ~549 km worth INR 5,327 crore (US\$ 718.40 million) are under implementation.
- In October 2020, the Department of Central National Highways has issued a permit to construct a 122 km National Highway from Kalvakurthi in Telangana to Karivena in Andhra Pradesh. The new national highway would reduce the distance to Tirupati from Hyderabad by 80 km.





Source: IBEF November 2020 Report

Growth Drivers



Source: IBEF November 2020 Report

Future growth Prospects

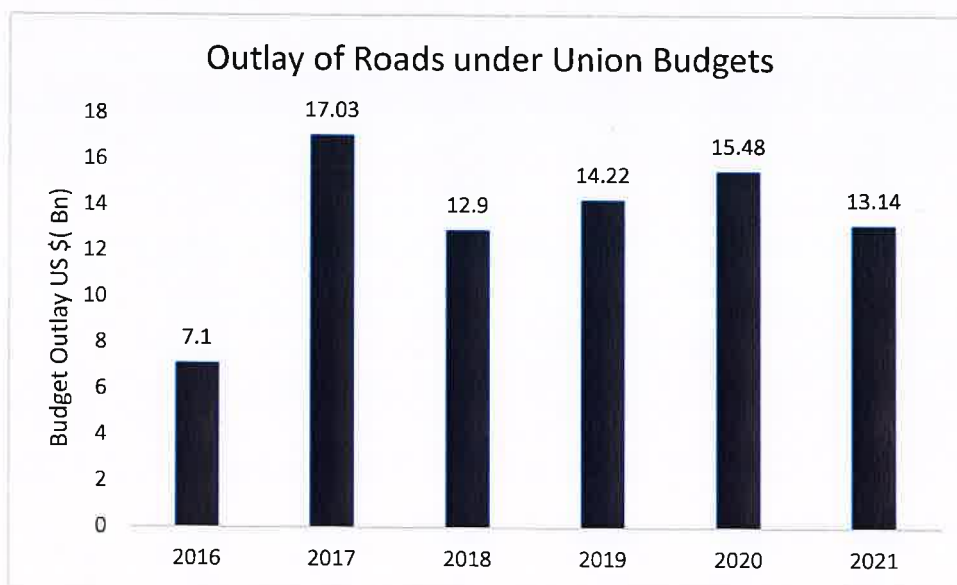
- In April 2020, the Government set a target of constructing roads worth INR 15 lakh crore (US\$ 212.80 billion) in next two years.
- In June 2020, NHAI became fully digital with the launch of unique cloud based and Artificial Intelligence powered Big Data Analytics platform - Data Lake and Project Management Software.
- In November 2020, the Government of India and the New Development Bank (NDB) signed a loan agreement for US\$ 500 million for the 'Delhi-Ghaziabad-Meerut Regional Rapid Transit System Project' to provide fast, reliable, safe and comfortable public transport system in the National Capital Region (NCR).



- During 2019-23, National Highway Authority of India (NHAI) will be able to generate Rs 1 lakh crore (US\$ 14.30 billion) annually from toll and other sources.
- NHAI is planning to raise Rs 40,000 crore (US\$ 5.72 billion) to monetize its highway assets through Infrastructure Investment Trust.

Highlights of Union Budget 2021-22

- The Government has allocated INR 1,18,101 lakh crore (highest ever outlay) for Ministry of Road Transport and Highways – of which INR 1,08,230 crore is for capital expenditure.
- Under the Bharatmala Pariyojana, with an estimated investment of Rs 5.35 lakh crore, already 13,000 km of roads worth Rs 3.30 lakh crore have been awarded for construction:
 - 3,800 km have already been constructed
 - Another 8,500 km to be awarded for construction by March 2022
 - Additional 11,000 km of national highway corridors to be completed by March 2022
- A large amount of ~INR 2.27 lakh crore has been earmarked for ongoing and new economic corridors/expressways.



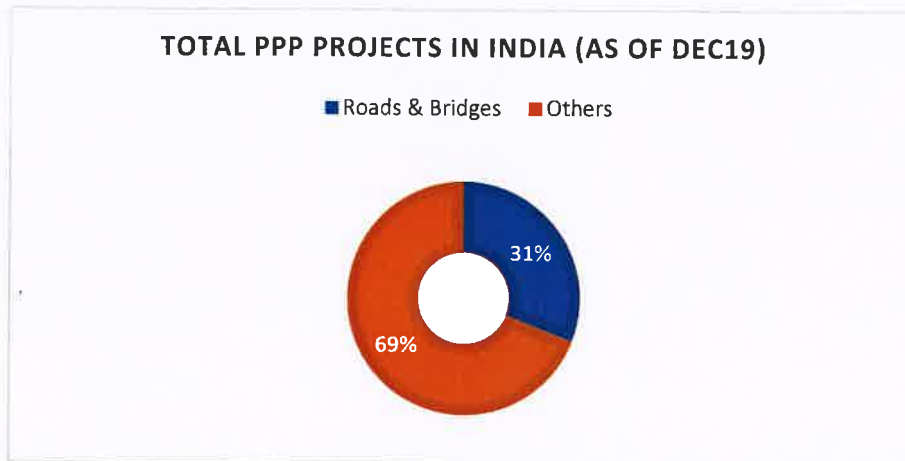
Source: IBEF Road Report November 2020

Private Sector Participation: -

- As of December 2019, out of the 9,242 PPP projects in India, 2,872 were related to roads and bridges.
- Projects awarded under build-operate-transfer (BOT) was 37.62% of the total awarded projects as of December 2019.
- In August 2020, the Government of India revised the Model Concession Agreement for BOT projects to plug delays by imposing a deadline on the NHAI and incentivizing timely work by concessionaires. According to revised norms, the NHAI will have to hand over 90% of the project land (vacant and ready to build) to private developers, thus creating a more market-friendly sector and attracting more private players.



- As on December 2019, 824 projects were recommended for development by Public Private Partnership (PPP) Appraisal Committee
- Investment of US\$ 31 billion for national highways is expected in PPP by the end of 2020.



(Source: IBEF Road Report November 2020)

Government initiatives: -

1. National Infrastructure Pipeline (NIP)

The government's ambitious National Infrastructure Pipeline which is to be implemented over the next 5 years (till FY25) is an attempt undertaken by the centre to facilitate economic revival by relying on infrastructure creation. The NIP covers a gamut of sectors, rural and urban infrastructure as well and entails investments to the tune of INR 102 lakh Crores to be undertaken by the central government, state governments and the private sector.

2. Bharatmala Pariyojana (BMP) – Phase I

- Bharatmala Pariyojana is a program for the highways sector that focuses on optimizing efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of Economic Corridors, Inter Corridors and Feeder Routes, National Corridor Efficiency Improvement, Border and International connectivity roads, Coastal and Port connectivity roads and Green-field expressways.
- A total of around 24,800 kms are being considered in Phase I. In addition, Phase I also includes 10,000 kms of balance road works under NHDP. Estimated outlay for Phase I is INR 5.35 lakh Crores spread over 5 years.



- Summary of Phase 1 Components and approved outlay of for the same are as follows: -

Sr. No.	Components	Length (Km)	Outlay (INR crore)
1	Economic corridors development	9,000	120,000
2	Inter- corridors & feeder roads	6,000	80,000
3	National Corridors Efficiency Improvement	5,000	100,000
4	Border and International Connectivity	2,000	25,000
5	Coastal and port connectivity roads	2,000	20,000
6	Expressways	800	40,000
Total		24,800	385,000
7	Balance Road works under NHDP	10,000	1,50,000
Total			5,35,000

Source: Annual Report Ministry of Road Transport and Highways FY 2020-21

Projects with aggregate length of approximately 13,171 kms have already been awarded under Bharatmala Pariyojana (including residual NHDP Works) till November 2020, while projects with length 2,587 kms are currently under bidding. Additionally, work on preparation of Detailed Project Reports for about 13,233 kms is under progress.

3. **FASTAG**

FASTag is a Radio Frequency Identification Technology (RFID) introduced by the Government of India along with the Ministry of Road Transport and Highway in October 2017. This measure was taken keeping in scrutiny several inconveniences for both individual drivers and the nation at large.

The National Highways Authority of India ("NHAI") has decided to make the use of FASTags mandatory from February 15, 2021 for all four-wheelers. Since December 2019, all lanes of national highways toll plazas were declared as "FASTag lanes" and Highways Minister Nitin Gadkari has announced that all vehicles must have FASTags.

NHAI has authorized 22 banks in India to provide FASTag cards to individuals. These 22 banks, along with NHAI plazas, common service centers, petrol pumps, and transport hubs have set up more than 28,000 point-of-sale terminals across India.



7. Valuation Approach and Methodology

VALUATION APPROACHES		
INCOME APPROACH	MARKET APPROACH	ASSET APPROACH
Estimates value based on the present value of future earnings of cash	Estimates value based on the multiples of comparable companies and precedent comparable transactions	Estimates value based on the fair value of the business' assets less the fair value of its liabilities
Applied	Not applied	Not Applied

Basis and Methodology of Valuation

- Basis of Valuation**

It means the indication of the type of value being used in an engagement. Fair Value as per ICAI VS defined as under:

"Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the valuation date."

Fair value basis has been adopted for enterprise valuation of the SPV

- Valuation Date**

Valuation Date is the specific date at which the value of the assets to be valued gets estimated or measured. Valuation is time specific and can change with the passage of time *inter-alia* due to changes in the condition of the asset to be valued and market parameters. Accordingly, valuation of an asset as at a particular date can be different from other date(s).

The Valuation Date considered for the fair enterprise valuation of the SPV is 30th March 2021 ("Valuation Date"). The attached Report is drawn up by reference to accounting and financial information as on 30th March 2021.

- Premise of Value**

Premise of Value refers to the conditions and circumstances how an asset is deployed. In the present case, we have determined the fair enterprise value of the SPV on a Going Concern Value defined as under:

"Going concern value is the value of a business enterprise that is expected to continue to operate in the future. The intangible elements of going concern value result from factors such as having a trained work force, an operational plant, the necessary licenses, systems, and procedures in place, etc."



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Approach & Method	Applied/Not Applied	Description	Rationale
Income Approach Discounted Cash Flow Method (DCF)	Applied	<ul style="list-style-type: none"> In the DCF method under the Income approach, forecast cash flows are discounted back to the Valuation date, estimating a net present value of the cash flow stream of the business. A terminal value at the end of the explicit forecast period is then determined and that value is also discounted back to the Valuation date to give an overall value for the business A discounted cash flow methodology typically requires the forecast period to be of such a length to enable the business to achieve a stabilized level of earnings, or to be reflective of an entire operation cycle for more cyclical industries The rate at which the future cash flows are discounted (the "discount rate") should reflect not only the time value of money, but also the risk associated with the business' future operations. The discount rate most generally employed is Weighted Average Cost of Capital ("WACC") or Cost of Equity (Ke), reflecting an optimal as opposed to actual financing structure 	<ul style="list-style-type: none"> Management has provided financial projections of the SPV, which represents their best estimate of the expected performance of the SPV for the balance tenor of their respective Concession period. Considering the aforementioned, DCF method has been adopted to estimate the enterprise value of the SPV.
Market Approach <ul style="list-style-type: none"> Market Price Method 	Not Applied	<ul style="list-style-type: none"> Under this method, the value of a company is arrived at considering its market price over an appropriate period. 	<ul style="list-style-type: none"> As the SPV is not listed, this method is not applied
Market Approach <ul style="list-style-type: none"> Comparable Companies Multiples ("CCM") Method 	Not Applied	<ul style="list-style-type: none"> Under Comparable Companies Method, the value of shares / business of a company is determined based on market multiples of publicly traded comparable companies. Although no two companies are entirely alike, the companies selected as comparable companies should be 	<ul style="list-style-type: none"> The Specified Projects are operational and do not have project implementation risk. Further, the projected income and cash flows of the SPV primarily depends on the key terms of the respective concession agreements, residual tenor, project-



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Approach & Method	Applied/Not Applied	Description	Rationale
		<p>engaged in the same or a similar line of business as the subject company.</p> <ul style="list-style-type: none"> The appropriate multiple is generally based on the performance of listed companies with similar business models and size. 	<p>specific characteristics/factors, etc. which may differ from the other projects. Accordingly, this method is not adopted.</p>
Market Approach <ul style="list-style-type: none"> Comparable Transaction Multiples ("CTM") Method 	Not Applied	<ul style="list-style-type: none"> Under Comparable Transaction Multiples Method, the value of shares /business of a company is determined based on market multiples of publicly disclosed transactions in the similar space as that of the subject company Multiples are generally based on data from recent transactions in a comparable sector, but with appropriate adjustment after consideration is given to the specific characteristics of the business being valued 	<ul style="list-style-type: none"> The projected income and cash flows of the SPV primarily depend on the key terms of the respective concession agreements, residual tenor, project-specific characteristics/factors, etc. which may differ from the other projects. We have not adopted this methodology due to unavailability of information in public domain involving recent transactions in similar projects
Asset based Approach <ul style="list-style-type: none"> Adjusted Net Asset Value Method 	Not Applied	<ul style="list-style-type: none"> Under the Adjusted Net Asset Value Method, a Valuation of a 'going concern' business is computed by adjusting the assets and liabilities to the fair market value as of the date of the Valuation. A net asset value methodology is typically most appropriate when: <ul style="list-style-type: none"> Valuing a holding company or a capital-intensive company. Losses are continually generated by the business; or Valuation methodologies based on a company's net income or cash flow levels indicate a value lower than its adjusted net asset value. 	<ul style="list-style-type: none"> The SPV has entered into concession agreements and their revenues are largely predetermined for the residual period of the project. In such a scenario, the true worth of the business is reflected in its future earning capacity rather than the historical cost of the project. The valuation of the SPV is carried out on a 'going concern' premise. Since the Net Asset value does not capture the future earning potential of the businesses, we have not adopted the Asset approach for the valuation of the SPV.

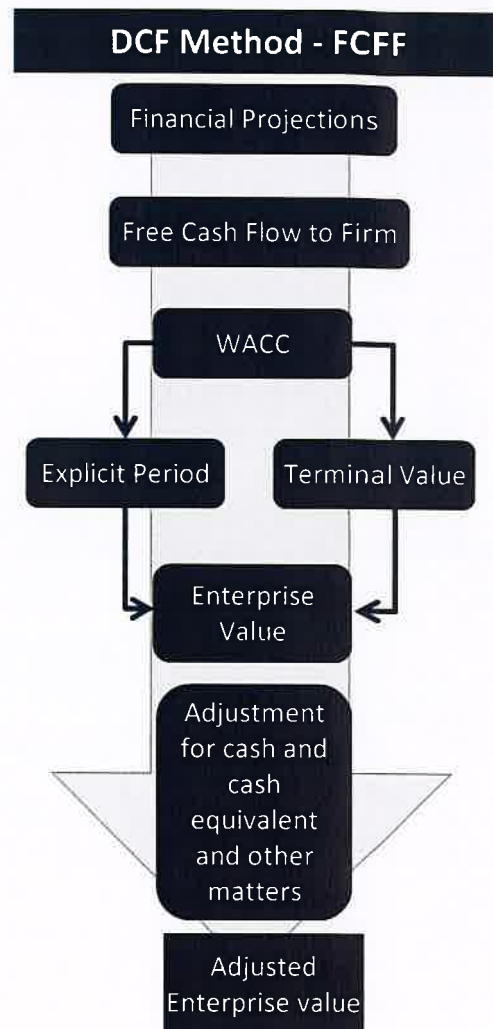


Income Approach

The Income Approach is widely used for valuation under "Going Concern" basis. It focuses on the income generated by a company in the past as well as its future earning capability.

Discounted Cash Flow ("DCF") Method

- Under the DCF method, the business is valued by discounting its free cash flows for the explicit forecast period and the perpetuity value thereafter.
- Free Cash Flows to Firm ("FCFF") under the DCF method has been applied for estimating the enterprise value of the SPV.
- FCFF represent the cash available for distribution to both, the owners and creditors of the business. FCFF for the explicit period and perpetuity value is discounted by the Weighted Average Cost of Capital ("WACC") to derive the net present value. The WACC is an appropriate rate of discount to calculate the present value of the future cash flows as it considers equity-debt risk by incorporating debt-equity ratio of the firm.
- Enterprise Value ("EV") is derived by aggregating the present value of FCFF for the balance tenor of the Concession Agreement ("Explicit period") and Terminal value at the end of the Explicit period.
- Terminal value is estimated based on the business' potential for further growth beyond the Explicit period. Considering *inter-alia* the estimated economic life of the projects, Terminal value has been estimated considering release of net working capital, at the end of the Explicit period.
- The Enterprise Value of the SPV have been determined as an aggregate of the present value of FCFF for the Explicit period and Terminal value.



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Weighted Average Cost of Capital (WACC)

WACC has been estimated as under:

Particulars	Definition/Formula
WACC	$Ke * (E / (D + E)) + Kd * (1-T) * (D / (D + E))$
Where:	
Ke	cost of equity
E	market value of equity
Kd	cost of debt
D	market value of debt
T	effective tax rate

The cost of equity is derived using the Capital Asset Pricing Model ("CAPM") as follows:

Particulars	Definition/Formula
Ke	$Rf + \beta * (Rm - Rf) + \alpha$
Where:	
Rf	the return on risk-free assets
Rm	the expected average return of the market
(Rm – Rf)	the average risk premium above the risk – free rate that a "market" portfolio of assets is earning
β	the beta factor, being the measure of the systematic risk of a particular asset relative to the risk of a portfolio of all risky assets
α	Company specific risk factor (alpha), if any

A summary of WACC for the Specified Projects is appended as per **Appendix 1**.



8. Valuation of NHIPPL

8.1. Key underlying assumptions as provided by the Management are as follows:

- **Operating Revenue:** Operating revenue for Specified Projects is projected based on the Traffic Study Reports of independent consultants appointed by NHIMPL.
- **Operational and Maintenance Expenses (Routine maintenance):** O&M expenses estimated by the Management over the Projected Period are supported by the Technical study reports of independent consultants.
- **Major Maintenance & Repair Expenses (MMR / Periodic maintenance):** Periodic maintenance expenses are costs that are incurred to bring the road asset back to an earlier condition or to keep the road asset operating at its present condition. Similar to O&M expenditure MMR expenditures estimated by the Management over the Projected Period are supported by the Technical study reports of independent consultants.
- **Project Management (PM) Expenses:** PM expenses shall be paid by NHIT to the Project Manager for the management of all the toll road projects. These expenses are taken as per the PM agreement between NHIT and the Project Manager.
- **Insurance and Other office Expenses:** These expenses estimated by the Management over the Projected Period are supported by the Technical study reports of independent consultants.
- **Pre-issuance Fees and Charges and Bank Guarantee (BG) expenses:** One time pre-issuance fee and charges amounting to INR 38 Cr and yearly BG expenses amounting to INR 0.30 Cr. shall be incurred by the SPV. We have relied on the projections provided by the Management.
- **Other expenses:** In respect of certain Specified projects, NHAI has entered into concession agreements with third party to operate the projects on BOT (Annuity) basis. Management represented that:
 - Annuity expenses payable to such third party for the balance duration of the respective concession agreement shall be borne by NHAI; and,
 - Operation and maintenance expenses and MMR expenses which may need to be incurred during the balance period of the respective concession agreement with such third party shall be borne by the respective party.
- **Depreciation and Amortization:** The Service Concession Agreement have been amortized over the period of concession on the basis of projected revenues. Since depreciation and amortization is a non-cash expenditure, it has been added back to arrive at the net cash flows.



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- **Taxes:** Income taxes are estimated considering, as appropriate, tax depreciation/ amortisation policy proposed to be followed by the SPV and corporate income tax rate of 25.17%.
- **Capital Expenditure:** Management has projected that capital expenditure aggregating ~INR 520 crore shall be incurred by the SPV during FY2022 and FY2023. There will be no further capital expenditure in the projected period. We have relied on the projections provided by the Management.
- **Working Capital:** Considering the nature of the business of operating toll road projects, the working capital requirement is expected to be Nil for the projected period.



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8.2. Specified Projects of NHIPPL

8.2.1. Palanpur (Gujarat) to Abu Road (Rajasthan) ("PLN-ABU")

8.2.1.1. Project Overview

Parameters	Details
Project Name	NH27 (NH14) Palanpur/Khemana - Aburoad (Stretch 3)
Length of the project	45.00 kms
Toll Plaza Location	Khemana
Project Type for the SPV	Toll, Operate and Transfer
Concession Period for the SPV - Start	1 April 2021
Concession Period for the SPV - End	31 March 2051
Date of Inspection	11 th February 2021

Source: Management information

8.2.1.2. Additional Procedures to be complied with in accordance with InvIT regulations

A. List of one-time sanctions/approvals which are obtained or pending:

As represented by the management, the list of sanctions/ approvals obtained till 30th March 2021 is provided in **Appendix 3**.

B. List of up to date/ overdue periodic clearances:

As represented by the management, all other material permits, registrations, licenses, approvals, consents and other authorizations (collectively, "Governmental Licenses") shall be obtained as per individual project requirement once NHIPPL is purchased by the Trust and the rights and obligations are assumed. NHIPPL would in due course and as required under applicable law procure all the Governmental Licenses issued by, and shall make all material declarations and filings with, the applicable Governmental Authority to own, lease, license, operate and use its properties and assets and to conduct the business by NHIPPL, as described in the Draft Placement Memorandum and as will be described in the Placement Memorandum and the Final Placement Memorandum. No notice of proceedings has been received relating to the revocation or modification of any Governmental Licenses, except as would not result in a Material Adverse Change. The general list of Governmental Licenses is enclosed in **Appendix 4**.

C. Estimates of already carried out as well as proposed major repairs and improvements along with estimated time of completion:

Historical Major Maintenance Expenses (INR Cr): Not Applicable



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Forecasted Major Maintenance Expenses (INR Cr):

Particulars for the year/ period ended	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25	31-Mar-26	31-Mar-27	31-Mar-28	31-Mar-29
No of Months	12	12	12	12	12	12	12	12
Major Maintenance Expenses	-	-	-	-	-	-	-	4.86

Particulars for the year/ period ended	31 Mar-30	31 Mar-31	31 Mar-32	31 Mar-33	31 Mar-34	31 Mar-35	31-Mar-36
No of Months	12	12	12	12	12	12	12
Major Maintenance Expenses	53.18	-	-	-	-	-	-

Particulars for the year/ period ended	31 Mar-37	31 Mar-38	31 Mar-39	31 Mar-40	31 Mar-41	31 Mar-42	31-Mar-43
No of Months	12	12	12	12	12	12	12
Major Maintenance Expenses	-	-	-	97.28	-	-	-

Particulars for the year/ period ended	31 Mar-44	31 Mar-45	31 Mar-46	31 Mar-47	31 Mar-48	31 Mar-49	31-Mar-50	31-Mar-51
No of Months	12	12	12	12	12	12	12	12
Major Maintenance Expenses	-	-	125.06	-	-	-	-	-

Source: Management information

- D. On-going material litigations including tax disputes and claims in relation to the assets, if any:
As represented by the Management, there are no litigations pending as at 30th March 2021.
- E. Revenue pendencies including local authority taxes associated with InvIT asset and compounding charges, if any
As represented by the Management, there are no revenue pendencies including local authority taxes associated or compounding charges with InvIT asset as at 30th March 2021.
- F. Vulnerability to natural or induced hazards that may not have been covered in town planning building control.
As represented by the Management, any natural or induced hazards would be adequately covered by insurance.
- G. Latest Pictures of the project along with date of physical inspection
Please refer **Appendix 5**.



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8.2.2. Abu Road (Rajasthan) to Swaroopganj (Rajasthan) ("ABU-SWA")

8.2.2.1. Project Overview

Parameters	Details
Project Name	NH27 (NH14) Aburoad - Swaroopganj (Stretch 1)
Length of the project	31.00 kms
Toll Plaza Location	Undavariya
Project Type for the SPV	Toll, Operate and Transfer
Concession Period for the SPV - Start	1 April 2021
Concession Period for the SPV - End	31 March 2051
Date of Inspection	11 th February 2021

Source: Management information

8.2.2.2. Additional Procedures to be complied with in accordance with InvIT regulations

- A. List of one-time sanctions/approvals which are obtained or pending:
As represented by the management, the list of sanctions/ approvals obtained till 30th March 2021 is provided in **Appendix 3**.
- B. List of up to date/ overdue periodic clearances:
As represented by the management, all other material permits, registrations, licenses, approvals, consents and other authorizations (collectively, "Governmental Licenses") shall be obtained as per individual project requirement once NHIPPL is purchased by the Trust and the rights and obligations are assumed. NHIPPL would in due course and as required under applicable law procure all the Governmental Licenses issued by, and shall make all material declarations and filings with, the applicable Governmental Authority to own, lease, license, operate and use its properties and assets and to conduct the business by NHIPPL, as described in the Draft Placement Memorandum and as will be described in the Placement Memorandum and the Final Placement Memorandum. No notice of proceedings has been received relating to the revocation or modification of any Governmental Licenses, except as would not result in a Material Adverse Change. The general list of Governmental Licenses is enclosed in **Appendix 4**.
- C. Estimates of already carried out as well as proposed major repairs and improvements along with estimated time of completion:

Historical Major Maintenance Expenses (INR Cr): Not Applicable



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Forecasted Major Maintenance Expenses (INR Cr):

Particulars for the year/ period ended	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25	31-Mar-26	31-Mar-27	31-Mar-28	31-Mar-29
No of Months	12	12	12	12	12	12	12	12

Major Maintenance Expenses	-	-	-	-	-	-	9.41	-
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Particulars for the year/ period ended	31 Mar-30	31 Mar-31	31 Mar-32	31 Mar-33	31 Mar-34	31 Mar-35	31-Mar-36
No of Months	12	12	12	12	12	12	12

Major Maintenance Expenses	-	-	-	-	-	-	-
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Particulars for the year/ period ended	31 Mar-37	31 Mar-38	31 Mar-39	31 Mar-40	31 Mar-41	31 Mar-42	31-Mar-43
No of Months	12	12	12	12	12	12	12

Major Maintenance Expenses	-	75.65	-	-	-	-	-
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Particulars for the year/ period ended	31 Mar-44	31 Mar-45	31 Mar-46	31 Mar-47	31 Mar-48	31 Mar-49	31-Mar-50	31-Mar-51
No of Months	12	12	12	12	12	12	12	12

Major Maintenance Expenses	90.57	-	-	-	-	-	120.18	-
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Source: Management information

- D. On-going material litigations including tax disputes and claims in relation to the assets, if any;
As represented by the Management, there are no litigations pending as at 30th March 2021.
- E. Revenue pendencies including local authority taxes associated with InvIT asset and compounding charges, if any
As represented by the Management, there are no revenue pendencies including local authority taxes associated or compounding charges with InvIT asset as at 30th March 2021.
- F. Vulnerability to natural or induced hazards that may not have been covered in town planning building control.
As represented by the Management, any natural or induced hazards would be adequately covered by insurance.
- G. Latest Pictures of the project along with date of physical inspection
Please refer **Appendix 6.**



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8.2.3. Kothakota Bypass (Telangana) to Kurnool (Andhra Pradesh) ("KOT-KUR")

8.2.3.1. Project Overview

Parameters	Details
Project Name	NH44 (NH7) Stretch of Kothakota Bypass - Kurnool Highway (Stretch 4)
Length of the project	74.622 kms
Toll Plaza Location	Pullur
Project Type for the SPV	Toll, Operate and Transfer
Concession Period for the SPV - Start	1 April 2021
Concession Period for the SPV - End	31 March 2051
Date of Inspection	12 th February 2021

Source: Management information

8.2.3.2. Additional Procedures to be complied with in accordance with InvIT regulations

A. List of one-time sanctions/approvals which are obtained or pending:

As represented by the management, the list of sanctions/ approvals obtained till 30th March 2021 is provided in **Appendix 3**.

B. List of up to date/ overdue periodic clearances:

As represented by the management, all other material permits, registrations, licenses, approvals, consents and other authorizations (collectively, "Governmental Licenses") shall be obtained as per individual project requirement once NHIPPL is purchased by the Trust and the rights and obligations are assumed. NHIPPL would in due course and as required under applicable law procure all the Governmental Licenses issued by, and shall make all material declarations and filings with, the applicable Governmental Authority to own, lease, license, operate and use its properties and assets and to conduct the business by NHIPPL, as described in the Draft Placement Memorandum and as will be described in the Placement Memorandum and the Final Placement Memorandum. No notice of proceedings has been received relating to the revocation or modification of any Governmental Licenses, except as would not result in a Material Adverse Change. The general list of Governmental Licenses is enclosed in **Appendix 4**.

C. Estimates of already carried out as well as proposed major repairs and improvements along with estimated time of completion:

Historical Major Maintenance Expenses (INR Cr): Not Applicable



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Forecasted Major Maintenance Expenses (INR Cr):

Particulars for the year/ period ended	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25	31-Mar-26	31-Mar-27	31-Mar-28	31-Mar-29
No of Months	12	12	12	12	12	12	12	12

Major Maintenance Expenses - - - - - 12.34

Particulars for the year/ period ended	31 Mar-30	31 Mar-31	31 Mar-32	31 Mar-33	31 Mar-34	31 Mar-35	31-Mar-36
No of Months	12	12	12	12	12	12	12

Major Maintenance Expenses 142.38 - - - - -

Particulars for the year/ period ended	31 Mar-37	31 Mar-38	31 Mar-39	31 Mar-40	31 Mar-41	31 Mar-42	31-Mar-43
No of Months	12	12	12	12	12	12	12

Major Maintenance Expenses - - 213.59 - - - -

Particulars for the year/ period ended	31 Mar-44	31 Mar-45	31 Mar-46	31 Mar-47	31 Mar-48	31 Mar-49	31-Mar-50	31-Mar-51
No of Months	12	12	12	12	12	12	12	12

Major Maintenance Expenses - 269.35 - - - - 331.10

Source: Management information

- D. On-going material litigations including tax disputes and claims in relation to the assets, if any;
As represented by the Management, there are no litigations pending as at 30th March 2021.
- E. Revenue pendencies including local authority taxes associated with InvIT asset and compounding charges, if any
As represented by the Management, there are no revenue pendencies including local authority taxes associated or compounding charges with InvIT asset as at 30th March 2021.
- F. Vulnerability to natural or induced hazards that may not have been covered in town planning building control.
As represented by the Management, any natural or induced hazards would be adequately covered by insurance.
- G. Latest Pictures of the project along with date of physical inspection
Please refer **Appendix 7**.



8.2.4. Belgaum (Karnataka) to Kagal (Karnataka) ("BEL-KAG")**8.2.4.1. Project Overview**

Parameters	Details
Project Name	NH48 (Old NH4) Stretch of Belgaum – Maharashtra / Karnataka Border (Kagal) Highway (Stretch 5)
Length of the project	77.705 kms
Toll Plaza Location	Hattargi and Kognoli
Project Type for the SPV	Toll, Operate and Transfer
Concession Period for the SPV - Start	1 April 2021
Concession Period for the SPV - End	31 March 2051
Date of Inspection	11 th February 2021

Source: Management information

8.2.4.2. Additional Procedures to be complied with in accordance with InvIT regulations**A. List of one-time sanctions/approvals which are obtained or pending:**

As represented by the management, the list of sanctions/ approvals obtained till 30th March 2021 is provided in **Appendix 3**.

B. List of up to date/ overdue periodic clearances:

As represented by the management, all other material permits, registrations, licenses, approvals, consents and other authorizations (collectively, "Governmental Licenses") shall be obtained as per individual project requirement once NHIPPL is purchased by the Trust and the rights and obligations are assumed. NHIPPL would in due course and as required under applicable law procure all the Governmental Licenses issued by, and shall make all material declarations and filings with, the applicable Governmental Authority to own, lease, license, operate and use its properties and assets and to conduct the business by NHIPPL, as described in the Draft Placement Memorandum and as will be described in the Placement Memorandum and the Final Placement Memorandum. No notice of proceedings has been received relating to the revocation or modification of any Governmental Licenses, except as would not result in a Material Adverse Change. The general list of Governmental Licenses is enclosed in **Appendix 4**.

C. Estimates of already carried out as well as proposed major repairs and improvements along with estimated time of completion:

Historical Major Maintenance Expenses (INR Cr): Not Applicable



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Forecasted Major Maintenance Expenses (INR Cr):

Particulars for the year/ period ended	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25	31-Mar-26	31-Mar-27	31-Mar-28	31-Mar-29
No of Months	12	12	12	12	12	12	12	12

Major Maintenance Expenses

Particulars for the year/ period ended	31 Mar-30	31 Mar-31	31 Mar-32	31 Mar-33	31 Mar-34	31 Mar-35	31-Mar-36
No of Months	12	12	12	12	12	12	12

Major Maintenance Expenses

Particulars for the year/ period ended	31 Mar-37	31 Mar-38	31 Mar-39	31 Mar-40	31 Mar-41	31 Mar-42	31-Mar-43
No of Months	12	12	12	12	12	12	12

Major Maintenance Expenses

Particulars for the year/ period ended	31 Mar-44	31 Mar-45	31 Mar-46	31 Mar-47	31 Mar-48	31 Mar-49	31-Mar-50	31-Mar-51
No of Months	12	12	12	12	12	12	12	12

Major Maintenance Expenses

Source: Management information

- D. On-going material litigations including tax disputes and claims in relation to the assets, if any;
As represented by the Management, there are no litigations pending as at 30th March 2021.
- E. Revenue pendencies including local authority taxes associated with InvIT asset and compounding charges, if any
As represented by the Management, there are no revenue pendencies including local authority taxes associated or compounding charges with InvIT asset as at 30th March 2021.
- F. Vulnerability to natural or induced hazards that may not have been covered in town planning building control.
As represented by the Management, any natural or induced hazards would be adequately covered by insurance.
- G. Latest Pictures of the project along with date of physical inspection
Please refer **Appendix 8**.



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8.2.5. Chittorgarh (Rajasthan) to Kota (Rajasthan) ("CHT-KOT")

8.2.5.1. Project Overview

Parameters	Details
Project Name	NH27 (NH76) Chittorgarh – Kota & Chittorgarh Bypass (Stretch 2)
Length of the project	160.500 kms
Toll Plaza Location	Bassi, Aroli and Dhaneshwar
Project Type for the SPV	Toll, Operate and Transfer
Concession Period for the SPV - Start	1 April 2021
Concession Period for the SPV - End	31 March 2051
Date of Inspection	11 th February 2021

Source: Management information

8.2.5.2. Additional Procedures to be complied with in accordance with InvIT regulations

- A. List of one-time sanctions/approvals which are obtained or pending:
As represented by the management, the list of sanctions/ approvals obtained till 30th March 2021 is provided in **Appendix 3**.
- B. List of up to date/ overdue periodic clearances:
As represented by the management, all other material permits, registrations, licenses, approvals, consents and other authorizations (collectively, "Governmental Licenses") shall be obtained as per individual project requirement once NHIPPL is purchased by the Trust and the rights and obligations are assumed. NHIPPL would in due course and as required under applicable law procure all the Governmental Licenses issued by, and shall make all material declarations and filings with, the applicable Governmental Authority to own, lease, license, operate and use its properties and assets and to conduct the business by NHIPPL, as described in the Draft Placement Memorandum and as will be described in the Placement Memorandum and the Final Placement Memorandum. No notice of proceedings has been received relating to the revocation or modification of any Governmental Licenses, except as would not result in a Material Adverse Change. The general list of Governmental Licenses is enclosed in **Appendix 4**.
- C. Estimates of already carried out as well as proposed major repairs and improvements along with estimated time of completion:

Historical Major Maintenance Expenses (INR Cr): Not Applicable



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Forecasted Major Maintenance Expenses (INR Cr):

Particulars for the year/ period ended	31-Mar-22	31-Mar-23	31-Mar-24	31-Mar-25	31-Mar-26	31-Mar-27	31-Mar-28	31-Mar-29
No of Months	12	12	12	12	12	12	12	12
Major Maintenance Expenses	-	-	-	46.81	-	-	-	22.48

Particulars for the year/ period ended	31 Mar-30	31 Mar-31	31 Mar-32	31 Mar-33	31 Mar-34	31 Mar-35	31-Mar-36
No of Months	12	12	12	12	12	12	12
Major Maintenance Expenses	-	45.12	-	-	-	31.20	-

Particulars for the year/ period ended	31 Mar-37	31 Mar-38	31 Mar-39	31 Mar-40	31 Mar-41	31 Mar-42	31-Mar-43
No of Months	12	12	12	12	12	12	12
Major Maintenance Expenses	55.46	-	-	-	33.97	-	68.18

Particulars for the year/ period ended	31 Mar-44	31 Mar-45	31 Mar-46	31 Mar-47	31 Mar-48	31 Mar-49	31-Mar-50	31-Mar-51
No of Months	12	12	12	12	12	12	12	12
Major Maintenance Expenses	-	-	-	47.39	-	83.81	-	-

Source: Management information

- D. On-going material litigations including tax disputes and claims in relation to the assets, if any;
As represented by the Management, there are no litigations pending as at 30th March 2021.
- E. Revenue pendencies including local authority taxes associated with InvIT asset and compounding charges, if any
As represented by the Management, there are no revenue pendencies including local authority taxes associated or compounding charges with InvIT asset as at 30th March 2021.
- F. Vulnerability to natural or induced hazards that may not have been covered in town planning building control.
As represented by the Management, any natural or induced hazards would be adequately covered by insurance.
- G. Latest Pictures of the project along with date of physical inspection
Please refer **Appendix 9**.



9. Valuation Conclusion

We have carried out the Enterprise Valuation of the SPV as of 30th March 2021, considering *inter-alia* Traffic Study and Technical Reports of independent consultants, Business plan/ Projected financial statements of the SPV and other information provided by/ on behalf of the Management, industry analysis and other relevant factors.

The outbreak of the Novel Coronavirus ("COVID-19"), declared by the World Health Organization as a "Global Pandemic" on 11th March 2020, has adversely affected the Global and Indian economy. Travel restrictions implemented by many countries has affected the economic activities. Governments have announced various measures to combat COVID 19 pandemic and to support the economic and business activities. The outbreak of COVID 19 Pandemic has led to significantly higher uncertainties in the near to medium term and its impact is evolving. Considering the unprecedented set of circumstances, Valuation analysis is reported on the basis of 'material valuation uncertainty' and accordingly, less certainty and a higher degree of caution should be attached to the Valuation analysis than would normally be the case. It may be noted that the estimated value may change significantly and unexpectedly over a relatively short period of time based on the evolving conditions/ uncertainties on account of COVID 19 pandemic.

Further, the Union Transport and Highway Minister informed the Lok Sabha (the Lower House of the Indian Parliament) on 18th March 2021, that all physical toll booths across the National Highways network will be removed and a GPS-based toll collection system will be rolled out within one year. In light of this announcement made by the Honorable Minister, we have been given to understand by the Management that due to lack of clarity on the implementation plan and related financial information, it is too early and difficult to assess the impact of implementation of GPS-based toll collection system on toll operations and maintenance expenses in future for the respective five projects and therefore, toll operations and maintenance expenses have been projected considering the existing toll collection system involving physical toll booths and FASTag.

The Valuation summary of the SPV as of 30th March 2021, is as follows:

SPV	WACC	Enterprise Value (INR Cr)
National Highways Infra Projects Pvt. Ltd. (NHIPPL)	10.4%	7,362.4



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The Project-wise break-up of SPV's Enterprise Value is as follows:

Project Name	Project EV (INR Cr)	Distribution
Abu Road-Palanpur	1,148.4	15.60%
Abu Road - Swaroopganj	742.9	10.09%
Kothakota Kurnool	1,943.2	26.39%
Belgaum Kagal	2,332.5	31.68%
Chittorgarh-Kota	1,195.3	16.24%
Total	7,362.3	100.00%
Add: Cash	0.1	
Total Enterprise Value	7,362.4	

Note: Note: Project EV has been estimated considering *inter-alia* apportionment of common expenses and income taxes of the SPV to the Specified Projects and may not be representative of the Enterprise Value of each Specified Project on a 'standalone' basis

Sensitivity Analysis

WACC	9.80%	10.00%	10.20%	10.40%	10.60%	10.80%	11.00%
Enterprise Value (INR Cr)	7,936.2	7,738.1	7,546.9	7,362.4	7,184.3	7,012.3	6,846.2



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Appendices



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Appendix 1 - WACC

Particulars		Remarks
Cost of Equity (Ke)		
Risk Free Rate (Rfr)	~ 6.71%	Based on 10-year Zero coupon yield curve for Govt securities as at 30 th March 2021
Equity Market Risk Premium	~ 7.0%	Equity Market equity risk premium is estimated considering inter-alia historical equity market returns over a risk-free rate and forward-looking equity market risk premium estimates. Data sources reviewed generated a range of equity risk premium indications. However, a 7% equity market risk premium was considered reasonable representative of the equity risk premium for India.
Relevered Beta	~ 0.96	Considering <i>inter-alia</i> 5-year monthly beta of comparable companies and debt-to-equity ratio
Additional Risk Premium	1.0%	Considering the company specific risk factors, including, operational nature of the underlying projects, revenue terms (toll), uncertainties due to Covid 19 pandemic, projected performance, etc.
Cost of Equity (Ke)	~ 14.4%	
Cost of Debt (Kd)		
Pre-Tax Cost of Debt (Kd)	~ 8.0%	Considering Management inputs <i>inter-alia</i> the operating nature of the SPV and discussions with the prospective lenders, InvIT/ SPV will be able to borrow at a weighted average interest rate of 8% per annum
Effective tax rate	~ 19.4%	Estimated considering <i>inter-alia</i> tax depreciation/ amortisation policy proposed to be followed by the SPV and corporate income tax rate
Post-Tax Cost of Debt (Kd)	~ 6.5%	
Debt-to-equity Ratio	~ 1.00	Considering <i>inter-alia</i> typical funding pattern for road infrastructure projects and long-term debt equity ratio and permissible leverage under the SEBI InvIT Regulations
WACC	~ 10.43%	
Rounded off WACC	~ 10.40%	



Appendix 2 – Discounted Cash Flow (DCF)

Enterprise Valuation of the SPV

Amount in INR Cr.										
Particulars	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030	FY2031
Revenue	493.4	522.8	566.6	699.0	795.1	866.4	946.0	1,029.4	1,116.3	1,181.6
EBITDA	358.2	399.4	440.4	539.8	623.6	668.2	735.6	804.8	886.8	936.5
Less: IM Expenses	(11.3)	(11.3)	(12.1)	(13.0)	(14.0)	(15.1)	(16.2)	(17.4)	(18.7)	(20.1)
Less: Income Tax	-	-	-	-	-	-	-	-	-	-
Less: MMR Expenses	-	-	-	(46.8)	-	-	(9.4)	(39.7)	(195.6)	(45.1)
Less: Capital Expenditure	(259.9)	(259.9)	-	-	-	-	-	-	-	-
Add/Less: Working Capital	-	-	-	-	-	-	-	-	-	-
Free Cashflows to the Firm ("FCFF")	87.1	128.2	428.2	480.0	609.6	653.1	710.0	747.7	672.5	871.3
Time to Midpoint	0.50	1.50	2.50	3.50	4.50	5.50	6.50	7.50	8.50	9.50
Discount Rate/ PV factor	0.95	0.86	0.78	0.71	0.64	0.58	0.53	0.48	0.43	0.39
10.40%										
PV of FCFF	82.9	110.5	334.3	339.4	390.4	378.9	373.1	355.9	290.0	340.3

Particulars	FY2032	FY2033	FY2034	FY2035	FY2036	FY2037	FY2038	FY2039	FY2040	FY2041
Revenue	1,195.4	1,253.1	1,432.7	1,646.0	1,825.0	1,965.2	2,126.4	2,293.2	2,480.1	2,673.6
EBITDA	952.0	1,008.6	1,161.0	1,305.8	1,460.0	1,574.1	1,695.0	1,797.2	1,924.6	2,087.9
Less: IM Expenses	(21.6)	(23.3)	(25.0)	(26.9)	(28.9)	(31.1)	(33.4)	(35.9)	(38.6)	(41.5)
Less: Income Tax	-	(56.0)	(271.6)	(286.7)	(348.0)	(371.0)	(398.1)	(390.3)	(452.0)	(487.5)
Less: MMR Expenses	-	-	-	(100.6)	(23.6)	(55.5)	(75.6)	(213.6)	(97.3)	(119.2)
Less: Capital Expenditure	-	-	-	-	-	-	-	-	-	-
Add/Less: Working Capital	-	-	-	-	-	-	-	-	-	-
FCFF	930.4	929.4	864.5	891.7	1,059.5	1,116.5	1,187.8	1,157.4	1,336.7	1,439.6
Time to Midpoint	10.50	11.50	12.50	13.50	14.50	15.50	16.50	17.50	18.50	19.50
Discount Rate/ PV factor	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16	0.15
10.40%										
PV of FCFF	329.1	297.8	250.9	234.4	252.3	240.8	232.1	204.8	214.3	209.0

Particulars	FY2042	FY2043	FY2044	FY2045	FY2046	FY2047	FY2048	FY2049	FY2050	FY2051
Revenue	2,889.4	3,112.5	3,356.0	3,602.8	3,883.2	4,182.8	4,511.3	4,842.4	5,202.0	5,586.0
EBITDA	2,251.3	2,454.3	2,651.7	2,862.2	3,096.3	3,325.3	3,604.2	3,885.8	4,183.8	4,501.9
Less: IM Expenses	(44.6)	(47.9)	(51.5)	(55.4)	(59.6)	(64.0)	(68.8)	(74.0)	(79.5)	(85.5)
Less: Income Tax	(549.9)	(592.3)	(636.4)	(644.4)	(739.5)	(790.2)	(889.4)	(948.0)	(1,013.6)	(1,040.4)
Less: MMR Expenses	(33.6)	(68.2)	(90.6)	(269.4)	(125.1)	(152.2)	(35.7)	(83.8)	(120.2)	(331.1)
Less: Capital Expenditure	-	-	-	-	-	-	-	-	-	-
Add/Less: Working Capital	-	-	-	-	-	-	-	-	-	-
FCFF	1,623.2	1,745.9	1,873.3	1,893.0	2,172.1	2,318.9	2,610.3	2,780.0	2,970.5	3,044.9
Time to Midpoint	20.50	21.50	22.50	23.50	24.50	25.50	26.50	27.50	28.50	29.50
Discount Rate/ PV factor	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.05
10.40%										
PV of FCFF	213.5	208.0	202.2	185.0	192.3	186.0	189.6	182.9	177.0	164.4
Present Value of FCFF	7,362.3									
Add: Cash	0.1									
Enterprise Value	7,362.4									



Project-wise break-up of SPV's Free Cash Flow to Firm #

Particulars	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030	FY2031
Free Cash Flow to Firm (FCFF)										
Abu Road - Palanpur	35.0	49.2	79.5	75.8	84.6	91.1	102.8	108.4	73.3	133.0
Abu Road – Swaroopganj	13.1	19.1	52.9	49.7	55.0	60.4	58.4	74.8	81.9	72.1
Kothakota - Kurnool	(8.0)	19.5	149.1	163.5	179.4	185.8	196.7	202.3	97.1	252.7
Belgaum - Kagal	79.6	70.2	75.4	155.4	200.0	218.1	236.3	255.7	276.0	299.6
Chittorgarh - Kota	(32.6)	(29.8)	71.4	35.6	90.5	97.7	115.7	106.4	144.2	113.9
SPV	87.1	128.2	428.2	480.0	609.6	653.1	710.0	747.7	672.5	871.3

Present Value of FCFF @ 10.40%

Abu Road - Palanpur	33.3	42.4	62.1	53.6	54.2	52.9	54.0	51.6	31.6	51.9
Abu Road – Swaroopganj	12.4	16.5	41.3	35.2	35.2	35.0	30.7	35.6	35.3	28.2
Kothakota - Kurnool	(7.6)	16.8	116.4	115.6	114.9	107.8	103.4	96.3	41.9	98.7
Belgaum - Kagal	75.8	60.5	58.8	109.9	128.1	126.6	124.2	121.7	119.0	117.0
Chittorgarh - Kota	(31.0)	(25.7)	55.7	25.2	58.0	56.7	60.8	50.7	62.2	44.5

Particulars	FY2032	FY2033	FY2034	FY2035	FY2036	FY2037	FY2038	FY2039	FY2040	FY2041
Free Cash Flow to Firm (FCFF)										
Abu Road - Palanpur	145.1	117.2	98.6	128.9	167.9	181.0	196.5	210.9	144.3	232.1
Abu Road – Swaroopganj	75.1	92.2	97.0	104.3	114.6	122.9	65.3	130.4	140.5	154.4
Kothakota - Kurnool	216.9	211.4	221.6	279.4	302.4	323.9	349.7	193.6	377.0	407.6
Belgaum - Kagal	322.6	327.3	285.8	225.9	282.9	322.4	347.4	372.5	402.6	376.7
Chittorgarh - Kota	170.7	181.4	161.6	153.2	191.6	166.3	229.0	250.0	272.3	268.8
SPV	930.4	929.4	864.5	891.7	1,059.5	1,116.5	1,187.8	1,157.4	1,336.7	1,439.6

Present Value of FCFF @ 10.40%

Abu Road - Palanpur	51.3	37.6	28.6	33.9	40.0	39.0	38.4	37.3	23.1	33.7
Abu Road – Swaroopganj	26.6	29.5	28.1	27.4	27.3	26.5	12.8	23.1	22.5	22.4
Kothakota - Kurnool	76.7	67.7	64.3	73.5	72.0	69.9	68.3	34.3	60.4	59.2
Belgaum - Kagal	114.1	104.9	83.0	59.4	67.4	69.6	67.9	65.9	64.5	54.7
Chittorgarh - Kota	60.4	58.1	46.9	40.3	45.6	35.9	44.7	44.3	43.6	39.0



Particulars	FY2042	FY2043	FY2044	FY2045	FY2046	FY2047	FY2048	FY2049	FY2050	FY2051
Free Cash Flow to Firm (FCFF)										
Abu Road - Palanpur	251.6	275.5	298.7	322.0	260.7	376.7	410.3	439.1	477.4	513.6
Abu Road – Swaroopganj	167.1	181.4	134.5	215.2	233.4	246.6	272.5	294.5	233.1	343.2
Kothakota - Kurnool	439.3	475.8	516.9	361.7	599.0	645.4	693.2	752.5	808.9	634.3
Belgaum - Kagal	446.6	509.2	540.0	579.5	629.4	605.3	705.1	783.2	834.6	900.5
Chittorgarh - Kota	318.6	304.0	383.3	414.5	449.6	444.9	529.2	510.6	616.4	653.2
SPV	1,623.2	1,745.9	1,873.3	1,893.0	2,172.1	2,318.9	2,610.3	2,780.0	2,970.5	3,044.9
Present Value of FCFF @ 10.40%										
Abu Road - Palanpur	33.1	32.8	32.2	31.5	23.1	30.2	29.8	28.9	28.5	27.7
Abu Road – Swaroopganj	22.0	21.6	14.5	21.0	20.7	19.8	19.8	19.4	13.9	18.5
Kothakota - Kurnool	57.8	56.7	55.8	35.4	53.0	51.8	50.4	49.5	48.2	34.2
Belgaum - Kagal	58.7	60.7	58.3	56.6	55.7	48.5	51.2	51.5	49.7	48.6
Chittorgarh - Kota	41.9	36.2	41.4	40.5	39.8	35.7	38.4	33.6	36.7	35.3

Project-wise FCFF has been estimated considering inter-alia apportionment of common expenses and income taxes of the SPV to the Specified Projects and may not be representative of the FCFF of each Specified Project on a 'standalone' basis



Appendix 3 – List of one-time sanctions/approvals

Abu Road (Rajasthan) to Swaroopganj (Rajasthan)

- Environmental clearance dated April 17, 2006 issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Palanpur to Swaroopganj section for rehabilitation and upgrading of existing NH-14 from 264.00 km to 340.00 km and NH-76 from 0/000 to 110/000 undertaken by NHAI.

Kothakota Bypass (Telangana) to Kurnool (Andhra Pradesh)

- Environmental clearance dated May 19, 2006, issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Kothakota to Kurnool section for upgrading of existing two lane to four lane divided carriageway configuration of NH-7 from 135.469 km to 211.000 km undertaken by NHAI.

Belgaum (Karnataka) to Kagal (Karnataka)

- Environmental clearance dated May 14, 2002 issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Belgaum Maharashtra Border for four laning and strengthening of NH-4 515 km to 592 km undertaken by NHAI.

Chittorgarh (Rajasthan) to Kota (Rajasthan)

- Environmental clearance dated February 2, 2006 issued by the IA-III Division, Ministry of Environment and Forests, Government of India in respect of Chittorgarh to Kota in Rajasthan section for upgrading of NH-76 of east west corridors undertaken by NHAI.

Source: Management information



Appendix 4 – List of Governmental Licenses

S. No.	Statutory Permission
1	Environmental Clearance
2	Forest Clearance
3	Tree Cutting permission
4	Borrow Area permission from state & local panchayat office
5	Boulder Extraction permission from state & local panchayat office
6	Quarry permission
7	Drilling & Blasting -Explosive License & permissing
8	Permission from State to draw Ground Water from river / reservoir
9	Factory License for Camp Set up
10	Shop & Establishment License for Setting up of Office other than Camp
11	Labour License
12	Inspector of Factories- For Setting up of Crusher, Batching Plant and HMP (CTE)
13	Inspector of Factories & Local Panchayat- For Consent to Operate- Crusher, Batching Plant and HMP (CTO)
14	CPCB permission for Batching plant, HMP and Crusher Set up
15	CPCB Permission/ State permission for using DG sets in camp and Construction projects
16	Approval /permission from Utility Shifting Agency- Electricity, Gas, Water pipelines for Excavations & elevated structure erection
17	Approval of Railways for ROB / RUB Construction
18	RTO permission to Operate and Run Construction equipments (movable) which does not have registration
19	Other any, as per local body/ state

Source: Management information



Appendix 5 – PLN-ABU: Latest Pictures of the project

Khemana Toll Plaza



Khemana Toll - Charges



Khemana Toll Office



Palanpur to Abu Road Stretch



Appendix 6 – ABU-SWA: Latest Pictures of the project

Undavariya Toll Plaza



Undavariya Toll - Charges



Undavariya Toll Office



Abu Road to Swaroopgunj Stretch



Appendix 7 – KOT-KUR: Latest Pictures of the project

Pullur Toll Plaza



Pullur Toll Plaza



Kothakota Kurnool Toll Road



Kothakota Kurnool Toll Road



Appendix 8 – BEL-KAG: Latest Pictures of the project

Hattargi Toll Plaza

Hattargi Toll Plaza



Hattargi Toll Road



Hattargi Toll Road



Hattargi Toll Road



Kognoli Toll Plaza

Kognoli Toll Plaza



Kognoli Toll Plaza



Kognoli Toll Road



Kognoli Toll Road



Appendix 9 – CHT-KOT: Latest Pictures of the project
Dhaneshwar Toll Plaza

Dhaneshwar Toll Plaza



Dhaneshwar Toll Office



Dhaneshwar Toll Road



Chittorgarh to Kota Stretch



Aroli Toll Plaza

Aroli Toll Plaza



Aroli Toll - Charges



Aroli Toll Plaza



Aroli Toll Road



Aroli Toll Plaza (Contd.)

Repairing Work at Chittorgarh to Kota Stretch



Repairing Work at Chittorgarh to Kota Stretch



Bassi Toll Plaza

Bassi Toll Plaza



Bassi Toll Office



Bassi Toll Road



Bassi Toll Road



ANNEXURE B

TECHNICAL CONSULTANT REPORTS

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Ref. No.: TYP SA-AVANZA/TOT/2020-21/1548

Date: 26.03.2021

To,
Shri R. K. Rathee
General Manager (T)
InvIT
National Highways Authority of India (NHAI)
G-5& G-6, Sector-10, Dwarka, New Delhi-110075

Subject: Technical Due Diligence of the National Highway stretches viz:(1)Abu road – Swaroopganj, (2)Chittorgarh – Kota & Chittorgarh Bypass, (3)Palanpur / Khemana – Abu road, (4)Kothakota Bypass – Kurnool and (5)Maharashtra/Karnataka Border (Kagal) to Belgaum in the States of Rajasthan, Gujarat, Karnataka and Telangana.

Reg: Submission of final report for stretch Palanpur / Khemana – Abu road.

Dear Sir,

Reference to above subject please find enclosed final report dated March 21 of **Palanpur / Khemana – Abu road stretch** along with Annexes as mentioned below

Annexure A (survey data 2018)
Annexure B (data provided by Authority)
Annexure C (cost estimates)
Topo survey map
Drone video

For TYP SA Avanza Joint Venture



Authorized Signatory

Enclosed- Annexure A
Annexure B
Annexure C
Topo survey map
Drone video



■ QUALITY CONTROL SHEET

DOCUMENT	Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana – Abu Road		
PROJECT	Preparation of report on physical condition of the National Highways on Roads Asset Under (the National Highways Infra Trust)		
CODE	IM4663-FR-STRETCH_3(Main Volume)		
AUTHOR	INITIALS	NKS	
	DATE	March - 2021	
VERIFIED	INITIALS	AB	
	DATE	March - 2021	
RECIPIENT	National Highways Authority of India		
NOTES			
TECHNICAL CONSULTANT	Tecnica Y Proyectos, S.A (TYPSA) In JV with AVANZA Engineering Pvt. Ltd. D-75 VASHALI NAGAR JAIPUR (RAJ.), 302021 TEL NO. – 0141 - 4022513		



PREPARATION OF REPORT ON PHYSICAL CONDITION OF
THE NATIONAL HIGHWAYS ON ROADS UNDER (InvIT) MODEL

Technical Due Diligence Report of NH27 (NH14) –
Palanpur/Khemana – Abu Road



This report may be reproduced and included in the draft placement memorandum, placement memorandum, final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust, and may be made available for inspection in the manner specified therein.

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ABBREVIATIONS

■ a1	Structural Coefficient for BC Layer (AASHTO and HDM-4)
■ a2	Structural Coefficient for DBM Layer (AASHTO and HDM-4)
■ AADT	Annual Average Daily Traffic
■ AASHTO	American Association of State Highway and Transportation Officials
■ ACRA	Total area of carriageway cracked
■ ACW	Wide Structural Cracking
■ ADT	Average Daily Traffic
■ FWD	Falling Weight Deflectometer
■ GOI	Government of India
■ GQ	Golden Quadrilateral
■ HDM	Highway Development and Maintenance Management Sstem
■ IRC	Indian Roads Congress
■ IRI	International Roughness Index
■ InvIT	Infrastructure Investment Trust
■ JV	JV Between TYPSA and AVANZA. The Consortium
■ LiDAR	Light Detection and Ranging
■ MBIU	Mobile Bridge Inspection Unit
■ MORTH	Ministry of Road Transport and Highways
■ MSA	Millions of Standard Axle (8,2 ton) (AASHTO and HDM-4)
■ NHAI	National Highways Authority of India
■ NHDP	National Highways Development Project
■ NSV	Network Survey Vehicle
■ Old BT Thickness	Old Bituminous Thickness (AASHTO and HDM-4)
■ P ₀	Initial serviceability
■ PIA	Project Influence Area
■ P _t	Terminal serviceability index
■ ROW	Right of Way
■ SFC	Side Friction Coefficient
■ SN	Structural Number (AASHTO and HDM-4)
■ SNP	Adjusted Structural Number
■ ToR	Terms of Reference
■ TOT	Toll Operate and Transfer

EXECUTIVE SUMMARY

1 INTRODUCTION

National Highways Authority of India (NHAI), an autonomous agency of the Government of India (GoI), is responsible for the development, maintenance and management of National highways network in India.

There are currently approximately 1,32,500 kilometers of national highways in India, constituting approximately 2.2% of India's entire road network but carrying approximately 40% of total road traffic.

To meet the growing need for further industrialization and development of the country, GoI has planned to expand the network of National Highways across the length and width of the country at a rapid pace. The various programmes which have been taken by GoI through NHAI are:

Phase I: **Golden Quadrilateral (GQ)** Comprising 4/6-laning of National Highways connecting four metro cities, namely, Delhi, Mumbai, Chennai and Kolkata with a total length of approximately 5846 km (which is mostly complete), and

Phase II: **North-South and East-West Corridors (NSEW)** comprising 4/6-laning of National Highways connecting Srinagar to Kanyakumari and Silchar to Porbandar. Total length this NSEW corridor is approximately 7300 km. The projects of NSEW are mostly awarded and construction is also largely complete.

Bharatmala Pariyojana: A flagship highway development programme which envisions the development of 50 economic corridors, provide connectivity to 550 districts in the country through National Highway linkages and improve the average speed of road travel in India.

In addition to this, various NHDP programs has been taken up by NHAI to match the rapid pace of modernization and industrial development of the country. The Government has planned to continue developing the National Highways at a rapid pace, which will require significant funding in the near future.

The National Highways Authority of India (NHAI) has initiated the process of setting up an infrastructure investment trust (InvIT) to monetize its road assets. This will be a private listed InvIT, through which institutional investors may invest in operational road projects offered by NHAI to the InvIT. In this model, the offered road assets are acquired by the InvIT while the investors acquire the units issued by the InvIT. Income generated from the underlying road assets would be paid out as distributions to the unit holders in the form of interest, dividend and return of capital. The InvIT would be managed by a competent Investment Manager staffed with experts to manage the assets efficiently.

Under the InvIT frame work, the right of collection of user fees of selected NH projects is proposed to be assigned for a specific time period to a Concessionaire. During this period, the O&M responsibility will also vest with the selected Concessionaire (unless costs are to be borne by existing concessionaires as per extant agreements). In return, the Concessionaire will pay an upfront quoted Concession Fee to NHAI.

Roads under InvIT include the following 5 stretches:

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
1	Abu Road - Swaroopganj	31.000	Undavariya	646.000	677.000
2	Chittorgarh - Kota & Chittorgarh Bypass	160.500	Bassi	891.929	1052.429
			Aroli		
			Dhaneshwar		

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
3	Palanpur / Khemana - Abu Road	45.000	Khemana	601.000	646.000
4	Kothakota Bypass - Kurnool	74.622	Pullur	135.469	211.000
5	Maharashtra Karnataka Border - Belgaum	77.705	Hattargi Kognoli	515.000	592.705

In order to assist potential investors in their evaluation, NHAI has requested for the preparation of a detailed report of inventory & physical condition of the highway, to be conducted through a selected consultant(s).

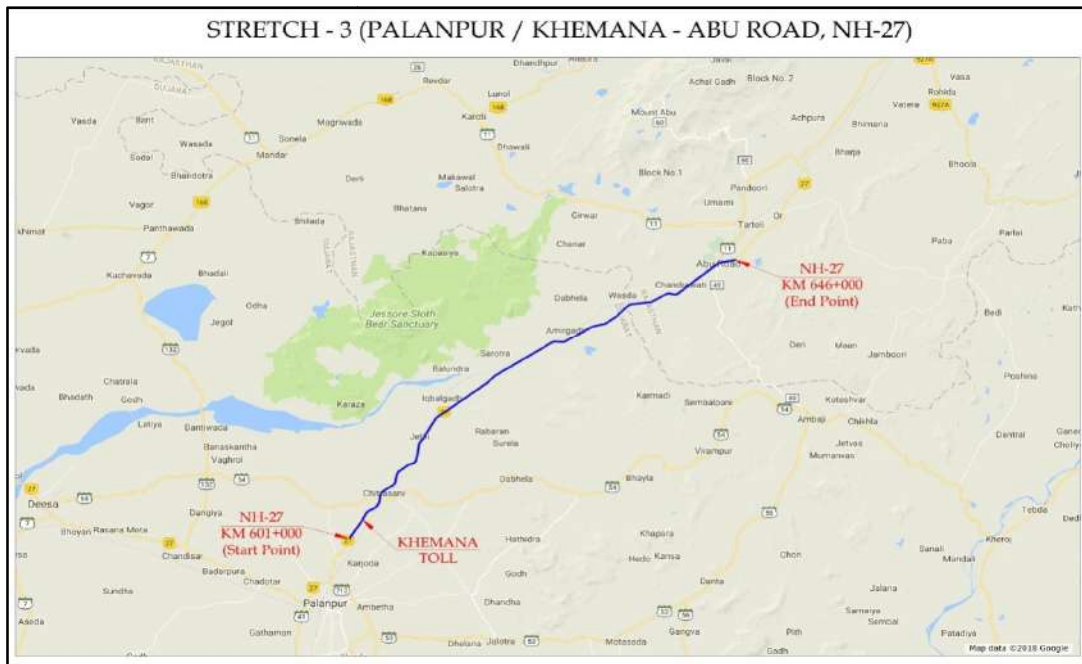
[TYPSA in a JV with Avanza Engineering Pvt. Ltd. have been appointed as the selected consultant for preparation of the aforesaid report]

2. STUDY OBJECTIVE

The general scope of the service is given in the sections that follow. However the entire scope of services would, inter-alia, include the items mentioned in the letter of invitation and the TOR. The consultant is responsible to make suitable proposals for improvement of the existing road and strengthening of pavement, as required and at the appropriate time to maintain the level of service over the design period. The consultant will prepare a report for each road asset.

The Consultant has conducted study for the possible location of a new toll plaza, if required. The local and slow traffic needing segregation from the main traffic was identified and provision of service and slip roads has been recommended, wherever necessary to improve efficiency and safety.

All the technical and maintenance schedules have been prepared as required by NHAI under the items mentioned in the letter of invitation and the TOR.



3. PROJECT STRETCH

Project Stretch starts from km 601.000 of NH27 at Palanpur in the State of Gujarat and ends at km 646.000 of NH27 at Abu Road in the State of Rajasthan. The length of Project Stretch is 45.00 km and has 4-lane configuration with toll plaza at Khemana.

This project stretch has been constructed under (BOT) annuity scheme and last annuity payment is due on 24/03/2024. Up to this date, the road will be maintained by the BOT Contractor, M/s L&T Infrastructure.

Various investigations were carried out for assessing physical condition of the Project Stretch. List of all investigations and its schedule is presented in table below:

Stretch - 3 (Palanpur / Khemana - Abu Road)			
S.No	Type of Investigations		Location
1	Traffic Surveys	TVC Survey	Khemana Toll Plaza
		OD Survey	
		Axle Load Survey	
2	Topographical Survey through LiDAR		Entire Stretch
3	NSV		Entire Stretch
4	FWD		Locations are mentioned in Ch. 4
5	Pavement	Test Pits	Locations are mentioned in Ch. 4
	Material Testing	Core Cutting	Locations are mentioned in Ch. 4
		DCPT	Locations are mentioned in Ch. 4
		Borrow Area Inventory	Locations are mentioned in Ch. 8
6	Structural Investigations	Visual Inspection	All Structures
		NDT	Distressed structures cited in Ch. 5
7	Road Safety Audit		Entire Stretch
8	Toll Plaza Audit		Khemana Toll Plaza

4. TRAFFIC STUDY

4.1. AVERAGE DAILY TRAFFIC AND AVERAGE ANNUAL DAILY TRAFFIC

TVC survey was carried out in the month of November 2020 with video recording in both directions of traffic movement for seven continuous days.

Based on these surveys ADT and AADT has been calculated using seasonal factors as per clause 6.2 of IRC-SP-19.

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
2 Wheeler	3,248	3,248	1,624
3 Wheeler	121	121	121
Passenger Car	7,376	7,376	7,376
Mini LCV	315	315	315

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
Mini Bus	36	36	54
Standard Bus	420	420	1,260
LCV -4 Tyre	18	18	18
LCV - 6 Tyre	61	61	92
2 - Axle trucks	776	776	2,328
3 - Axle trucks	1,125	1,125	3,375
MAV (4 - 6)	4,659	4,659	20,966
Oversized vehicles >6	258	258	1,161
HCM/EME	0	0	0
Tractors	18	18	27
Tractor with Trailer	74	74	333
Cycles	28	28	28
Cycles rickshaw	309	309	618
Animal Cart	19	19	76
Hand Cart	8	8	64
Exempted vehicles	10	10	20
Total Tollable	15,044	15,044	36,944
Total	18,879	18,879	39,855

4.2. O-D SURVEY

O-D survey was conducted for 24 Hrs on a working day at proposed locations by road side interview method using sampling of vehicles passing the stretch. During O-D survey information like trip origin, destination, location of origin and destination from toll plazas and frequency of route was derived, in addition to this, other information like purpose of trip, occupancy of passenger trip, local commodity movement etc were also collected. The findings of O-D survey are used to establish discounts as per concession agreement and to outline project influence area (PIA).

S. No.	Zones of Influence	Passenger	Goods
1	Swaroopganj side	21.3%	17.9%
2	Abu, Aburoad	26.0%	3.5%
3	Palanpur	23.7%	12.8%
4	Ahmedabad	0.0%	9.5%
5	Rest of Gujarat	3.9%	18.2%
6	Udaipur, Kota, Chittorgarh side	2.1%	6.8%
7	Jodhpur, Falna side of Rajasthan	6.3%	7.3%
8	Rest of Rajasthan	15.0%	14.1%
9	MP, UP, Bihar, WB, Jharkhand, Odisha	0.3%	3.5%
10	Delhi, Punjab, Haryana, Himachal, J&K	0.9%	5.7%

S. No.	Zones of Influence	Passenger	Goods
11	Maharashtra and South India	0.6%	0.5%

4.3. TOLL TRAFFIC SEGMENTATION

Toll traffic segmentation as reported by Toll Plaza Management is tabulated below:

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commercial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
No. of Monthly Passes	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
All types of Single Entry	58.8%	79.9%	83.0%	81.2%	96.1%	76.1%
Multiple Entry	2.4%	8.8%	12.1%	8.2%	2.3%	17.4%
Reuse of Multiple Entry Ticket	0.1%	0.3%	0.1%	0.0%	0.0%	0.0%
Reuse of Monthly Passes	2.8%	0.0%	0.1%	0.0%	0.0%	0.0%
Concession Entry	0.5%	2.7%	2.5%	2.9%	0.9%	4.4%
Exempted	35.4%	8.3%	2.2%	7.7%	0.6%	2.1%

4.4. TRAFFIC GROWTH RATES

Traffic growth rates for the study, to be used subsequently for forecasting traffic on the Project Stretch, have been estimated by adopting the Elasticity of Transport Demand method as stipulated in IRC 108, which is a proven and therefore most commonly used technique in India. The method relies on the correlation between:

- Past trends in traffic growth on the Project Stretch / Traffic passing through Toll Plazas,
- Vehicle registration in the area of influence.
- Time series data on Net/Gross State Domestic Product (NSDP or GSDP) for project influence area.

Based on moderated elasticity values and the projected economic indicators (India GDP), the future average annual compound traffic growth rates by vehicle type have been thus estimated and recommended for normal conditions.

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.77%	2.90%	2.80%	3.89%	3.39%	2.90%	2.48%	2.12%	1.81%
Bus	0.00%	4.42%	4.63%	4.47%	6.20%	5.41%	4.62%	3.95%	3.38%	2.89%
LCV	0.00%	4.24%	4.44%	4.28%	5.94%	5.18%	4.43%	3.79%	3.24%	2.77%
2 AT	0.00%	-1.03%	-1.08%	-1.04%	-1.45%	-1.54%	-1.61%	-1.68%	-1.76%	-1.84%
3 AT	0.00%	-1.15%	-1.20%	-1.16%	-1.61%	-1.71%	-1.79%	-1.87%	-1.95%	-2.04%
MAV	0.00%	5.18%	5.43%	5.24%	7.27%	6.34%	5.42%	4.63%	3.96%	3.39%

The construction of Mumbai-Delhi Railway Freight Corridor is in progress and expected to be operational by year 2025. Due to this corridor operation, a partial reduction in the traffic of heavy commercial vehicles

(trucks and MAVs) is expected. Based on the corporate plan report(DFCC) this reduction will be applied as follows Traffic projections for Tollable Vehicles on AADT basis:

Tollable traffic		
Year	Total vehicle	Total PCU
2020	15,028	36,871
2025	16,619	38,040
2030	18,987	38,646
2035	24,528	50,788
2040	31,089	65,563
2045	38,628	82,959
2050	47,018	102,746

As per the Model Concession Agreement for InvIT Roads, NHAI may undertake or cause to undertake the process for capacity augmentation of the Project Stretch to 6/8-lane configuration in case that the average daily tollable traffic in any accounting year exceeds the designed capacity of 40,000 PCUs for Project Stretch and continues to exceed the designed capacity for three consecutive accounting years, and until the Level of Service C of the highway is reached, 60,000 PCU. According to the estimated traffic projections, the Authority could undertake the process for capacity augmentation of this project stretch at anytime from 2031 to 2039, when the level of service C is reached, and the construction period for capacity augmentation can be assumed to be 2.0 years.

4.5. AXLE LOAD SURVEY AND CALCULATION VDF

Axle load survey in both directions has been carried out at all three toll plazas 2 normal days (48hrs) using axle load. Methodology and procedure stipulated in IRC 37 has been followed.

VDF has been computed for various categories of commercial vehicles and presented is below.

Type	Palanpur to Abu Road	Abu Road to Palanpur
LCV	1.167	0.339
2A	1.275	1.117
3A	3.231	3.753
4A	5.047	8.730
5A	8.170	7.379
6A	8.923	8.879

5. DETAILED ROAD INVENTORY

Detailed inventory of Project Stretch is captured through NSV, LiDAR and field reconnaissance. Salient features like built-up settlements, carriageway dimensions, surface type, junctions, service roads, road furniture etc. are recorded for entire Project Stretch. Overview of summarized road inventory is presented in table below.

S.No.	Description	Details
1	Project Stretch	Palanpur / Khemana - Abu Road

S.No.	Description	Details	
2	Length of Project Stretch (in km)	45.000 Km	
3	Road Type (length in km)	BT	45.000 km
		CC	-
4	Length of Urban Section (in km)	10.426 Km	
5	Length of Slip/Service Road (in km)	LHS	11.580 km
		RHS	11.010 km
6	No. of Bypasses	NIL	
7	No. of Major Junctions	06	
8	No. of Minor Junctions	19	
9	No. of Major Bridges	04	
10	No. of Minor Bridges	14	
11	Culverts	73	
	No. of Slab Culverts	00	
	No. of Pipe Culverts	43	
	No. of Box Culverts	30	
12	No. of Flyovers	01	
13	No. of ROBs	01	
14	No. of Tunnels	Nil	
15	No. of RUBs	Nil	
16	No. of Vehicular Underpasses	06	
17	No. of Pedestrian Cattle Underpasses	01	
18	No. of Toll Plazas	01	
19	No. of Bus Bays/Bus Shelter	RHS-06& LHS-05	
20	No. of Truck Lay Bys	01	
21	No. of Toilet Blocks	RHS-01 & LHS-01	
22	No. of Way Side Amenities	Nil	

6. REVIEW OF PAVEMENTS

The existing pavement along the entire project is flexible except for the rigid pavement at Khemana Toll Plaza; and the project road has four lanes with paved shoulder.

It should be noticed that this project road is under a BOT (Annuity) Contract with tenure up to 24/03/2024; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road.

Field Survey for Surface Distress and Riding Quality was carried out using Network Survey Vehicle (NSV). NSV is a highly-specialized survey Vehicle designed and developed for in time assessment of Pavement Surface Condition by getting information with respect to distress type and its severity.

NSV is equipped with a fully integrated data collection system obtained from a Multi-Laser Profiler, Digital Imaging System and Video camera unit whose outputs are all linked via a highly accurate distance measuring instrument and this data is later processed with the help of adequate software applications to get for rutting, raveling, roughness (IRI), cracking etc; and subsequently many of this data was used to calculate the Pavement Condition Index (PCI) values.

Roughness and Rutting of pavement are measured using a Digital Laser Profiler (DLP), integrated into the NSV.

The profiler is capable of measuring:

- Pavement Roughness (one laser in each wheel path and centre)
- Rutting (full transverse pavement measurement)

Roughness and Rutting are two of the most important quality parameters of pavement describing its riding quality and durability and are very significant in gaining negative or positive feedback from road users.

PCI provides a numerical rating for the condition of road segments within the road network, where 0 is the worst possible condition and 100 is the best possible condition as per ASTM.

6.1. PAVEMENT CONDITION INDEX (PCI)

Regular monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI can also provide feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.

In this project, the PCI is calculated as per the international guidelines provided in ASTM-D6433. For different pavement condition, according to ASTM-D6433, PCI values are presented in the following table.

PCI condition details length wise for both directions is given in tables below:

Condition	PCI Range	Length LHS Outer (km)	PCI %	Length LHS Inner (km)	PCI %
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	2	4	14	31
Fair	55 - 70	35	78	20	44
Poor	40 - 55	7	16	10	22
Very Poor	25 - 40	1	2	1	2
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Condition	PCI Range	Length RHS Outer (km)	PCI %	Length RHS Inner (km)	PCI %
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	7	15	1	2
Fair	55 - 70	34	76	29	63
Poor	40 - 55	4	9	12	26
Very Poor	25 - 40	0	0	4	9
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

6.2. INTERNATIONAL ROUGHNESS INDEX (IRI)

The National Highway Authority of India (NHAI), via letter no. 11041/218/2007 –Admn. Dated 03.11.2009 on POLICY MATTERS –TECHNICAL (37/2009) has approved the use of Laser Profiling devices for NHAI works. Consequently, IRI measurement has been progressively introduced in India. IRI correlation with BI values can be calculated by the following formula:

$$BI = 630 \cdot (IRI)^{1.12}$$

Where:

BI: Bump Integrator Roughness or Unevenness Index (mm/km).

IRI: International Roughness Index.

The following tables show roughness in outer and inner lane for both directions. It is observed that roughness index is lower in outer lane as compared to inner lane in both directions.

Condition	Range	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	IRI < 2.8	39	87	25	56
Fair	2.8 - 4.0	6	13	19	42
Poor	IRI > 4.0	0	0	1	2

Condition	Range	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	IRI < 2.8	41	91	29	63
Fair	2.8 - 4.0	4	9	16	37
Poor	IRI > 4.0	0	0	0	0

6.3. RUTTING

Rutting is one of the important factors which determine the functional performance of pavement. Rutting is characterized by permanent deformation of the pavement in wheel path due to heavy load vehicles. It is one of the main modes of failure in asphalt mixes.

Rutting condition details length wise for both directions are given in table below.

Condition	Rut Depth	Length LHS	Percentage	Length LHS	Percentage
-----------	-----------	------------	------------	------------	------------

	Range (mm)	Outer (km)	LHS Outer (%)	Inner (km)	LHS Inner (%)
Good	< 5	0	0	11	24
Fair	5 - 10	21	47	30	67
Poor	> 10	24	53	4	9

Condition	Rut Depth Range (mm)	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	< 5	8	18	0	0
Fair	5 - 10	36	80	13	28
Poor	> 10	1	2	32	72

6.4. ESTIMATED DESIGN TRAFFIC

The design traffic is calculated in terms of the cumulative number of standard axles in the two directions of the carriageway during the design life of the road. The estimated cumulative design traffic (In Million Standard Axles, MSA) considering estimated traffic and VDF parameters is presented in the figure below.

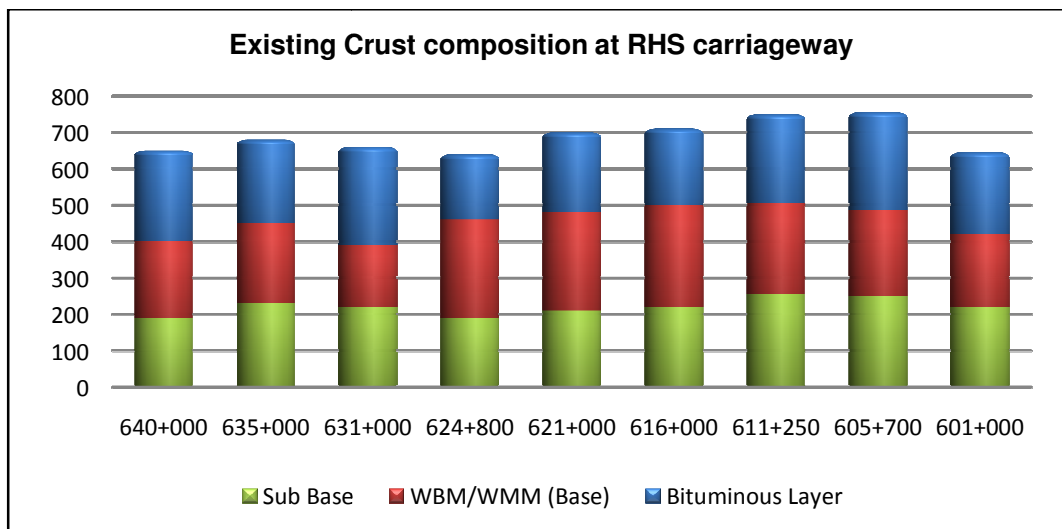
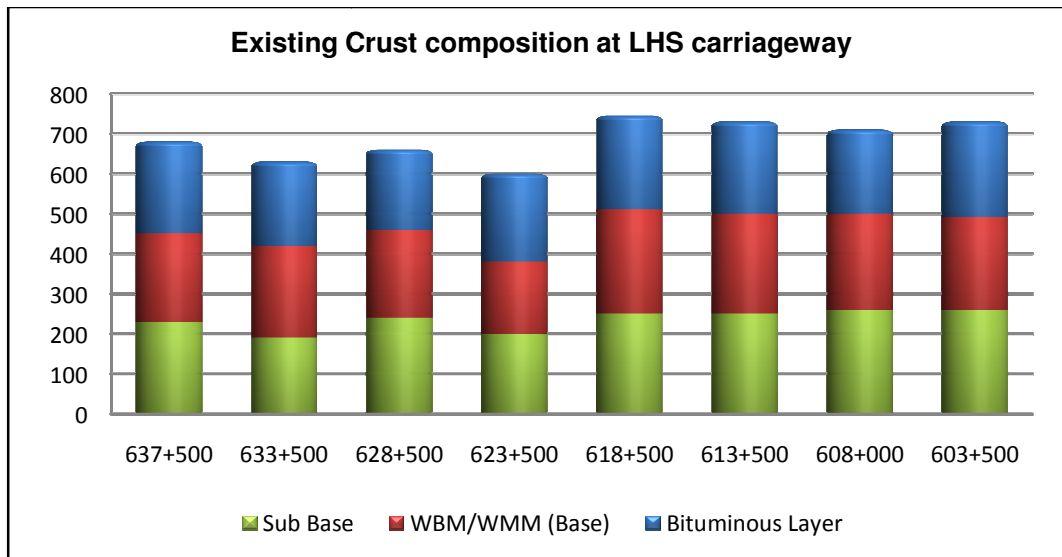
Section	Traffic in year (i.e. 2020)	10 years (i.e. 2030)	20 years (i.e. 2040)	30 years (i.e. 2050)
I : Palanpur - Abu road LHS	5.7	66.3	149.9	231.4
I : Palanpur - Abu road RHS	7.8	96.0	227.5	358.2

As can be observed from above table, the cumulative estimated design traffic in RHS is quite higher than to LHS.

6.5. PAVEMENT CRUST COMPOSITION

Pavements are layered structure comprising of combination of materials. These materials, their associated properties, and their interactions determine properties of the resultant pavement. Therefore, a good understanding of these materials, how they are characterized, and how they perform is fundamental for understanding pavement behavior and deterioration.

Details of existing pavement composition (pavement course, material type, and thickness) were recorded at every 5.0 km interval by measuring thickness of each crust layer in test pit excavated to evaluate the sub-grade strength along the Project Stretch. Core samples of the bituminous layers were also extracted from both carriageways.



The average thickness of bituminous layer was observed as 222mm for LHS side and 233mm for RHS side and granular layer thickness of 464mm in LHS side and 455mm in RHS side.

6.6. PAVEMENT MATERIAL INVESTIGATION

Pavement material investigations were carried out to know the properties of the existing sub-grade, Granular Sub Base (GSB) Wet Mix Macadam (WMM) and Bituminous/Concrete layers. Visual inspection of the existing pavement condition was carried out prior to commencement of material investigation work. The existing subsoil is generally consistent throughout the Project Stretch and is predominantly Silty sand, Silt sand with low plasticity and Clay sand. Given this soil type, Liquid Limit (LL) is ranging between 24-32%, and these values are within the limit as per MoRT&H 5th Revision Specifications. Soaked CBR of existing soil is ranging from 8% to 20% with an average value of 13%, and DCPT test for Exposed

base CBR values varies from 12% to 63% with average value of 37% and for sub grade base CBR value varies from 8% to 34% with average of 20% both direction.

The existing granular layer material was tested for determination of its gradation and all other parameters. Most of the obtained gradations of existing WMM materials are confirming to the specified MoRT&H 5th Revision Specifications. The GSB materials tested are conforming to Grade I /II/III of granular Sub-base as per Table 400-1 of MORT&H 5th Revision Specifications.

The existing bituminous layer material was also tested for determination of its gradation and its bitumen content.

6.7. ANALYSIS OF PAVEMENT CONDITION DATA – STRUCTURAL CONDITION OF PAVEMENT

Structural Condition of pavement has been evaluated using Falling Weight Deflectometer (FWD) and subsequent analysis was carried out to ascertain the relative performance of the pavement for entire Project Stretch, in the context of evaluating its residual life, and resulting overlay and other maintenance requirements.

The results are provided at below table:

Side	Initial Kilometric Point (km)	Final Kilometric Point (km)	Average Deflection (mm/100)	Characteristic deflection (mm/100)
LHS	601+000	605+000	13	19
LHS	605+000	610+000	14	23
LHS	610+000	615+000	22	35
LHS	615+000	620+000	18	28
LHS	620+000	625+000	20	34
LHS	625+000	630+000	19	28
LHS	630+000	635+000	19	34
LHS	635+000	640+000	17	29
LHS	640+000	646+000	20	30
RHS	646+000	640+000	20	30
RHS	640+000	635+000	16	27
RHS	635+000	630+000	14	23
RHS	630+000	625+000	15	24
RHS	625+000	620+000	18	31
RHS	620+000	615+000	14	23
RHS	615+000	610+000	14	24
RHS	610+000	605+000	10	16
RHS	605+000	601+000	14	21

6.8. MATERIAL TESTING

Field testing on the pavement materials were done as well as samples were collected and brought to laboratory for further testing on various layers i.e. sub-grade, granular sub base, wet mix macadam and bituminous mixes and results are tabulated below.

SUBGRADE SOIL:

Chainage 601+000 to 646+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI) %	FSI [IS :2720-Pt- 40] %	Max. Dry density (gm/cc)	OMC (%)	Soaked CBR at 3 energy level	Un-soaked CBR at 3 energy level
Maximum	32.00	19.00	15.00	17.12	2.13	12.00	20.00	31.00
Minimum	24.00	16.00	12.00	10.00	1.75	9.50	8.00	11.00
Average	26.88	17.83	12.83	13.43	1.92	10.62	12.94	18.59

GRANULAR SUB BASE:

Chainage 601+000 to 646+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI) %	Max. Dry density (gm/cc)	OMC (%)	CBR Value at 98 % dry density (Soaked) %	Specific Gravity
Maximum	24.00	NIL	NP	2.24	7.00	39.00	2.83
Minimum	22.00	NIL	NP	2.16	6.00	34.00	2.76
Average	23.18	NIL	NP	2.19	6.47	36.71	2.80

WET MIX MACADAM:

Chainage 601+000 to 646+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI) %	Max. Dry density (gm/cc)	OMC (%)	Specific Gravity	Impact (%)
Maximum	24.00	Nil	NP	2.27	6.50	2.85	25.00
Minimum	22.00	Nil	NP	2.23	5.50	2.79	18.00
Average	23.12	Nil	NP	2.25	6.24	2.82	21.47

BITUMINOUS MIXES:

Two types of mixes compose basically the bituminous layers of the highway:

- BITUMINOUS CONCRETE (BC): BC is a Dense Graded Bituminous Mix used as Wearing Course for roads with intense traffic. BC Mix consists of Coarse Aggregates, Fine Aggregates, Filler and Binder blended as per Marshall Mix Design.
- DENSE BITUMINOUS MACADAM (DBM): DBM is Closely Graded used as a binder course for pavements subjected to heavy traffic.

Subsequent review and analysis of the collected data analysis was carried out by using KGP back application. IRC: 115-2014 and IRC: 37-2012 procedures were used as reference and guideline to ascertain the relative performance of the pavement for all Project Stretches, in the context of evaluating residual life, overlays and other maintenance requirements.

Back calculated elastic modulus values have been obtained and tabulated below:

Layer	Condition	Modulus Range	Length in km	
			LHS	RHS
Bituminous	Good	More than 3000	-	-
	Fair	3000 - 750	41.00	45.00
	Poor	Less than 750	4.00	-
Granular	Good	More than 500	-	-
	Fair	500 - 100	45.00	45.00
	Poor	Less than 100	-	-
Subgrade	Good	More than 298	-	-
	Fair	75 - 298	45.00	45.00
	Poor	Less than 75	-	-

The in-service three-layer pavement system has been analyzed with the back-calculated corrected layer moduli and layer thicknesses. The critical strains have been calculated by the IITPAVE program. From the performance criteria equations, the residual/remaining rutting and fatigue life have been estimated.

6.9. DETERMINATION OF MAINTENANCE REQUIREMENT

Based on the pavement investigation survey results (Surface Distress, Riding Quality, Material Investigations and Structural Condition), the sections along the Project Stretch were identified for overlay requirement and routine maintenance requirement, if any. The sections have been rated based on four criteria, namely PCI, Roughness, Rutting and Remaining Life (based on FWD).

The limits and ranges for each criterion are mentioned in table below as per AASHTO.

Ratings	PCI	Roughness index	Rut Depth	Remaining life of Pavement
Good	>70	<2000	<5	>Design life for 10 years
Average	40-70	2000 - 3000	5-10	-
Poor	<40	>3000	>10	<Design life for 10 years

In order to show current pavement conditions, the following figure shows the sections marked with the appropriate colors based on the distress values for entire Project Stretch.



6.10. MAINTENANCE PLAN

The AAHSTO-HDM analysis results show that:

- For both LHS and RHS:
 - In 2019, different overlay works have been established in the whole stretch due to structural reasons in accordance to point 4.7 of present report.
 - In 2024 and 2038, overlay works (30 to 50 mm) have been established in the whole stretch due to structural reasons.
 - In 2031 and 2045, milling and overlay works (30 to 50 mm) have been established in the whole stretch due to functional improvement reasons.
 - Some patching works are required due to expected cracking in 2023, 2029, 2030, 2036, 2037, 2043 and 2044.

7. REVIEW OF STRUCTURES

One of the objective of this assignment was to carry out inventory of all the existing structures, condition surveys for all the highway structures and also to analyze their condition and to propose defects/repairs or rehabilitation if require. There are total of 100 structures along the Project Stretch:

S No.	Type of Structure	Nos.
1	Box Culvert	30
2	Slab Culvert	0
3	Pipe Culvert	43
4	Minor bridge	14
5	Vehicular Underpass/Pedestrian/cattle Underpasses	7
6	Major Bridge	4
7	Road Over Bridge	1
8	Flyover	1
9	Tunnel	0
Total		100

Visual inspections and condition surveys were carried out as per IRC: SP:35 on all structures in the Project Stretch. For all non-accessible structures, Mobile Bridge Inspection Unit (MBIU) was used during inventory and condition surveys.

For structures identified to be in a distressed condition based on visual survey, supplementary testing was carried out as per IRC SP:35 and IRC SP:40. However, selection of particular test or particular element of structure was made based on specific requirement of the structure. The following NDT were conducted to analyze the distresses on major bridge only.

- Rebound Hammer Test (RHT)
- Ultrasonic Pulse Velocity test (UPV)
- Carbonation test

Following are locations of NDT test conducted on the Major Bridge along the Project Stretch:

S.No	Str. No.	Chainage	Type of Structure	Side	Pier	No. of samples			Remarks
						UPV	RHT	Carbonation	
1	610/1	609+220	Major Bridge	LHS	II	4	3	1	Overall structure is in good condition
					V	4	3	2	Overall structure is in good condition
				RHS	III	4	3	3	Overall structure is in good condition
2	627/2	626+550	Major Bridge	LHS	I	4	3	1	Overall structure is in good condition
					III	4	3	2	Overall structure is in good condition
				RHS	II	4	4	3	Overall structure is in good condition
3	639/2	638+540	Major Bridge	RHS	III	1	1	-	Overall structure is in good condition
4	640/2	639+500	Major Bridge	RHS	II	1	1	-	Overall structure is in good condition

After reviewing the condition survey and supplementary test results obtained from NDT, suitable repair and rehabilitation measures have been proposed.

As per condition survey findings it is evident that most of the structures are in good condition and only protection works and expansion joints, etc. are minimally distressed.

BOQ has been prepared for routine maintenance viz. greasing of bearings, Expansion joint cleaning of drainage ducts, repair of Parapet walls and crash barriers and repair of pitching and accidental damages.

8. ROAD SAFETY ASSESMENT AND SUMMARY OF SAFETY IMPROVEMENT

Road Safety Audit (RSA) of the Project Stretch Palanpur/Khemana (Ch. 601.000 Km) – Abu Road (Ch. 646.000 Km) of total length 45 Km was carried out along the project stretch in order to:

- Identify issues related to Road Safety along the Project Stretch.
- Propose Improvement Proposals for the identified issues/locations along the Project Stretch.

8.1. PROVISION OF ATMS

The following Specifications and Standards shall be applied in addition to 'Manual on Specifications and Standards for Highways' published as IRC: SP: 99-2013 with all amendments and additions till date. Provision of ATMS in latest NHA policy in vogue (currently, NHA Policy Circular-Technical (214/2016) dt.15.09.2016 is being practiced which may be amended in due course of time) will govern the implementation. Latest Policy / Circular at the time of execution shall prevail.

The ATMS implementation shall cover design, supply, installation, commissioning and operation and maintenance of Advanced Traffic Management Systems.

The system would include out-door equipment including variable message sign systems, vehicle detection speed system, close circuit TV camera (CCTV) system, and transmission system. The indoor equipment would comprise a large display board, central computer (with Network Management System – NMS), CCTV monitor system, call center system in a control center with uninterrupted power supply. The systems shall meet following objectives:

- Smooth and uninterrupted traffic flow
- Enhance road safety
- Real time information and guidance to users
- Emergency assistance round the clock
- Alerts for abnormal road and weather conditions
- Reduced journey time and inconvenience

8.2. ACCIDENT DATA ANALYSIS/SAFETY IMPROVEMENTS

The first task of the team was to collect and review the available Accident data from the accidents that have occurred in this highway stretch. The analysis of accident data can help to identify patterns that could be linked to safety deficiencies on the road. The accident data for the last year in the Project Stretch is given in Table.

Accident Summary for April 2018- February 2020 Khemana Toll						
Month	Total Accidents Nos	Fatal Accident Nos	Major Nos	Minor Nos	Severity Index	No. of Persons Injured per 100 accidents
April	5	0	2	3	0.00	100
May	4	0	0	4	0.00	100
June	7	0	2	5	0.00	100
July	10	0	3	7	0.00	100
August	1	0	1	0	0.00	100
September	5	1	0	4	0.20	80
October	8	1	0	7	0.13	87.50
November	5	0	0	5	0.00	100
December	6	1	1	4	0.17	83.33
January	4	0	0	4	0.00	100
February	8	1	2	5	0.13	87.50
March	2	0	1	1	0.00	100
Total	65	4	12	49	6.15	93.85

The accident data provided by PIU is not location wise therefore locations of accidents could not be assessed.

Based on the Road Safety Audit conducted at site the following is recommend:

S.No	Safety issue	Description of safety issue	Proposed safety improvements
1.	Major/Minor Junctions along the Project Stretch	There are a total 24 junctions on this highway project (Palanpur/Khemana- Abu road) In which some of the junctions needs to be improved; these can be classified as T- junctions, Y- junctions and Cross junctions.	Junction, Sign boards required. Junction, Lighting, rumble strips, signage and road studs are required. Junction, acceleration and deceleration lanes required. All locations of junctions are provided in RSA Report.
2.	Deficiencies in Safety Barriers	Deficiencies were observed related to safety barriers. Typical configuration/ layout of crash barriers will follow the standards as per IRC- SP: 84 -2019. Built-up section along the Project road. Curve and Elevated embankment. Broken safety barrier and improper installation need extension. Along Project.	21010 m W-Beam Barrier is required. And all location given in RSA report.
3.	Curves Delineation	It was also observed that along the length of curve portion delineators/Sign board/ and Chevron marking have not been properly provided. It is recommended that proper sign marking shall be provided in accordance with IRC: 79-1981	It is recommended that proper signage & marking on curve location to be provided.
4.	4 U-Turn – Median opening	Median Opening should generally be limited to intersections with public streets or major generators of traffic and should not be accepted for individual business needs.	Improper Median Cuts along the Project Stretch should be reconstructed as per IRC:84 by reconstructing the median to ensure the safety of road users. If necessary then proper median cuts should be provided as per IRC 84: 2019.
5.	Unauthorised Ramps along the Project Stretch	Number of unauthorised ramps were observed along the project stretch at places where the majority of farmer access to their fields and un-paved road has been developed.	unauthorised Ramps on LHS side and RHS side. A properly designed T or Y-Junction might be recommended for those ramps which lead to small habitations and groups of agriculture fields where the number and type of vehicles can justify their cost. Also, some of those ramps should be closed if alternatives are identified to access to and from the highway in consultation with authority.
6.	Improper Pedestrian Crossing along the Project Stretch	It was observed that required pedestrian crossing facilities have not been provided and in the absence of these, the local population devise their own unauthorized ways to facilitate crossing the highways affecting the safety of road users and their own safety.	Pedestrian Crossing should be properly provided.
7.	Service Roads/ Slip Lanes	Service road is necessary in built up area to segregate slow moving & fast moving vehicles.	1250 m Service Road Required along Built up area.

9. TOLL PLAZAS

Toll on this Project stretch of NH 27 is currently being collected at one location –Km 602+750, Khemana Toll Plaza.

Aerial view of the Toll Plaza is given below:



- Today, this toll plaza is closed to its capacity to manage peak hour traffic at a reasonable service level. Consequently, an expansion of the number of lanes is recommendable; moreover, as per NHAI guidelines, the minimum number of toll lanes must be six in each direction (total 12), therefore at least two lanes in each direction are required to be added. Considering a design for next 20 years (2040) the number of lanes will be acceptable provided that it operates with the maximum number of ETC lanes.
- It is recommendable that for the 12 lanes of the plaza, 2 (1+1) will be ETC dedicated, and the 2 center lanes (1+1) to be reversible, which will force to shift the ETC dedicated lanes from their current position. Also, we recommend the installation and/or upgrading of ETC systems in all lanes.

Since overloading of vehicles has been identified as a major problem of road failures it is recommended that separate space for unloading and storage of goods from overloaded vehicles is provided.

▪ COSTS ESTIMATES

The Project cost estimates have been prepared based on various items of works required such as

- Toll Plaza
- Intersections improvements
- Traffic Signs & Markings
- Service Roads/Service Lane
- Structures (Culverts)
- Bus bays & Truck Lay Bys
- ATMS& TMS

Provision of granular sub-base and WMM base courses has been considered for the service roads, Truck lay byes, Bus byes, and Toll plaza. Provision of 'bituminous courses', has been considered of DBM and

Bituminous Concrete for service roads, Overlaying in carriageway, pavement for Truck Terminals, Bus bays and provision of Cement Concrete pavement kept for Toll plaza lanes. Repair and Rehabilitations of existing culverts, bridges & other structures is also proposed base on the NDT Tests and Inventory of the structures.

*Initial minor Operation & Maintenance of Pavement / Structures/Road Appurtenance/Road markings etc. Should be taken up by Authority and should be completed in all respect at the time of handover to InvIT Concessionaire.

Table A (Work to be taken up as proposed by Authority)		
S No	Item	Remark
1	Repair of Flexible Pavement by filling of pot holes	All the works shall be completed by Authority prior handing over to InvIT Concessionaire.
2	Jungle Clearance in ROW including Shoulders & Slops	
3	Cleaning of Road Surface	
4	Cleaning/ clearing of all the culverts	
5	Cleaning of Lined/ Unlined drains	
6	Placement of Road Furniture, wherever required	
7	Road Marking including Centerline/ Edge line/ Kerb line, Paining of mile stone & Crash Barrier	
8	Replacement of W-Beam/ RCC Crash Barrier	
9	Providing missing cats eyes	
10	Installation of missing/ damages delineators/ roadway indicators	
11	Providing & Fixing of Retro-reflective stickers	
12	Providing LED Solar Blinkers & median opening	
13	Maintenance of damaged kerb/ drains	
14	Maintenance of the Street Lights	
15	Filling of expansion joints	
16	Repair of Parapet walls, Protection Walls	

Initial Cost for Engineering and Safety Improvements for Base year 2020:

Palanpur/Khemana - Aburoad Section (from km 601+000 to km 646+000) of NH-27 in the State of Rajasthan			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Toll Plaza	49332367	4.93
2	Intersections Improvements	26340092	2.63
3	Miscellaneous Items (Road Marking, Drain, Street Light etc.	105960270	10.6
4	Service Roads/Service Lanes	24412372	2.44
5	Culverts	1460273	0.15
6	Bus Bays	13554723	1.36
7	ATMS & TMS	172993854	17.3
	Total	394053952	39.41
	Escalation 5% per Annum for 1 year	19702698	1.97
	Total Amount with Escalation =	413756650	41.38
	Contingency charges @ 5%	20687832	2.07
	Total Amount =	434444482	43.44

Operation and Maintenance Cost for Base year 2020-2021:

The Project Operation and Maintenance cost estimates have been prepared based on various circulars and analysis:

- Routine Maintenance for BT works at MCW consider as @ 7lacs/km/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 $7 \times 1.05^{10} = 11.40$ lacs/km/year) circular NHAI/11033/CGM(Fin)/2011
- Routine Maintenance for BT works at Service/Slip roads consider as 60% of @ 7lacs/km/year for 2010-2011
- Equipment Based Survey Works (Annual/Periodic as per Maintenance Schedule) based on market rate
- Contingency @ 3 %
- Toll Plaza operation and maintenance charges @ 32.5 lacs/lane/year
- System Integrator maintenance charges @ 5.04 lacs/lane/year
- Electricity & Patrolling expenses @ 2.03 lacs/km/year
- Additional RPV(Route patrolling vehicle) for state police department and Ambulance services for state government health authority to be provided
- The ATMS systems shall cover design, supply, installation, commissioning and operation and maintenance including charges for electricity to be provided
- SPV charges or Other Office expenses @ 407 lacs/year
- Insurance cost
- And GST @ 12% on all above item has been added in total Operation and Maintenance cost

FOR PERIODIC MAINTENANCE WORKS:

- Periodic maintenance works for main carriageway and service road is proposed as per MoRT&H circular (RW/NH-33044/10/2022-S&R dated 21-August-2018)

- Periodic renewal is proposed at every 6th year after completion of existing annuity period i.e 2024. For Main carriageway 40mm BC and for Service/Slip roads/bus bays/ truck lay bay/junction etc. 30mm BC is proposed for every successive renewal period.

Total Operation and Maintenance cost for (30 Years)	
Particular	Str-3
Routine Maintenance	159.77
Toll Plaza Operation and Maintenance	127.06
Electricity & Patrolling expenses	56.19
Other office expenses	144.56
Insurance	35.50
GST @ 12%	62.77
Total Routine Maintenance cost	585.86
Major Maintenance :- (Cycles)	
2029-2030	39.02
2035-2036	39.02
2045-2046	46.91
Construction Period (2038-2040)	
DLP Period 5 years (2040-2045)	

NHAI may require the capacity augmentation of the Project Stretch to 6/8-lane configuration in case the average daily traffic of PCUs in any accounting year exceeds the designed capacity of 40,000 PCUs (Target Traffic) for Project Stretch and continues to exceed the designed capacity for three consecutive accounting years. In this case, traffic is estimated to reach the 40,000 PCUs in 2030 and in years 2032 and 2033 the traffic also exceeds the target of 40,000 PCU. Consequently, it can be assumed that during 2030-2042 the Authority may undertake or cause to undertake the preparation of DPR for capacity augmentation (widening to 6-lane configuration) and the subsequent Tender for construction works. The construction period for capacity augmentation can be assumed to be 2.0 years.

The Authority could undertake the process for capacity augmentation of this project stretch at any time from 2030 to 2042, when the level of service C is reached.

It should be noted that this project stretch remains under a BOT (Annuity) contract that terminates on 2024, therefore, this issue should be closely monitored by Authority.

Capacity Augmentation Cost: Based on Year 2020

Palanpur/Khemana to Abu road Section (from km 601+000 to km 646+000) of NH-27 in the State of Rajasthan)			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Bituminous Courses	567608580.00	56.76
2	Repair & Rehabilitation of Existing Structures	22375451.78	2.24
3	Clearing and Grubbing	82768369.38	8.28
4	Toll Plaza	33932366.65	3.39
5	Widening of Road 4 Lane to 6 Lane	1592519505.10	159.25
6	Widening of Structure 4 Lane to 6 Lane	791138820.00	79.11
7	Intersections Improvements	98731537.00	9.87
8	Miscellaneous Items	601658483.89	60.17
9	Service Roads/Service Lanes	327973309.41	32.80
10	RE Wall And Approaches	570662446.80	57.07
11	Bus/ Truck Lay Bays	45726634.13	4.57
12	Drain	131025379.83	13.10
13	Land Escaping and Tree Plantation	9083363.00	0.91
14	ATMS & TMS	294252955.78	29.43
	Total	5169457202.74	516.95
	Escalation @ 5% per Annum for 1 year	258472860.14	
	Cost for Capacity Augmentation	5427930062.88	542.79

All cost are mentioned in this report are based on year 2020. And the cost for Major Maintenance Work /Routine maintenance and Operational maintenance works would be escalated for their consecutive appearance years on the basis of Price index.

Note:-

Detailed investigations have been conducted in year 2018. From 2018 to 2020 Concessioner has taken up below mentioned major maintenance works. However, considering these major maintenanceworks, improvement proposals i.e. Initial Maintenance Cost has been taken accordingly and final estimate/BOQ is prepared.

Since only 40mm BC in overlay was laid by Concessionaire, therefore using IITPAVE considering 40mm BC, residual life for design MSA was calculated again for which 40mm bituminous concrete can sustain for next 5 years i.e 2024. Afterwards major maintenance is again required to maintain the structural strength of existing flexible stretch. Then, a successive periodical maintenance for every 6th year is recommended.

S No	Description	Remark
1	Renewal of BC overlay with 40 mm thickness without milling in entire stretch full carriageway width.	Executed in August 2019

1 INTRODUCTION

National Highways Authority of India (NHAI), an autonomous agency of the Government of India (GoI), is responsible for the development, maintenance and management of National highways network in India.

There are currently approximately 1,32,500 kilometers of national highways in India, constituting approximately 2.2% of India's entire road network but carrying approximately 40% of total road traffic.

To meet the growing need for further industrialization and development of the country, GoI has planned to expand the network of National Highways across the length and width of the country at a rapid pace. The various programmes which have been taken by GoI through NHAI are:

Phase I: **Golden Quadrilateral (GQ)** comprising 4/6-laning of National Highways connecting four metro cities, namely, Delhi, Mumbai, Chennai and Kolkata with a total length of approximately 5846 km (which is mostly complete), and

Phase II: **North-South and East-West Corridors (NSEW)** comprising 4/6-laning of National Highways connecting Srinagar to Kanyakumari and Silchar to Porbandar. Total length this NSEW corridor is approximately 7300 km. The projects of NSEW are mostly awarded and construction is also largely complete.

Bharatmala Pariyojana: A flagship highway development programme which envisions the development of 50 economic corridors, provide connectivity to 550 districts in the country through National Highway linkages and improve the average speed of road travel in India.

In addition to this, various NHDP programs has been taken up by NHAI to match the rapid pace of modernization and industrial development of the country. The Government has planned to continue developing the National Highways at a rapid pace, which will require significant funding in the near future.

The National Highways Authority of India (NHAI) has initiated the process of setting up an infrastructure investment trust (InvIT) to monetize its road assets. This will be a private listed InvIT, through which institutional investors may invest in operational road projects offered by NHAI to the InvIT. In this model, the offered road assets are acquired by the InvIT while the investors acquire the units issued by the InvIT. Income generated from the underlying road assets would be paid out as distributions to the unit holders in the form of interest, dividend and return of capital. The InvIT would be managed by a competent Investment Manager staffed with experts to manage the assets efficiently.

Under the InvIT frame work, the right of collection of user fees of selected NH projects is proposed to be assigned for a specific time period to a Concessionaire. During this period, the O&M responsibility will also vest with the selected Concessionaire (unless costs are to be borne by existing concessionaires as per extant agreements). In return, the Concessionaire will pay an upfront quoted Concession Fee to NHAI.

The following 5 stretches which shall be awarded on InvIT model:

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
1	Abu Road - Swaroopganj	31.000	Undavariya	646.000	677.000
2	Chittorgarh - Kota & Chittorgarh Bypass	160.500	Bassi	891.929	1052.429
			Aroli		
			Dhaneshwar		

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
3	Palanpur / Khemana - Abu Road	45.000	Khemana	601.000	646.000
4	Kothakota Bypass - Kurnool	74.622	Pullur	135.469	211.000
5	Maharashtra Karnataka Border - Belgaum	77.705	Hattargi Kognoli	515.000	592.705

Table 1. List of Roads under InvIT

Accordingly TYPISA-AVANZA has carried out detailed reports on inventory & physical condition of all stretches including all proposals study.

Below general details of Palanpur/Khemana – Abu Road are presented.

1.1. GENERAL

Project Stretch starts from km 601.000 of NH-27 at Palanpur/Khemana and ends at km 646.000 of NH-27 at Abu Road in the State of Rajasthan. The length of Project Stretch is 45.000 km and has 4-lane configuration with toll plaza at Khemana. Alignment of Project Stretch is presented in Figure 1.

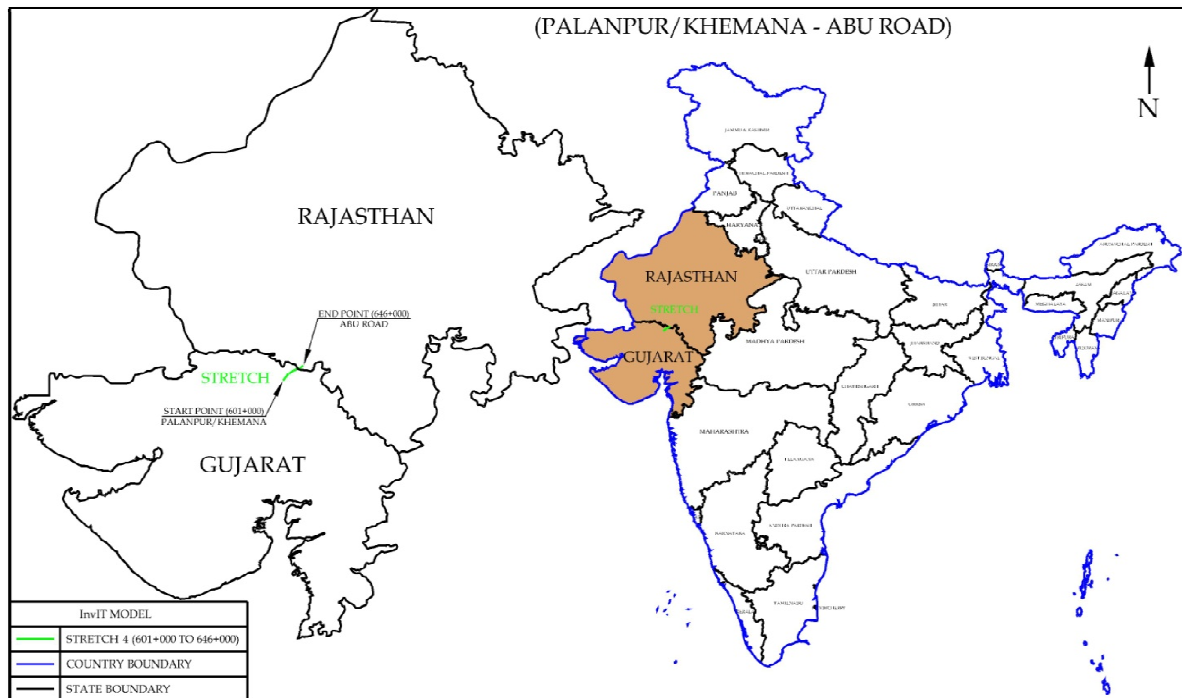


Figure 1. Alignment Map

Various investigations were carried out for assessing the physical condition of the Project Stretch. List of all investigations carried out are tabulated below.

Stretch - 3 (Palanpur / Khemana - Abu Road)

S.No	Type of Investigations		Location
1	Traffic Surveys	TVC Survey	Khemana Toll Plaza
		OD Survey	
		Axle Load Survey	
2	Topographical Survey through LiDAR		Entire Stretch
3	NSV		Entire Stretch
4	FWD		Locations are mentioned in Ch. 4
5	Pavement	Test Pits	Locations are mentioned in Ch. 4
	Material Testing	Core Cutting	Locations are mentioned in Ch. 4
		DCPT	Locations are mentioned in Ch. 4
		Borrow Area Inventory	Locations are mentioned in Ch. 8
6	Structural Investigations	Visual Inspection	All Structures
		NDT	Distressed structures cited in Ch. 5
7	Road Safety Audit		Entire Stretch
8	Toll Plaza Audit		Khemana Toll Plaza

Table 2. Detail list of Survey Dates

Existing inventory of features of Project Stretch is captured through NSV, LiDAR and field reconnaissance survey. Features like built-up settlements, carriageway dimensions, service roads, junctions, road furniture etc. are recorded for entire Project Stretch. The highway inventory is linked to the existing kilometre posts established along the Project Stretch. Detailed inventory including an overview of the Project Stretch is presented in this chapter.

1.1.1. START AND END POINT

All details of Project Stretch are given below.

Road No	Chainage in Km		Description of Road	Easting	Northing	Length (Km)
	From	To		Start & End Point	Start & End Point	
Stretch 3	601+000	646+000	Palanpur / Khemana - Abu Road	72°27'16.75"E	24°13'47.53"N	45.000
				72°46'55.72"E	24°27'59.28"N	

Table 3. Detail list of Survey Dates

1.1.2. INVENTORY

While inventory is captured chainage-wise with their existing physical condition, an overview of all inventories is presented in table below for quick reference.

S.No.	Description	Details	
1	Project Stretch	Palanpur / Khemana - Abu Road	
2	Length of Project Stretch (in km)	45.000 Km	
3	Road Type (length in km)	BT	45.000 km

S.No.	Description	Details	
		CC	-
4	Length of Urban Section (in km)	10.426 Km	
5	Length of Slip/Service Road (in km)	LHS	11.580 km
		RHS	11.010 km
6	No. of Bypasses	NIL	
7	No. of Major Junctions	06	
8	No. of Minor Junctions	18	
9	No. of Major Bridges	04	
10	No. of Minor Bridges	14	
11	Culverts	73	
	No. of Slab Culverts	00	
	No. of Pipe Culverts	43	
	No. of Box Culverts	30	
12	No. of Flyovers	01	
13	No. of ROBs	01	
14	No. of Tunnels	Nil	
15	No. of RUBs	Nil	
16	No. of Vehicular Underpasses	06	
17	No. of Pedestrian Cattle Underpasses	01	
18	No. of Toll Plazas	01	
19	No. of Bus Bays/Bus Shelter	RHS-06 & LHS-05	
20	No. of Truck Lay Bys	01	
21	No. of Toilet Blocks	RHS-01 & LHS-01	
22	No. of Way Side Amenities	Nil	

Table 4. Inventory on Project Stretch

Soft copy of full inventory is provided as complementary data.

1.2. OBJECTIVE OF STUDY & SCOPE OF WORK

General Scope of Services shall cover but be not limited to the following major tasks:

- Review of all available reports and published information about the project road and the project influence area;
- Detailed reconnaissance;
- Traffic studies including traffic surveys and Axle load survey and demand forecasting for next thirty years;
- Inventory and condition surveys for road and highway assets;
- Inventory and condition surveys for bridges, cross-drainage structures, other Structures, river training/Protection works and drainage provisions;
- Pavement investigations;

- Sub-grade characteristics and strength: investigation of required sub-grade and sub-soil characteristics and strength for road and embankment design and sub soil investigation;
- Identification of sources of construction materials;
- Provide all inputs required for financial analyses;
- Contract packaging and implementation schedule with regard to Facilities/works that are to be executed in specified contract period;
- Strip plan indicating the predominant features of the project corridor; location of all existing utility services (both over- and underground) and the scheme for their relocation;
- Design for up gradation of toll plaza and identification of their numbers and location and office cum residential complex.

1.2.1. REVIEW OF DATA AND DOCUMENTS

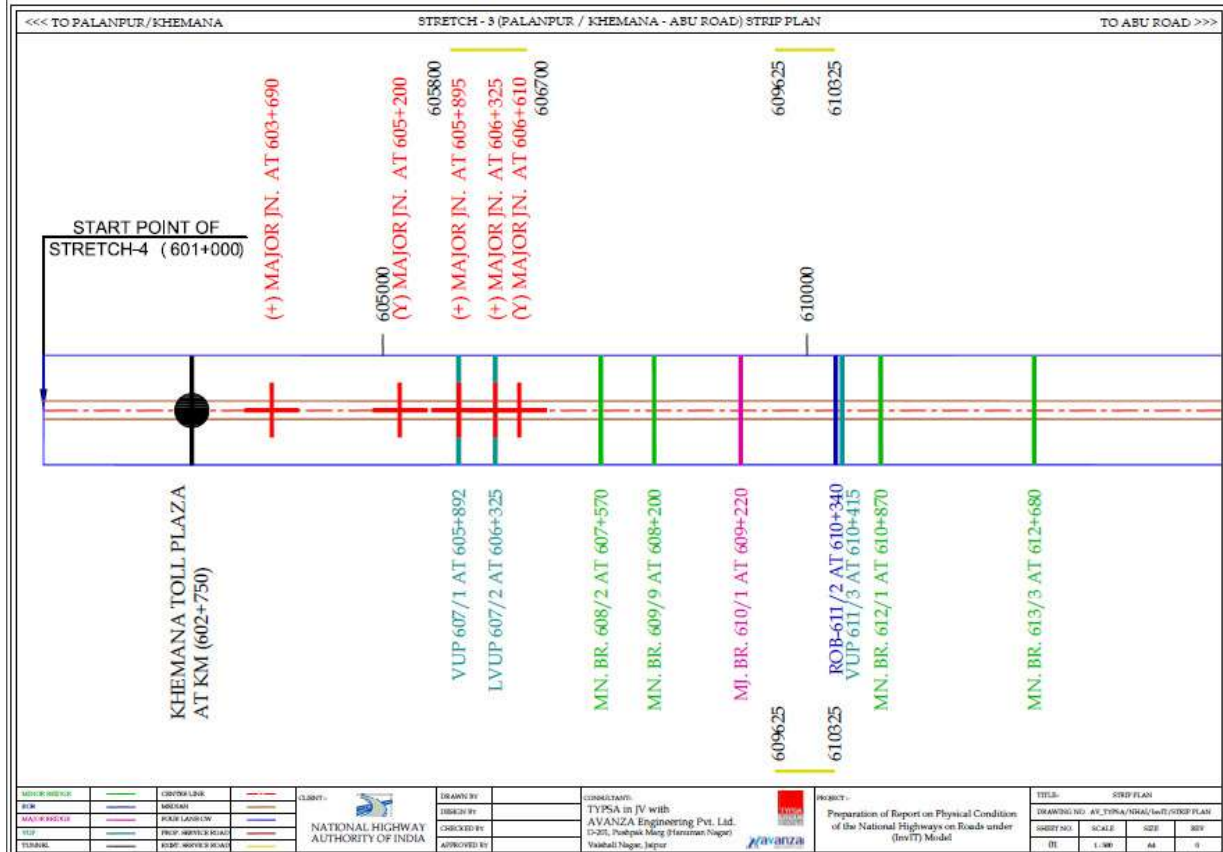
- Project Report based on which the execution work was carried out;
- Deviations from the design during execution (based on the-then site conditions);
- As-Built drawings of the executed works;
- Road inventory;
- Road condition, year of original construction, year and type of major maintenance/rehabilitation works(maintenance history);
- Condition of bridges and cross-drainage structures;
- Sub-surface and geo-technical data for existing bridges;
- Hydrological data, drawings and details of existing bridges;
- Existing geological maps, catchment area maps, contour plans etc. for the project area;
- Condition of existing river bank / protection works, if any;
- Details of sanctioned / on-going works on the stretch sanctioned by NHAI/other agencies for Tie-in purposes;
- Survey and evaluation of locally available construction materials;
- Historical data on classified traffic volume (preferably for 5 years or more);
- Type and location of existing utility services (e.g. Fiber Optical Cable, O/H and U/G Electric, telephone line, Water mains, Sewer, Trees etc.).

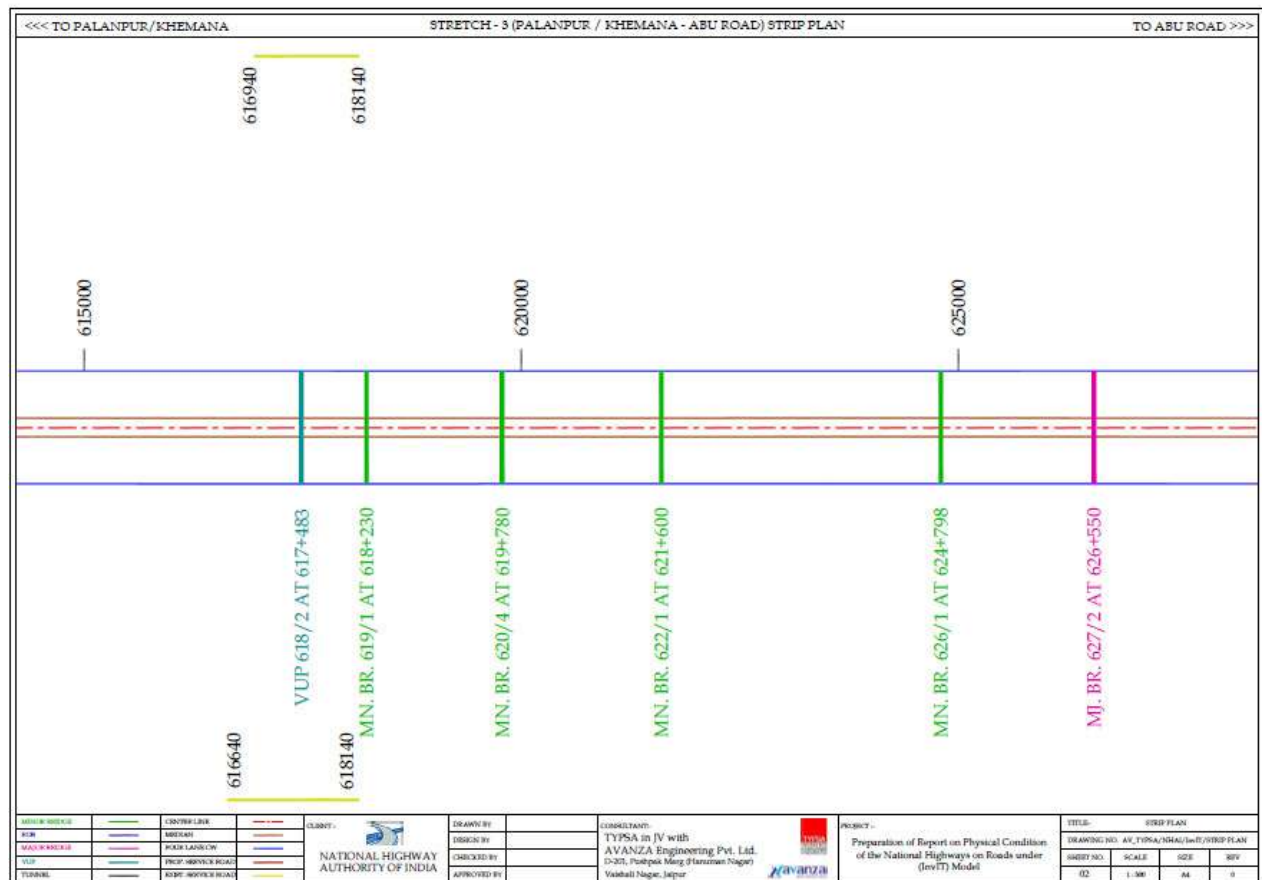
1.2.2 TEAM COMPOSITION

- Team Leader
- Senior Highway Engineer
- Pavement Design Expert
- Senior Bridge Engineer
- Traffic and Transportation Expert
- HDM Expert
- Highway Rehabilitation Expert
- Sr. Geotechnical Expert
- Sr. Tolling Systems Expert
- Sr. Financial & Costing Analysis Expert
- Quantity Surveyor
- GIS Executive
- Sr. CAD Engineer
- Sr. CAD Draftsman
- Sr. Surveyor

1.3. STRETCH STRIP KEY MAP

The kilometric chainages that are showed in the following Strip Key Maps correspond to those estimated and showed in the drawings prepared after a LiDAR survey of the stretch. For a reference between these kilometric chainages.

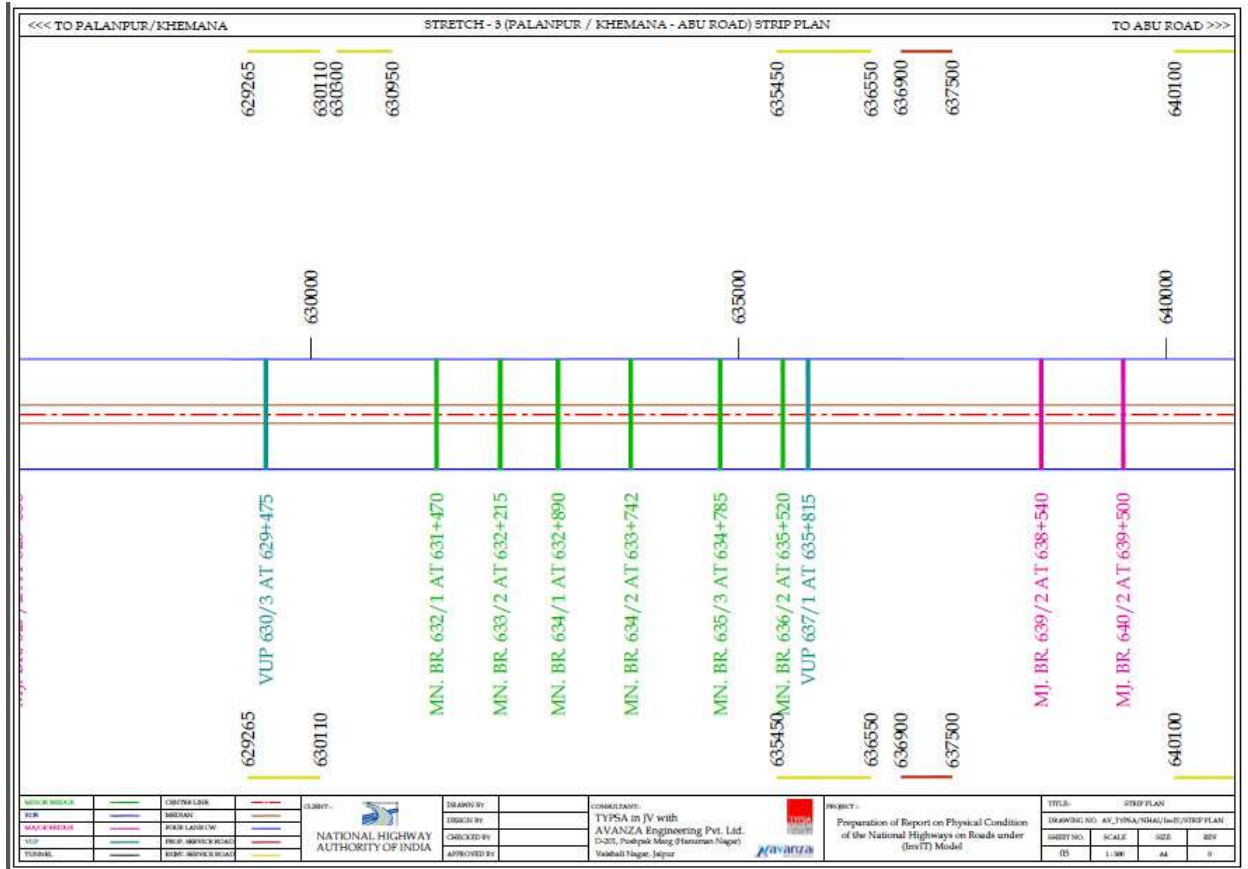






PREPARATION OF REPORT ON PHYSICAL CONDITION OF
THE NATIONAL HIGHWAYS ON ROADS UNDER (InvIT) MODEL

Technical Due Diligence Report of NH27 (NH14) –
Palanpur/Khemana – Abu Road



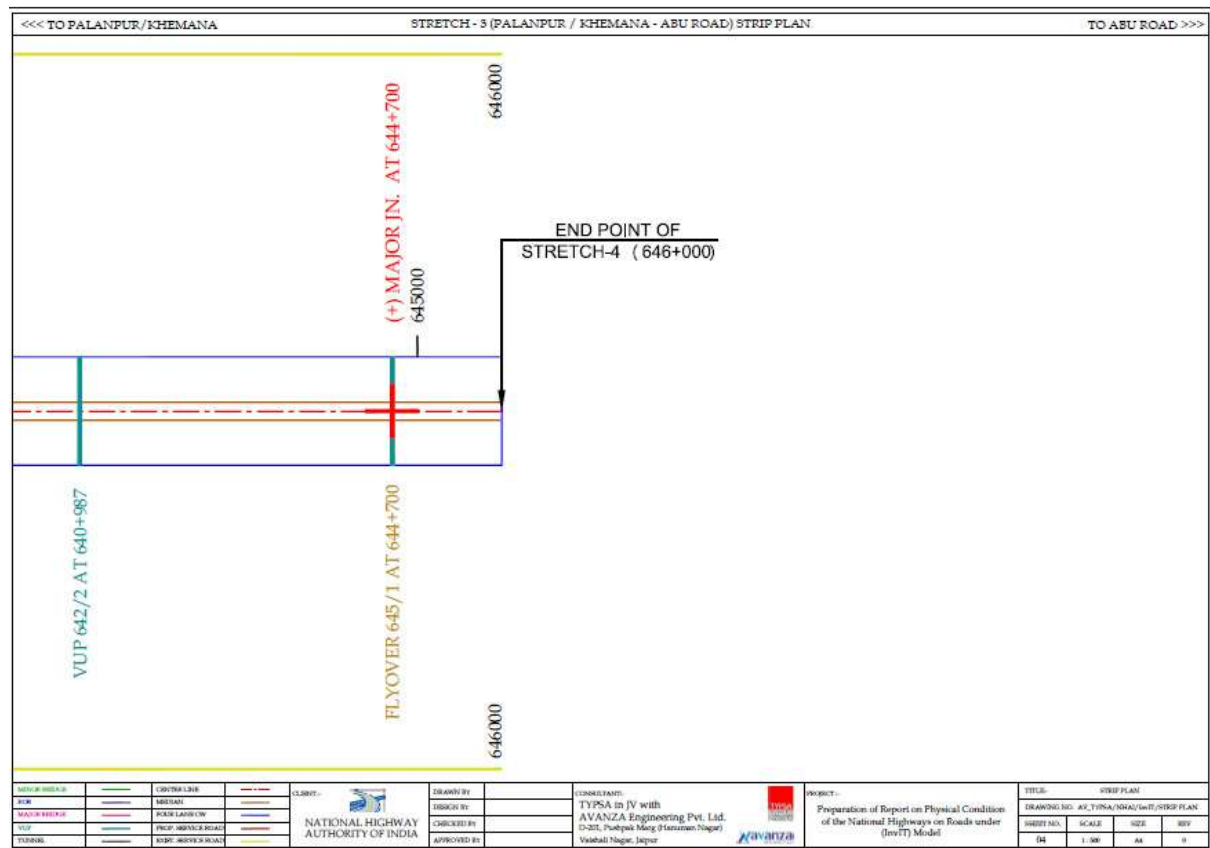


Figure 2. Stretch Strip key map

1.4. DESCRIPTION OF THE PROJECT

Project Stretch starts from km 601.000 of NH27 at Palanpur and ends at km 646.000 of NH27 at Abu Road in the State of Rajasthan. The length of Project Stretch is 45.00 km and has 4-lane configuration with toll plaza at Khemana. This stretch has been constructed under BOT (Annuity) and Toll is being collected by NHAI through open competitive bidding. Last Annuity is due on 24.03.2024.

The project road was initially part of NH-14 (old no.); the national highways in the country have been renumbered in recent past and now the project stretch is part of NH-27. Starting from Porbandar in Gujarat and ends at Silchar in Assam. The corresponding starting and ending chainages have also been revised. Location of toll plaza is at Km 602+750, (Khemana Toll Plaza).

DFCC: The construction of Mumbai-Delhi Railway Freight Corridor runs parallel to this stretch and is being constructed at present. It is expected to be operational by year 2025. Due to this corridor operation, a partial reduction in the traffic of heavy commercial vehicles (trucks and MAVs) is expected. Based on the O-D pattern, it has been considered a 21% total reduction of the 3-axle and 24% total reduction in MAV commercial long distance traffic, and 20% reduction of the 2-axle trucks traffic in year 2026.

1.4.1. BUILT-UP SECTION

Sr.No.	Description	Chainage		Length (km)	Side
		Start	End		
1	Khemana	601.400	602.000	0.6	LHS
2	Jaspuriya	604.900	605.100	0.200	RHS
3	Chitrasani	605.900	606.800	0.900	LHS
4	Jethi	614.400	614.800	0.400	BOTH
5	Sarotra	623.500	624.300	0.800	LHS
6	Amirgadh	629.100	630.063	0.963	BOTH
7	Abu road	639.800	645.000	5.200	RHS

Table 5. List of Villages/Towns

1.4.2. KILOMETRE STONES

Existing km stones are available all along the project stretch.

1.4.3. RIGHT OF WAY

Available ROW along the project corridor in open areas varies between 45 m to 68 m with an average of 54 m.

1.4.4. CARRIAGEWAY

The existing carriageway is of four lane divided standards. The carriageway width slightly varies at merging and diverging at junctions, median openings, at approaches to structures and on structures deck. It may be noted that, details of carriageway on structures shall be referred from Structures Inventory section of this chapter. Details of carriageway along the Project Stretch are provided below.

S.No	Chainage (km)		LHS width (m)		Median width (m)	RHS width (m)	
	From	To	Carriageway	Paved Shoulder		Carriageway	Paved Shoulder
1	601+000	646+000	7.00	1.50	4.50	7.00	1.50

Table 6. Details of carriageway of Stretch

1.4.5. INTERSECTIONS

List of Major road intersections across the project road (i.e. intersection with SH & NH):

S.No	Existing Chainage	Type of junction	Direction		Type Cross Road	Remarks	
			Left	Right			
1	603+800	+	Hebatpur	Karjoda	BT	At Grade	
2	605+200	Y	-	Chitrasni	BT	At Grade	
3	605+895	+	Pirajpura	Chitrasni	BT	VUP	SH-54

S.No	Existing Chainage	Type of junction	Direction		Type Cross Road	Remarks	
			Left	Right			
4	606+325	+	Chitrasani	Kotda	BT	VUP	
5	606+610	Y	-	Chitrasni	BT	VR	At Grade
6	644+700	+	Mount Abu	Ambaji	BT	Flyover	SH-11

Table 7. Major Intersections

1.5. TERRAIN

Project Road is passing through plain and rolling terrain. From km 601+000 to 646+000.

1.6. NEED OF THE PROJECT

National Highways Authority of India has launched InvIT trust in October 2020 with an aim of resource generation to financially leverage ongoing projects of NHAI. This is the first InvIT to be sponsored by any government entity. To begin with, government has approved following 5 highway road assets having value around 5000 Cr. for a concession period of 30 years, to be dealt under InvIT model in the first phase.

Stretches Under InvIT Model				
S. No.	Name	NH No.	Lanes	Length (kms)
1.	Palanpur – Abu Road (Gujarat – Rajasthan)	NH 27	4	45.00
2.	Abu Road – Swaroopganj (Rajasthan)	NH 27	4	31.00
3.	Chittorgarh-Kota & Chittorgarh Bypass (Rajasthan)	NH 27	4	160.50
4.	KothaKataBypass To Kurnool (Telengana)	NH44	4	74.622
5.	Maharashtra Border – Belgaum (Karnataka)	NH 4	4	77.705

This report deals with one of the highways (S.No.1) selected for InvIT model by the government.

The InvIT will enable NHAI to monetize selected national highways having reasonable toll collection records and provide an attractive platform to long term investors as the operating highway infrastructure assets will yield stable and regular dividends. This is a monetization exercise of existing operating highway infrastructure with securitization of toll receipts and likely to generate upfront cash through asset recycling.

2 SOCIO ECONOMIC PROFILE OF PROJECT INFLUENCE AREA

2.1. DEMOGRAPHIC CHARACTERISTICS OF RAJASTHAN

The relationship between demographics and transportation is a complex one. Some demographic variables are obviously related to transportation systems. The overall size of the population, density of population, and rural/urban proportion of population impacts on transportation demand. Rajasthan state has Geographical area of 342,239 sq. km which is 10.4% of total area of country. As per Census of 2011 the Rajasthan state population 68,548,437 with a density of 200/sq.km. The literacy rate of state is 68%.

According to census off 2011, Rajasthan has a total population of 68,548,437. Rajasthan's population is made up mainly of Hindus, who account for 88.49% of the population. Muslims make up 9.07%, Sikhs 1.27% and Jains 0.91% of the population. The state of Rajasthan is also populated by Sindhis, who came to Rajasthan from Sindh province (now in Pakistan) during the India-Pakistan separation in 1947.

Project road starts from Palanpur connecting villages are Chitrasani, Jaspuriya, Khemana, Amirgarh and ends at Abu Road. This chapter tells us about socio-economic profile of Rajasthan and Gujarat state, and various districts, cities in Project Influence Area in terms of Demography, Climate, Terrain, Irrigation, Industry and Transportation etc. It also presents various developments proposed in the Project Influence Area.

Largest cities of Rajasthan by population	
City Name	Population
Jaipur	3,073,349
Jodhpur	1,138,300
Kota	1,001,694
Bikaner	647,804
Ajmer	551,101
Udaipur	474,531
Bhilwara	360,009
Alwar	341,422
Bharatpur	252,838
Sri Ganganagar	249,914

Table 8. Largest cities of Rajasthan by population

2.2. LANGUAGE

Hindi is the official and the most widely spoken language in the state (90.97% of the population as per the 2001 census), followed by Bhili (4.60%), Punjabi (2.01%), and Urdu (1.17%).

The languages taught under the three-language formula are:

- First Language: Hindi.
- Second Language: English.

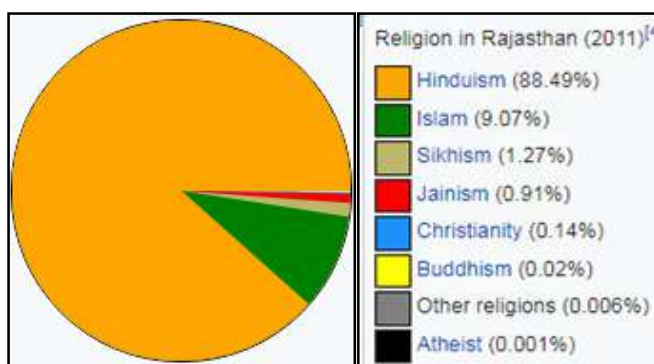


Figure 3. Languages in project area

2.3. GEOLOGY AND SOIL

Geologically, the state can be broadly divided into three natural regions, viz Aeolian sand, alluvium and aravallis. The Aeolian deposits belong to the Pleistocene and recent times, While dune free area of Barmer, Bikaner and Jaisalmer, contains ex-posed marine deposits of Jurassic and Eocene periods showing an anomaly in nature of rock deposits in the region . Besides the Vindhyan system crops out around Jodhpur where there are small patches of Malani Volcanic and granite rocks formation.

The types of soil available in Rajasthan are mostly sandy, saline, alkaline and chalky (calcareous). Clay, loamy, black lava soil and nitrogenous soils are also found. The districts of Jaisalmer, Bikaner, Barmer, Jalor, Jodhpur, Ganganagar, Sirohi, Jhunjhunu, Pali and Sikar have alkaline and saline soils with a calcareous base. There is some nitrate concentration in the soil of these regions. The Jaisalmer region has Aeolian sand that varies from sandy to sandy loam. In fact Jaisalmer is renowned for its sandstone. Due to lack of water availability vegetation comprises of only thorny bush and cactuses. There is only seasonal vegetation such as a few grass species, shrubs and dwarf trees.

The whole district of Ganganagar North western plains consist of alluvial and Aeolian soil as it is flooded by the Ghaggar River. The four districts of Dausa, Tonk, Jaipur and Ajmer are watered by river Banas and its tributaries and thus the fertile soil sustains mixed xerophytic and mesophytic vegetation.

The flood plains of Rajasthan consist of the districts of Bharatpur, Alwar and Dhaulpur and the northern region of SawaiMadhopur which are flooded by the river Ghambhiri and Banganga. Thus this region is the repository of alluvial, clay and loamy soil. The Bhilwara district and the major parts of Udaipur district, Chittorgarh district, Sirohi district and the tract of Aravali Hills forms a part of inter-mountain plateau and consists of dark- lava soils. Major cash crops like cotton and sugarcane are grown in this black soil region. Other food crops are also grown. The Hadauti plateau includes the districts of Baran, Bundi, Jhalawar and Kota and so on that have black soil. This region is fertile owing to the presence of the Chambal River and its distributaries and cotton, sugarcane and opium are grown. Some districts of Rajasthan such as Dungarpur, Banswara, Udaipur, Bhilwara and Chittaurgarh have red and yellowish soils.

2.4. DEMOGRAPHIC FACTORS OF PROJECT ROAD

As of 2011 India Palanpur had a population of 140,344. Males constitute 53% of the population and females 47%. Palanpur has an average literacy rate of 86%, higher than the national average of 59.5%: male literacy is 94%, and female literacy is 78%. In Palanpur, 13% of the population is under 6 years of age.

Population growth through the years	
Year	Population
1941	20,300
1951	22,600
1961	29,100
1981	61,300
1991	90,300
2001	122,300
2011	141,592

Table 9. Population growth through the years

As of the 2011 India census, Abu Road had a population of 55,595. Males constitute 52% of the population and females 48%. Abu Road has an average literacy rate of 80.81%, higher than the state average of 66.11%. 89.63% of the males and 70.97% of females are literate. 11.89% of the population is under 6 years of age.

Name	District	Population Census 1991- 03-01	Population Census 2001- 03-01	Population Census 2011- 03-01
Abu Road	Sirohi	39802	47,337	55599

Table 10. Demographic Feature of Project District

The village of Khemana is home to 2,327 people, among them 1,124 (48%) are male and 1,203 (52%) are female. 66% of the whole population are from general caste, 19% are from schedule caste and 15% are schedule tribes. Child (aged under 6 years) population of Khemana village is 15%, among them 53% are boys and 47% are girls. There are 488 households in the village and an average 5 persons live in every family.

Genre	Total	General	Schedule Caste	Schedule Tribe	Child
Total	2,327	1,536	450	341	348
Male	1,124	727	232	165	183
Female	1,203	809	218	176	165

Table 11. Caste wise male female population 2011 - Khemana

2.5. CLIMATE

Abu Road enjoys all types of weather. In summer, it's hot and humid with an average temperature of 40 Degrees with hot sandy winds. In winter, it's 7 to 14 degrees, which is quite cold as compared to other cities in Rajasthan and in Monsoon; the average rainfall is about 14 to 20 inches per season.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	24.2	26.9	32.8	37.4	39.8	37.3	33.9	30.3	32.6	33.3	29.3	25.5	31.8
	75.6	80.4	91.0	99.3	103.6	99.1	93.0	86.5	90.7	91.9	84.7	77.9	89.2
Average low °C	7.0	9.1	14.3	20.2	25.0	26.1	24.5	23.2	21.4	16.9	11.7	7.7	17.2

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
(°F)	44.6	48.4	57.7	68.4	77.0	79.0	76.1	73.8	70.5	62.4	53.1	45.9	63.0
Avg precipitation mm	3.5	2.0	1.2	6.6	18.2	92.7	188.8	205.1	96.2	19.1	17.2	3.6	654.3
(inches)	0.14	0.08	0.05	0.26	0.72	3.65	7.43	8.08	3.79	0.75	0.68	0.14	25.8

Table 12.Climate Data of Abu Road

In summer, it is hot and humid with an average temperature of 42 Degrees with hot sandy winds. The temperature of Palanpur sometimes reaches up to 46 Degrees. However just before monsoon it becomes swelteringly hot along with humidity. In winter, it's 5 to 15 degrees, which is quite cold as compared to other cities in Gujarat and in Monsoon; the average rainfall is about 20 to 30 inches per season.

2.6. POPULATION

Palanpur is one of the largest cities of Banaskantha district in Gujarat and also the administrative headquarter of Banaskantha. If we look at chronology of Palanpur, it dates back to Parmar dynasty of Rajputs when the city was developed by one of the members of the dynasty; Prahlanan who received the area as gift from his brother Chandravati.

During that time the city of Palanpur was called Prahlananpur based on the name of its founder. During that time the city was completely fortified with only thoroughfare being the 7 darwajas which were built in different directions.

Khemana Village, with population of 2327 is Raipur sub district's the 11th most populous village, located in Raipur sub district of Bhilwara district in the state Rajasthan in India. Total geographical area of Khemana village is 13 km² and it is the 7th biggest village by area in the sub district. Population density of the village is 178 persons per km². Nearest town of the village is Gangapur and distance from Khemana village to Gangapur is 20 km. The village has its own post office and the pin code of Khemana village is 311805. Raipur is the sub district head quarter and the distance from the village is 16 km. District head quarter of the village is Bhilwara which is 70 km away. 0.18 square kilometer (1%) of the total village's area is covered by forest.

Abu Road is a city and municipality in Sirohi district of Rajasthan state in western India. It is the tehsil headquarters of Abu Road Tehsil by that name. It lies southeast of Mount Abu and its railway station is an important stop on the main Indian Railways line between Delhi and Ahmedabad. Mount Abu is 27 km up the hill from Abu Road. The old name of Abu Road city was Kharadi. The Rajputana Malwa Railway set up the railway station here on December 30, 1880, and the station was named Abu Road. The road to Mount Abu was built in 1845, during the rule of Maharao Shiv Singh of Sirohi.

2.7. TOURISM

Palanpur is an ancient city in the state of Gujarat. Though it became the seat of the British later, it was initially founded by Prahlanan who was a rajput. Known by the name Prahlananpur, the city has many places of historical significance and is a delight for the tourists visiting the city. Palanpur has several temples dedicated to Hinduism and Jainism.

Hindu Temples. The Chaulukya dynasty ruler Jayasimha Siddharaja of Anhilwad Patan is believed to be born in Palanpur. His mother Meenaladevi built Pataleshwar Temple dedicated to Shiva. Other Hindu temples are Lakshman Tekri temple, Mota Ramji Mandir, Ambaji Mata Mandir.

- Kirti Stambh: The 22m (72 feet) high Tower of Fame was built by a wealthy Jain merchant in the 12 century A.D. and is dedicated to Adinathji (Rishabh Natha), the first of the Tirthankaras. The tower is decorated with Jain Pantheons.

- MotuDerasar: The PallaviyaParshwanath Temple, also known as MotaDerasar, was built by King Prahaladan which is dedicated to Parshwanath, 23rd tirthankar.

2.8. MINES & MINERALS OF PALANPUR –ABU ROADINDUSTRY

Palanpur is popular for diamonds. The diamond industry has developed a lot in the last 40 years. Perhaps, the credit goes to the great diamond merchants of Palanpur. The Jains have excelled in diamond cutting and polishing. They have expanded the diamond business to other cities like Surat, Mumbai, Chennai and Kolkata and also to other countries like Belgium, London, New York and Singapore. Owing to the flourishing diamond trade, Palanpur is known as the city of diamonds.

The Mount Abu is full of minerals therefore the industries based on minerals were developed rapidly. These industries produce Portland cement, Synthetics Yarn, High Tension Insulators, TirupatiFibers, R.P.R.L. Marble, and Granite, Polymers /Resins and mineral powder. Similarly, medium scale industries produces tiles and slabs of cement, marble and granites, HCL acid, ERW tubes, HDPE pipes and fittings.

S.No.	Name of Mineral	Production (Tones)
1	LIME STONE (Cement Grade)	11,400,211
2	Calcite	83,163
3	Wollestonite	124,744
4	Masonry stone	654,150
5	Granite	51,371
6	Marble Block &Khanda	231,060
7	Lime stone (Crucher)	455,109

Table 13.Production of mineral 2010-11

2.9. GEOLOGY AN SOIL

The soil of Palanpur is sandy loam. It is rich in primary minerals that contribute to its agricultural potential. As the silty soil is permeable and well drained, it is ideal for cultivation of crops like wheat, bajra and pulses. Besides having high capacity to retain water and nutrients, the soil is slightly alkaline with a pH range of 8.10. Yet, this does not hinder the growth of agricultural crops.

Abu Road The types of soil available in Rajasthan are mostly sandy, saline, alkaline and chalky (calcareous). Clay, loamy, black lava soil and nitrogenous soils are also found. The districts of Jaisalmer, Bikaner, Barmer, Jalor, Jodhpur, Ganganagar, Sirohi, Jhunjhunu, Pali and Sikar have alkaline and saline soils with a calcareous base. There is some nitrate concentration in the soil of these regions. The Jaisalmer region has Aeolian sand that varies from sandy to sandy loam. In fact Jaisalmer is renowned for its sandstone. Due to lack of water availability vegetation comprises of only thorny bush and cactuses. There is only seasonal vegetation such as a few grass species, shrubs and dwarf trees.

The whole district of Ganganagar North western plains consists of alluvial and Aeolian soil as it is flooded by the GhaggarRiver.The four districts of Dausa, Tonk, Jaipur and Ajmer are watered by river Banas and its tributaries and thus the fertile soil sustains mixed xerophytic and mesophytic vegetation.

2.10. AGRICULTURE AND IRRIGATION

Palanpur is established on Dt.:30-12-1955. Work started on Dt.: 01-10-1957 under the Bombay Agricultural Produce Act-1939 for the better regulation of purchase and sale of Agricultural Commodities

in Market area. There are 106 villages of Palanpur Taluka in the market area of this Committee and Palanpur is declared as principal Market Yard in the Market area. Arrivals of Agricultural Commodities in Palanpur Market Yard are from districts like Mehsana Dist., Sabarkantha Dist., Banaskantha Dist., Saurashtra, Kutch and Rajasthan in the Market area to extend sale and purchase facilities.

The economy of Mount Abu the only hill station of Rajasthan is not up to the mark with poverty still prevailing among a major portion of the society. In this hilly region industrial development has got a secondary importance due to its ecological structure. Education system is still at its nascent state with people more concentrating into agriculture and cottage industry.

Mount Abu has been an abode of different kinds of flora and fauna, some of which are rare of their kind. The place is of significant ecological importance with the tropical deciduous forest of the Aravalli range and many natural lakes and waterfalls. The Aravalli Range is inhabited by primitive tribal communities, living among the dense green forests since the ancient times. Mount Abu in the present times has an amazing mix of the royal Rajput and British Heritage homes and bungalows, along with tribal communities like the Bils, Meena, Kathodi and Garasiyas. These tribes are still living their ancient lives, by staying within the dense forest in small mud cottages. These people earn their livelihood through agricultural activities and animal husbandry. Maize is the main crop grown over here beside wheat. They generally do farming for self-consumption.

2.11. INDUSTRY

After the White Revolution in Palanpur which was engineered by National Dairy Development Board, Dairy farming in the city has gained momentum. For the continuance of cooperative movement in this sector, the role of Banas Dairy is instrumental. Under NDD, Banas Dairy is considered as one of the largest dairies. The city has now become the manufacturer of various dairy products such as Pasteurized Milks, Ghee, Tea and Coffee Whitener, ice creams etc. Many whole sellers and retailers have developed in the city selling dairy products. Though not substantial, various other industries have also emerged in Palanpur. Along National highway 14, marble stone cutting industry has also developed. Various other small scale industries which have come up in the recent years are stone crushers, cement industries, metal pipe and cement manufacturing, small tools and submersible pumps. Isabgol produced from Psyllium seeds, which is used as a natural laxative is also manufactured in Palanpur.

The main industries of Abu Road include textile, rugs, woolen goods, vegetable oil and dyes. Heavy industries consist of copper and zinc smelting and the manufacture of railway rolling stock. The other industries related to Private Sector include steel, cement, ceramics and glass wares, electronic, leather and footwear, stone and other chemical industries. Altogether the industrial sector accounts for about 32.5 per cent of the total share of the state's economy. During 1995- 96 and 2001-02, the industrial sector of Rajasthan experienced growth at the rate of 6.9% per annum.

Head	Unit	Particulars
Registered Industrial Unit	NO.	6,383
Total Industrial Unit	NO.	6,585
Registered Medium & Large Unit	NO.	10
Estimated Avg. no. of Daily Worker Employed In Small Scale Industries	NO.	30,000
Employment In Large And Medium Industries	NO.	7,235
No. of Industrial Area	NO.	12
Turnover Of Small Scale Ind.	IN LACS	11,059

Head	Unit	Particulars
Turnover Of Medium & Large Scale Industries	IN LACS	16,865

Table 14. Industries in Aburoad

2.12. CONNECTING ROADS

National Highway 27 connecting Beawar in Rajasthan with Radhanpur in Gujarat passes through Abu Road, thus connecting it with the cities of Pali, Palanpur. Further, State Highways in Gujarat SH 712, SH 132 pass through Palanpur and connect Abu Road with nearby towns in Gujarat. State Highway SH 41 connects it with Mehsana& Ahmedabad. Abu Road is well connected via bus; more 150 buses are departure from Abu road to other cities. This place is in the border of the Sirohi District and Banaskantha District. Banaskantha District Amirgadh is west towards this place. It is near to the Gujarat State Border.

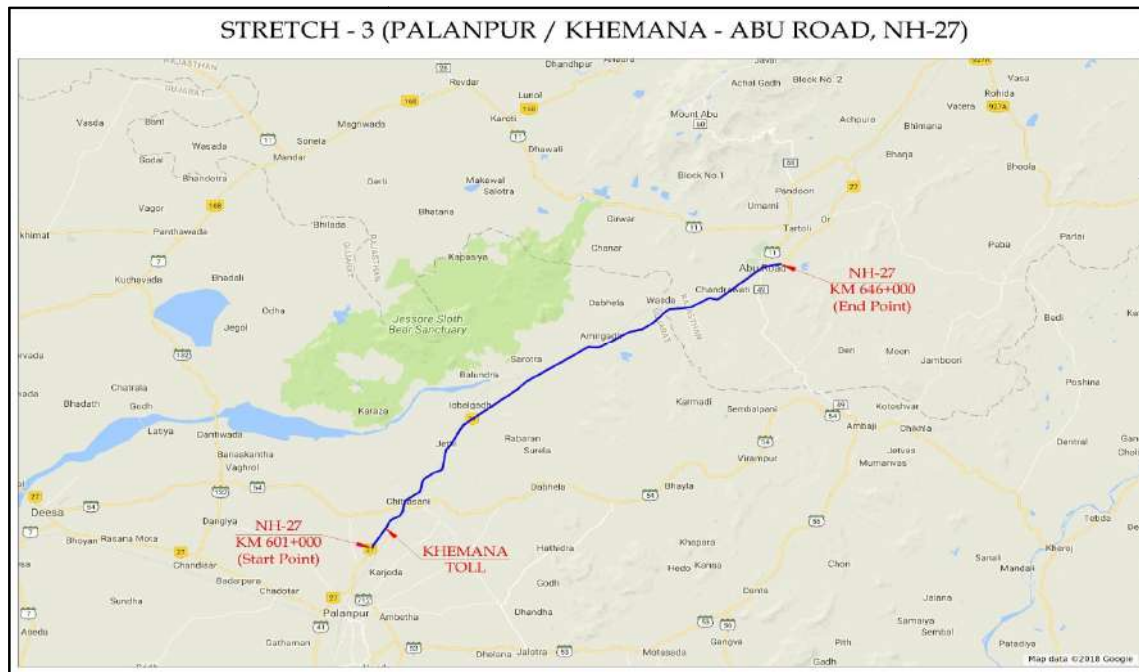


Figure 4. Map of connecting roads

2.13. UTILITIES

Abu Road is a city and municipality in Sirohi district of Rajasthan state in western India. It is the tehsil headquarters of Abu Road Tehsil by that name. It lies southeast of Mount Abu and its railway station is an important stop on the main Indian Railways line between Delhi and Ahmedabad. Mount Abu is 27 km up the hill from Abu Road. Sirohi is divided into 5 divisions in which mountabu is one of them, abu has tehsils where the tehsildaris termed as the head. The tourist preferred abu has 23 small villages, all under one Tehsildar. The tehsildar reports to the SDO of the region who in turn reports to the district collector. The active Nagarpalika is one of the oldest in the country and works with full dedication and the chairman is elected on the basis of elections conducted in the region in a span of 5 years. The poverty grasped place is administrated by many poverty alleviation programs for the welfare of the people by the government. The election comity made its Nagar Palika Board of 25 Parshads.

3. TRAFFIC STUDY

3.1. GENERAL

Traffic surveys have been carried out on the project road in order to identify present and likely future traffic scenarios so as to propose suitable measures and to evolve appropriate design methods. The primary objectives of these traffic surveys are to establish and assess the characteristics of traffic movement on the project road, pavement design, capacity augmentation proposals, junction improvement etc.

3.1.1. Project Background

National Highways Authority of India (NHAI) has decided to set up Infrastructure Investment Trust (InvIT) and monetize national highway projects. InvITs are instruments on the pattern of mutual funds and are designed to pool small sums of money from several investors to invest in assets that give cash flow over a period.

3.2. OBJECTIVES OF TRAFFIC STUDY

The objective of traffic study is to provide basic input for the following:

- Finding out the present level of traffic flow and its various characteristics (through Classified Traffic Volume Count).
- Capacity assessment based on demand forecasting for next 30 years.
- Identifications of zone of influence of the project stretch as per O-D Survey and Commodity Movement Characteristics survey.
- Axle Load Survey to determine the Vehicle Damage Factor (V.D.F) as input to pavement design.
- Deriving Growth Factor for Traffic demand Forecasting.
- Study traffic leakages through local alternative routes.
- Study of possible location & design of toll plaza.

3.3. PROJECT DESCRIPTION

The project site starts from Palanpur and ends at Abu Road covering a length of 45 Kms. (601+000 to 646+000). Project stretch is presented in Figure 5, where project road is the shortest itinerary, in length and travel time, between Palanpur and Abu Road providing congestion free services in the area. There is no alternative road or leakages at Toll Plaza.

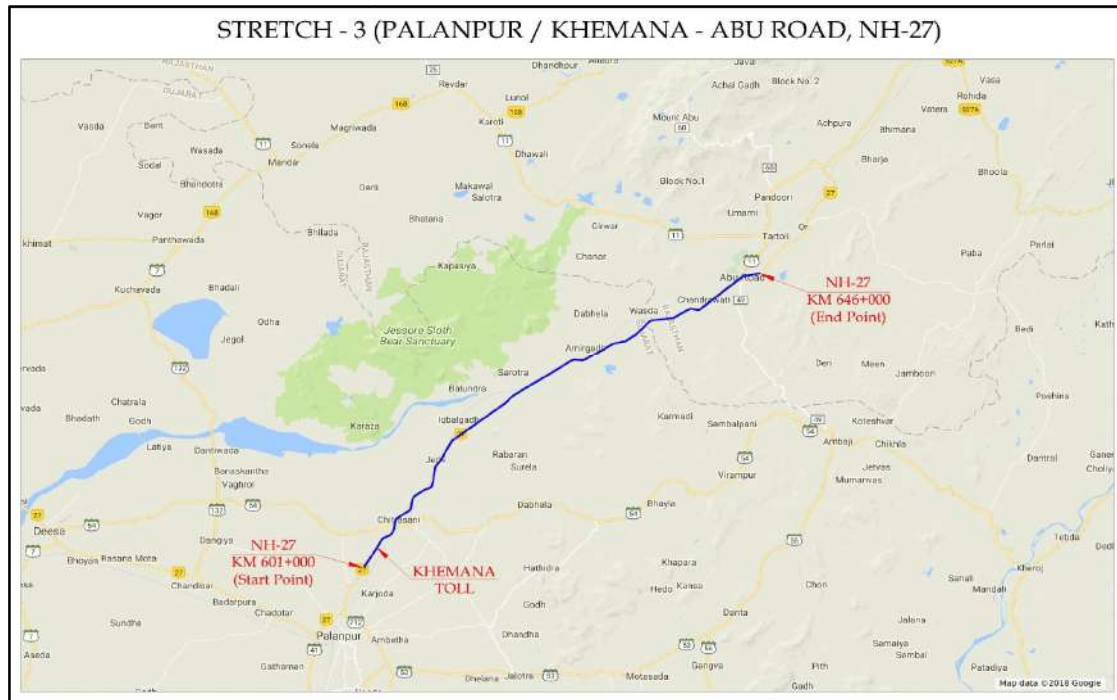


Figure 5.Key Map of Highway

3.3.1. Methodology

The methodology of the study is briefly described below:

1. Establish the base line traffic on the corridor based on the traffic surveys and analysis.
2. Identify key traffic generators for the study.
3. Estimate the induced and diverted traffic.
4. Establish the traffic growth rates using elasticity analysis.
5. Forecast the traffic for different horizon years.
6. Recommend the right capacity for the elements of the project corridor.

3.3.2. Organization of the Report

The Traffic chapter has organized into sections as discussed below:

Section 1 gives Introduction

Section 2 discusses the Project Characteristics

Section 3 discusses the Traffic Surveys and Analysis

Section 4 presents the Traffic Forecast

Section 5 presents the Capacity Analysis

3.4. PROJECT CHARACTERISTICS

3.4.1. REGIONAL SETTING

Project stretch mostly fall in the state of Rajasthan. It is one of main highway corridor connecting Gujrat with important tourist destination Mount Abu.



Figure 5 A: Project Corridor in Regional Perspective

The project road fall in closeness of web of national highways connecting important cities of Rajasthan and Gujrat. Palanpur, Ahmedabad, Mount Abu, Udaipur are some of important cities which are used by traffic plying on this stretch.

Other major highways along the project road are:-

Beawar – Pali Pindwara – NH -62

Kishangarh-Udaipur- Ahmedabad – NH 58

3.5. TRAFFIC SURVEY LOCATIONS AND ANALYSIS

The classified traffic count station, Axle load and Origin Destination surveys location was decided near to the toll plaza to reassess the requirements. Traffic survey location was as under (Khemana Toll Plaza). Traffic survey locations are as under.

3.5.1. Survey Plan

The feasibility and design of any highway facility (or a corridor) depends on the volume and intensity of traffic likely to flow on it in the design year. The estimation of the likely traffic scenario in the design year on the highway/corridor proposed for improvement, with an optimal lane configuration as in the present case, requires basic information regarding the current level of traffic and its characteristics on it. Thus, the collection of basic data on the nature and extent at present of different traffic parameters assumes greater significance.

The traffic on the Project corridor is characterized by a high degree of motorized vehicles, which consist of two wheelers, commercial vehicles, cars and buses. Non-motorized vehicles are mainly cycles.

3.5.2. Homogeneous sections

Reconnaissance survey carried out to understand the travel pattern on the project road. Based on the reconnaissance survey, only one homogeneous section is considered for analysis.

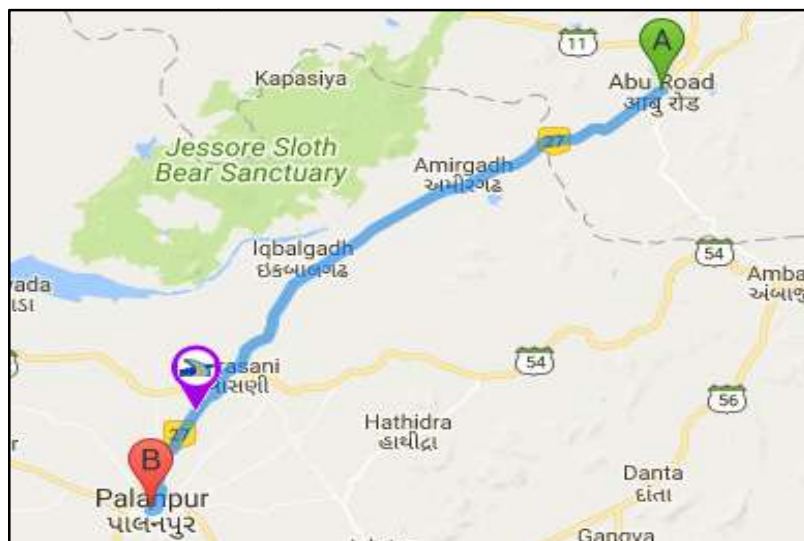


Figure 6. Toll Plaza cum Traffic Survey Locations (Khemana Toll Plaza)

3.5.3. Traffic survey locations

Traffic studies detail mode wise traffic estimates, travel pattern of passenger and freight (goods) vehicles, speed and delay (travel time) characteristics and axle load characteristics. Traffic surveys conducted as per the guidelines given in IRC: SP-19. The locations and type of various traffic surveys have carefully finalized based on reconnaissance survey as well as requirements of the RFP.

The following traffic surveys carried out on the project corridor as well as competing corridors to assess and estimate the potential traffic on the project corridor.

Following traffic surveys had been conducted to assess the traffic on the project road.

Traffic surveys have been conducted during the month of November as specified in Table 15.

Sr. No.	Type Of Survey	Survey Location Name	Start Date	End date	Total Days
1	Classified Traffic Volume Count	Khemana Toll Plaza	25-11-2020	01-12-2020	7
2	OD Survey	Khemana Toll Plaza	24-12-2020	25-12-2020	1
3	Axle Load Survey	Khemana Toll Plaza	24-12-2020	25-12-2020	1

Table 15. Schedules of Traffic Surveys

3.6. VEHICLE CLASSIFICATION

The classified traffic volume counts were carried out for 7 continuous days at the selected survey stations as per IRC guidelines on the subject (IRC: 9-1972) using video-graphic method.

The following classes of vehicles are counted separately:

S. No.	VehicleCategory
1	Car, Jeep and Van
2	TwoWheeler
3	Auto Rickshaw
4	Minibus
5	Bus
6	Mini LCV
7	LCV
8	2 - axle Truck / Bus
9	3 - axle Truck / Bus
10	MAV up to 6 – axles
11	Oversized Vehicles (more than 6 - axles)
12	Heavy Machinery & Earth Moving Equipment
13	WithoutTrailer
14	WithTrailer
15	Cycle
16	CycleRickshaw
17	Animal DrawnCart

Table 16. Classifications of vehicles

The traffic count data analyzed to depict hourly and daily variations, traffic volume count per day and weekly Average Daily Traffic (ADT) for each vehicle type. The Annual Average Daily Traffic (AADT) is worked out by applying seasonal factors.

3.7. SURVEY METHODOLOGY

The methodology carried out is as follows:

- Traffic surveys have been carried out in accordance with the guidelines specified by IRC: 9-1972, IRC SP 19 -2001 and IRC: 102-1988. The methodology adopted for the traffic study is detailed as below.
- The project road corridor is considered a homogeneous section based on traffic flow pattern.
- The traffic surveys including classified traffic volume count is carried out for this traffic homogeneous section.
- The classified directional traffic volume counted over seven consecutive days for 24 hours on each day. The vehicle classification considered was in accordance with IRC:64. Number of vehicles in either direction was noted at 1-hour intervals in accordance with their classification by observers specially trained for this purpose.
- The classified traffic count data collected has been analyzed for hourly and daily traffic intensity, traffic composition, peak hour factor (PHF), directional distribution, average daily traffic (ADT) and finally annual average daily traffic (AADT) by applying the seasonal correction factors.
- Traffic volume analysis has been carried out to assess the volume of traffic, composition, hourly variation in traffic over 24 hours, and the daily variation in the traffic over 7 days at the project locations. The compiled data obtained from field traffic survey has been analyzed to work out the average daily traffic in terms of total vehicles and total PCUs. The PCU factors used in the analysis, as referred from IRC:64 is presented in Table 17.

VehicleType	PCU Factor
FastMovingVehicle (FMV)	
Two Wheeler	0.5
Three Wheeler	1.0
Car/ Jeep/ Van/ Taxi	1.0
Mini Bus	1.5
Full Bus	3.0
LCV	1.5
2-Axle Truck	3.0
3 - Axle Truck	3.0
Article/ Semi Artic Truck	4.5
Tractor with Trailer	4.5
Tractor without Trailer	1.5
SlowMovingVehicle (SMV)	
Cycle	0.5
Cycle Rickshaw	2.0
Bullock Cart	8.0
Horse Drawn Cart	4.0

Table 17.Vehicle Classification and PCU Factors

3.8. TRAFFIC VOLUME ANALYSIS

The analysis of classified volume counts observed at the counting location (collected for seven continuous days) was carried out to arrive the:

- Average Daily Traffic (ADT) for fast and slow moving vehicles.
- Traffic Composition
- Annual Average Daily Traffic (AADT)

3.8.1. SEASONAL FACTOR

The traffic plying on any road generally varies over different periods of the year depending on the cycle of different socio-economic activities in the regions through which it generates or terminates. Therefore, in order to have a more realistic picture of the traffic on the project road, it is required to assess its seasonal variation to estimate the annual average daily traffic (AADT). The ADT observed during the survey duration has been multiplied by a seasonal correction factor (SCF) to arrive at AADT. The seasonal correction factors have been derived for the month of November from past monthly toll plaza traffic as we had available the classified monthly number of vehicles from 2015 to 2017 as provided by PIU NHAI. The following tables show the number of vehicles for 2017 and the average monthly number of vehicles for the years 2015/2016/2017:

KhemanaToll Plaza - Traffic 2017									
Month	Bus	CJV	LCV LGV	MAV + 4 axle	3 - wheeler	Truck - 2 Axle	Truck - 3 Axle	2 - wheeler	Others
January	10,502	170,581	5,441	27,997	7,041	31,761	84,194	55,007	78
February	12,060	164,779	5,060	28,900	6,967	30,974	81,647	56,350	100
March	14,241	173,818	5,509	33,986	6,679	34,571	91,898	57,270	147
April	15,198	186,184	5,003	30,574	7,381	33,650	86,431	58,305	124
May	17,176	212,017	5,132	30,381	7,577	33,604	84,760	58,826	131
June	13,668	180,134	5,102	28,848	7,123	30,224	78,958	61,858	128
July	12,529	151,050	5,208	31,298	6,518	25,598	73,950	57,642	147
August	13,505	183,908	5,600	39,681	10,329	31,108	98,981	86,248	164
September	14,303	152,247	5,657	29,341	7,342	30,532	85,580	71,019	217
October	15,369	203,975	6,437	29,522	7,312	30,812	78,096	67,643	169
November	12,224	135,603	5,316	25,959	5,262	25,589	65,913	46,259	127
December	14,437	173,043	6,748	33,075	6,857	32,165	84,473	53,242	134

Table 18. Actual Monthly Traffic for 2017

Khemana Toll Plaza – Average Traffic 2015 - 2017									
Month	Bus	CJV	LCV LGV	MAV + 4 axle	3 - wheeler	Truck - 2 Axle	Truck - 3 Axle	2 - wheeler	Others
January	8,724	128,257	5,029	28,766	6,279	37,403	79,062	50,217	519
February	9,698	134,795	4,525	22,611	6,437	27,506	81,641	52,011	2,762

Khemana Toll Plaza – Average Traffic 2015 - 2017									
Month	Bus	CJV	LCV LGV	MAV + 4 axle	3 - wheeler	Truck - 2 Axle	Truck - 3 Axle	2 - wheeler	Others
March	10,598	141,409	4,966	24,894	6,781	29,656	85,118	57,494	2,924
April	11,677	170,760	4,860	24,876	7,190	33,094	86,626	51,662	123
May	12,900	192,714	4,920	25,288	7,264	32,325	85,212	37,435	102
June	10,714	165,207	4,943	25,159	6,630	29,534	55,509	54,203	103
July	9,647	151,565	5,030	26,504	6,681	27,056	76,467	53,508	101
August	9,934	168,958	5,193	28,442	8,991	29,247	84,113	69,975	107
September	11,404	160,679	5,142	25,314	7,974	30,298	82,420	65,351	126
October	11,327	165,753	5,455	25,913	7,134	30,365	81,821	61,645	118
November	10,810	175,986	5,286	23,693	6,620	26,927	71,156	52,861	84
December	11,326	168,098	5,845	28,108	7,021	30,913	84,119	54,433	95

Table 19. Actual Average Monthly Traffic for the Period 2015 - 2017

As discussed above seasonal correction factor is calculated based on toll collection data. As survey is conducted in month of November, following table give the SCF of various vehicles:

Khemana Toll Plaza - Seasonal Factors for November based on actual Traffic									
Scenario	Bus	CJV	LCV LGV	MAV + 4 axle	3 - wheeler	Truck - 2 Axle	Truck - 3 Axle	2 - wheeler	
SCF	0.99	0.91	0.96	1.09	1.07	1.13	1.12	1.04	

Table 20. Estimated Seasonal Factors for the Month of November

Due to the COVID – 19 a certain uncertainty is perceived in the travel behavior pattern of road users a SCF of 1.0 is used for all vehicle categories in this report.

3.8.2. ANNUAL AVERAGE DAILY TRAFFIC (AADT)

Using the seasonal factors is 1, the ADT (Average Daily Traffic) has been converted into AADT (Annual Average Daily Traffic) applying seasonal correction factor as per Clause 6.2 IRC SP: 19, using this procedure, AADT has been worked out and presented in table 21.

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
2 Wheeler	3,248	3,248	1,624
3 Wheeler	121	121	121
Passenger Car	7,376	7,376	7,376
Mini LCV	315	315	315
Mini Bus	36	36	54

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
Standard Bus	420	420	1,260
LCV -4 Tyre	18	18	18
LCV - 6 Tyre	61	61	92
2 - Axle trucks	776	776	2,328
3 - Axle trucks	1,125	1,125	3,375
MAV (4 - 6)	4,659	4,659	20,966
Oversized vehicles >6	258	258	1,161
HCM/EME	0	0	0
Tractors	18	18	27
Tractor with Trailer	74	74	333
Cycles	28	28	28
Cycles rickshaw	309	309	618
Animal Cart	19	19	76
Hand Cart	8	8	64
Exempted vehicles	10	10	20
Total Tollable	15,044	15,044	36,944
Total	18,879	18,879	39,855

Table 21. Annual Average Daily Traffic (AADT) (Red box above: Tollable traffic)

3.8.3. PAST TRAFFIC GROWTH

The pattern of yearly traffic growth varies due to the changes of commercial and industrial use, and the capacity changes along the highway segment. Growth between year 2018 to 2020 has been worked out and presented in table 21.

Vehicle	2018	2020	Yearly Growth	Remarks
Passenger Car	5,980	7,376	11%	A CAGR of 8-9% is normal for cars on a highway, since due to COVID higher traffic growth is coming in the month from September to till date due to unlocking of traffic movement . Normal traffic growth will occur in long run.
Mini LCV	465	315	-18%	Small Distance Vehicle and changed travel pattern due to COVID. Long Run traffic growth will be normal
Minibus	28	36	13%	Normal
Standard Bus	258	420	28%	New Launch of Bus Facilities in the Public Transportation

Vehicle	2018	2020	Yearly Growth	Remarks
				System. As per IHMCL data 288 buses are observed in 2019. Long Run traffic growth will be normal
LCV -4 Tyre	121	18	-61%	Conversion of Vehicles to higher Axles due to loading of road transportation cost. And COVID Effect is also contributing to the growth observed. Post COVID a normal growth rate is likely to Prevail.
LCV - 6 Tyre	536	369	-17%	
2 - Axle trucks	569	776	17%	
3 - Axle trucks	1455	1125	-12%	
MAV (4 - 6)	3,418	4,658	17%	

Table 22.Past Traffic Growth 2018 to 2020 (ADT)

3.8.4. COMPOSITION OF TRAFFIC

Analysis was carried out to find the composition of traffic in terms of fast and slow moving traffic and in terms of various types of vehicles. Predominantly car and two-wheeler traffic has been observed on the project road. The observed vehicular compositions are shown inFigure 6.

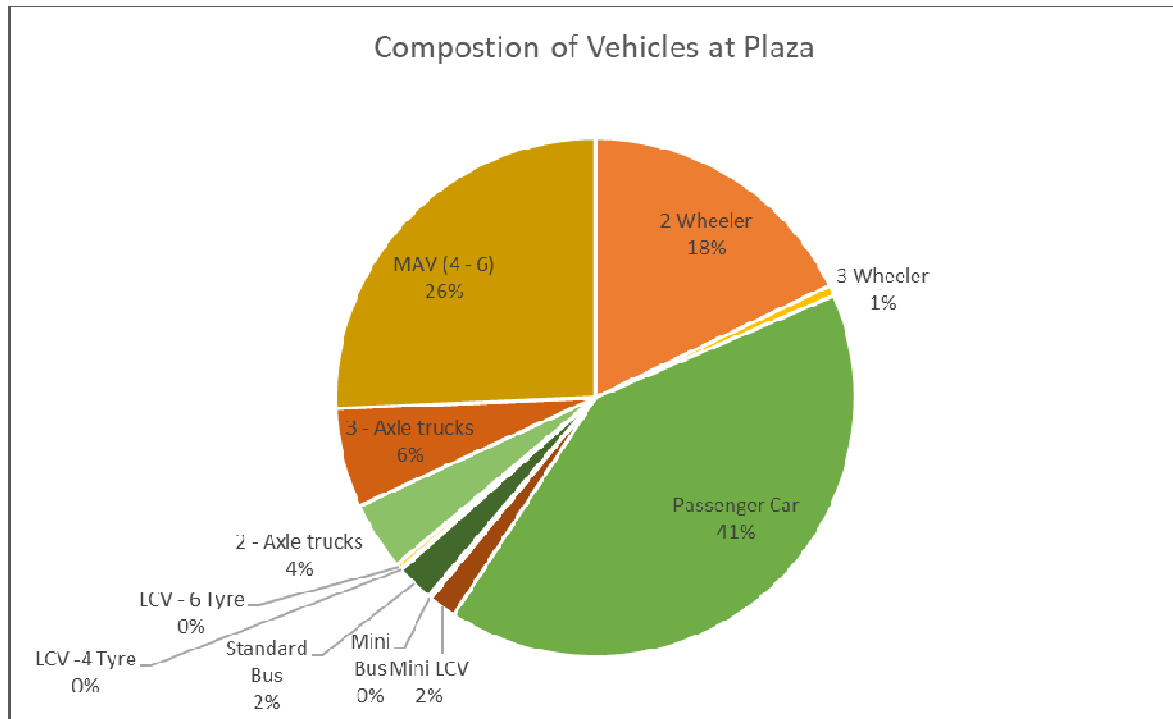


Figure 6.Traffic Composition at Khemana

3.8.4.1. HOURLY VARIATION OF TRAFFIC

Analysis has carried out to study the hourly variation and peak-hour traffic characteristics. The hourly variation of traffic at survey locations is presented graphically below Figure 7.

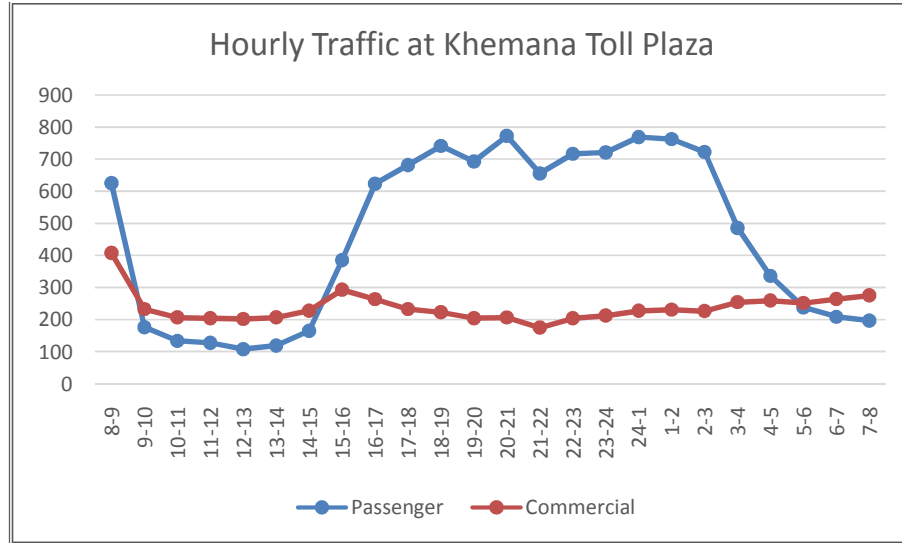


Figure 7. Hourly Variation of Traffic at Khemana

Above figure suggest peak commercial traffic at nighttime or and passenger vehicle peak at mid-day time.

3.8.4.2. PEAK HOUR FACTOR ANALYSIS

The Peak-hour traffic has been estimated based on hourly traffic volumes observed at the Toll Plaza.

Estimated Peak hour details, traffic analyzed from ADT, peak-hour volume of total traffic and tollable traffic have been estimated and presented in Table 23.

Location	PeakHour	PeakHourVehicles		PeakHourFactors		Directional Split (Tollable)
		Total	Tollable	Total	Tollable	
Khemana	10:00 – 11:00 am	1,138	782	6.70%	6.10%	46.0% Palanpur to Abu Road
						54.0% Abu Road to Palanpur

Table 23. Peak-Hour and Peak-Hour Factors

3.8.4.3. DAILY VARIATION OF TRAFFIC

Daily variation of Traffic flow has studied and presented below at all the traffic survey location. There is some variation in the daily traffic and the pattern is on expected line. Daily variation has been analyzed for toll plaza locations and presented in Figure 8.

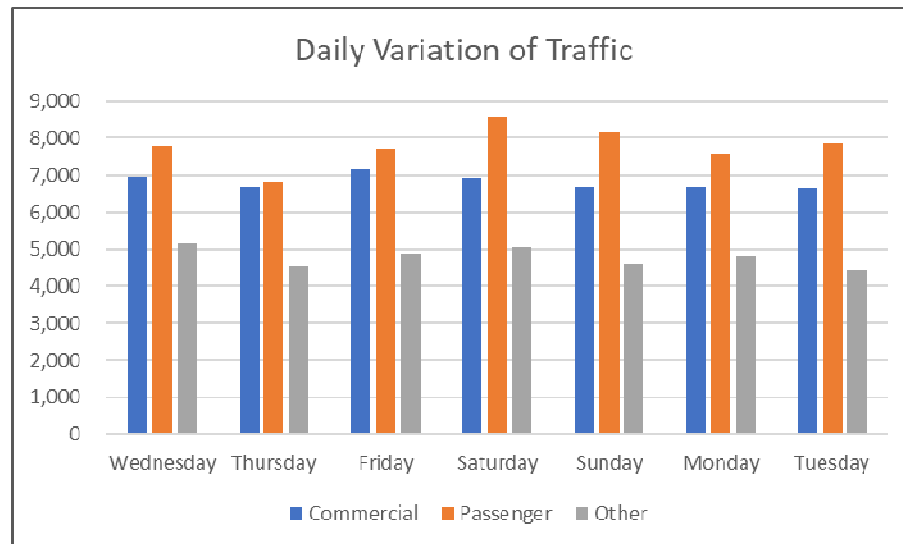


Figure 8. Daily Variation of Traffic at Khemana

The Salient Features for the traffic are:

- Freight vehicles are around 40%. This is expected as the highway is bordering Gujrat and Rajasthan
- LCV and 2 Axle vehicles are similar in numbers and MAVs less.
- Passenger vehicles is around 60% on project corridor
- Two wheelers are high in numbers due to the presence of villages and towns on the corridor.

3.9. ORIGIN DESTINATION SURVEY

During the OD survey all the relevant information was collected from the vehicle operators in pre designed format by stopping vehicles at random sample basis. The collected data includes vehicle number, origin and destination place, commodity carried, distance travelled, no. of trips in a month, willingness to pay toll etc. The Table 27 presents relevant O/D zone locations.

Zone No.	Place Name
1	Swaroopganj side
2	Mount Abu, Abu road
3	Palanpur
4	Ahmedabad
5	Kandla Side, Rest of Gujarat
6	Udaipur, Kota, Chittorgarh side
7	Jodhpur, Falna side of Rajasthan
8	Rest of Rajasthan
9	MP, UP, Bihar, WB, Jharkhand, Odisha
10	Delhi, Punjab, Haryana, Himachal, J&K

Zone No.	Place Name
11	Maharashtra and South India

Table 24. Coding details of various OD Zones

3.9.1. ANALYSIS OF ORIGIN AND DESTINATION AND COMMODITY MOVEMENT SURVEY

The origin destination survey was carried out at Khemana Toll Plaza. Data collected has been analyzed by checking incorrect and inconsistent records with original field data sheets. The checked and corrected data were used for final analysis. Table 25 presents the percentage sample size collected.

Vehicle Type	Sample	ADT	Sample %
Car	631	7,376	8.55%
Mini bus	5	36	13.89%
Bus	90	420	21.43%
LCV	72	79	91.14%
2A	69	776	8.89%
3A	134	1,125	11.91%
MAV	419	4,659	8.99%
Total	1,420	14,471	9.81%

Table 25. Percentage Sample Size for all locations in OD Survey

3.9.2. COMMODITY ANALYSIS

Different commodities recorded during the O-D survey were classified into different categories and due consideration has been given to include all possible commodities moving along the project road. After coding of Origin – Destination data, commodity movements found on corridor has been analyzed commodity wise vehicle category wise. The analysis results are presented in Table 26 shown below. Composition of commodity movement on the corridor has been presented in Figure 9.

Commodity	LCV	2A	3A	4A	5A	6A	Total
Empty	100%	41%	17%	14%	14%	8%	17%
Agriculture Product	0%	1%	6%	5%	6%	8%	6%
Perisable products	0%	3%	8%	7%	4%	0%	5%
Building Materials	0%	9%	8%	10%	24%	39%	17%
Cement	0%	0%	8%	5%	5%	12%	6%
Chemical Products	0%	4%	12%	16%	13%	8%	12%
Coal	0%	0%	0%	3%	6%	10%	4%
Consumer Products	0%	7%	8%	5%	5%	2%	6%
Diesel	0%	0%	0%	1%	0%	0%	0%
Machine and Machine Parts	0%	20%	16%	19%	6%	5%	13%
Manufacturing Products	0%	1%	4%	2%	0%	0%	1%

Commodity	LCV	2A	3A	4A	5A	6A	Total
Metals	0%	8%	2%	3%	6%	2%	4%
Milk	0%	3%	2%	2%	8%	2%	4%
Minerals & Ores	0%	0%	0%	0%	0%	2%	0%
Parcel & paper Products	0%	1%	1%	1%	1%	0%	1%
Petroleum Products	0%	0%	2%	1%	0%	0%	1%
Rubber & Plastic Products	0%	0%	2%	2%	0%	0%	1%
Textile Products	0%	0%	5%	2%	0%	0%	1%
Wood and Forest Products	0%	0%	1%	3%	1%	0%	1%
Miscellaneous	0%	1%	0%	0%	0%	2%	0%

Table 26. Vehicle wise Commodity Distribution (%)

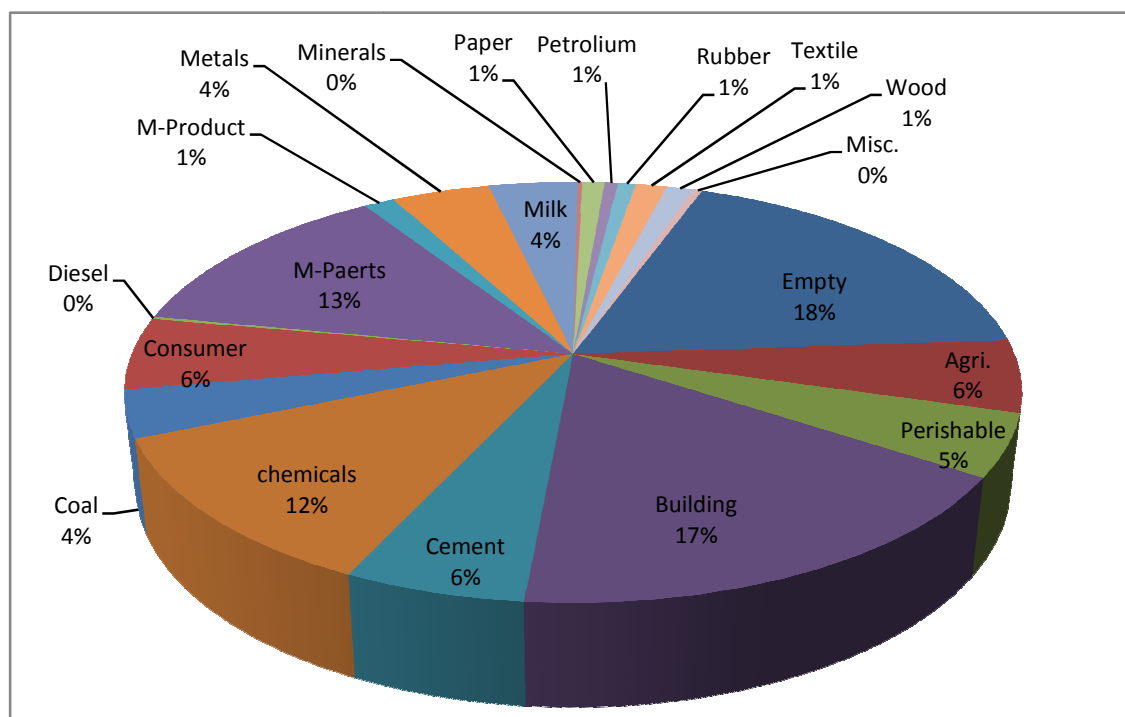


Figure 9. Commodity Distribution

3.9.3. TRAVEL PATTERN

The travel pattern of different categories about different locations between these broadly classified zones is presented in

Zone From/To	Swaroopganj side	Abu, Aburoad	Planapur	Ahmedabad	Rest of Gujarat	Udaipur Kota Chittod side	Jodhpur Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB,Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Maharashtra and South India
Swaroopganj side	0.3%	1.5%	10.2%	7.8%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Abu, Aburoad	0.3%	2.1%	11.7%	6.3%	5.1%	0.0%	0.0%	0.0%	0.3%	0.0%	0.3%
Palanpur	5.4%	4.8%	8.4%	0.0%	1.8%	0.9%	0.0%	2.4%	0.0%	0.0%	0.0%
Ahmedabad	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest of Gujarat	0.9%	0.3%	0.0%	0.0%	0.0%	0.6%	0.3%	1.8%	0.0%	0.0%	0.0%
Udaipur Kota Chittod side	0.0%	0.9%	0.3%	0.6%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Jodhpur Falna side of Rajasthan	0.0%	0.0%	0.0%	3.3%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest of Rajasthan	0.0%	0.3%	7.8%	4.8%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MP, UP, Bihar, WB,Jharkhand, Odisha	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Delhi, Punjab, Haryana, Himachal, J&K	0.0%	0.6%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maharashtra and South India	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%

Table 27,28and 29.

Zone From/To	Swaroopganj side	Abu, Aburoad	Planapur	Ahmedabad	Rest of Gujarat	Udaipur Kota Chittod side	Jodhpur Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB,Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Maharashtra and South India
Swaroopganj side	0.3%	1.5%	10.2%	7.8%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Abu, Aburoad	0.3%	2.1%	11.7%	6.3%	5.1%	0.0%	0.0%	0.0%	0.3%	0.0%	0.3%
Palanpur	5.4%	4.8%	8.4%	0.0%	1.8%	0.9%	0.0%	2.4%	0.0%	0.0%	0.0%
Ahmedabad	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest of Gujarat	0.9%	0.3%	0.0%	0.0%	0.0%	0.6%	0.3%	1.8%	0.0%	0.0%	0.0%

Zone From/To	Swaroopganj side	Abu, Aburoad	Planapur	Ahmedabad	Rest of Gujarat	Udaipur Kota Chittod side	Jodhpur Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB, Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Maharashtra and South India
Udaipur Kota Chittod side	0.0%	0.9%	0.3%	0.6%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Jodhpur Falna side of Rajasthan	0.0%	0.0%	0.0%	3.3%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rest of Rajasthan	0.0%	0.3%	7.8%	4.8%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MP, UP, Bihar, WB, Jharkhand, Odisha	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Delhi, Punjab, Haryana, Himachal, J&K	0.0%	0.6%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maharashtra and South India	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%

Table 27. Zone wise Passenger Vehicle Movement

Zone From/To	Swaroopganj side	Abu, Aburoad	Planapur	Ahmedabad	Rest of Gujarat	Udaipur Kota Chittod side	Jodhpur Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB, Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Maharashtra and South India
Swaroopganj side	0.0%	3.3%	7.3%	1.4%	5.2%	0.0%	0.0%	0.5%	0.3%	0.0%	0.0%
Abu, Aburoad	0.3%	0.3%	1.4%	0.3%	1.1%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
Planapur	5.4%	0.5%	4.3%	0.0%	0.3%	1.1%	0.0%	0.8%	0.0%	0.3%	0.0%
Ahmedabad	0.8%	0.0%	0.0%	0.0%	0.0%	1.4%	2.4%	4.1%	0.5%	0.3%	0.0%
Rest of Gujarat	1.6%	0.3%	0.0%	0.0%	0.0%	3.5%	0.5%	7.3%	3.0%	1.9%	0.0%
Udaipur Kota Chittod side	0.0%	1.9%	1.1%	0.3%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
Jodhpur Falna side of Rajasthan	0.0%	0.5%	0.8%	1.4%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%
Rest of Rajasthan	0.0%	0.3%	2.2%	4.9%	6.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
MP, UP, Bihar, WB, Jharkhand, Odisha	0.0%	0.0%	0.0%	1.1%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Delhi, Punjab, Haryana, Himachal, J&K	0.0%	0.8%	0.0%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maharashtra and South India	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 28. Zone wise Goods Vehicle Movement

S. No.	Zones of Influence	Passenger	Goods
1	Swaroopganj side	21.3%	17.9%
2	Abu, Aburoad	26.0%	3.5%
3	Palanpur	23.7%	12.8%
4	Ahmedabad	0.0%	9.5%
5	Rest of Gujarat	3.9%	18.2%
6	Udaipur, Kota, Chittorgarh side	2.1%	6.8%
7	Jodhpur, Falna side of Rajasthan	6.3%	7.3%
8	Rest of Rajasthan	15.0%	14.1%
9	MP, UP, Bihar, WB, Jharkhand, Odisha	0.3%	3.5%
10	Delhi, Punjab, Haryana, Himachal, J&K	0.9%	5.7%
11	Maharashtra and South India	0.6%	0.5%

Table 29. Zone wise Goods and Passenger Vehicle Movement (%)

Major OD pairs are highlighted in pink in above table. From above tables it is derived that 50 % of passenger vehicles are through traffic at Toll Plaza and 85% of Freight vehicles are through.

3.9.1. ORIGIN AND DESTINATION DESIRE LINES

The desire lines have been prepared based on the analysis of Origin and destination travel trips and Trip desire patterns for the station used on project road. The details of OD desire lines are shown in Figure 10 and Figure 11.

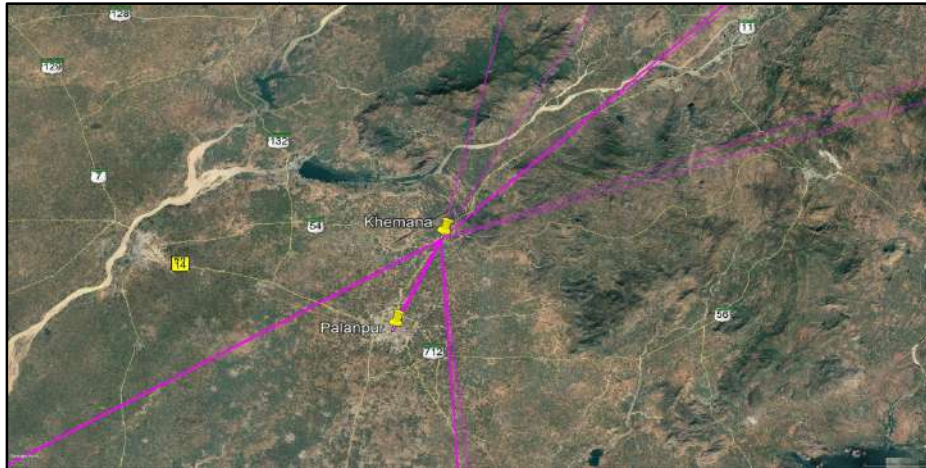


Figure 10. Map Showing Pattern of Goods Traffic



Figure 11. Map Showing Major Passenger Traffic

3.9.2. LEAD AND LOAD ANALYSIS

The survey data was analyzed to assess the lead and load distribution for commercial vehicles. Location wise Trip length frequency distribution for goods vehicles is shown in Table 30.

Trip Length (km)	LCV	2A	3A	4A	5A	6A
25 – 50	15%	3%	6%	3%	2%	3%
50 – 100	20%	4%	9%	1%	3%	1%
100 – 250	15%	3%	3%	1%	2%	1%
250 – 500	15%	10%	17%	7%	16%	14%
500 – 1000	24%	59%	38%	35%	46%	59%
1000 – 1500	9%	21%	25%	45%	30%	22%
1500 – 2000	2%	0%	1%	8%	0%	0%
> 2000	0%	0%	1%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%

Table 30. Trip Length Frequency Distribution (%)

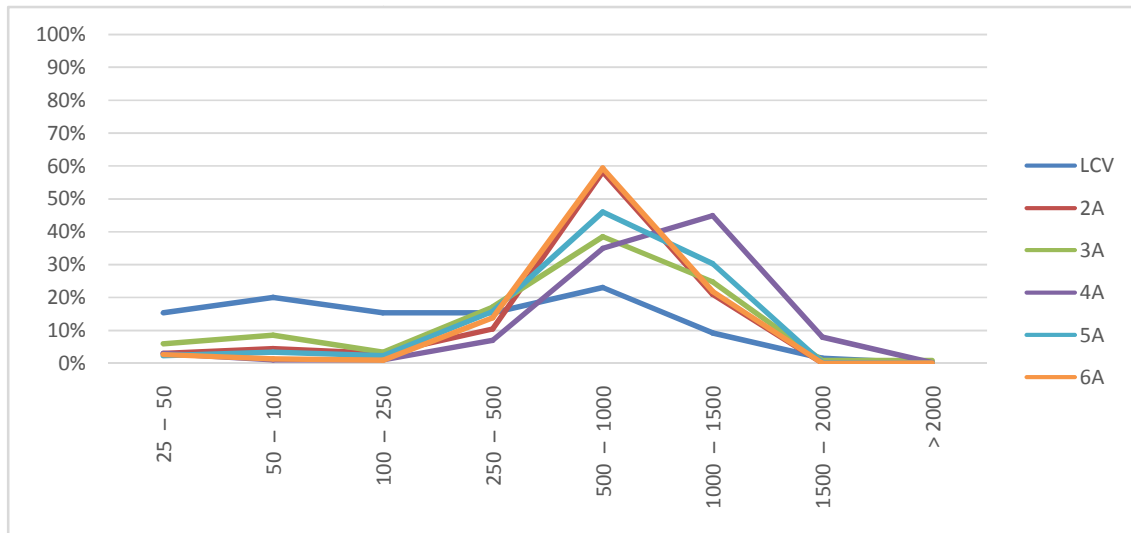


Figure 12. Trip Length Frequency Distribution (km)

Predominant traffic movement has been reported between 500 and 1500 km category.

3.10. TRAFFIC GROWTH

3.10.1. GENERAL

This section presents estimates of traffic growth rates. Traffic growth rates for the study, to be used subsequently for forecasting traffic on the Project Stretch, have been estimated by adopting the Elasticity of Transport Demand method as stipulated in IRC: 108, which is a proven and therefore most commonly used technique in India. The method relies on the correlation between:

- Past trends in traffic growth on the Project Stretch / Traffic passing through Toll Plazas.
- Time series data on Gross State Domestic Product (GSDP) for project influence area.

For all modes, GSDP has been considered as independent variable and elasticity estimate associated with GSDP has been considered for estimating traffic growth. GSDP can be forecasted more reliably as compared to other economic parameters as it can be correlated with the National GDP.

Regression analysis has been carried out using past trends on traffic, vehicles registration and economic indicators, to estimate elasticity for each type of vehicle. Toll plaza traffic collected from PIA NHAI has been used for regression analysis.

The projected growth rates worked out for major vehicle groups, namely, car, LCV, bus/ trucks, MAV and Oversized vehicles. The likely future shift among the vehicle categories, like, the probable shift of vehicle ownership from 2-axle trucks to 3-axle trucks, 3-axle trucks to MAVs and 2/3 wheeler market to car, etc., have also been taken into account while adjusting the elasticity values.

3.10.2. PAST TRAFFIC GROWTH

Following table presents the actual traffic growth registered for Khemana Toll Plaza as provided by PIA NHAI. The traffic numbers have been normalized and presented in below table.

Type/Year	2017	2016	2015	2014	2013	2012	2011	2010
-----------	------	------	------	------	------	------	------	------

Bus	13,768	9,684	8,738	6,606	7,152	6,148	4,805	2,933
CJV	173,945	160,287	146,813	106,279	115,362	103,943	98,949	67,310
LCV / LGV	5,518	4,920	4,861	3,523	3,537	2,372	1,687	868
MAV (+ 4 axle)	30,797	26,436	20,160	12,120	9,788	7,668	7,473	5,285
Three wheeler	7,199	7,256	6,795	5,085	6,805	5,418	4,641	3,577
Truck - 2 Axle	30,882	30,657	29,542	23,842	27,241	25,473	25,156	18,038
Truck - 3 Axle	82,907	73,679	81,730	65,213	66,585	59,716	59,879	43,049
Two wheeler	60,806	56,344	48,050	38,895	42,899	36,713	34,661	31,240
Others	139	1,578	74	52	54	41	40	23

Table 31. Average Monthly Traffic Volume

Significant traffic has been reported between 2012 and 2015 due to forcefully diverted traffic from other parallel corridors in view of construction works. Due to that actual traffic growth trends could not be analyzed properly. Due to this reason, only traffic growth trends from year 2014 to 2017 and estimated traffic for 2020 have been taken in to account for estimation of future traffic trends.

3.10.3. PROJECT INFLUENCE AREA

Project influencing area (PIA) has been outlined based on location and traffic patterns observed. The socio-economic indicators of the project influence area affect the traffic growth on the Project Stretch. Although this project is partially located in Gujarat, PIA % consideration is present below:-

Year	PIA % Passenger	PIA % Goods
Rajasthan	95%	60%
Gujarat	5%	30%
Other states	-	10%

Table 32. PIA State % contribution

Year	PIA GSDP Passenger	PIA GSDP Goods
2012-2013	60353	70759
2013-2014	63130	74507
2014-2015	66864	80036
2015-2016	70680	85679
2016-2017	75061	92212

PIA State GSDP

Source: Central Statistics Office, New Delhi

Note: GSDP constant prices base, 2011-2012

3.10.4. ESTIMATES OF TRANSPORT DEMAND ELASTICITY

Regression analysis has been carried out between GSDP, Vehicles Registration in the PIA and Past Traffic passing through Toll Plaza using the econometric model methodology specified in IRC 108 as detailed below.

$$\text{Loge } P = A_0 + A_i \text{ Loge } \text{GSDP}$$

Where:

P = Traffic Volume

GSDP = Gross State Domestic Product

A₀ = Regression Constant

A_i = Regression (Coefficient)

The value of A_i is known as the Elasticity Coefficient. The Elasticity coefficient is the factor by which the GSDP growth rate has to be multiplied to arrive at the growth rate of traffic. The following table summarizes the results of the regression analysis for transport demand elasticity. The final growth rates have been derived by establishing a relation between the time series data available for India GDP and GSDP of PIA.

First, a regression analysis with India GDP and PIA GSDP has been carried out considering the following values of GDP:

Year	GDP
2014-15	1,24,67,959
2015-16	1,37,71,874
2016-17	1,53,91,669
2017-18	1,70,98,304
2018-19	1,89,71,237
2019-20	2,03,39,849

Table 33. India GDP

Source: IMF & Central Statistics Office, New Delhi

Note: GDP constant prices base, 2011-2012

The regression analysis arrives to an elasticity value of 0.984 for passenger and 1.080 for freight which is used later on this chapter to determine GSDP growth and the traffic growth projections.

Regarding past trends and their correlation with corresponding PIA GSDP, regression analysis of Past Traffic (2014 - 2018) and Vehicles Registration of PIA (2011 - 2017) have been carried out with PIA GSDP arriving to the following elasticity values for each toll plazas:

Vehicle	Elasticity - Past Traffic	Elasticity - VR	Average
Car	0.37	0.53	0.45
Bus	0.19	0.85	0.52
LCV	0.48	1.00	0.74
2 AT	-0.18	0.91	0.36
3 AT	-0.20	0.91	0.35
MAV	0.12	0.91	0.51

Table 34. Results of Regression Analysis

Three axle and two axle traffic show a negative trend probably due to the replacement of standard trucks by MAVs and also, and in less extent, by LCVs. It can be also observed in above tables above a significant growth of Multi-Axle Vehicles most likely due to the development of Adani port near Bhuj,

Gujarat. This should be considered a kind of short term effect which most probably will not sustain for longer periods. Past trends of goods handled by Adani port has been presented in Figures below.

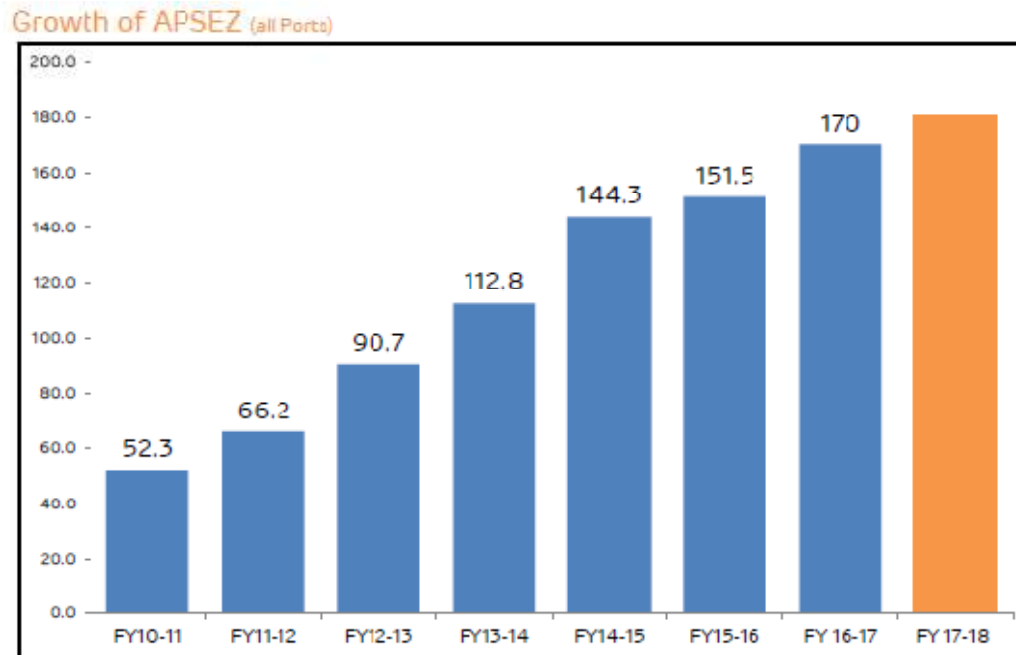


Figure 13. Yearly MMT (Million Metric Tons) Traffic Handled

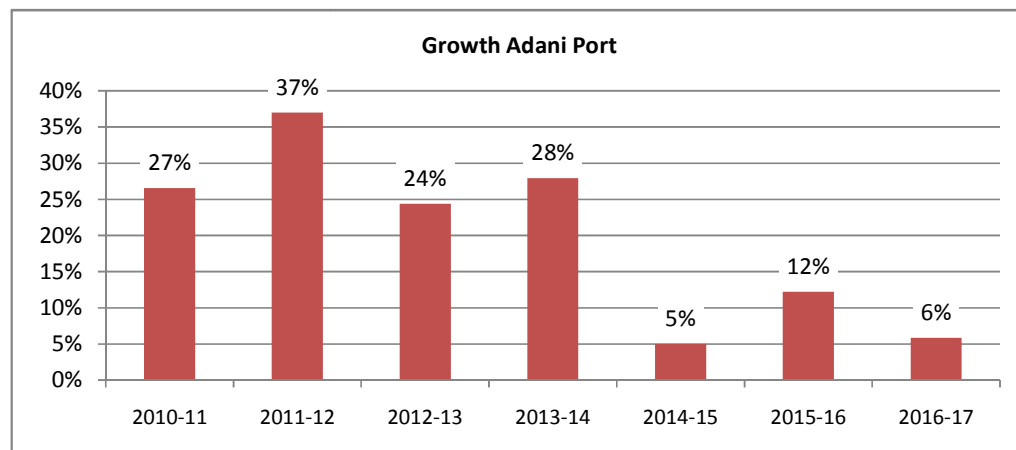


Figure 14. Growth of Adani Port

In view of the reduced growth in last 3 years of MMT handled, it is evident that growth of Multi-Axle Vehicles will no longer continue as in previous years but in more logical values.

There are many factors that will influence the traffic growth in the project highway in addition to economic changes. The trends on transportation modes are shifting constantly, as an example the below mentioned Delhi-Mumbai Dedicated Railway Freight Corridor, which will absorb a substantial quantity of the freight that currently is transported by heavy vehicles in this corridor; or above effect from a Port development. But also the traffic growth trends are changing between the different types of commercial vehicles based

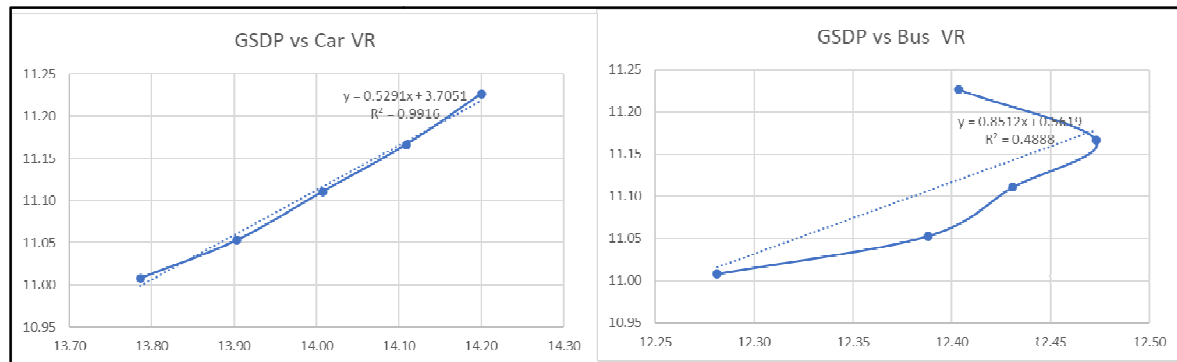
on changes in their efficiency and the own users requirements. Another factor is based on the continuous changes on freight types and packaging (containerization of goods and commodities) and the improvements on transportation logistics. Each year a considerable amount of new kilometers of highways are added to the National and State networks allowing changes in the actual patterns of traffic. With all these factors and considerations, it is important that the elasticity values of traffic obtained from regressions with economic indicators are moderated to contemplate influencing factors and previous projects experience.

The elasticity values recommended in below table, although derived from regression and trend analysis of historical traffic, past registration of vehicles and GSDP for the PIA, have been moderated to stay within realistic and widely accepted limits.

Recommended Elasticity Coefficients						
Vehicle Type	2020 - 2025	2025 - 2030	2030 - 2035	2035 - 2040	2040 - 2045	2045 - 2050
Car	0.53	0.48	0.43	0.39	0.35	0.31
Bus	0.85	0.77	0.69	0.62	0.56	0.50
LCV/LGV	0.74	0.67	0.60	0.54	0.49	0.44
Truck - 2 Axle	-0.18	-0.20	-0.22	-0.24	-0.26	-0.29
Truck - 3 Axle	-0.20	-0.22	-0.24	-0.27	-0.29	-0.32
MAV 6+	0.91	0.81	0.73	0.66	0.59	0.53

Table 35. Recommended Elasticity Values

Following figures give the regression charts of different vehicles vs PIA GSDP.



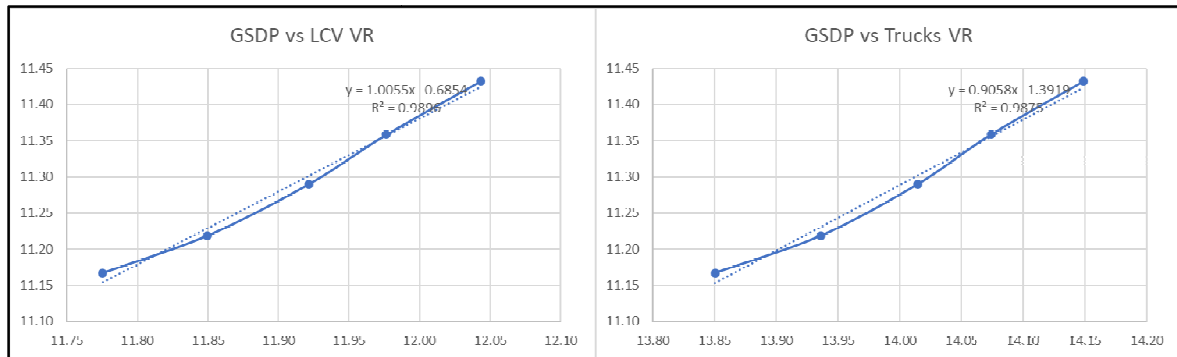


Figure 16. Regression Curves of Vehicle Registration vs GSDP

3.10.5. TRAFFIC GROWTH RATES-RECOMMENDED

India GDP for the next years can develop as follows:

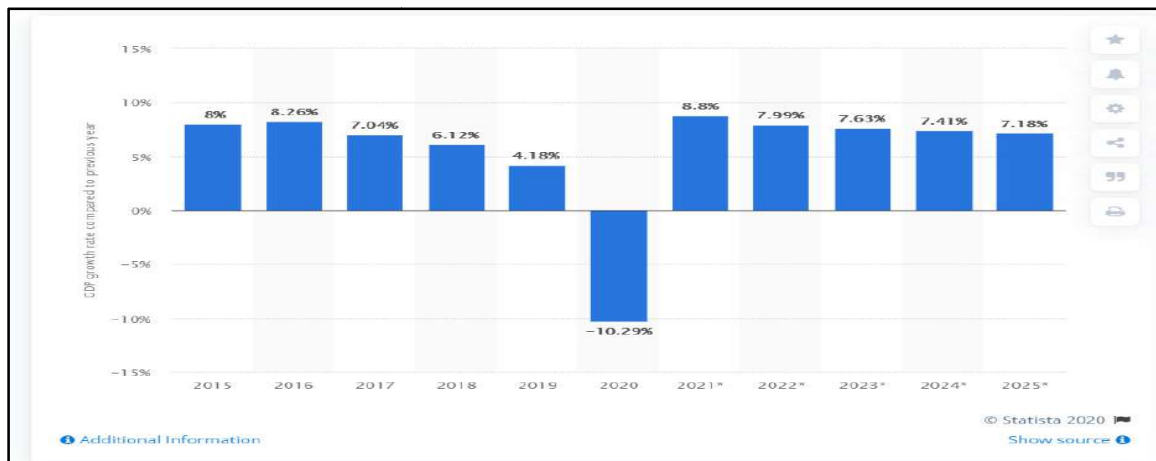


Figure 18. Projection of Indian GDP

(Source: <https://www.statista.com/statistics/263617/gross-domestic-product-gdp-growth-rate-in-india/>)

Considering current social and economic trends, the above scenario for GDP growth can be considered optimistic (see below “Optimistic” scenario”) and it is recommendable to assume a more conservative approach with a discount of 0.50% to above GDP growths. Therefore, the estimated average growth of India GDP for the following periods of 5 years and corresponding PIA GSDP has been considered as shown in Table 36:

COVID-19 is going to influence our lives for a long time till the vaccines are made available to the masses. COVID-19 is bound to impact our lifestyle as well as travel habits though they are yet to get reflected at ground level.

Social distancing protocols may become the new norm in future, and this will have a major impact on the travel habits. The population in lesser income group will continue to travel in the mass transportation. The population with higher income will use the private transportation more and more. However, the burden on the roads is bound to increase with the increment in the GDP and purchasing power. In the same vein, COVID-19 has impacted the auto industry and sales are at rock bottom. Thus, all the major auto brands

are coming up with promotional schemes such as more discounts and EMI schemes etc., These schemes may lead to more affordability. They may use ridesharing to share the costs and thus reduce their overall cost of transportation. This will result in higher private vehicles on road. Considering these traffic growth rate suggested above will hold good in long run. As a precautionary measure GSDP growth rate is moderated to upto FY 24 to calculate the growth rate.

Period	GDP	PIA GSDP Passenger	PIA GSDP Goods
2020 - 2025	4.29%	4.64%	5.11%
2025 - 2030	7.18%	7.07%	7.78%
2030 - 2035	6.82%	6.71%	7.39%
2035 - 2040	6.48%	6.38%	7.02%
2040 - 2045	6.16%	6.06%	6.67%
2045 - 2050	5.85%	5.76%	6.33%

Table 36A. Projections of

(Source of India GDP 2019-2023: IMF)

India GDP and PIA GSDP

Based on the moderated elasticity values and the projected economic indicators (India GDP), the future average annual compound traffic growth rates by vehicle type have been thus estimated and recommended as follows:

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.77%	2.90%	2.80%	3.89%	3.39%	2.90%	2.48%	2.12%	1.81%
Bus	0.00%	4.42%	4.63%	4.47%	6.20%	5.41%	4.62%	3.95%	3.38%	2.89%
LCV	0.00%	4.24%	4.44%	4.28%	5.94%	5.18%	4.43%	3.79%	3.24%	2.77%
2 AT	0.00%	-1.03%	-1.08%	-1.04%	-1.45%	-1.54%	-1.61%	-1.68%	-1.76%	-1.84%
3 AT	0.00%	-1.15%	-1.20%	-1.16%	-1.61%	-1.71%	-1.79%	-1.87%	-1.95%	-2.04%
MAV	0.00%	5.18%	5.43%	5.24%	7.27%	6.34%	5.42%	4.63%	3.96%	3.39%

Table 37. Recommended Traffic Growth Rates at interval of Five Years

The Optimistic and Pessimistic (assumed GDP-0.5%) traffic growth rates scenarios would be as follows:

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.91%	3.05%	2.94%	4.08%	3.56%	3.04%	2.60%	2.23%	1.90%
Bus	0.00%	4.64%	4.86%	4.69%	6.51%	5.68%	4.85%	4.15%	3.55%	3.03%
LCV	0.00%	4.45%	4.66%	4.50%	6.24%	5.44%	4.65%	3.98%	3.40%	2.91%
2 AT	0.00%	-1.08%	-1.13%	-1.09%	-1.52%	-1.62%	-1.69%	-1.77%	-1.85%	-1.93%
3 AT	0.00%	-1.20%	-1.26%	-1.22%	-1.69%	-1.80%	-1.88%	-1.96%	-2.05%	-2.14%
MAV	0.00%	5.44%	5.70%	5.50%	7.63%	6.65%	5.69%	4.86%	4.16%	3.55%

Table 38. Optimistic Traffic Growth Rates at interval of Five Years

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.63%	2.76%	2.66%	3.69%	3.22%	2.75%	2.35%	2.01%	1.72%

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Bus	0.00%	4.20%	4.40%	4.24%	5.89%	5.14%	4.39%	3.75%	3.21%	2.74%
LCV	0.00%	4.03%	4.21%	4.07%	5.65%	4.92%	4.21%	3.60%	3.08%	2.63%
2 AT	0.00%	-0.98%	-1.03%	-0.99%	-1.37%	-1.46%	-1.53%	-1.60%	-1.67%	-1.74%
3 AT	0.00%	-1.09%	-1.14%	-1.10%	-1.53%	-1.63%	-1.70%	-1.78%	-1.86%	-1.94%
MAV	0.00%	4.92%	5.15%	4.98%	6.91%	6.02%	5.15%	4.40%	3.76%	3.22%

Table 39. Pessimistic Traffic Growth Rates at interval of Five Years

3.10.6. IMPACT OF DELHI-MUMBAI DEDICATED RAILWAY FREIGHT CORRIDOR

The construction of Mumbai-Delhi Railway Freight Corridor is in progress and expected to be operational by year 2025. Due to this corridor operation, a partial reduction in the traffic of heavy commercial vehicles (trucks and MAVs) is expected. Based on the **Diversion Curve Analysis** this reduction will be applied as follows:

Following figure give the proposed alignment of DFCC Corridor.

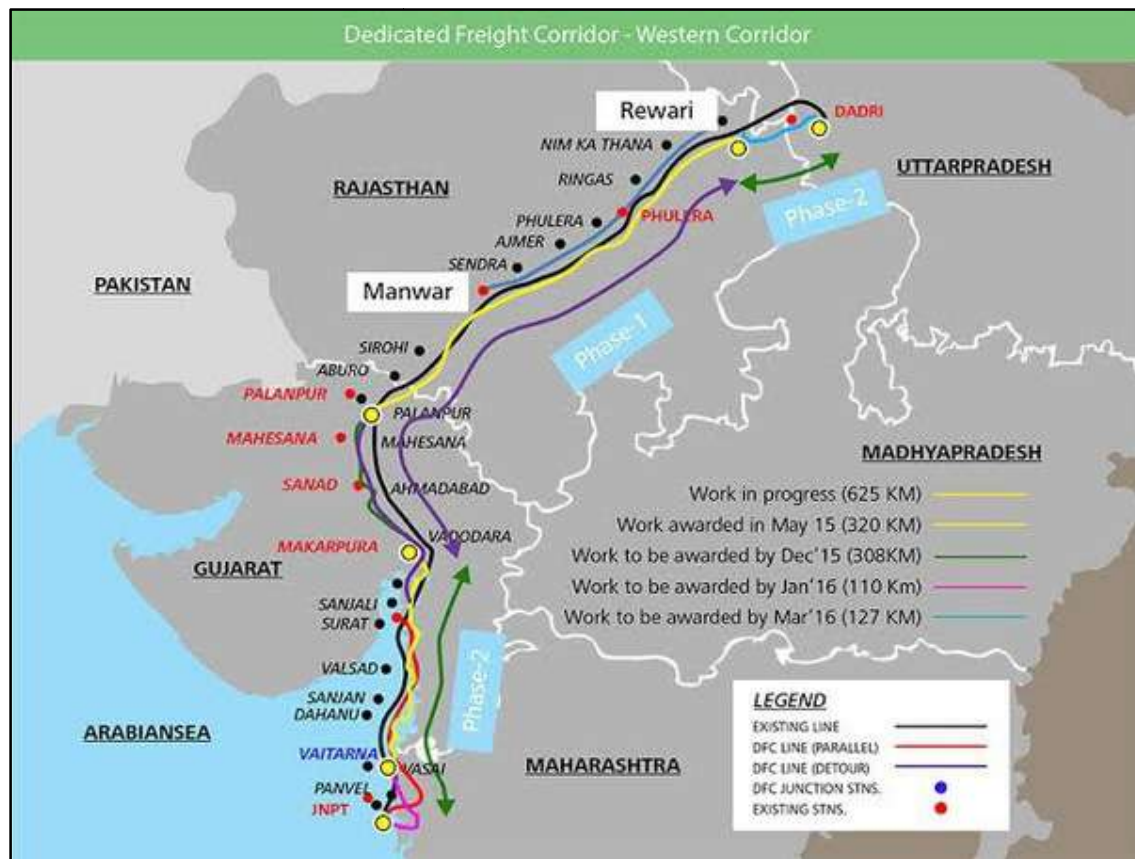


Figure 15B. Proposed DFCC Alignment

Small distance freight vehicles parallel to project road are less likely to shift to DFCC as from Palanpur to Phulera are the candidate origin destination pair. These trips are almost negligible in this project. Any freight vehicle traveling more than 500 Km is considered as traffic likely to divert to DFCC.

Vehicle	Traffic Distribution		Generalized Cost				Diversion		Net Diversion			
	500-1000 Km	>1000 Km	By Rail 500-1000 Km	By Road 500-1000 Km	By Rail > 1000 Km	By Road > 1000 Km	Div % 500 - 1000 Km	Div % > 1000 Km	Div % 500 - 1000 Km	Div % > 1000 Km	Total -2025	Total -2026
2 AT	34%	12%	12473	24999	23964	41665	92%	91%	31%	11%	17%	25%
3 AT	22%	16%	18709	25277	35945	42128	83%	75%	18%	12%	12%	18%
MAV	27%	10%	23633	49111	45405	81851	93%	92%	25%	9%	14%	21%

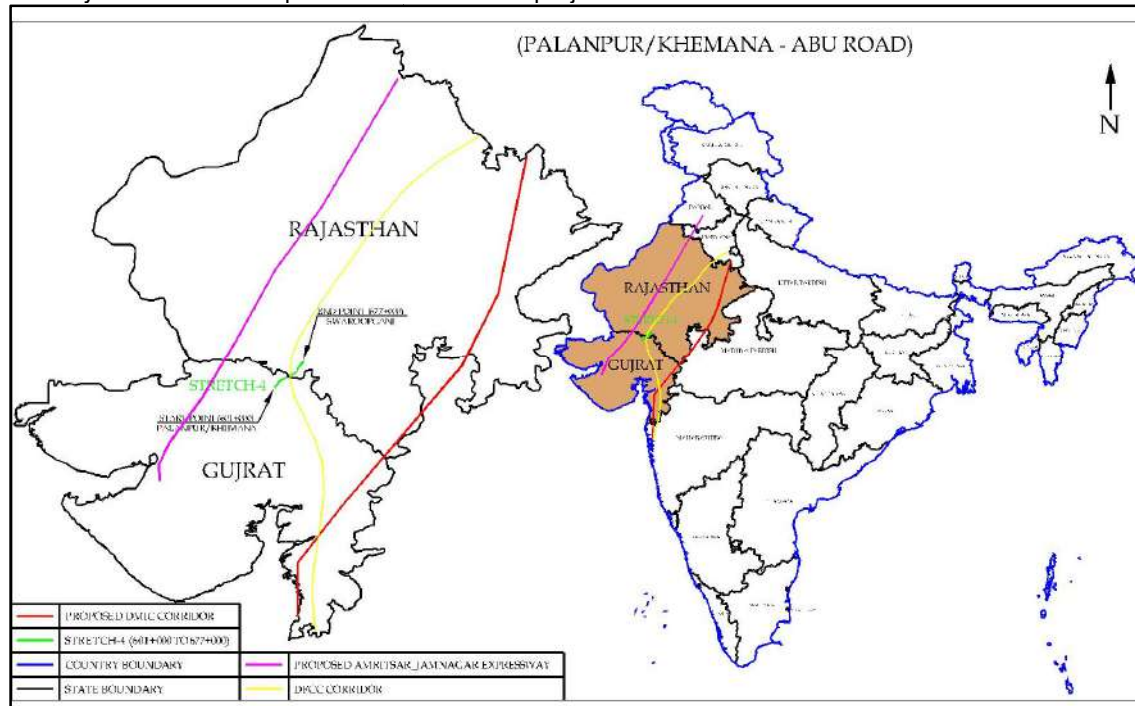
Table 40. Decrease of Commercial Traffic due to diversion of freight to Railway

Loss of commercial traffic due to Impact of DFCC is presented below:-

Year	2 Axle	3 Axle	MAV
FY-2025	115	125	634
FY-2026	173	187	951

This road cannot be taken as competing route to DMIC and Delhi Mumbai Expressway because they are far away. Proposed Amritsar – Jamnagar Expressway is about 110 Kms west of this route serving port bound traffic to Jamnagar. As most of heavy vehicle long distance traffic are going to shift to DFCC, almost negligible traffic will shift to this route from project route.

Following map indicates the all the routed running parallel to the project road and indicates that DFCC is the only route which competes for traffic on the project road.



3.11. TRAFFIC PROJECTIONS AND CAPACITY ANALYSIS

The following tables present the estimated traffic based on AADTtollabletraffic growth rates for the project stretch for the period of the concession. In the year 2021 means the year from April 2020 to March 2021, i.e., Financial Year 2020-21.

Year	Car/Jeep	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/EME	Total Vehicles	Total PCUs	% ge Growth
2021	7,376	333	36	420	61	776	1,125	4,659	242	0	15,028	36,871	
2022	7,778	350	38	433	64	767	1,103	4,992	259	0	15,785	38,823	5.29%
2023	8,202	369	39	447	68	758	1,081	5,350	278	0	16,591	40,914	5.39%
2024	8,693	390	40	463	72	742	1,050	5,771	300	0	17,521	43,334	5.92%
2025	9,214	412	42	480	76	516	808	4,750	324	0	16,619	38,040	-12.22%
2026	9,766	436	43	497	80	285	540	3,302	349	0	15,297	30,780	-19.08%
2027	10,314	459	45	513	84	278	523	3,546	375	0	16,136	32,550	5.75%
2028	10,892	484	46	530	89	272	507	3,807	402	0	17,028	34,445	5.82%
2029	11,503	510	48	548	94	265	491	4,088	432	0	17,977	36,474	5.89%
2030	12,148	537	49	566	99	259	475	4,389	464	0	18,987	38,646	5.95%
2031	12,830	566	51	585	104	253	460	4,712	498	0	20,059	40,970	6.01%
2032	13,480	593	52	603	109	246	444	5,026	531	0	21,085	43,202	5.45%
2033	14,163	622	54	621	114	239	429	5,361	567	0	22,169	45,577	5.50%
2034	14,881	652	56	640	120	233	414	5,717	604	0	23,316	48,102	5.54%
2035	15,635	684	57	659	125	226	399	6,098	644	0	24,528	50,788	5.58%
2036	16,427	717	59	679	132	220	385	6,504	687	0	25,810	53,644	5.62%
2037	17,179	748	61	697	137	214	371	6,895	729	0	27,032	56,379	5.10%
2038	17,966	781	62	716	143	207	358	7,310	773	0	28,317	59,272	5.13%
2039	18,789	815	64	736	150	201	345	7,750	819	0	29,668	62,330	5.16%
2040	19,649	851	66	756	156	195	332	8,216	868	0	31,089	65,563	5.19%
2041	20,549	888	67	777	163	189	320	8,711	921	0	32,584	68,980	5.21%
2042	21,394	923	69	796	169	183	308	9,181	970	0	33,994	72,217	4.69%
2043	22,274	959	71	815	176	178	297	9,677	1,023	0	35,469	75,620	4.71%
2044	23,189	997	72	835	183	172	286	10,200	1,078	0	37,012	79,198	4.73%
2045	24,143	1,036	74	855	190	167	275	10,751	1,136	0	38,628	82,959	4.75%

Year	Car/Jeep	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/EME	Total Vehicles	Total PCUs	% ge Growth
2046	25,136	1,077	76	876	198	162	265	11,332	1,198	0	40,318	86,912	4.77%
2047	26,057	1,114	78	895	205	156	255	11,877	1,255	0	41,892	90,609	4.25%
2048	27,011	1,154	79	915	212	151	245	12,449	1,316	0	43,532	94,476	4.27%
2049	28,001	1,194	81	935	219	147	236	13,048	1,379	0	45,239	98,518	4.28%
2050	29,027	1,236	83	955	227	142	227	13,676	1,445	0	47,018	102,746	4.29%

Table 41. Traffic Volumes (AADT Tollable)

As per the Concession Agreement for InvIT projects, NHAI may undertake or cause to undertake the process for capacity augmentation of the Project Stretch to 6/8-lane configuration in case that the average daily tollable traffic in any accounting year exceeds the designed capacity of 40,000 PCUs for Project Stretch and continues to exceed the designed capacity for three consecutive accounting years, and until the Level of Service C of the highway is reached, 60,000 PCU. According to the estimated traffic projections, the Authority could undertake the process for capacity augmentation of this project stretch at anytime from 2031 to 2038, when the level of service C is reached, and the construction period for capacity augmentation can be assumed to be 2.0 years.

3.12. AXLE LOAD SURVEY ANALYSIS

Axle load survey in both directions has been carried out at all three toll plazas 2 normal days (48hrs) using axle load. Methodology and procedure stipulated in IRC 37 has been followed. Axle loads obtained from the survey have been converted into equivalent standard axles by using equivalency factors recommended by AASTHO. Equation adopted for computation of VDF has been presented below.

$$\text{Single axle with single wheel on either side, } ESA = \left(\frac{\text{axle load in kN}}{65} \right)^4$$

$$\text{Single axle with dual wheels on either side, } ESA = \left(\frac{\text{axle load in kN}}{80} \right)^4$$

$$\text{Tandem axle with dual wheels on either side, } ESA = \left(\frac{\text{axle load in kN}}{148} \right)^4$$

$$\text{Tridem axle with dual wheels on either side, } ESA = \left(\frac{\text{axle load in kN}}{224} \right)^4$$

Using the above equations, VDF has been computed for various categories of commercial vehicles and presented in Table 42.

Type	Palanpur to Abu Road	Abu Road to Palanpur
LCV	1.167	0.339
2A	1.275	1.117
3A	3.231	3.753
4A	5.047	8.730
5A	8.170	7.379

6A	8.923	8.879
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Table 42. Vehicle Damage Factors (VDF) for Commercial Vehicles

3.13. LANE CHOICE BEHAVIOR

The lane choice behavior of the carriageway describes the preferred lane by the commercial traffic moving along the Project Stretch. This in turn has effect on the pavement structure in terms of distress caused due to movement of heavy commercial traffic on the same preferred lane. The lane choice behavior as observed in the Project Stretch is inner lane on both LHS and RHS. However pavement design of road shall be done according to IRC 37 which duly takes in to account the lane choice behavior for Indian road conditions.

3.14. TRAFFIC SEGMENTATION

For understanding the revenue stream at the toll plaza, existing traffic segmentation is collected from the toll plaza as given in the below table.

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commercial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
No. of Monthly Passes	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
All types of Single Entry	58.8%	79.9%	83.0%	81.2%	96.1%	76.1%
Multiple Entry	2.4%	8.8%	12.1%	8.2%	2.3%	17.4%
Reuse of Multiple Entry Ticket	0.1%	0.3%	0.1%	0.0%	0.0%	0.0%
Reuse of Monthly Passes	2.8%	0.0%	0.1%	0.0%	0.0%	0.0%
Concession Entry/LDV	0.5%	2.7%	2.5%	2.9%	0.9%	4.4%
Exempted	35.4%	8.3%	2.2%	7.7%	0.6%	2.1%

Table 43. Traffic Segmentation (based on user fee collection)

3.15. POSSIBILITY OF TOLLLEAKAGE

The project site starts from Palanpur and ends at Abu Road covering a length of 45 Kms. (601+000 to 646+000) and toll plaza at km 602+750 (near Kheemana village). As per current survey one earthen (unpaved) track 3 to 3.5 mtr width and 1.10 kms length is found. Since between exit and entry point on Highway to earthen track is 300 mtr therefore diversion of traffic for toll savings is not significant because of more length and time to travel, less width of track and village problems, there is no leakage of traffic is found at Toll Plaza.



Figure16 D. Possible Leakage Route

Existing earthen track at Khemana Toll LHS side

Length of earthen track -1.100 Km

Width of earthen road - 3 to 3.5m

4. PAVEMENTS

4.1. GENERAL

The existing pavement along the entire project is flexible except for the rigid pavement at Khemana Toll Plaza; and the project road has four lanes (2+2) with paved shoulder and 2 carriageways.

It should be noticed that this project road is under a BOT (Annuity) **Contract with tenure up to 24/03/2024**; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (major maintenance) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road by InvIT tender.

Pavement evaluation includes the investigation and assessment of its current condition, and the design of the strengthening/improvement of those sections where remaining life is estimated to be of less than 10 years.

The general procedure for the evaluation and strengthening design of in-service pavements follows the guidelines of IRC: 37-2012 – “Guidelines for the Design of Flexible Pavements” and IRC: 115-2014- “Structural Evaluation and Strengthening of Flexible Road Pavements Using Falling Weight Deflectometer (FWD) Technique”.

The kilometeric chainage used for the processing of the NSV data, see below point 4.5, has been theoretically assigned from the start to the end points of the stretch by the NSV. For the rest of the section within this Chapter, it has been used the kilometeric chainage as per the existing kilometeric stones on site. In Annexure 12 (Strip Plan & Kilometeric Reference) it is provided a table of reference between the existing KM stones on site and the kilometeric chainage used for NSV data in present report.

The works undertaken by the consultant to evaluate the pavement of this project stretch have mainly consisted in:

1. Field works, which included data collection of the geometry and condition of the pavement, its visual survey, a structural evaluation, pavement materials investigation and traffic surveys of the highway stretch under study. It was developed a systematic survey program of the parameters that define the condition of the pavement using high-performance survey vehicles and equipment (NSV). These vehicles are really efficient and allow collecting large amount of surface pavement condition data accurately and in a short time. This systematic survey is important not only to study the present condition of pavements, but also to be able to forecast their future evolution as accurately as possible. It was programmed and executed a campaign of test pits and core cuttings to investigate the thicknesses of the pavement crust and the characterization sub-grade soils, and granular and bituminous materials. In addition, and in order to evaluate the bearing capacity of the pavement, deflections measures were taken by FWD.
2. Following the field works, all data collected from the various surveys, site testing and investigations was analyzed and processed. The works included the processing and analysis of pavement survey data, the laboratory testing and characterization of materials sampled at site, the analysis of traffic data collected from surveys and the estimations of future traffic demand, the calculation and normalization of deflection values from FWD, back-calculation to obtained the elastic moduli of the pavement layers, the estimation of remaining life based on the number of MSA, the calculation of required overlays, and the establishment of a maintenance plan through HDM-4.
3. BOQ of the required improvement works

The detail of all these works is described below in this chapter.

4.2. FIELD WORKS AND INVESTIGATIONS

4.2.1. NSV DATA

A network Survey Vehicle is a high-performance survey equipment that allows the collection of roads geometrical data (such as slope, cross slope and radius of curvature), roads surface pavement distresses (such as cracking, IRI, rutting, raveling) road assets inventory data, and roads images (frontal and pavement). NSVs have been developed to obtain all such information in one single pass along each lane of the highway.

It is a basic tool to collect essential data before starting to manage a highway network (main source of data for a Road Assets Management System (RAMS) or at any time to evaluate the condition of road pavements while providing all the necessary measures to help forecasting their evolution as accurately as possible. In parallel it allows to create or maintain an inventory of all highway basic elements and furniture subjected to maintenance. It should be noted that in addition to an efficient NSV it is of major importance the capacity and experience to analyze, process and manage the data collected by NSV to warrant a reliable and high quality final product.

4.1.1.1 COMPONENTS OF THE SYSTEM

Following is a brief description of different components/systems of a NSV.

The GPS Vision system consists of a high grade Differential Global Positioning System (DGPS), Rocket grade Inertial Measurement Unit (IMU), sub centimeter Distance Measuring Instrument (DMI), six 1600 x 1200 optical cameras mounted in stereo pairs viewing forward front, left and right, a house front camera, two optical to infrared downward pavement facing cameras. Two sets of line lasers mounted behind the rear wheels projecting to rear of vehicle and point lasers in the wheel path projecting down and several computers and mass storage devices and user interface system.



Figure 16. GPS vision system

The components of GPS Vision System contribute to the following features:

- The external hardware is interfaced with a central data logger unit which stores the collected location, image and laser data for transfer to processing software.
- Laser profilometer utilizes a class I profiler to collect roughness measurements in the form of the International Roughness Index (IRI).
- Rutting profile of the pavement surface is generated using two line-lasers mounted at each wheel path and two thermal cameras mounted at the roof of the vehicle over each wheel path laser enclosure to capture full lane rutting profile.
- Pavement right of way image logs are captured which are geometrically correct to quickly locate and measure any roadway feature and extract that data for further plotting on maps or to populate databases.
- Road geometry measurement is done using built-in high resolution Inertial Navigation System to calculate the radius of curvature, cross-fall and etc.
- A GPS system Vertical accuracy of the vehicle location is utilized.
- The system has a built-in Distance Measuring Instrument (DMI) with less than 1 mm accuracy.

4.1.1.2 PAVEMENT CONDITION DATA COLLECTION

The images collected by GPS Vision system are used to obtain all the necessary pavement distresses to estimate the Pavement Condition Index (PCI); rutting, raveling, cracking, potholes, and so on. These images organized based on the survey planned will be used in desktop based feature extraction software for extracting road distresses and right of way features and its attributes and storing them in industry standard RDBMS.

The distresses on the roads will be identified and captured in a virtual environment through viewing of stereo-pair high resolution images.

The images of the pavement captured are used to identify sample units. Multiple sample units are marked along the road and each sample unit are recorded with road distresses based on the surface type i.e., Asphalt, PCC and etc.

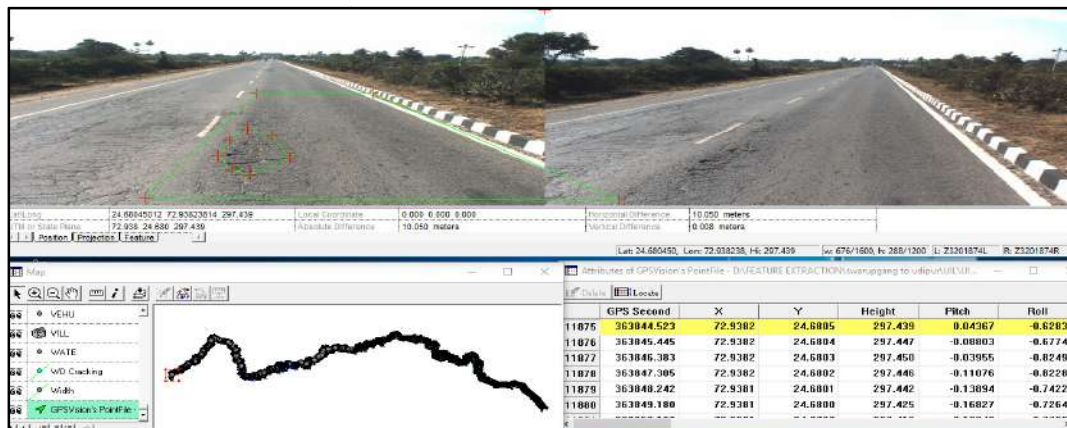


Figure17 A. Snapshot of feature extraction software window

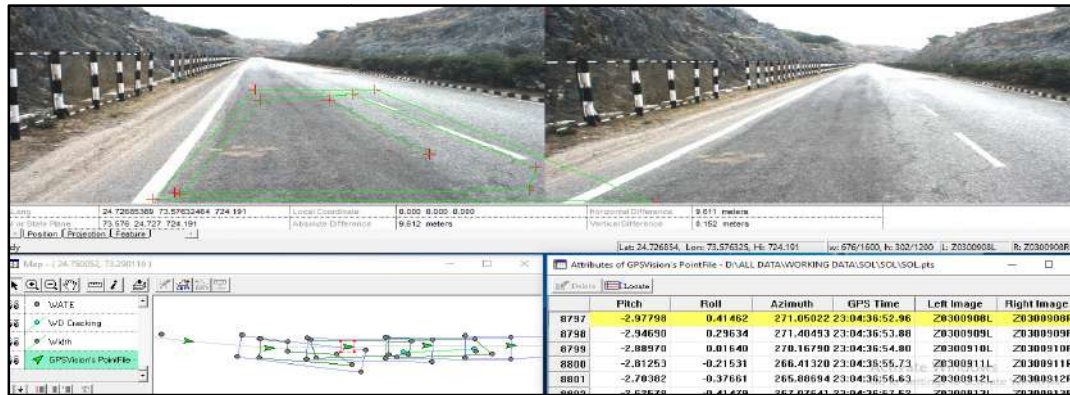


Figure 17. Snapshot of feature extraction of wide cracking

The type and severity of pavement distress is assessed by visualizing the processed digital image in the feature extraction software and then marking the distresses in the sample unit.

The distress data are used to calculate the PCI for each sample unit using ASTM methodology. The PCI of the pavement section is determined based on the PCI of the inspected sample units within the section.

In addition, measurements of the International Roughness Index (IRI) and Rutting of the highway are collected through a class I laser profilometer. The IRI measurements are later analyzed and process to obtain the final IRI values of the road/lane of the required segments (100 m, 500 m, 1,000 m...). Based on these values, it can be calculated the Roughness of road in BI terms using the corresponding conversion formula.

The PCI, Rutting and IRI rating for the roads will finally be done based on the required standards about road condition applicable to each particular project.

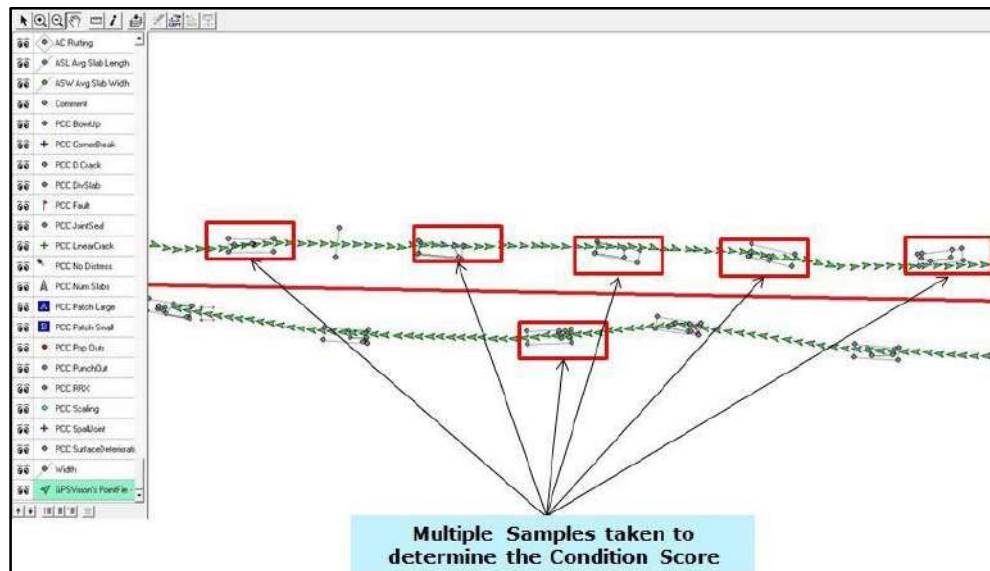


Figure 18. Window showing multiple samples

4.1.1.3 RIGHT OF WAY DATA COLLECTION

As in the road distress feature extraction process stereo pair images is used in feature extraction software to extract right of way inventory.

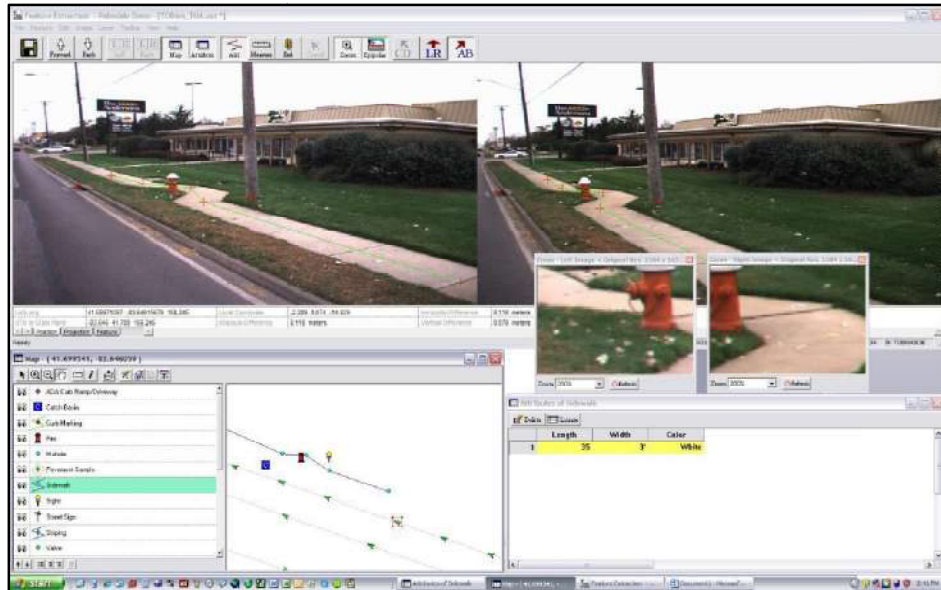


Figure 19. Snapshot showing extraction of Right of Way features

This process of inventory is repeated for all road assets that are required to be part of the final inventory. The minimum aspects to be collected from each asset are as follows, although other special and additional details/attributes of particular assets can be collected. They are described below:

- Road
- Section (LHS/RHS)
- Kilometric Point (initial and final)
- Latitude and Longitude
- Date
- Margin (LEFT/RIGHT/BOTH (LEFT AND RIGHT)),

In addition to the above other special and additional details/attributes of importance for particular assets can be collected.

Typical road assets are:

- Affected service
- Bypass
- Carriageway
- Culvert (asset inventory included in further section)
- Delineator post
- Embankment
- Flyover
- Fuel station

- Guard post
- Guide post
- Hectometre stone
- High mast lights
- Junction
- Kilometre stone
- Land use
- Line drain
- Median opening
- Median
- Pedestrian cattle underpass
- Pedestrian guardrail
- Punctual road marking
- Retaining structure
- Roadside arboriculture
- Safety barrier
- Shoulder
- Sign
- Slip-Service road
- Solar blinker
- Street light
- Toilet block
- Toll plaza
- Truck lay bay
- Urban section
- Village town
- Water body
- Way side amenity

4.2.2. TEST PITS AND CORE CUTTINGS

Pavement layer thicknesses are an essential input for processing of back calculation of layer moduli and, in turn, estimation of remaining life and overlay requirements of the in-service pavement. Hence, it is necessary that accurate information is collected about layer thicknesses and characteristics from different sources.

The investigations were carried out along the existing road using trial pits and the following investigation and tests were conducted in those pits:

- Pavement Composition, layer thicknesses
- In-situ Dynamic Cone Penetration Tests to determine the field CBR of expose base and sub-grade.
- In-situ Field Density and Moisture Content test at sub-grade top.
- Collection and preservation of samples of all materials for further testing at the laboratory.

A total of 17 test pits were investigated at the site. As recommended in IRC:115-2014, 0.6 m x 0.6 m test pits were excavated at 2.5 km interval or at suitable larger interval where other records suggest uniformity

of pavement composition in such larger sections. The test pits were excavated along the outer lane (LHS/RHS) from the outside edge of the outer lane in the earthen shoulders exposing pavement layers sufficiently to note the condition and thickness of each layer. After collecting necessary data from the test pits it were backfilled with suitable material and manually compacted so that it does not adversely affect the structural condition of the pavement and also do not create any traffic safety hazard.

After the completion of field work, samples of 1.0 kg at each of the location were collected and preserved in poly-bags so as to preserve the field conditions of the samples.

The samples collected were transported to environment controlled laboratory to undergo the laboratory investigations. Their suitability was assessed in accordance to MORT&H provisions.

4.2.2.1. DCP TEST

The aim of the Dynamic Penetration Test (DCP) is to determine the effort required to force a point through the soil and so obtain the resistance value which corresponds to the mechanical properties of the soil. The preliminary use is in cohesion less soils when static penetration test is difficult to perform or dynamic properties of the soil are of special interest.

The DCP values obtained in terms of mm/blow can further be used to determine the elastic modulus of the sub-grade. The penetration and no. of blows observed are plotted in the form of a curve. The bearing ratio (CBR) for Exposed base and Sub-grade base are usually calculated for the maximum penetration values as per Road Note 31.

4.2.2.2. FIELD DENSITY AND MOISTURE CONTENT TEST

The aim of this field test is to determine the in situ density of natural or compacted soils using sand pouring cylinders.

With this test it is possible to determine the field density of the soil. The moisture content is likely to vary from time and hence the field density also. So it is required to report the test result in terms of dry density. The relationship that can be established between the dry density with known moisture content is as follows:

$$\gamma_d = \gamma_b / (1 + \omega)$$

Where:

γ_d : Dry density

γ_b : Bulk density

ω : Water content

4.2.2.3. PAVEMENT COMPOSITION

For each test pit, the following information was recorded:

- Test pit reference (Identification number, location).
- Pavement composition (material type and thickness).
- Sub-grade type (textural classification) and condition (dry, wet).

In order to further investigate the bituminous layers of the pavement at the laboratory level and to determine with more accuracy the thicknesses of the bituminous layers, core cutting samples were extracted at every 5 km of each carriageway at the same road chainages where test pits were located.

4.2.3. FWD

4.2.3.1. GENERAL

The deflection of a pavement is the vertical deviation suffered by this pavement when it supports a standard load. The deflection itself is not a value that can define the structural capacity of a pavement. It depends on:

- Intensity of the applied load
- Surface on which it is applied
- Thickness of every layer
- Elastic module of each of the layers
- Cohesion degree among layers
- Resistance characteristics of support layers
- Discontinuity presence near the load
- Temperature of pavements
- Moisture

The higher the bearing capacity, the lower the deviation (deflection) the pavement will suffer.

Falling Weight Deflectometer (FWD) is the most common and used vehicle for knowing the support capacity of pavements.

It has been carried out a structural strength survey for existing pavements in this stretch of highway using Falling Weight Deflectometer (FWD) technique in accordance with the procedure given in IRC: 115 for flexible road pavements.

4.2.3.2. DATA COLLECTION METHODOLOGY

A Falling Weight Deflectometer (FWD) is used for the measurement of deflection along the wheel path and spacing obtained by the condition survey.

The general considerations for FWD data collection are described below:

- Data collection with FWD should be carried out on the whole length of each segment along inner as well as outer wheel paths of all the lanes.
- The spacing between measurement points is defined according to IRC: 115-2014.
- All lanes are to be measured. Thus, Inner and Outer lanes have measurement on each kilometer of data collection.
- Three drops are applied on each point of data collection (according to IRC: 115-2014).
- As FWD applies a load as a result of dropping a mass on the pavement, the applied force is not exactly 40 kN. Thus, the results have been standardized to 40 kN (according to IRC: 115-2014).
- Temperature measurement is done every 1hrs in accordance with IRC: 115-2014.
- Six deflections data are obtained from FWD on each point of data collection, one per geophone. For current pavement analysis only maximum deflections (corresponding to Geophone 0) have been used, except for Back-calculation analysis, in which all geophones data is required.

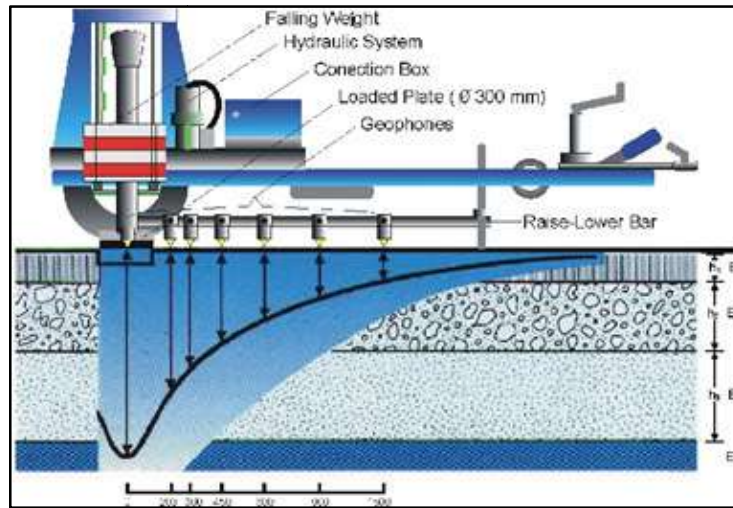


Figure 20 Scheme of results of Geophones of Falling Weight Deflectometer

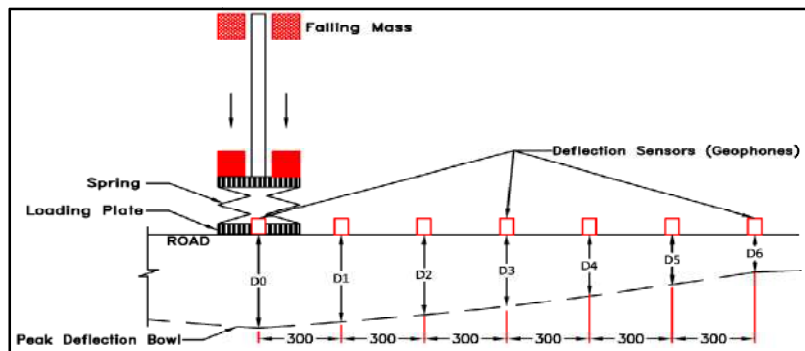


Figure 21. Working principle of a typical FWD



Figure 22. Falling Weight Deflectometer geophones

Pavement condition survey was done based on IRC: 115-2014 guidelines, which recommends a previous visual observation of the pavement for estimation of cracking, rutting and other distresses in the

pavement. Based on the data collected from that condition survey, the road length is classified into sections of uniform performance in accordance with the criteria given in Table 2 of IRC: 115-2014.

Classification	Pavement condition
Good	Isolated cracks of less than 3.0 mm width in less than 5% area of total paved surface AND average rut depth less than 10 mm
Fair	Isolated or interconnected cracks of less than 3.0 mm width in 5 to 20% area of total paved surface AND/OR average rut depth between 10 to 20 mm
Poor	Wide interconnected cracking of more than 3.0 mm width in 5 to 20% area (include area of patching and raveling in this) of paved area OR cracking of any type in more than 20% area of paved surface AND/OR average rut depth of more than 20 mm

Table 44. Pavement Condition Levels

From our visual inspection of this stretch, it was determined that the condition of the pavement was practically good along all the stretch, and consequently, we tested the corresponding number of points per kilometer as per the recommended measurement scheme in IRC: 115-2014.

Typical method of site data collection using FWD is described in below steps.

- Prepare the FWD unit for deflection testing
- Bring the FWD to a stopped position at the beginning of the test section, centered on the outside wheel path (or specific position), and take a measurement by applying load using following sequence: One settling drop to ensure proper contact. Three drops with an applied load of 40 kN \pm 10% (or Specified Load).
- Deflections are recorded from the sensors located at the center of the loading plate for each drop except the settling drop.
- Along with these deflection data, the parameter like chainage, temperature, date and time and position of sensors will also be recorded. The performa used to collect deflections data at site is provided below.
- After each measurement, drive the FWD forward to next measurement point.

Performa for Recording Pavement Deflection Data																
Name of the Road :								Date & Time of Observation								
No. of Lanes & Carriageway Type :								Climatic Conditions (hot/humid/cold)								
Homogenous Section :																
S. No.	Lane Position	Location of test point		Temperature °C		Load Drop No	Peak Load Applied (kN)	Peak Deflection (mm) observed at a radial distance (mm) of								Remarks
		Chainage (km)	Distance from carriageway edge (m)	Air	Pavement			0	300	600	900	1200	1500	1800		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

Table 45. Proforma for recording Deflection Data

4.2.3.3. DATA ANALYSIS

Normalization of data obtained from the average of three readings at each location is done taking into account the standardizing of loads to 40 kN, and the temperature and seasonal correction factors.

Analysis of data is done in accordance with IRC: 115-2014 to find the layer moduli of the existing pavement using KGPBACK.

4.3. ESTIMATION OF TRAFFIC (MSA)

The objective of this section is to estimate the Design Traffic (heavy traffic) in terms of Million Standard Axles (MSA) that this stretch of highway will be supporting during the concessional period of 30 years. This Traffic will be later compared with the residual traffic load calculated in terms of MSA that determines the Remaining Life of the pavement. Below calculations are based on the Traffic Surveys and Traffic Demand Report previously contemplated in section 3.

4.3.1. LANE CHOICE BEHAVIOR

For four-lane dual carriageway highways, as the stretch under study, it is important first to determine the preferred lane by the heavy traffic (particularly MAVs and 2/3-Axle Trucks) when moving along this highway; as this behavior has an effect on that lane pavement structure in terms of distress caused due to movement of heavy commercial traffic.

The lane choice behaviour as observed in the Project Stretch is inner lane on both LHS and RHS as heavy vehicles try to optimize their operating cost. However, and in reference to lanes, we have decided to strictly follow IRC: 37 recommendations for lane distribution factor for our pavement design, which duly takes in to account the lane choice behaviour for Indian road conditions.

4.3.2. ESTIMATION OF AXLE LOAD AND VEHICLE DAMAGE FACTOR (VDF)

The traffic loading on the highway can be determined and standardized by using Equivalent Standard Axle Load (ESAL) factors like the Vehicle Damage Factor (VDF).

The VDF is a multiplier for converting the number of commercial vehicles of different axle loads to the number of standard axle load repetitions. The strengthening of an existing pavement is based upon the cumulative number of 80 kN (8.16 ton) Equivalent Standard Axles (ESA) that will pass over it during the design period.

The classes of traffic which transmit higher loads and can thus produce substantial damages to the pavement are: LCV/LGV (light cargo vehicles), Buses, 2/3 axle Trucks and Multi Axle Vehicles (MAV); and consequently these are the vehicles to be considered for pavement designing.

VDF are calculated in accordance with the guidelines provided in IRC: 37.

As mentioned earlier in Chapter 3, Axle Load surveys of commercial vehicles were carried out at the toll plaza locations to estimate corresponding VDFs and to check the pattern of overloaded vehicles which can negatively affect the performance of existing pavements.

The spectrum of axle load in terms of axle weights of single, tandem, tridem and multi-axle have been determined and compiled under various classes with class intervals of 10 kN, 20 kN and 30 kN for single, tandem and tridem axles respectively.

The equations for computing equivalency factors for single, tandem and tridem axles given below have been used for converting different axle load repetitions into equivalent standard axle load repetitions.

$$\text{Single axle with single wheel on either side, ESA} = \left(\frac{\text{axle load in kN}}{65} \right)^4$$

$$\text{Single axle with dual wheels on either side, ESA} = \left(\frac{\text{axle load in kN}}{80} \right)^4$$

$$\text{Tandem axle with dual wheels on either side, ESA} = \left(\frac{\text{axle load in kN}}{148} \right)^4$$

$$\text{Tridem axle with dual wheels on either side, } ESA = \left(\text{axle load in kN} / 224 \right)^4$$

Summation of all ESA gives the total damaging effect for that location. By knowing the number of vehicles weighed and number of axles weighed and total damaging effect, VDF and Axle Equivalency were computed.

$$VDF = \text{Total ESA} / \text{No. of vehicles weighed}$$

$$\text{Axle Equivalency} = \text{Total ESA} / \text{No. of axles weighed}$$

For the purpose of structural design of pavement, only the number of commercial vehicles with laden weight of 30 kN or more and their axle loading pattern has been considered.

Based on the spectrum of axle loads and analysis of axle load data at surveyed location the resulting VDFs are as given in Table 46.

Type	Palanpur to Abu Road	Abu Road to Palanpur
LCV	1.167	0.339
2 Axle truck	1.275	1.117
3 Axle truck	3.231	3.753
MAV	7.380	8.320
BUS	1.000	1.000

Table 46. Vehicle Damage Factors (VDF)

The combined VDF for different types of vehicles are given in the following figure:

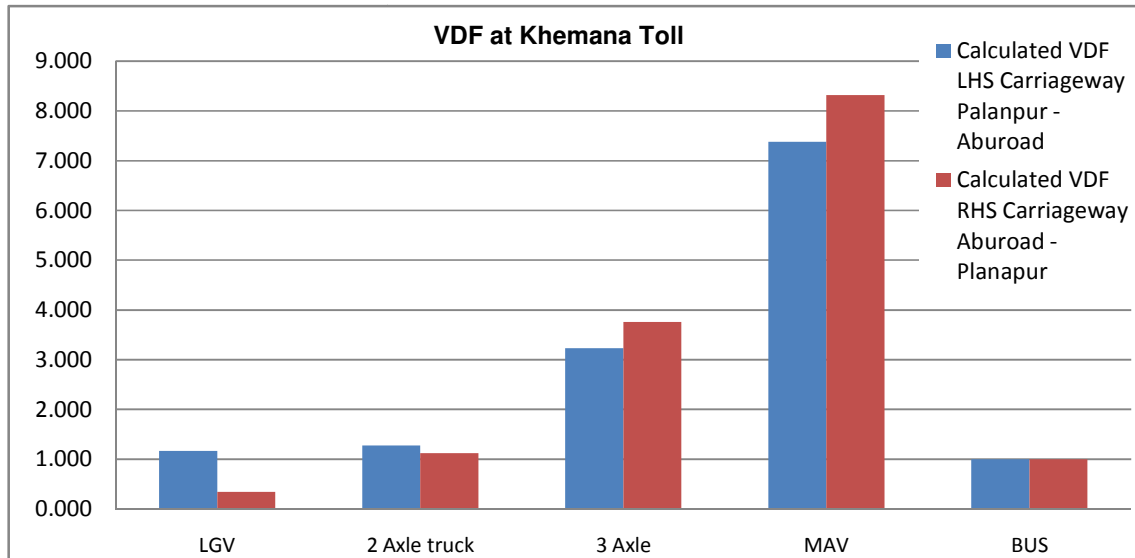


Figure 23. VDF observed for various classes of vehicle

- At Khemana (Toll) VDF of all commercial vehicles except for LGV are nearly same on both carriageways. The VDF values of MAV in RHS are slightly higher as compared to LHS.

4.3.3. DESIGN TRAFFIC (MSA)

The design traffic is considered in terms of the cumulative number of standard axles in both directions of the carriageway during the design life of the road. This can be computed using the following equation:

$$N = \frac{365 \times [(1 + r)^n - 1]}{r} \times A \times D \times F'$$

where **N** is the cumulative number of standard axles to be catered for the design in terms of Million Standards Axle (MSA), **A** is the initial traffic in terms of the number of commercial vehicles per day, **D** is the lane distribution factors, **F** is the vehicle damage factor, **n** is the design life in years, and **r** is the annual growth rate of commercial vehicles. The traffic in the year of completion is estimated using the following formula: $A = P (1 + r)^x$ where **P** is the number of commercial vehicles as per last count, and **x** is the number of years between the last count and the year of completion between the last count and the year of completion of the project.

Based on the IRC-37-2012 of design the pavement is designed uniformly with the below section. To achieve economy based on the projected MSA pavement section can be varied at different locations.

The entire stretch has been divided in one single section based on the traffic load.

Section No	Starting		Ending		Length of Homogeneous Section (km)
	Existing km	Location	Existing km	Location	
I	601+000	Palanpur	646+000	Abu Road	45.000

Table 47. Homogeneous Traffic Sections

The estimated total traffic in terms of AADT for this section (from Chapter 3) starting from 2020 is summarized for 10 years of Concession Period (i.e. 2030), 20 years of Concession Period (i.e. 2040) and 30 year of Concession Period (i.e. 2050) as below:

Section	Traffic in year (i.e. 2020)	10 years (i.e. 2030)	20 years (i.e. 2040)	30 years (i.e. 2050)
I : Palanpur - Abu Road	15,028	18,987	31,089	47,018

Table 48. Traffic Estimates in AADT

Section wise design traffic in MSA based on VDF parameters has been worked out and summarized in table below:

Section	Traffic in year (i.e. 2020)	10 years (i.e. 2030)	20 years (i.e. 2040)	30 years (i.e. 2050)
I : Palanpur - Abu road LHS	5.7	66.3	149.9	231.4
I : Palanpur - Abu road RHS	7.8	96.0	227.5	358.2

Table 49. Traffic Estimates in MSA

From Table 49 it may be observed that the traffic on Section – I Palanpur - Abu Road is similar on both carriageways. Section-I a design value of 100 MSA for both carriageway LHS and RHS is considered for Structural evaluation for pavement of next 10 years.

4.3.4. YEARLY ESTIMATED DESIGN TRAFFIC

For the 10 years of the first design period, the estimated design traffic in MSA is calculated with the same lane distribution factor throughout the period. It has been considered that this project stretch will operate with 4 lanes at least until year 2040.

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No of Years
	2	2	4	8	1				
2020	194	437	651	2114	217	5747381	5747381	5.75	0
2021	201	433	644	2212	226	5958314	11705695	11.71	1
2022	209	429	638	2314	234	6179484	17885180	17.89	2
2023	217	425	631	2421	244	6411359	24296539	24.30	3
2024	225	421	625	2533	253	6654426	30950965	30.95	4
2025	234	359	555	2333	263	6114225	37065189	37.07	5
2026	246	267	452	2005	278	5242258	42307447	42.31	6
2027	258	263	444	2132	293	5521014	47828461	47.83	7
2028	272	259	437	2267	308	5818182	53646643	53.65	8
2029	286	255	429	2411	325	6134909	59781552	59.78	9
2030	301	251	422	2564	343	6472414	66253967	66.25	10
2031	314	247	414	2703	358	6777896	73031863	73.03	11
2032	328	243	407	2849	375	7100579	80132442	80.13	12
2033	342	239	399	3004	392	7441378	87573820	87.57	13
2034	358	235	392	3167	411	7801257	95375077	95.38	14
2035	373	231	385	3338	429	8181232	103556309	103.56	15
2036	388	227	378	3493	446	8522097	112078406	112.08	16
2037	402	223	371	3655	464	8879294	120957700	120.96	17
2038	417	220	364	3824	482	9253564	130211264	130.21	18
2039	433	216	357	4001	501	9645683	139856947	139.86	19
2040	450	212	351	4186	521	10056460	149913406	149.91	20
2041	464	209	344	4352	539	6948504	156861910	156.86	21
2042	479	205	337	4524	557	7202687	164064597	164.06	22
2043	495	201	330	4703	576	7467243	171531840	171.53	23
2044	511	198	324	4890	595	7742574	179274413	179.27	24
2045	527	194	318	5083	616	8029097	187303510	187.30	25
2046	542	191	311	5255	633	8283224	195586734	195.59	26
2047	557	187	305	5434	652	8546242	204132976	204.13	27
2048	573	184	299	5618	670	8818444	212951420	212.95	28
2049	588	180	293	5808	690	9100134	222051554	222.05	29

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No of Years
	2	2	4	8	1				
2050	605	177	287	6005	710	9391626	231443180	231.44	30

Table 50.Section - LHS (Khemana) From Palanpur to Abu road

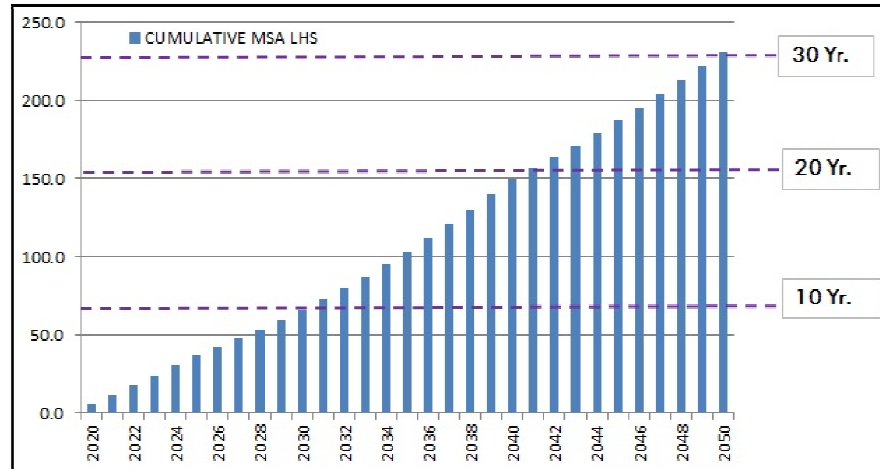


Figure 24.Cumulative MSA: Section - LHS (Khemana). From Palanpur to Abu road

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No of Years
	1	2	4	9	1				
2020	121	339	474	2863	203	7847044	7847044	7.85	0
2021	126	336	469	2995	211	8169629	16016673	16.02	1
2022	130	333	464	3134	219	8507500	24524173	24.52	2
2023	135	330	460	3279	228	8861359	33385531	33.39	3
2024	140	327	455	3430	237	9231939	42617470	42.62	4
2025	146	266	387	3272	246	8738261	51355731	51.36	5
2026	153	175	287	3003	260	7922274	59278005	59.28	6
2027	161	172	282	3194	274	8390603	67668608	67.67	7
2028	169	169	277	3396	288	8889111	76557719	76.56	8
2029	178	167	272	3612	304	9419698	85977417	85.98	9
2030	188	164	267	3841	321	9984388	95961805	95.96	10
2031	196	161	263	4049	335	10496897	106458702	106.46	11
2032	204	159	258	4268	351	11037609	117496311	117.50	12
2033	214	156	253	4500	367	11608042	129104353	129.10	13
2034	223	154	249	4744	384	12209795	141314148	141.31	14
2035	233	151	244	5001	402	12844555	154158703	154.16	15

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No of Years
	1	2	4	9	1				
2036	242	149	240	5232	418	13415353	167574055	167.57	16
2037	251	146	235	5474	434	14012941	181586997	181.59	17
2038	260	144	231	5728	451	14638552	196225549	196.23	18
2039	270	141	227	5993	469	15293473	211519022	211.52	19
2040	280	139	222	6271	488	15979052	227498075	227.50	20
2041	290	137	218	6519	504	11061167	238559242	238.56	21
2042	299	134	214	6777	521	11486017	250045259	250.05	22
2043	309	132	210	7045	539	11927894	261973153	261.97	23
2044	319	129	206	7324	557	12387467	274360620	274.36	24
2045	329	127	202	7614	576	12865432	287226051	287.23	25
2046	338	125	197	7873	592	13290255	300516307	300.52	26
2047	347	123	193	8139	610	13729663	314245970	314.25	27
2048	357	120	189	8415	627	14184144	328430114	328.43	28
2049	367	118	186	8701	645	14654204	343084317	343.08	29
2050	377	116	182	8996	664	15140366	358224684	358.22	30

Table 51.Section - RHS (Khemana) From Palanpur to Abu road

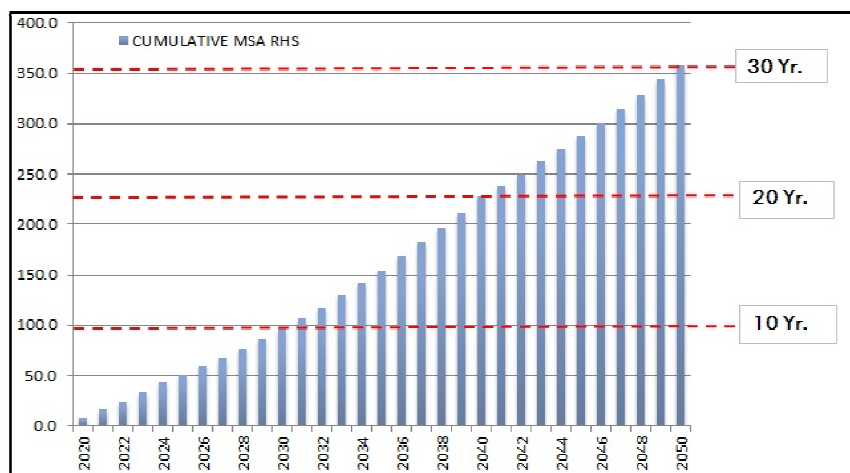


Figure 25.Cumulative MSA Section – RHS (Khemana). From Palanpur to Abu road

As can be observed from above figure the cumulative estimated design traffic in RHS is slightly higher as compared to LHS.

4.4. SUBGRADE STRENGTH AND PAVEMENT MATERIALS INVESTIGATION

4.4.1. FIELD TEST RESULTS

The locations of test pits investigated for this highway stretch (Palanpur - Abu road) with their coordinates are provided in the next table.

S.No.	Chainage	Direction	Test Pit No.	Coordinates	
				X	Y
1	601+000	RHS	19	241511	2682022
2	603+500	LHS	18	-	-
3	605+700	RHS	17	244151	268542
4	608+000	LHS	16	245512	2687064
5	611+250	RHS	15	297489	2689409
6	613+500	LHS	14	248243	2591534
7	616+000	RHS	13	249627	2693483
8	618+500	LHS	12	251763	2695026
9	621+000	LHS	11	253710	2696372
10	623+500	LHS	10	255747	2697913
11	624+800	RHS	9	257697	2699047
12	628+500	LHS	8	-	-
13	631+000	RHS	7	262286	2701178
14	633+500	LHS	6	264553	2702182
15	635+000	RHS	5	265645	2703043
16	637+500	LHS	4	267832	2703846
17	640+000	RHS	3	270151	2704573

Table 52. Test Pit Locations

4.4.1.1. DCPT VALUES

The results obtained in site for DCP test are given in the next table.

CBR values using DCPT						
S. No.	Chainage	Direction	DCPT No.	Test Pit No.	Layer	CBR Value (%)
1	640+000	RHS	3	3	Exposed Base	32
					Sub-grade Base	16
2	637+500	LHS	4	4	Exposed Base	37
					Subgrade Base	32
3	635+000	RHS	5	5	Exposed Base	38
					Subgrade Base	8

CBR values using DCPT						
S. No.	Chainage	Direction	DCPT No.	Test Pit No.	Layer	CBR Value (%)
4	633+500	LHS	6	6	Exposed Base	51
					Subgrade Base	30
5	631+000	RHS	7	7	Exposed Base	16
					Subgrade Base	34
6	628+500	LHS	8	8	Exposed Base	31
					Subgrade Base	15
7	624+800	RHS	9	9	Exposed Base	63
					Subgrade Base	15
8	623+500	LHS	10	10	Exposed Base	12
					Subgrade Base	13
9	621+000	LHS	11	11	Exposed Base	32
					Subgrade Base	14
10	618+500	LHS	12	12	Exposed Base	47
					Subgrade Base	16
11	616+000	RHS	13	13	Exposed Base	22
					Subgrade Base	23
12	613+500	LHS	14	14	Exposed Base	36
					Subgrade Base	16
13	611+250	RHS	15	15	Exposed Base	61
					Subgrade Base	21
14	608+000	LHS	16	16	Exposed Base	22
					Subgrade Base	27
15	605+700	RHS	17	17	Exposed Base	60
					Subgrade Base	18
16	603+500	LHS	18	18	Exposed Base	20
					Subgrade Base	19
17	601+000	RHS	19	19	Exposed Base	45
					Subgrade Base	26

Table 53. Test Results. CBR values using DCPT

The graphical representation of field DCPT-CBR % is presented in Figure 26 and Figure 27.

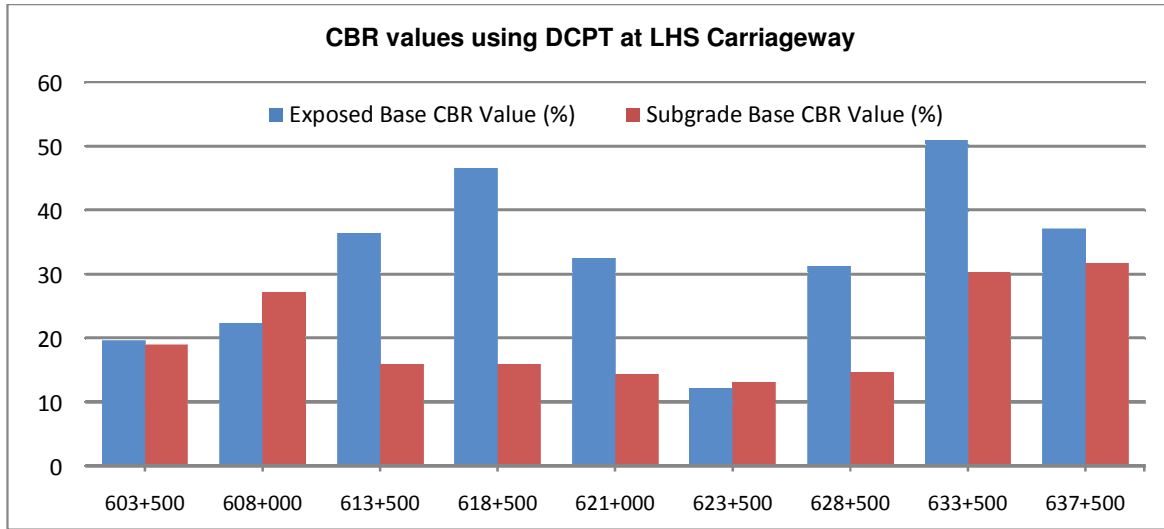


Figure 26. CBR values at LHS

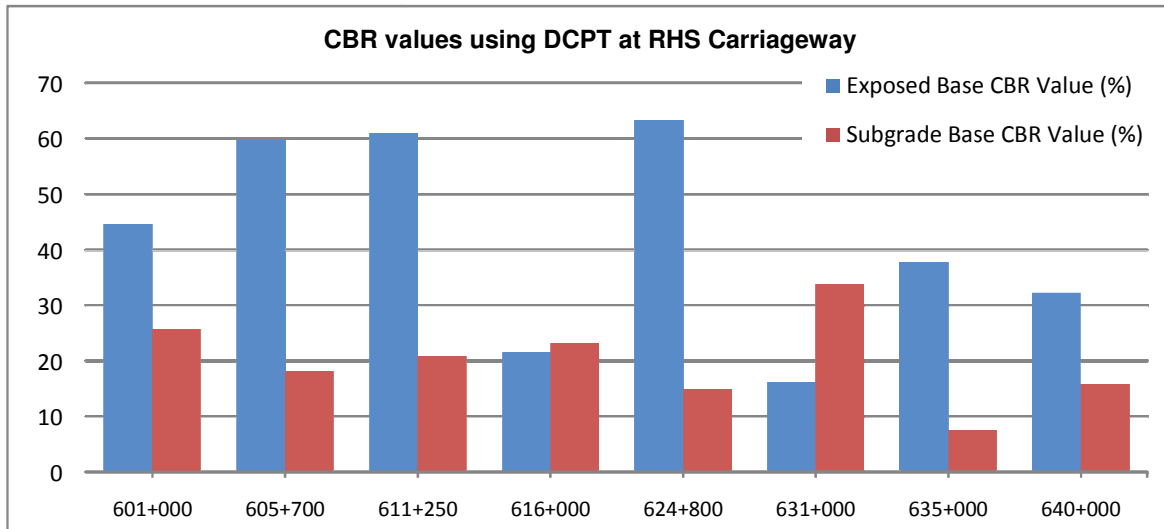


Figure 27. CBR values at RHS

4.4.1.2. FIELD DENSITY AND MOISTURE CONTENT TEST

The following values were obtained:

Value from Chainage 601+000 to 646+000	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)
Maximum	1.93	11.24	1.87
Minimum	1.50	1.70	1.47
Average	1.78	5.21	1.69

Table 54. Test Results. CBR values using DCPT

S.No.	Chainage	Direction	Test Pit No.	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)
1	601+000	RHS	19	1.87	4.75	1.785
2	603+500	LHS	18	1.68	2.48	1.639
3	605+700	RHS	17	1.87	4.25	1.794
4	608+000	LHS	16	1.5	1.8	1.473
5	611+250	RHS	15	1.86	5.06	1.770
6	613+500	LHS	14	1.72	2.43	1.679
7	616+000	RHS	13	1.91	3.02	1.854
8	618+500	LHS	12	1.7	1.7	1.672
9	621+000	LHS	11	1.93	3.2	1.870
10	623+500	LHS	10	1.74	2.13	1.704
11	624+800	RHS	9	1.86	5.12	1.769
12	628+500	LHS	8	1.78	8.09	1.647
13	631+000	RHS	7	1.61	7.92	1.492
14	633+500	LHS	6	1.75	8.59	1.612
15	635+000	RHS	5	1.82	9.42	1.663
16	637+500	LHS	4	1.7	7.44	1.582
17	640+000	RHS	3	1.89	11.24	1.699

Table 55. Test Results. Field Density and Moisture Content

A variation in Bulk Density/Moisture content/Dry Density along the project road was observed. The Bulk Density varies from 1.50gm/cc to 1.93 g/cc, whereas Dry Density varies from 1.47gm/cc to 1.87gm/cc, while Moisture content % varies from 1.70% to 11.24%.

The graphical representation of Bulk Density/Moisture content/Dry Density is presented in Figures below.

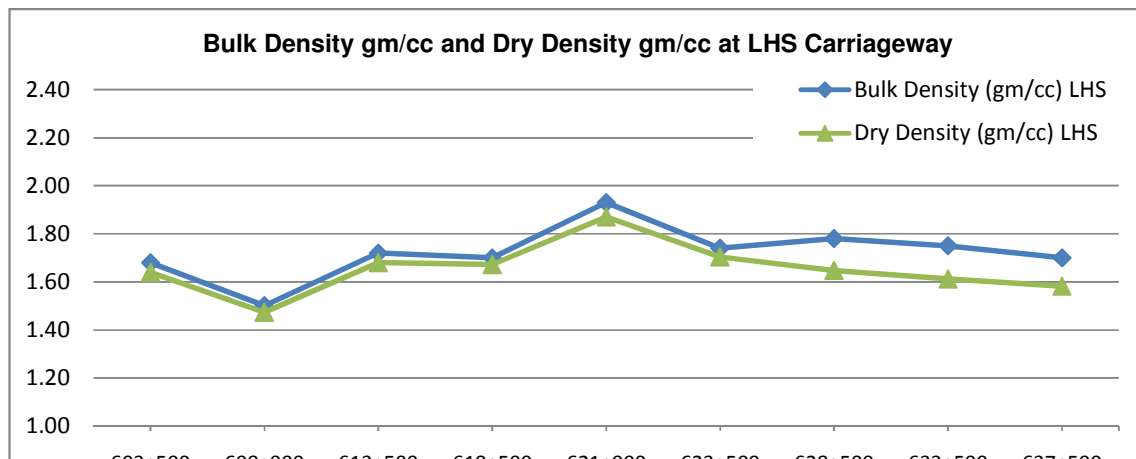


Figure 28. Bulk Density gm/cc and Dry Density gm/cc at LHS

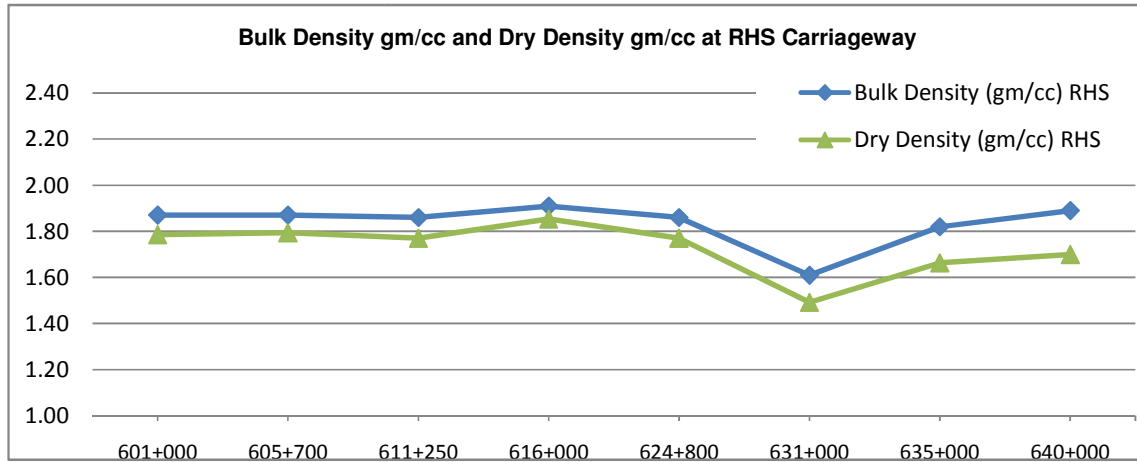


Figure 29. Bulk Density gm/cc and Dry Density gm/cc at RHS

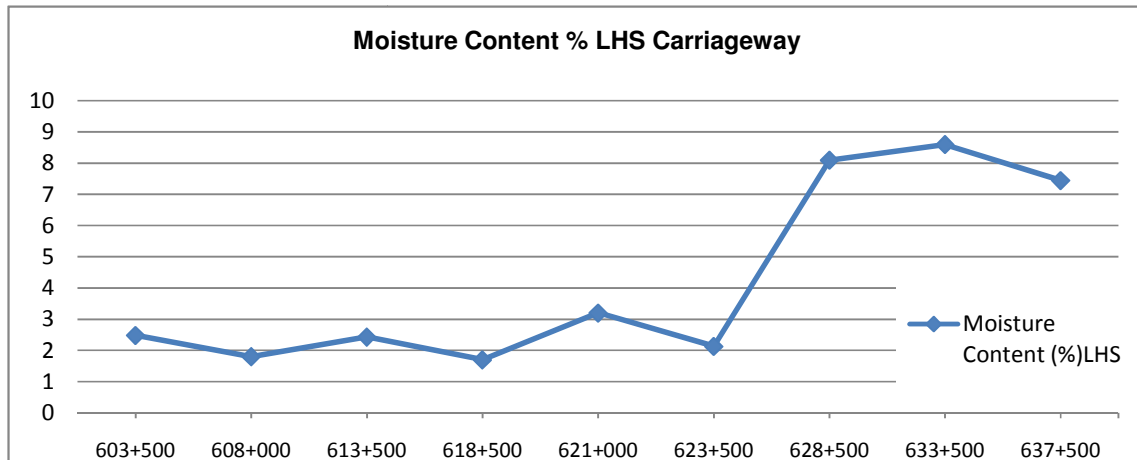


Figure 30. Moisture Content % at LHS

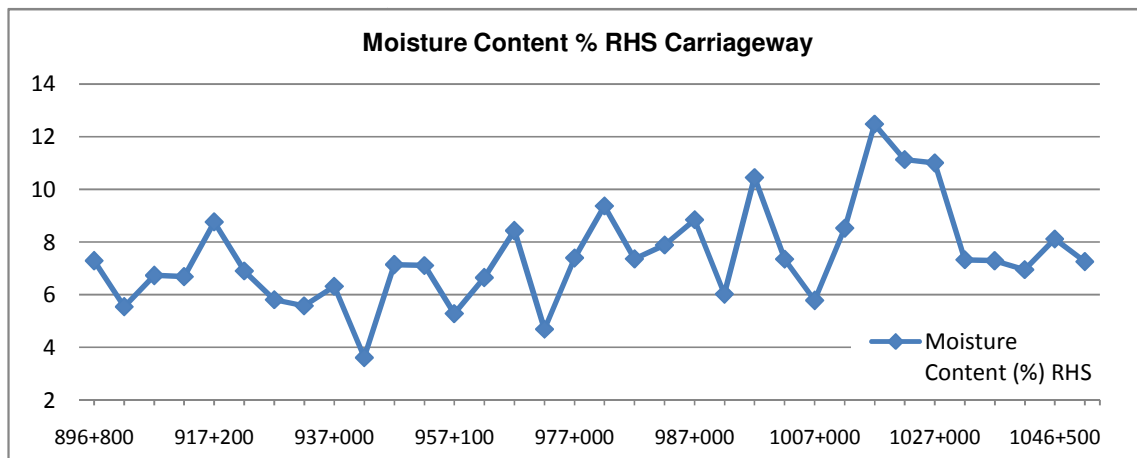


Figure 31. Moisture Content % at RHS

4.4.1.3. PAVEMENT COMPOSITION

The results about pavement crust obtained from each test pit at this stretch are recorded, and a broad variation in pavement thickness along the project road was observed. The Bituminous part at LHS side varies from 100mm to 235mm and RHS side varies from 220 mm to 280 mm. While non-bituminous depth at LHS side varies from 405 mm to 645 mm and at RHS side is varies from 370 mm to 460 mm. The details of crust composition chainage wise and the existing Crust composition Maximum, Minimum and Average values (LHS/RHS) carriageway wise are presented below in Table 56 and Table 57.

Value from Chainage 601+000 to 646+000	Bituminous Layer mm	WBM/WMM (Base) mm	Sub Base mm
Maximum	240	260	260
Minimum	200	180	190
Average	222	229	235

Table 56. Crust composition at LHS

Value from Chainage 601+000 to 646+000	Bituminous Layer mm	WBM/WMM (Base) mm	Sub Base mm
Maximum	270	280	255
Minimum	180	170	190
Average	233	234	221

Table 57. Crust composition at RHS

The details of crust composition chainage wise are presented in the following table:

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
1	640+000	RHS	3	Bituminous Layer	250
				WBM/WMM (Base)	210
				GSB (Sub-base)	190
				TOTAL CRUST	650
2	637+500	LHS	4	Bituminous Layer	230
				WBM/WMM (Base)	220
				GSB (Sub-base)	230
				TOTAL CRUST	680
3	635+000	RHS	5	Bituminous Layer	230
				WBM/WMM (Base)	220
				GSB (Sub-base)	230
				TOTAL CRUST	680
4	633+500	LHS	6	Bituminous Layer	210
				WBM/WMM (Base)	230
				GSB (Sub-base)	190

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
				TOTAL CRUST	630
5	631+000	RHS	7	Bituminous Layer	270
				WBM/WMM (Base)	170
				GSB (Sub-base)	220
				TOTAL CRUST	660
6	628+500	LHS	8	Bituminous Layer	200
				WBM/WMM (Base)	220
				GSB (Sub-base)	240
				TOTAL CRUST	660
7	624+800	RHS	9	Bituminous Layer	180
				WBM/WMM (Base)	270
				GSB (Sub-base)	190
				TOTAL CRUST	640
8	623+500	LHS	10	Bituminous Layer	220
				WBM/WMM (Base)	180
				GSB (Sub-base)	200
				TOTAL CRUST	600
9	621+000	RHS	11	Bituminous Layer	220
				WBM/WMM (Base)	270
				GSB (Sub-base)	210
				TOTAL CRUST	700
10	618+500	LHS	12	Bituminous Layer	235
				WBM/WMM (Base)	260
				GSB (Sub-base)	250
				TOTAL CRUST	745
11	616+000	RHS	13	Bituminous Layer	210
				WBM/WMM (Base)	280
				GSB (Sub-base)	220
				TOTAL CRUST	710
12	613+500	LHS	14	Bituminous Layer	230
				WBM/WMM (Base)	250
				GSB (Sub-base)	250
				TOTAL CRUST	730
13	611+250	RHS	15	Bituminous Layer	245
				WBM/WMM (Base)	250
				GSB (Sub-base)	255

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
				TOTAL CRUST	750
14	608+000	LHS	16	Bituminous Layer	210
				WBM/WMM (Base)	240
				GSB (Sub-base)	260
				TOTAL CRUST	710
15	605+700	RHS	17	Bituminous Layer	270
				WBM/WMM (Base)	235
				GSB (Sub-base)	250
				TOTAL CRUST	755
16	603+500	LHS	18	Bituminous Layer	240
				WBM/WMM (Base)	230
				GSB (Sub-base)	260
				TOTAL CRUST	730
17	601+000	RHS	19	Bituminous Layer	225
				WBM/WMM (Base)	200
				GSB (Sub-base)	220
				TOTAL CRUST	645

Table 58. Detailed Crust composition

The graphical representations of these values are presented in Figure 32 and Figure 33.

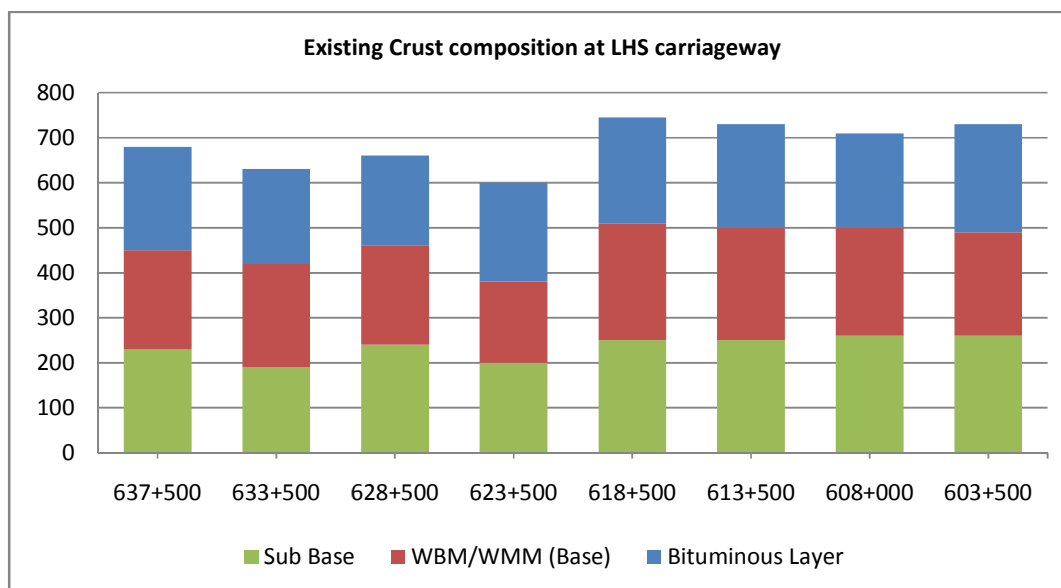


Figure 32. Existing Concrete pavement composition at LHS

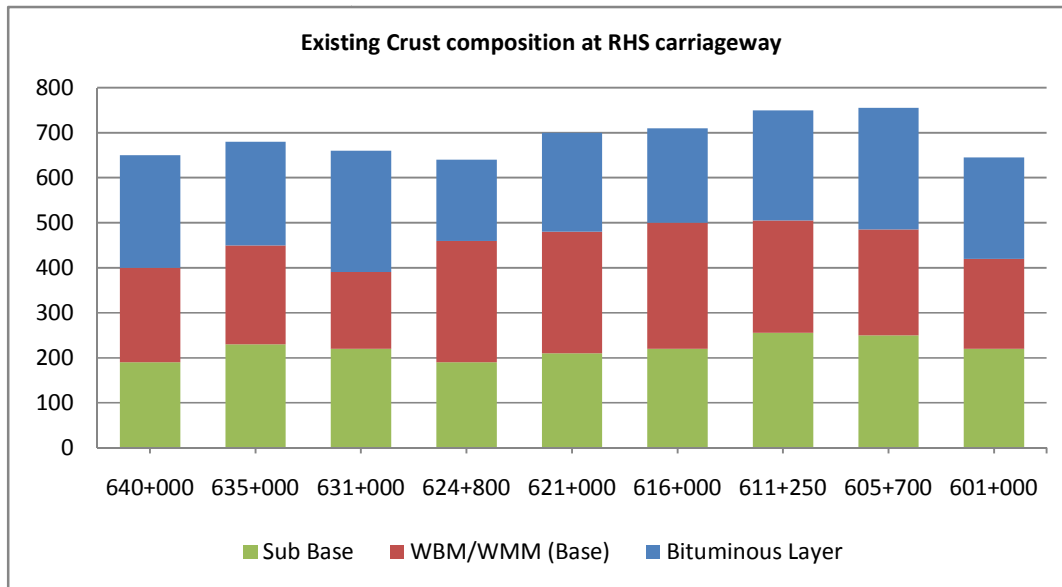


Figure 33. Existing Concrete pavement composition at RHS

4.4.2. LABORATORY RESULTS

4.4.2.1. SOIL AND GRANULAR MATERIAL

The laboratory test conducted for the samples of material extracted from tests pits are given in following table.

S.No	Test Parameters	Method Reference
1	Water Content	IS:2720 (Part 2)
2	Grain Size Analysis	IS:2720 (Part 4)
3	Atterberg's Limits	IS:2720 (Part 5)
4	MDD-OMC (Compaction)	IS:2720 (Part 8)
5	CBR	IS:2720 (Part 16)
6	Free Swell Index	IS:2720 (Part 40)

Table 59. Tests carried out on Sub-grade Soil/GSB/WMM

4.4.2.1.1 SUB GRADE SOIL

The laboratory tests carried out for the soil samples of sub-grade revealed that soil along the alignment is predominantly silty sand of non-plastic in nature & clayey sand of medium plasticity. At some chainages the sub-grade soil were found to be clayey silt of low to medium plasticity & silty gravels. OMC value varies from 9.50% to 12.00% and those of MDD vary from 1.75 gm/cc to 2.13 gm/cc.

CBR test was conducted by three energy level method as prescribed & the values vary from 8% to 20% for soaked condition and 11% to 31% for un-soaked condition. The summary of laboratory test results is given in Table 60. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 601+000 to 646+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI) %	FSI [IS :2720-Pt- 40] %	Max. Dry density (gm/cc)	OMC (%)	Soaked CBR at 3 energy level	Unsoaked CBR at 3 energy level
Maximum	32.00	19.00	15.00	17.12	2.13	12.00	20.00	31.00
Minimum	24.00	16.00	12.00	10.00	1.75	9.50	8.00	11.00
Average	26.88	17.83	12.83	13.43	1.92	10.62	12.94	18.59

Table 60. Test Results of Soil Layer

4.4.2.1.2 GRANULAR SUB BASE

The test results of GSB are generally Sandy Gravels. OMCvalue is in the range of 6.0% to 7.0 % and that of MDD is in the range of 2.16gm/cc to 2.24gm/cc. CBR value is in the range of 34.0% to 39.0 %. Specific gravity value is in the range of 2.76% to 2.83 %. The laboratory test results are given in Table 61. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 601+000 to 646+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI) %	Max. Dry density (gm/cc)	OMC (%)	CBR Value at 98 % dry density (Soaked) %	Specific Gravity
Maximum	24.00	NIL	NP	2.24	7.00	39.00	2.83
Minimum	22.00	NIL	NP	2.16	6.00	34.00	2.76
Average	23.18	NIL	NP	2.19	6.47	36.71	2.80

Table 61. Test Results of Granular Sub base Material

4.4.2.1.3 WET MIX MACADAM

The WMM sample is generally Silty Gravels of low plasticity. Plasticity Value is not found. The laboratory test results are given in Table 62. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 601+000 to 646+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI) %	Max. Dry density (gm/cc)	OMC (%)	Specific Gravity	Impact (%)
Maximum	24.00	Nil	NP	2.27	6.50	2.85	25.00
Minimum	22.00	Nil	NP	2.23	5.50	2.79	18.00
Average	23.12	Nil	NP	2.25	6.24	2.82	21.47

Table 62. Test Results of Wet Mix Macadam

4.4.2.2. PAVEMENT TYPE/MIXES (RIGID/FLEXIBLE)

Two types of mixes compose basically the bituminous layers of the highway:

- BITUMINOUS CONCRETE (BC): BC is a Dense Graded Bituminous Mix used as Wearing Course for roads with intense traffic. BC Mix consists of Coarse Aggregates, Fine Aggregates, Filler and Binder blended as per Marshall Mix Design.
- DENSE BITUMINOUS MACADAM (DBM): DBM is a close Graded Bituminous mix of lower bitumen content and used as a binder course for all flexible pavements.

4.4.3. LABORATORY INVESTIGATION

Laboratory investigations were conducted to the core cutting samples collected in accordance to the provisions mentioned in various standard codes as follows:

- Compressive strength (N/mm²).
- Gradation (as per MORTH // Table 500-10).
- Binder Content (as per MORTH // Clause 507.2.5).
- Bulk Density (as per AASHTO T 166).

Summary of core cutting samples, and test results of Bitumen Core (BC) are provided in table and figures shown below. The detailed laboratory test results are collected in tabular form in Annexure Labs Investigation.

Chainage 601+000 to 646+000	Density (gm/cc)	Binder Content (%)	Thickness (mm)
Maximum	2.60	4.72	145
Minimum	2.35	3.44	17
Average	2.47	3.95	52

Table 63. Test Results of Bituminous Concrete

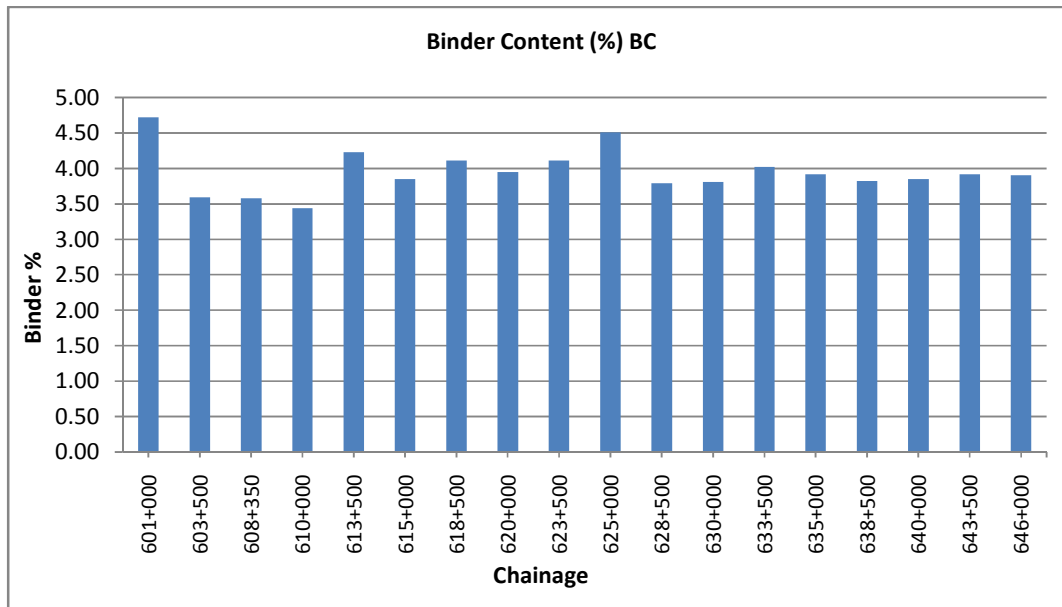


Figure 34. Binder Content (%) BC

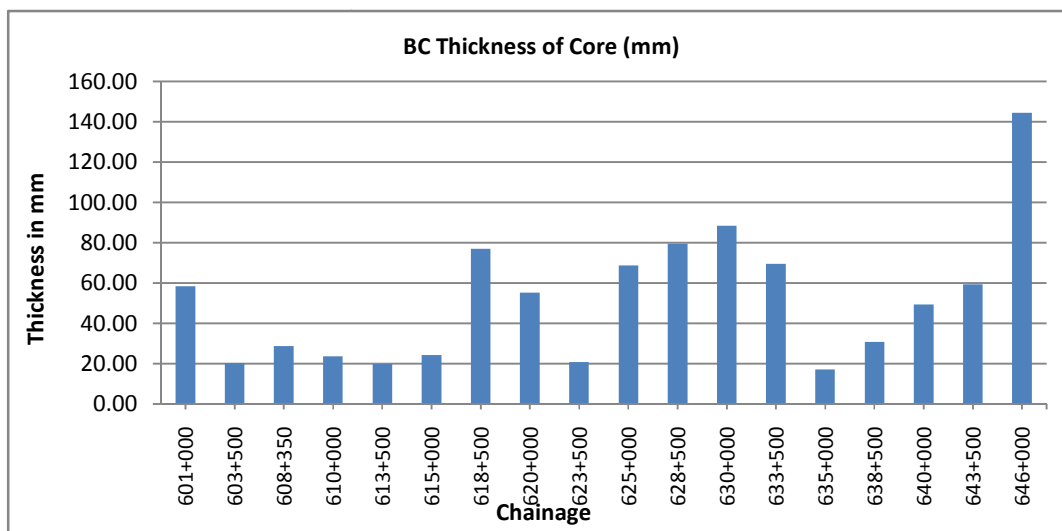


Figure 35.BC Thickness (mm)

Summary of core cutting samples, and test results of Bitumen Core (DBM) are provided in table and figures shown below. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 601+000 to 646+000	Density (gm/cc)	Binder Content (%)	Thickness (mm)
Maximum	2.60	4.24	232
Minimum	2.37	3.12	55
Average	2.53	3.72	147

Table 64.Test Results of Dense Bituminous Macadam

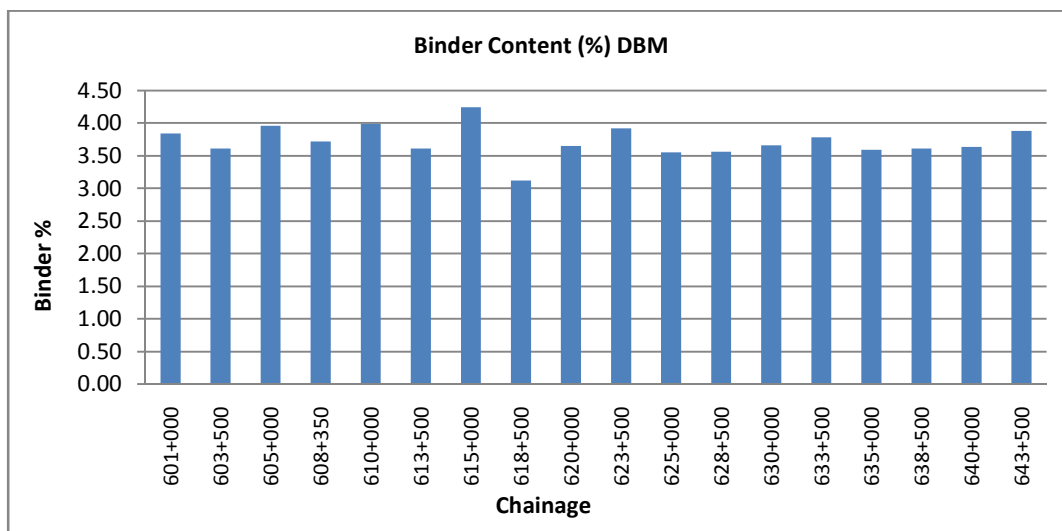


Figure 36.Binder Content (%) DBM

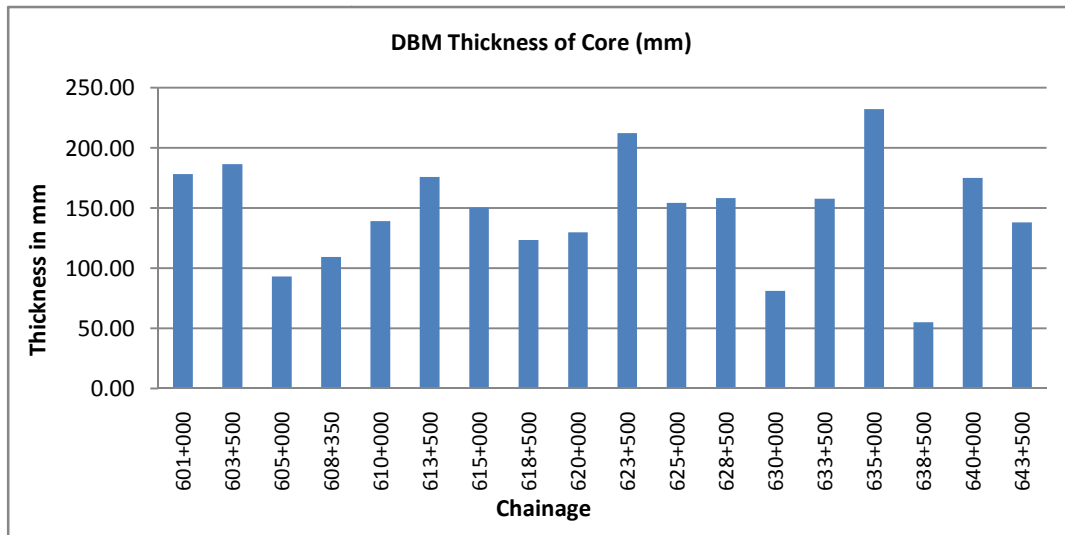


Figure 37.DBM Thickness (mm)

4.5. PAVEMENT CONDITION (NSV DATA)

The analysis of various performance parameter data as collected during NSV survey is presented in this section.

Graphs and tables are represented in average kilometric values. Detail of average hectometre values are collected in Annexure IRI and Rut Depth results.

The kilometric chainage used for the processing of the NSV data in this section has been theoretically assigned from the start to the end points of the stretch by the own NSV. In Annexure 12 (Strip Plan & Kilometric Reference) it is provided a table of reference between the existing KM stones on site and the kilometric chainage used in present report.

4.5.1. PAVEMENT CONDITION INDEX (PCI)

Analysis of (cracks, potholes, patching, etc.) is undertaken to determine PCI of the Stretch. The Pavement Condition Index rates the condition of the surface of a road and provides a numerical rating for the condition of pavement segments within the project stretch, where 0 is the worst possible condition and 100 is the best.

The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities.

Regular monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI can also provide feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.

In this project, the PCI is calculated as per the international guidelines provided in ASTM-D6433. For different pavement condition, according to ASTM-D6433, PCI values are presented in the following table.

PCI	Rating
85 - 100	Good
70 - 85	Satisfactory
55 - 70	Fair
40 - 55	Poor
25 - 40	Very poor
10 - 25	Serious
0 - 10	Failed

Table 65. PCI Values

For each pavement distress type/severity combination identified by the pavement inspectors in a sample unit, a deduct value is calculated from the appropriate deduct curve, based on the quantity of distress present. The deduct curves are significantly different from distress to distress, reflecting the implications for present and future road conditions of the particular distress type. Load-related distresses, such as alligator cracking and rutting, have much steeper deduct curves (i.e. a given quantity of a load-related distress will result in a higher deduct value than the same quantity of a non-load related distress such as bleeding).

The individual deduct values are totaled, adjusted to account for the interaction of multiple distresses, and subtracted from the "perfect" PCI of 100 to give the actual PCI of the sample unit inspected. The deduct value computation and correction is performed by computer software; the pavement distress data are entered (distress type, severity and quantity for each distress type/severity combination) and the software performs all of the remaining calculations. As the estimation of quantity of the distress defects is based totally on visual assessment from the video, it was found that it was most consistent and reproducible to give the pavement inspector ranges of magnitude (<1, 1-5, 5-10 etc.), of the estimated percent area of the distress to choose from. The value of the ranges varies by distress. Use of the ranges has worked out well in practice, with good levels of repeatability in surveying sections with different teams of inspectors.

The PCI for a section of pavement is calculated in five steps:

- Step 1: The first step is the determination of distress types and severity levels of each distress type in the inspection units. This data is obtained after processing the field survey data. Firstly, the total quantity of each distress type at each severity level is added. Then the total quantity of each distress type at each severity level is divided by the total area of the sample unit (10 m section) and multiplies by 100 to obtain the percent density of each distress.
- Step 2: Determination of deduct values for each of the distresses and under each severity level from the distress deduct value curves as shown in the fig.
- Step 3: Computation of total deducts value by adding the deduct values of all distress types under each severity levels.
- Step 4: Determination of the maximum corrected deduct value (CDV) from the graph as shown in the following figure.
- Step 5: Compute $PCI = 100 - CDV$ for each sample unit inspected.

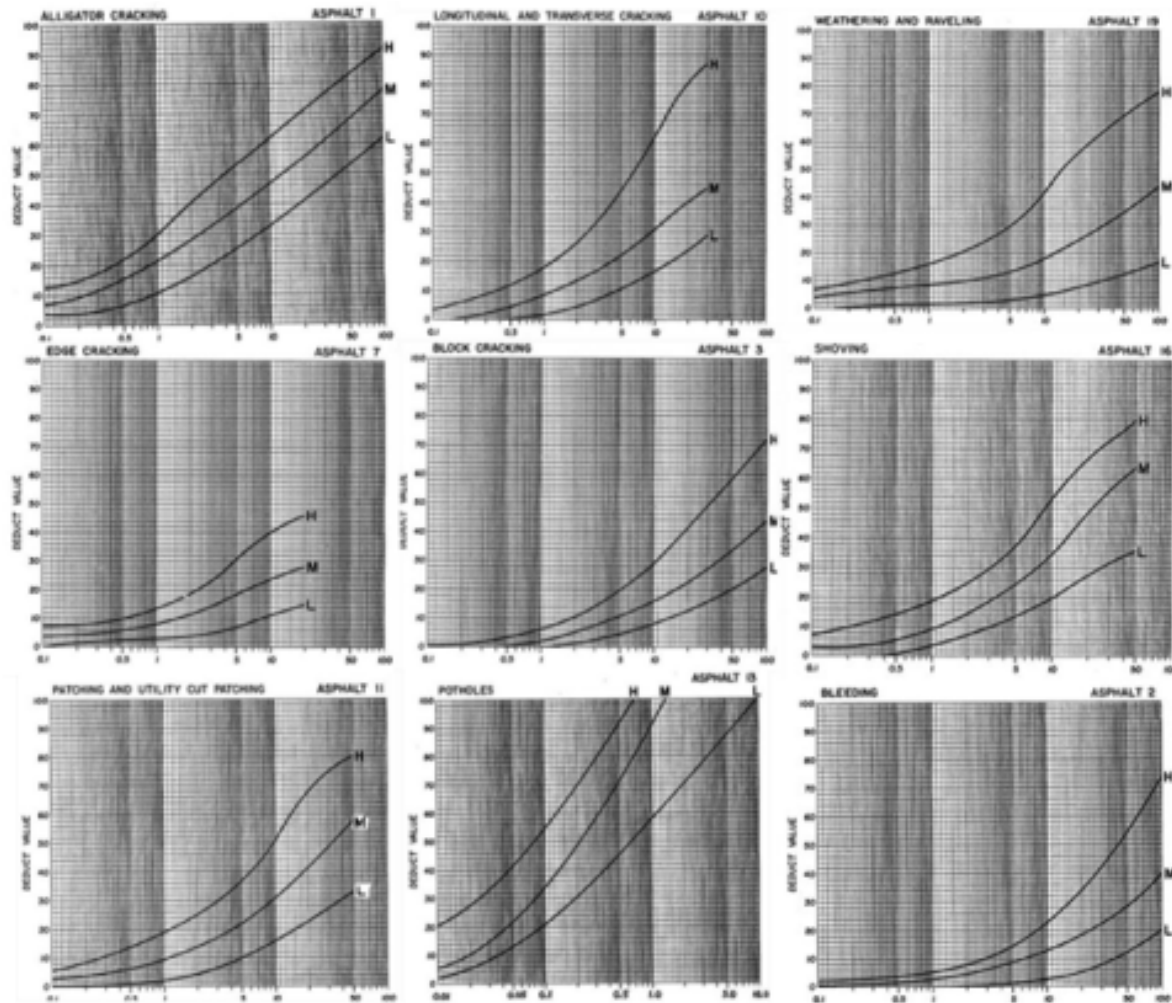


Figure 38. Deduct values curve

The maps of PCI along the whole stretch are shown in the following figures:

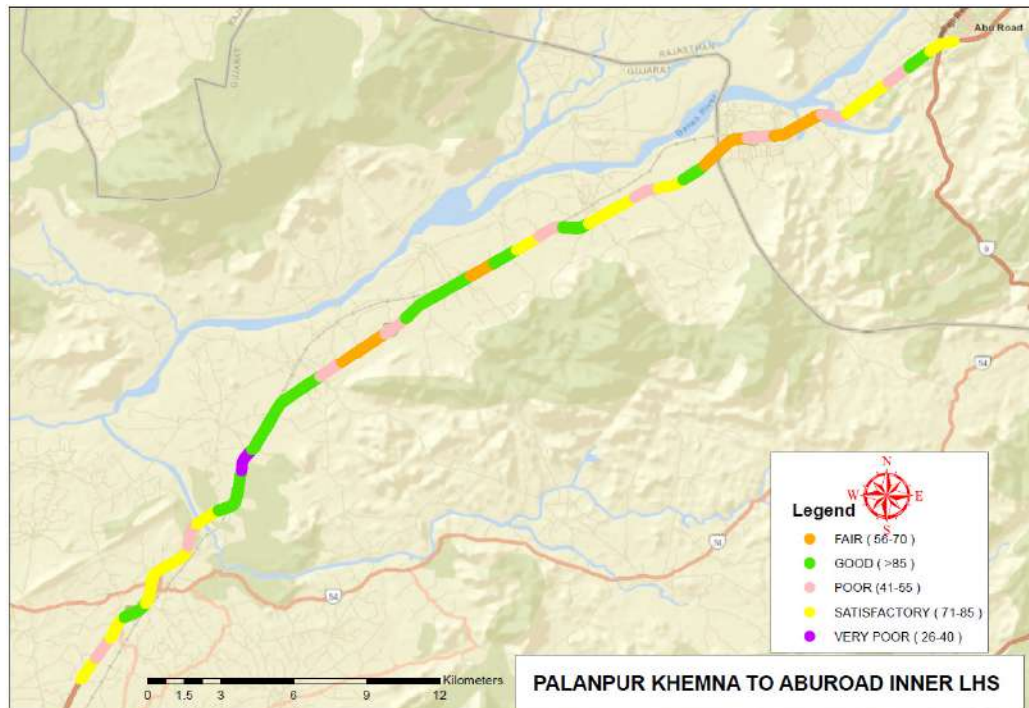


Figure 39. PCI along the stretch (LHS, Inner Lane)

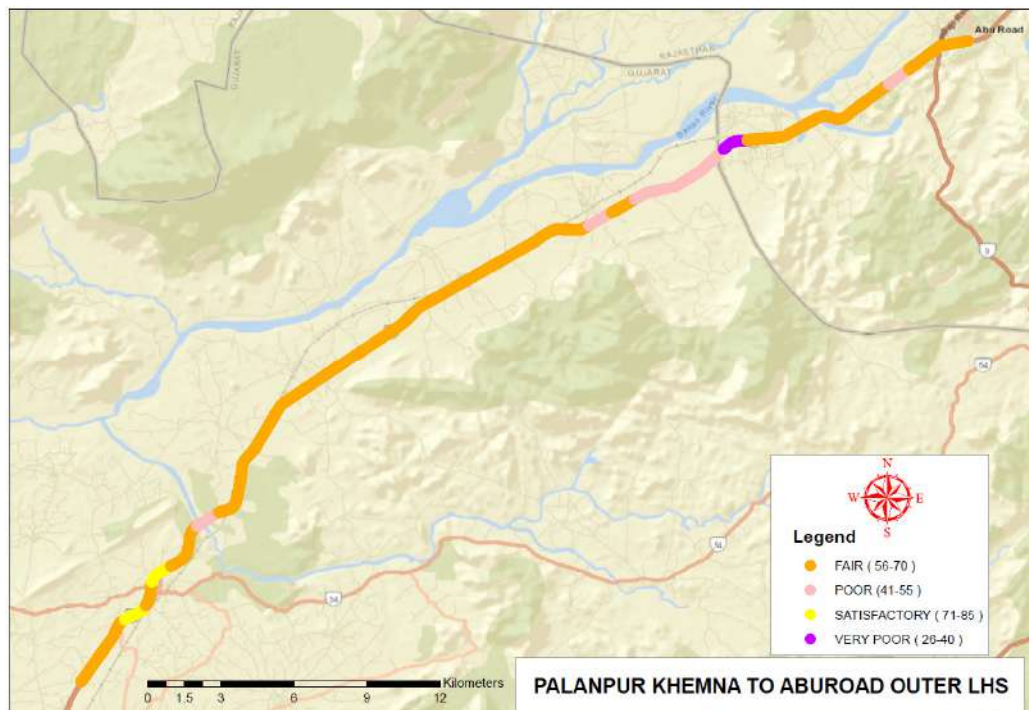


Figure 40. PCI along the stretch (LHS, Outer Lane)

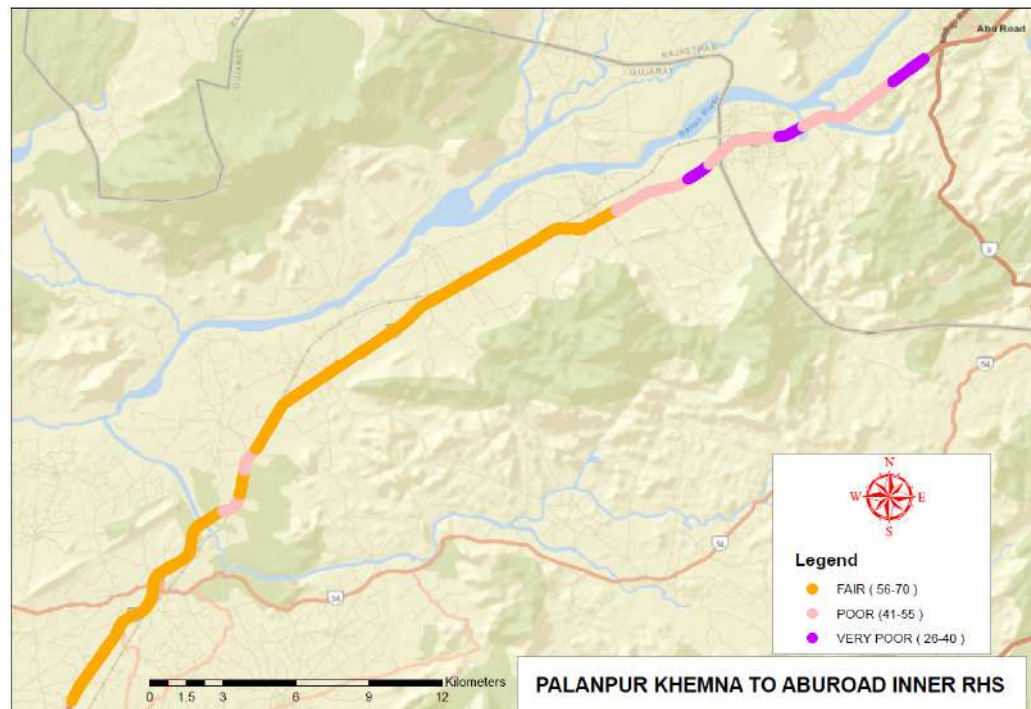


Figure 41. PCI along the stretch (RHS, Inner Lane)

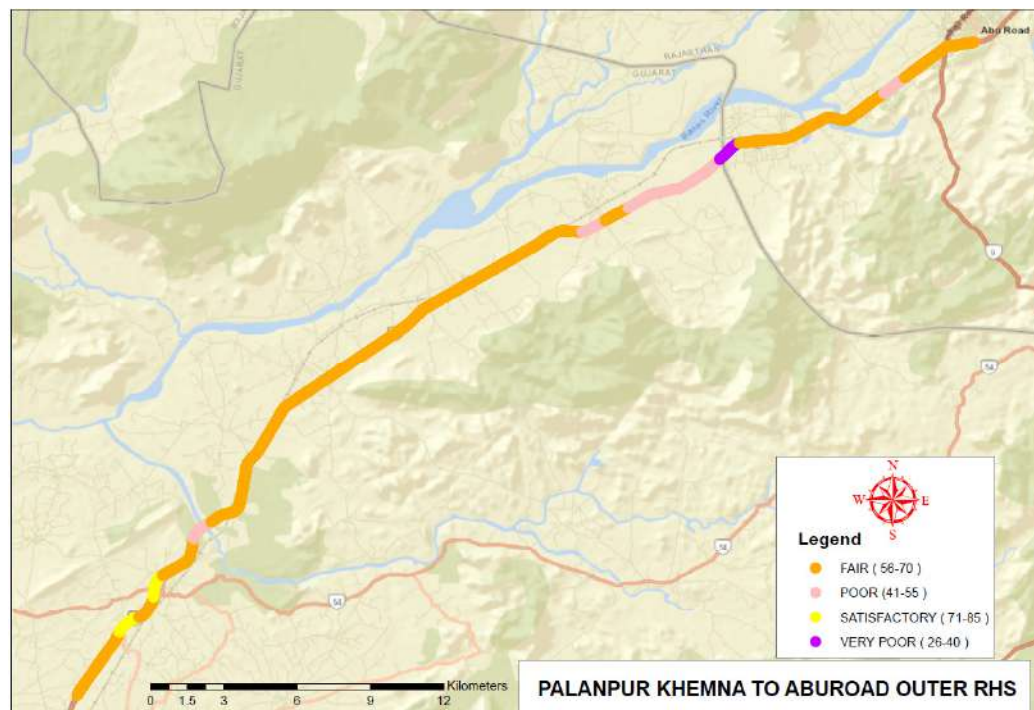


Figure 42. PCI along the stretch (RHS, Outer Lane)

4.5.1.1. OUTER/INNER LANE PCI

Length wise PCI condition details for both directions are given in Table 66 and Table 67.

It can be observed that PCI values are higher in inner lane LHS and higher in outer lane in RHS.

Condition	PCI Range	Length LHS Outer (km)	PCI %	Length LHS Inner (km)	PCI %
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	2	4	14	31
Fair	55 - 70	35	78	20	44
Poor	40 - 55	7	16	10	22
Very Poor	25 - 40	1	2	1	2
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Table 66.LHS outer lane and inner lane PCI results

Condition	PCI Range	Length RHS Outer (km)	PCI %	Length RHS Inner (km)	PCI %
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	7	15	1	2
Fair	55 - 70	34	76	29	63
Poor	40 - 55	4	9	12	26
Very Poor	25 - 40	0	0	4	9
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Table 67.RHS outer lane and inner lane IRI results

4.5.1.2. LHS/RHS LANE PCI

Length wise summarized PCI condition details for both the directions are given in the next table:

Condition	PCI Range	LHS (km)	LHS (%)	RHS (km)	RHS (%)
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	16	18	8	9
Fair	55 - 70	55	61	63	69
Poor	40 - 55	17	19	16	18
Very Poor	25 - 40	2	2	4	4
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Table 68.Direction wise Roughness distribution

It is observed that PCI value was slightly higher in LHS as compare to RHS.

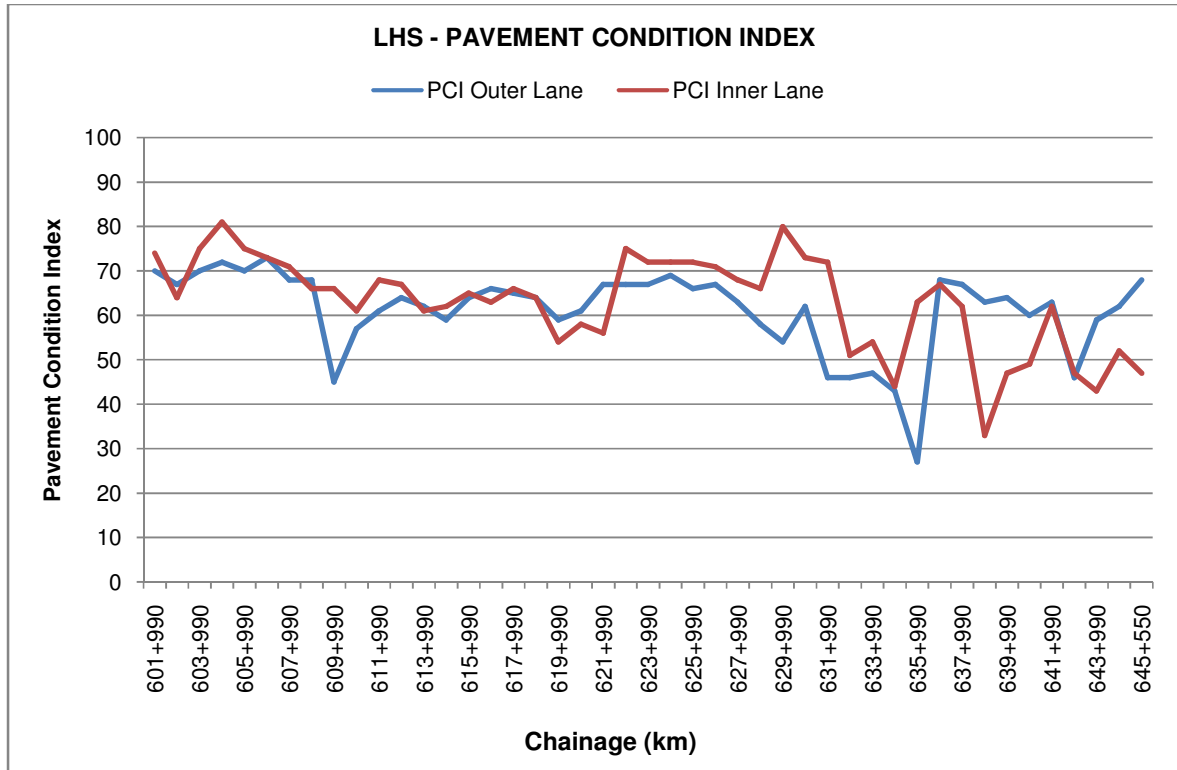


Figure 43. PCI for LHS carriageway

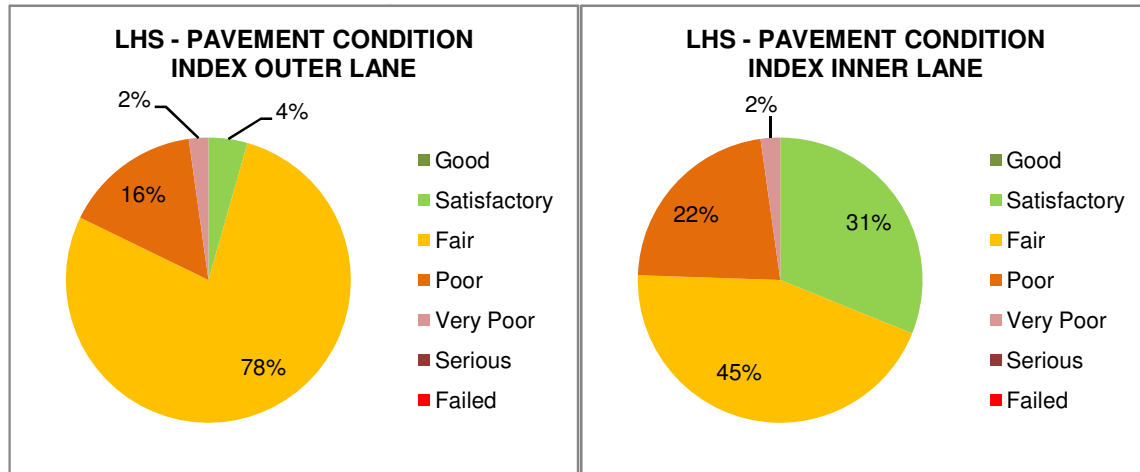


Figure 44. LHS Pavement Condition Index. Figures

It is observed from the Figure 44 shows that 0% on outer/inner lane of Project Stretch LHS has a PCI value in Good condition, whereas Satisfactory was in range between 4%-31% in outer/inner lane and Fair condition is in range of 78% in outer lane and 45% in inner lane. The rest of all (Poor/Very poor/serious/failed) section is in 18% in outer lane and 24% in inner lane.

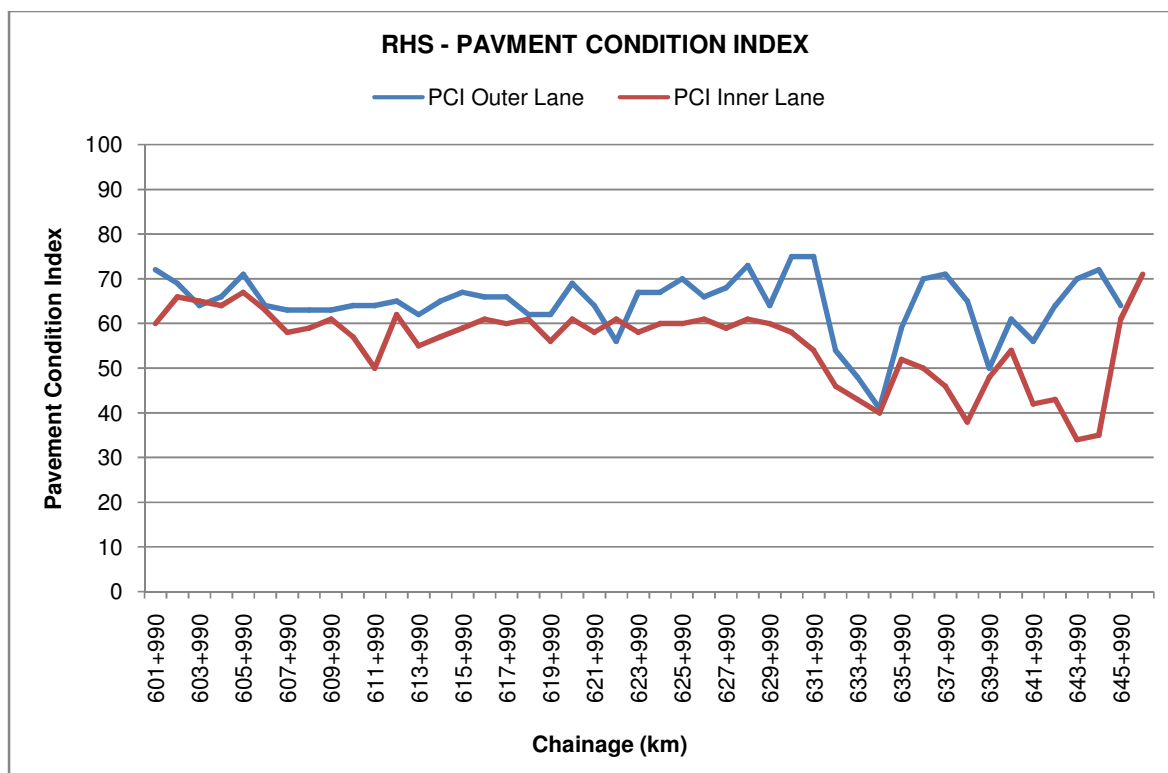


Figure 45.RHS Pavement Condition Index

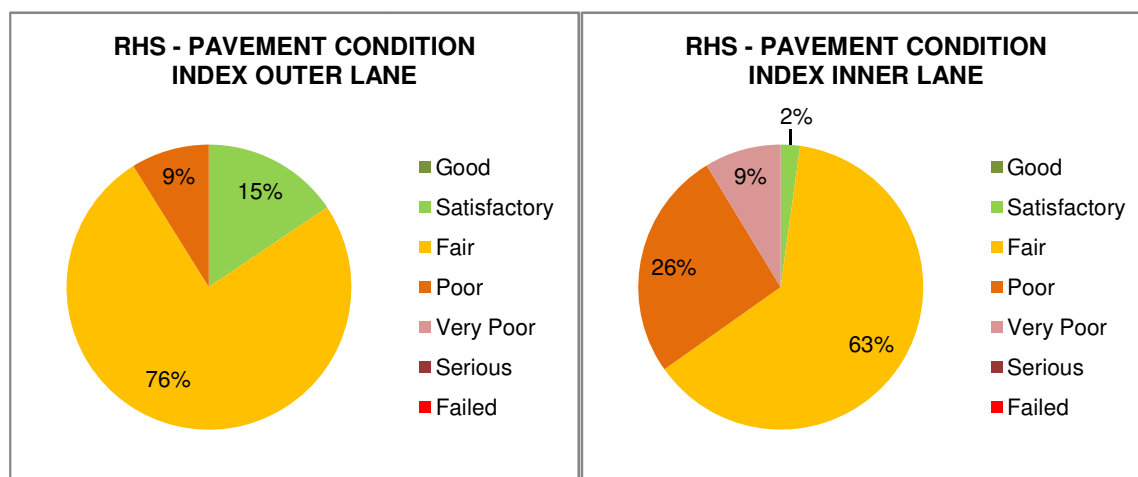


Figure 46.RHS Pavement Condition Index. Figures

It is observed from the Figure 46 that 0% on outer/inner lane of Project Stretch LHS has a PCI value in Good condition, whereas Satisfactory was in range between 15%-2% in outer/inner lane and Fair condition is in range of 76% in outer lane and 63% in inner lane. The rest of all (Poor/Very poor/serious/failed) section is in 9% in outer lane & 35% in inner lane.

KP	LHS OuterLane	LHS InnerLane	RHS OuterLane	RHS InnerLane
601+990	70	74	72	60
602+990	67	64	69	66
603+990	70	75	64	65
604+990	72	81	66	64
605+990	70	75	71	67
606+990	73	73	64	63
607+990	68	71	63	58
608+990	68	66	63	59
609+990	45	66	63	61
610+990	57	61	64	57
611+990	61	68	64	50
612+990	64	67	65	62
613+990	62	61	62	55
614+990	59	62	65	57
615+990	64	65	67	59
616+990	66	63	66	61
617+990	65	66	66	60
618+990	64	64	62	61
619+990	59	54	62	56
620+990	61	58	69	61
621+990	67	56	64	58
622+990	67	75	56	61
623+990	67	72	67	58
624+990	69	72	67	60
625+990	66	72	70	60
626+990	67	71	66	61
627+990	63	68	68	59
628+990	58	66	73	61
629+990	54	80	64	60
630+990	62	73	75	58
631+990	46	72	75	54
632+990	46	51	54	46
633+990	47	54	48	43
634+990	43	44	41	40
635+990	27	63	59	52

KP	LHS OuterLane	LHS InnerLane	RHS OuterLane	RHS InnerLane
636+990	68	67	70	50
637+990	67	62	71	46
638+990	63	33	65	38
639+990	64	47	50	48
640+990	60	49	61	54
641+990	63	62	56	42
642+990	46	47	64	43
643+990	59	43	70	34
644+990	62	52	72	35
645+550	68	47	64	61
646+000				71

Table 69. PCI Results

Graphs and tables are represented in average kilometric values. Detail of average hectometre values are shown in Annexure IRI and Rut Depth results.

4.5.2. INTERNATIONAL ROUGHNESS INDEX (IRI)

Road roughness has been defined as the variation in surface elevation that induces vibration in moving vehicles. In particular, the International Roughness Index (IRI) is a scale for roughness based on the response of a standardized motor vehicle to the road surface. It is considered that the road user's view of satisfactory or unsatisfactory road condition is primarily influenced by roughness or ride quality. IRI has become the most accepted world standard for Roughness.

The IRI can be measured by an extensive range of equipment from rod and level through response-type meters up to very accurate laser-based profilometers. The IRI is expressed in units of meters per kilometer, with low values indicating smooth roads, and high values indicating rough roads with poor ride quality.

Roughness is one of the important parameters for determining the functional characteristics of pavements. In India, the roughness has been traditionally measured using the fifth wheel bump integrator (developed by CRRIL). Bump Integrator Roughness (BI) has been traditionally the standardize measurement of the longitudinal road profile in India, either in m/km or mm/m.

The National Highway Authority of India (NHAI), via letter no. 11041/218/2007 –Admn. dated 03/11/2009 on POLICY MATTERS –TECHNICAL (37/2009) has approved the use of Laser Profiling devices for NHAI works. Consequently, IRI measurement has been progressively introduced in India. IRI correlation with BI values can be calculated by the following formula:

$$BI = 630 \cdot (IRI)^{1.12}$$

Where:

BI: Bump Integrator Roughness or Unevenness Index (mm/km).

IRI: International Roughness Index.

The following table shows the applicable and equivalent values that can define the roughness condition of highway pavements in India:

Condition	Roughness (BI)	IRI (m/km)
Good	BI < 2000	IRI < 2.8
Fair	2000 - 3000	2.8 - 4.0
Poor	BI > 3000	IRI > 4.0

Table 70. IRI Condition Scale

The maps of International Roughness Index along the whole stretch are shown in the following figures:

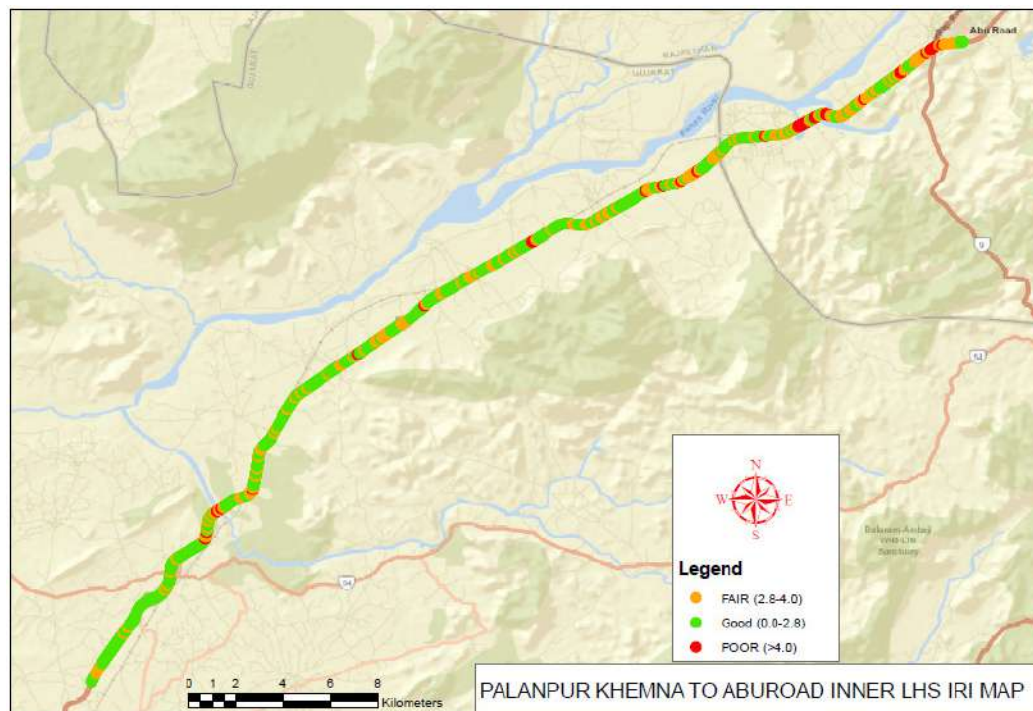


Figure 47. Roughness Index along the stretch (LHS, Inner lane)

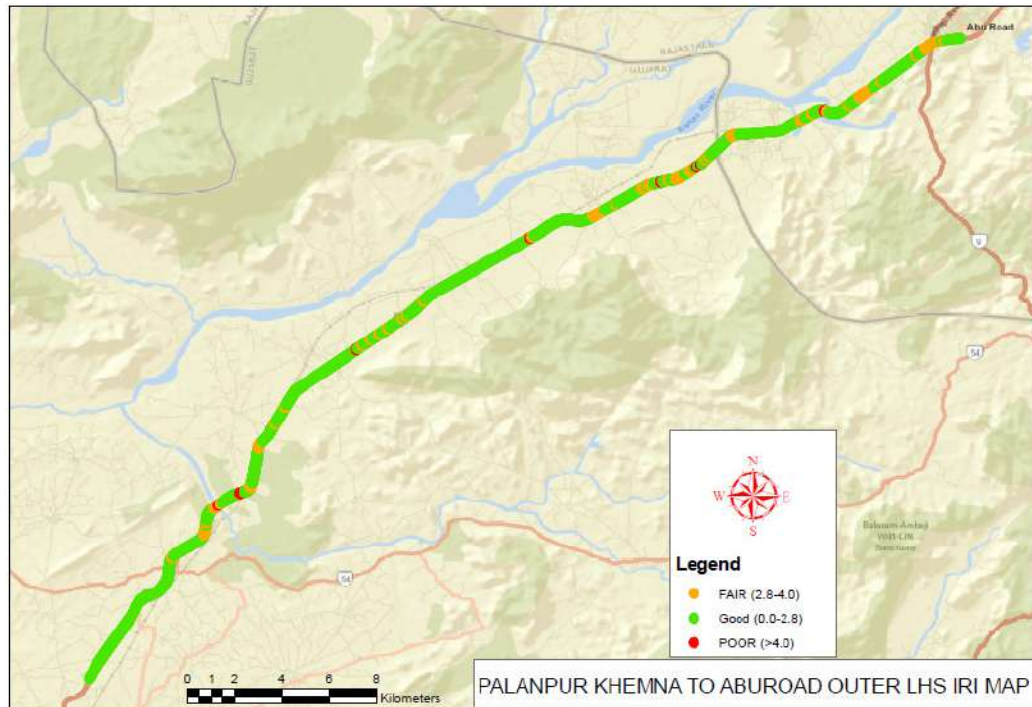


Figure 48. Roughness Index along the stretch (LHS, Outer lane)

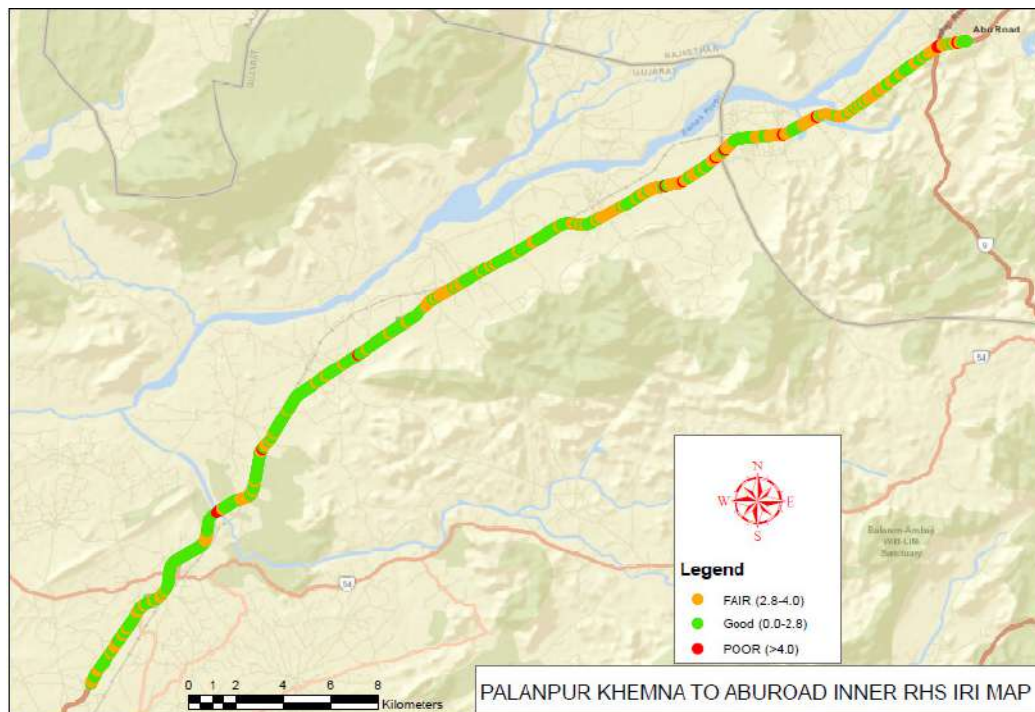


Figure 49. Roughness Index along the stretch (RHS, Inner lane)

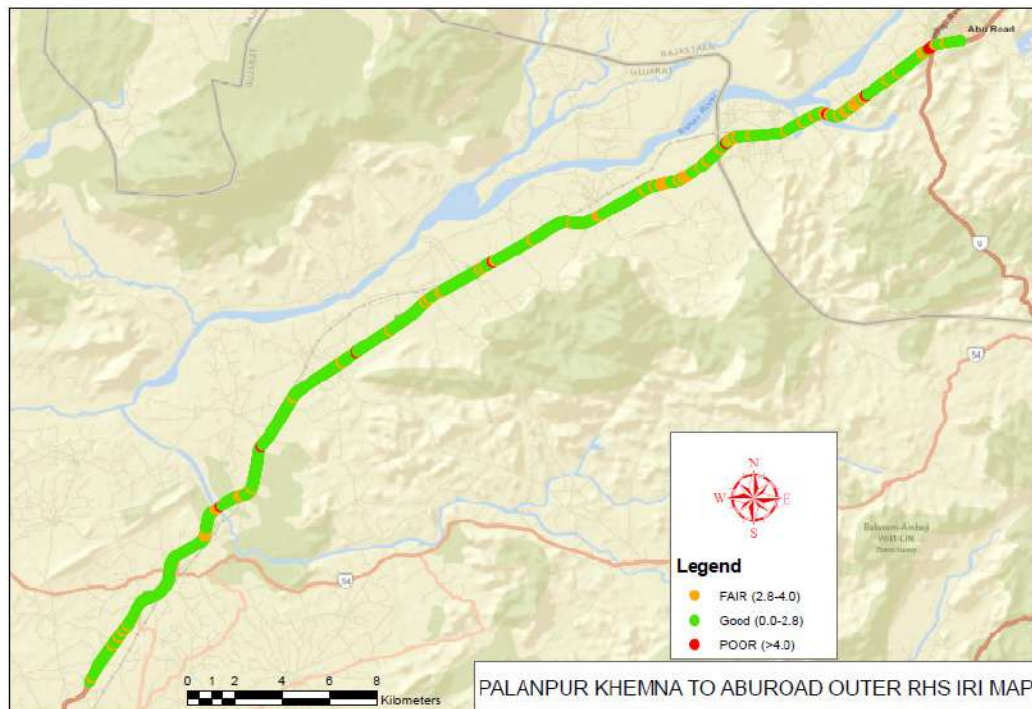


Figure 50. Roughness Index along the stretch (RHS, Outer lane)

4.5.2.1. OUTER/INNER LANE ROUGHNESS INDEX

It is observed that roughness index was similar in inner lane as compared to outer lane for both the direction. The International Roughness Index of the both lanes at some sections was beyond the desirable limit of 4.0 mm/km.

It is observed that roughness index is lower in outer lane as compared to inner lane in both directions.

Condition	Range	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	IRI < 2.8	39	87	25	56
Fair	2.8 - 4.0	6	13	19	42
Poor	IRI > 4.0	0	0	1	2

Table 71.LHS carriageway outer lane and inner lane IRI results

Condition	Range	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	IRI < 2.8	41	91	29	63
Fair	2.8 - 4.0	4	9	16	37
Poor	IRI > 4.0	0	0	0	0

Table 72.RHS carriageway outer lane and inner lane IRI results

4.5.2.2. LHS/RHS ROUGHNESS INDEX

Length wise summarized IRI condition details for both the directions are given in the next table:

Condition	IRI (m/km)	LHS (km)	LHS (%)	RHS (km)	RHS (%)
Good	IRI < 2.8	64	71	70	77
Fair	2.8 - 4.0	25	28	21	23
Poor	IRI > 4.0	1	1	0	0

Table 73. Direction wise Roughness distribution

It is observed that roughness index was similar in LHS as compared to RHS.

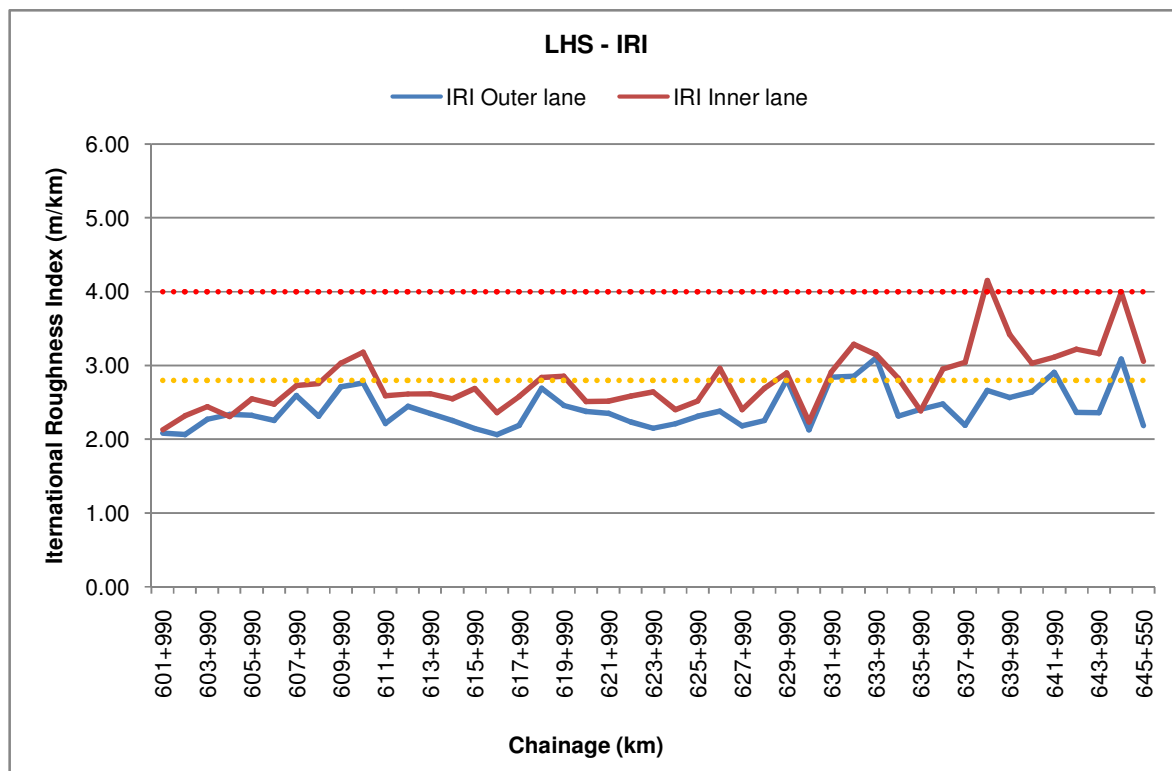


Figure 51. LHS International Roughness Index

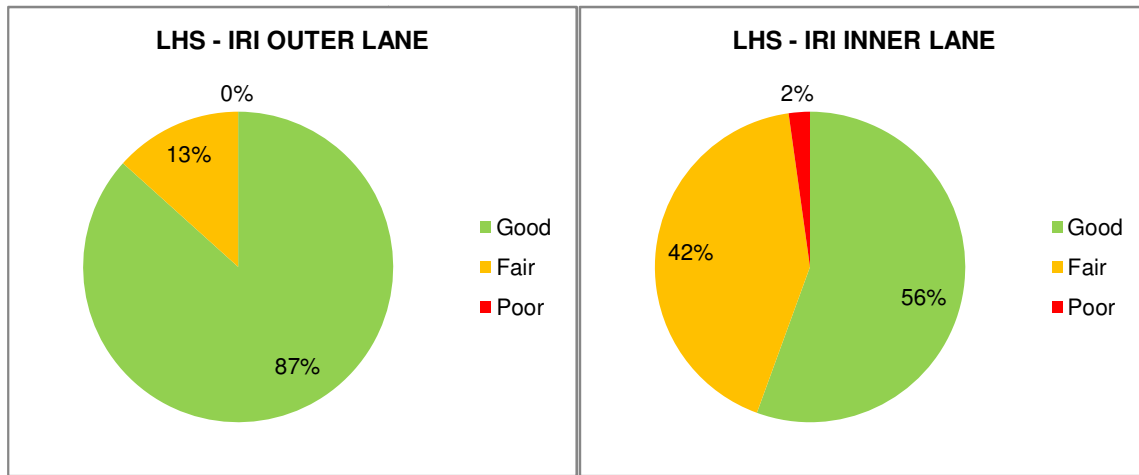


Figure 52.LHS International Roughness Index. Figures

It is observed from Figure 52 that 87%-56% of Project Stretch LHS on outer/inner has IRI value in Good range, whereas Fair was in range between 13% in outer lane and 42% in inner lane and, Poor condition, is in range of 0% in outer lane and 2% in inner lane.

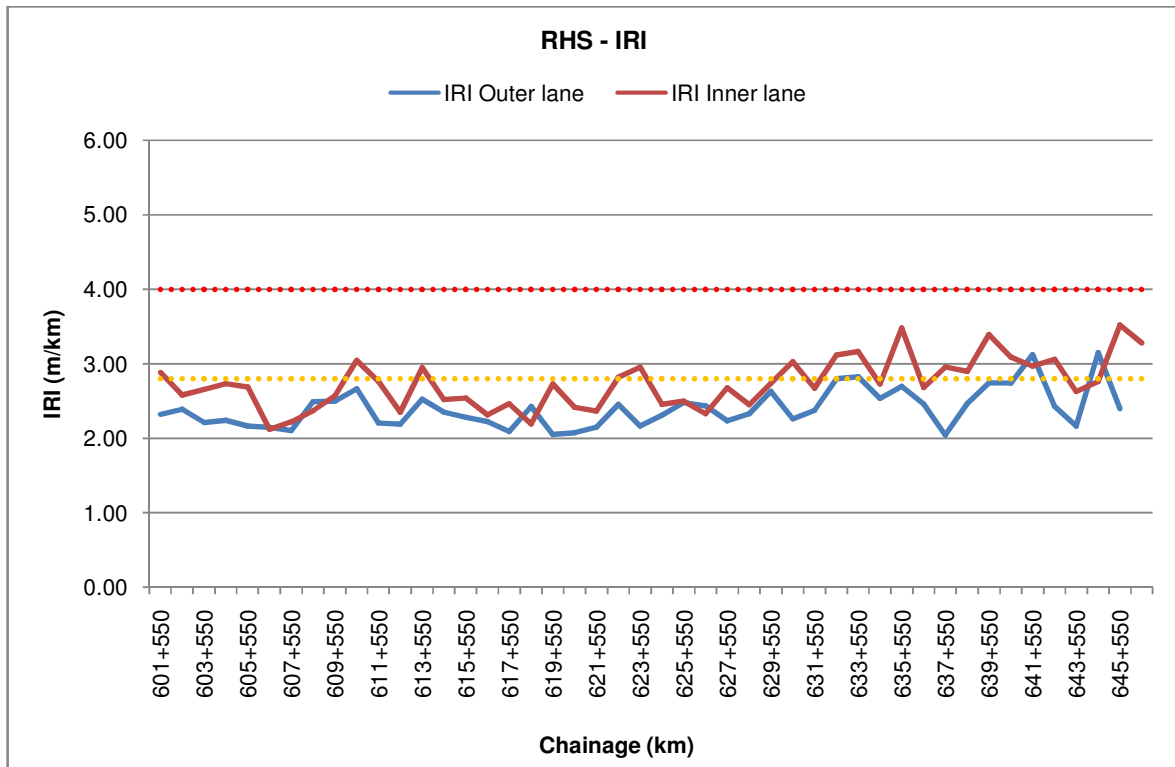


Figure 53. RHS International Roughness Index

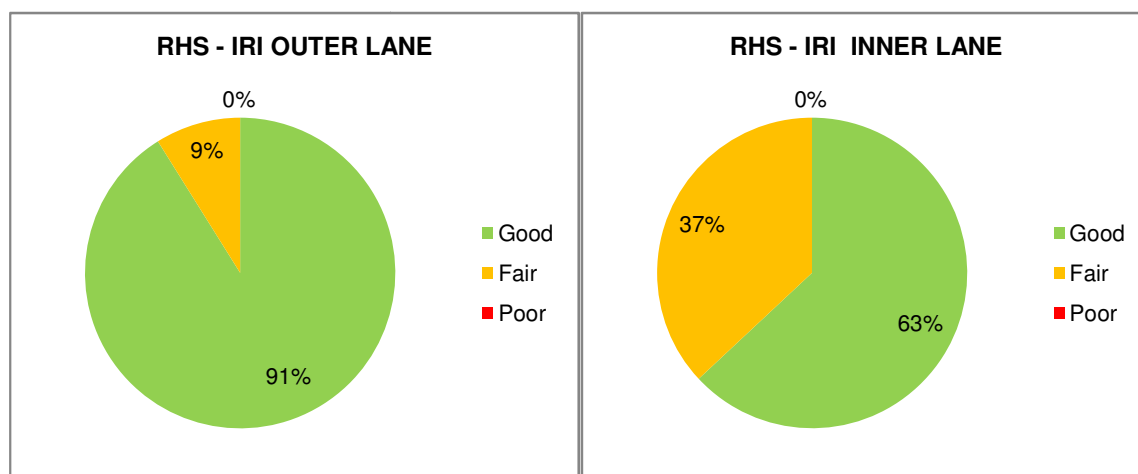


Figure 54.RHS International Roughness Index. Figures

It is observed from Figure 54 shown below that 91%-63% of Project Stretch RHS on outer/inner has IRI value in Good range, whereas Fair was in range between 9% in outer lane and 37% in inner lane, and there is no length in Poor condition in both lanes.

KP	LHS OuterLane	LHS InnerLane	RHS OuterLane	RHS InnerLane
601+990	2.1	2.1	2.3	2.9
602+990	2.1	2.3	2.4	2.6
603+990	2.3	2.4	2.2	2.7
604+990	2.3	2.3	2.2	2.7
605+990	2.3	2.5	2.2	2.7
606+990	2.3	2.5	2.2	2.1
607+990	2.6	2.7	2.1	2.2
608+990	2.3	2.8	2.5	2.4
609+990	2.7	3.0	2.5	2.6
610+990	2.8	3.2	2.7	3.0
611+990	2.2	2.6	2.2	2.8
612+990	2.4	2.6	2.2	2.3
613+990	2.3	2.6	2.5	3.0
614+990	2.3	2.6	2.4	2.5
615+990	2.1	2.7	2.3	2.5
616+990	2.1	2.4	2.2	2.3
617+990	2.2	2.6	2.1	2.5
618+990	2.7	2.8	2.4	2.2
619+990	2.5	2.9	2.1	2.7
620+990	2.4	2.5	2.1	2.4
621+990	2.4	2.5	2.1	2.4

KP	LHS OuterLane	LHS InnerLane	RHS OuterLane	RHS InnerLane
622+990	2.2	2.6	2.5	2.8
623+990	2.1	2.6	2.2	3.0
624+990	2.2	2.4	2.3	2.5
625+990	2.3	2.5	2.5	2.5
626+990	2.4	3.0	2.4	2.3
627+990	2.2	2.4	2.2	2.7
628+990	2.3	2.7	2.3	2.5
629+990	2.8	2.9	2.6	2.7
630+990	2.1	2.2	2.3	3.0
631+990	2.8	2.9	2.4	2.7
632+990	2.9	3.3	2.8	3.1
633+990	3.1	3.1	2.8	3.2
634+990	2.3	2.8	2.5	2.7
635+990	2.4	2.4	2.7	3.5
636+990	2.5	3.0	2.5	2.7
637+990	2.2	3.0	2.0	3.0
638+990	2.7	4.2	2.5	2.9
639+990	2.6	3.4	2.7	3.4
640+990	2.6	3.0	2.7	3.1
641+990	2.9	3.1	3.1	3.0
642+990	2.4	3.2	2.4	3.1
643+990	2.4	3.2	2.2	2.6
644+990	3.1	4.0	3.1	2.8
645+550	2.2	3.1	2.4	3.5
646+000				3.3

Table 74. IRI Results (m/km)

4.5.3. RUTTING

Rutting is one of the important factors which determine the functional performance of pavement. Rutting is characterized by permanent deformation of the pavement in wheel path due to heavy load vehicles. It is one of the main modes of failure in asphalt mixes.

Condition	Rut Depth Range (mm)
Good	< 5
Fair	5 - 10
Poor	> 10

Table 75. Rut Condition scale

The maps of Rut Depth along the whole stretch are shown in the following figures:

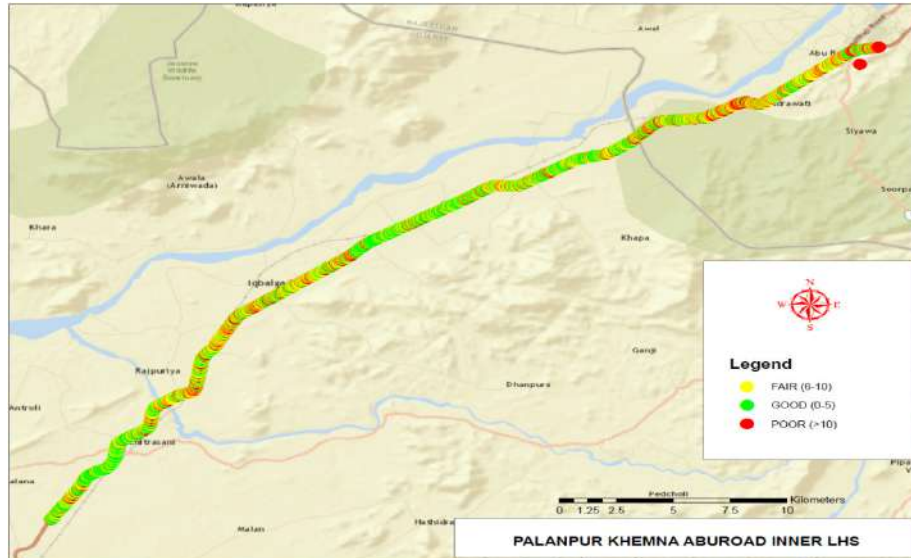


Figure 55. Rutting along the stretch (LHS, inner lane)

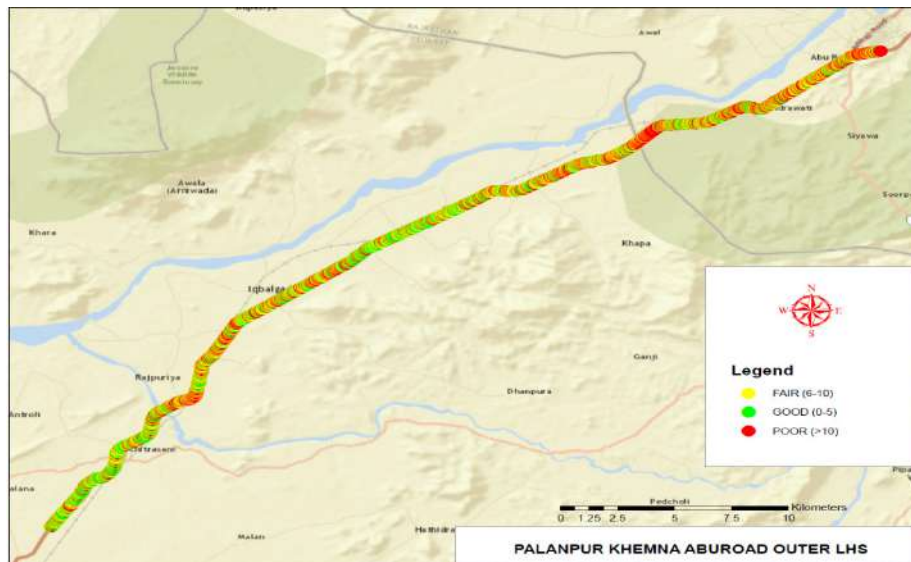


Figure 56. Rutting along the stretch (LHS, outer lane)

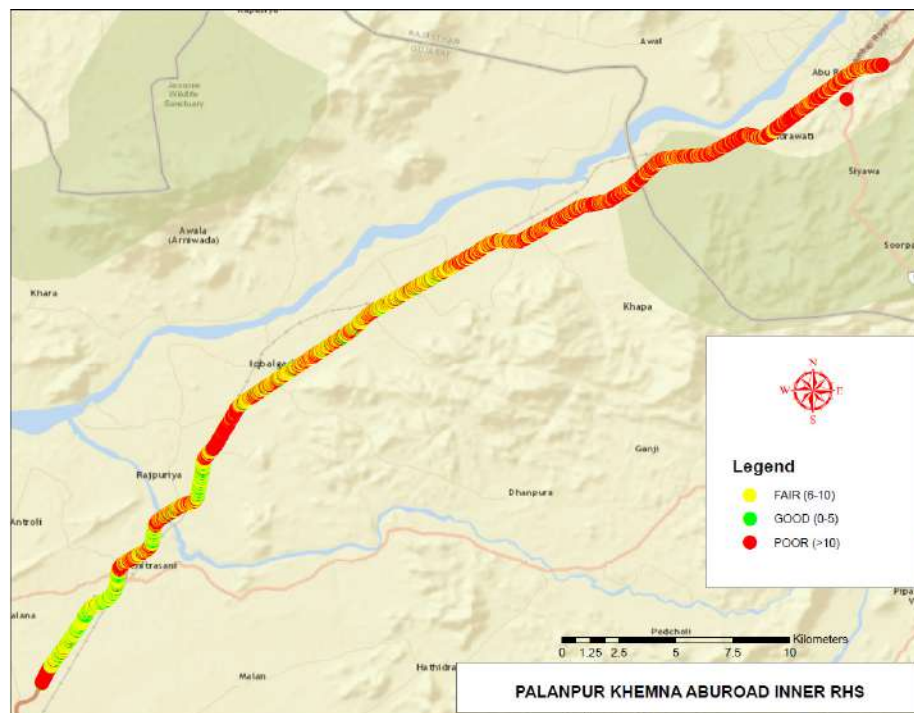


Figure 57. Rutting along the stretch (RHS, inner lane)

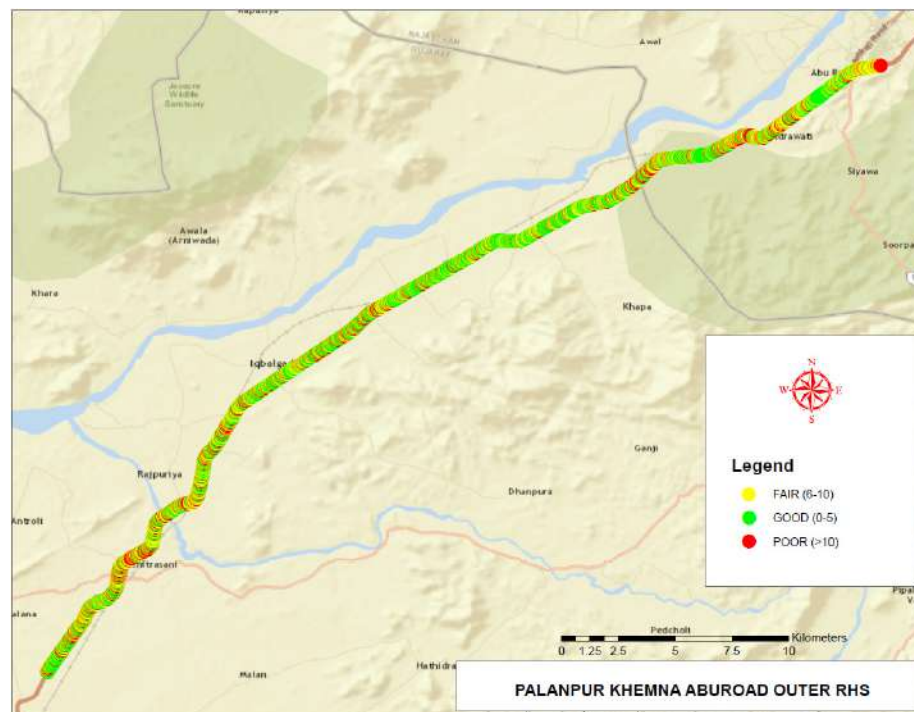


Figure 58. Rutting along the stretch (RHS, outer lane)

4.5.3.1. OUTER/INNER LANE RUT DEPTH

The rut depths observed for all 4 lanes (2-LHS and 2- RHS) are presented in the figures shown below.

It is observed that Rut Depth value is higher in outer lane as compared to inner lane in LHS and, on the contrary, in RHS inner lane has higher values.

Condition	Rut Depth Range (mm)	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	< 5	0	0	11	24
Fair	5 - 10	21	47	30	67
Poor	> 10	24	53	4	9

Table 76.LHS carriageway outer lane and inner lane Rut Depth results

Condition	Rut Depth Range (mm)	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	< 5	8	18	0	0
Fair	5 - 10	36	80	13	28
Poor	> 10	1	2	32	72

Table 77.RHS carriageway outer lane and inner lane Rut Depth results

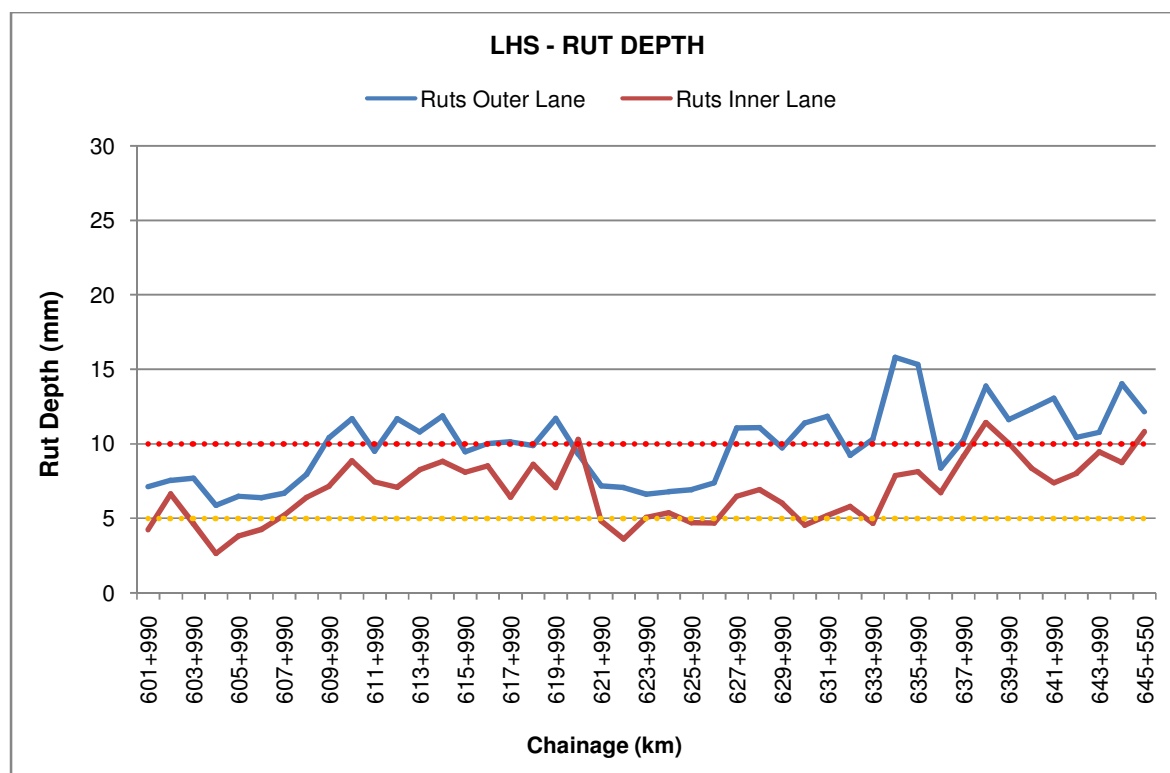


Figure 59. Rut Depth observed for Inner and Outer Lane of LHS carriageway

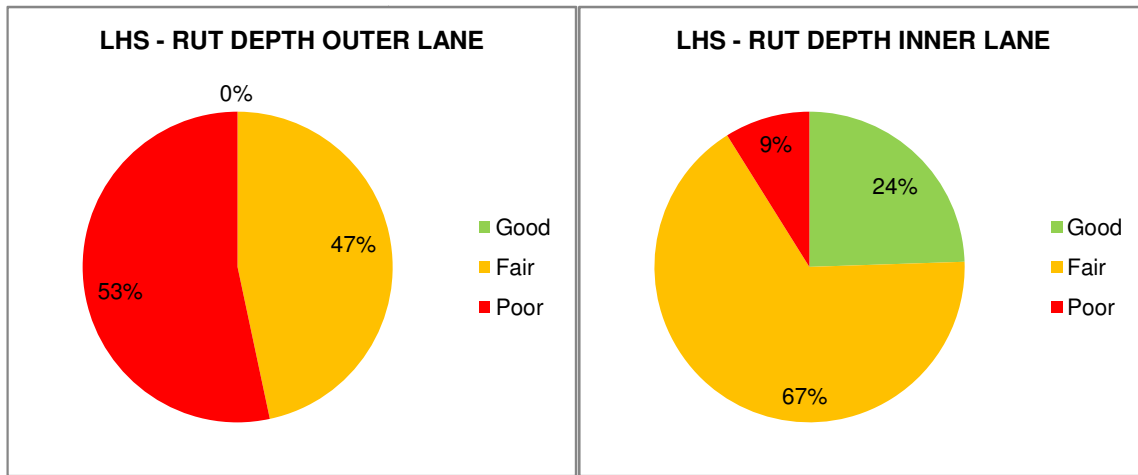


Figure 60. LHS Rut Depth Outer/Inner Lane

It is observed from the Figure 60 that 0%-24% of Project Stretch on outer/inner has Rutting value in Good range, whereas Fair was in 47% in Outer lane and 67% in Inner lane and, Poor condition, is in range of 53% in outer lane and 9% in inner lane.

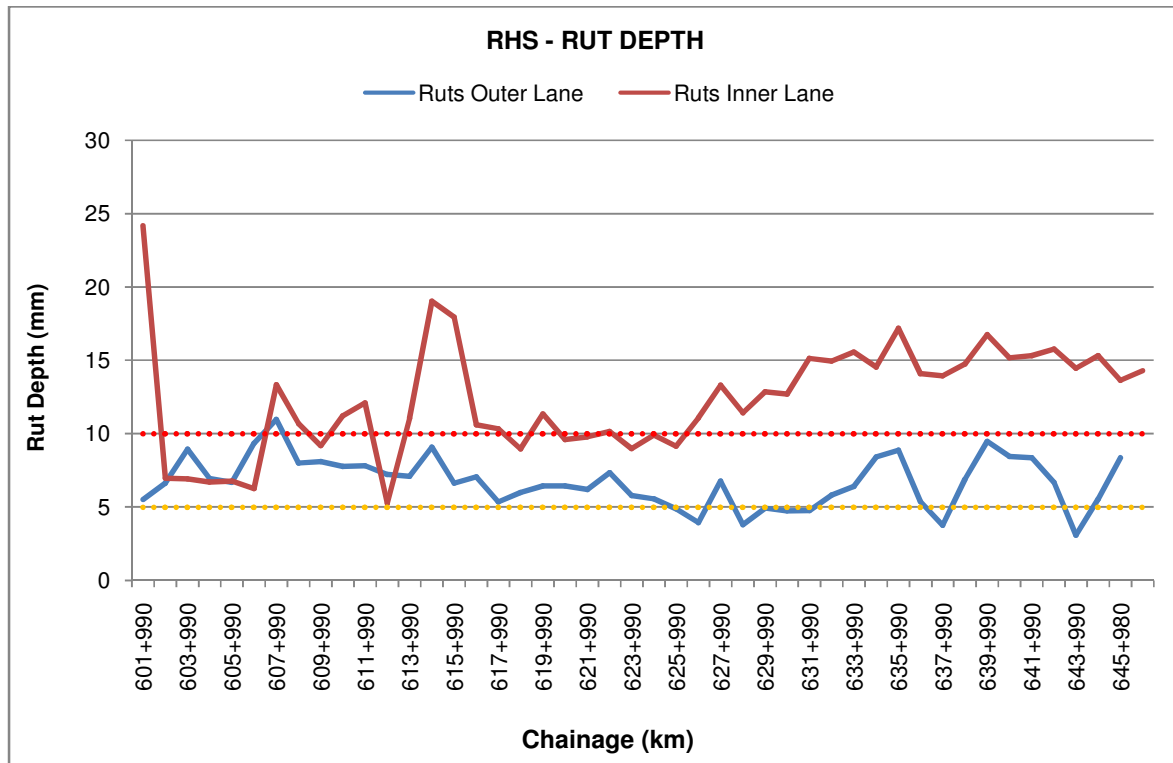


Figure 61. Rut Depth observed for Inner and Outer Lane of RHS carriageway

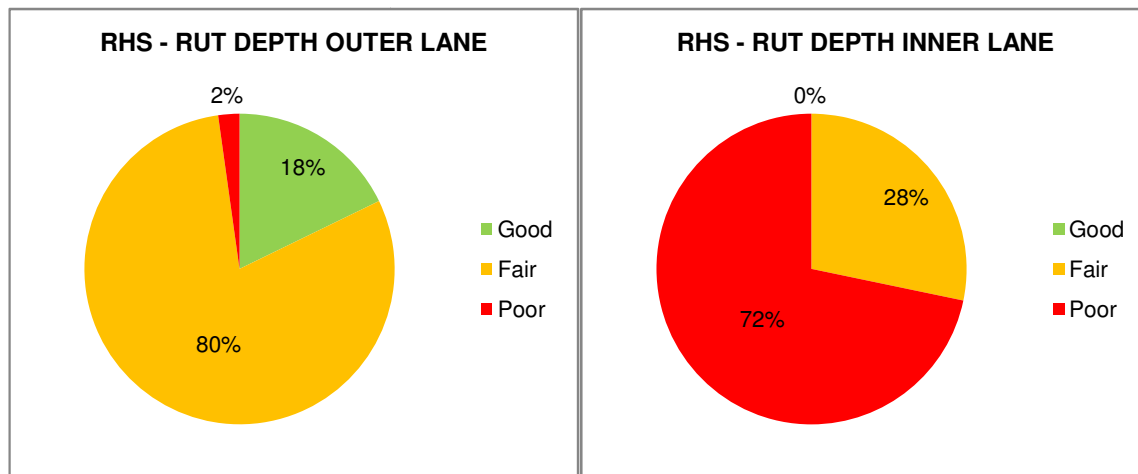


Figure 62. RHS Rut Depth Outer/Inner Lane

It is observed from the Figure 62 that 18%-0% of Project Stretch on outer/inner has Rutting value in Good range, whereas Fair was in 80% in Outer lane and 28% in Inner lane and, Poor condition, is in range of 2% in outer lane and 72% in inner lane.

4.5.3.2. LHS/RHS RUT DEPTH

Length wise summary of Rut depth condition details for both the directions is given in Table 78:

Condition	Rut Depth (mm)	LHS (km)	LHS (%)	RHS (km)	RHS (%)
Good	RD < 5	11	12	8	9
Fair	5 < RD < 10	51	57	49	54
Poor	RD < 10	28	31	33	37

Table 78. Direction wise Rut depth distribution

KP	LHS Outer Lane	LHS Inner Lane	RHS Outer Lane	RHS Inner Lane
601+990	7	4	6	24
602+990	8	7	7	7
603+990	8	5	9	7
604+990	6	3	7	7
605+990	6	4	7	7
606+990	6	4	9	6
607+990	7	5	11	13
608+990	8	6	8	11
609+990	10	7	8	9
610+990	12	9	8	11
611+990	10	7	8	12
612+990	12	7	7	5

KP	LHS Outer Lane	LHS Inner Lane	RHS Outer Lane	RHS Inner Lane
613+990	11	8	7	11
614+990	12	9	9	19
615+990	9	8	7	18
616+990	10	9	7	11
617+990	10	6	5	10
618+990	10	9	6	9
619+990	12	7	6	11
620+990	9	10	6	10
621+990	7	5	6	10
622+990	7	4	7	10
623+990	7	5	6	9
624+990	7	5	6	10
625+990	7	5	5	9
626+990	7	5	4	11
627+990	11	6	7	13
628+990	11	7	4	11
629+990	10	6	5	13
630+990	11	5	5	13
631+990	12	5	5	15
632+990	9	6	6	15
633+990	10	5	6	16
634+990	16	8	8	15
635+990	15	8	9	17
636+990	8	7	5	14
637+990	10	9	4	14
638+990	14	11	7	15
639+990	12	10	9	17
640+990	12	8	8	15
641+990	13	7	8	15
642+990	10	8	7	16
643+990	11	9	3	14
644+990	14	9	6	15
645+550	12	11	8	14
646+000				14

Table 79. Rut depth results (mm)

Graphs and tables are represented in average kilometric values. Detail of average hectometre values are shown in Annexure IRI and Rut Depth results.

4.6. FWD RESULTS

Structural Condition of pavement has been evaluated using Falling Weight Deflectometer (FWD) and subsequent analysis was carried out to ascertain the relative performance of the pavement for entire Project Stretch, in the context of evaluating its residual life, overlay and other maintenance requirements.

Normalization of data obtained from the average of three readings at each location is done taking into account the temperature and seasonal correction factors. The results are provided at below table.

Side	Initial Kilometric Point (km)	Final Kilometric Point (km)	Average Deflection (mm/100)	Bituminous Layer (mm)
LHS	601+000	605+000	13	19
LHS	605+000	610+000	14	23
LHS	610+000	615+000	22	35
LHS	615+000	620+000	18	28
LHS	620+000	625+000	20	34
LHS	625+000	630+000	19	28
LHS	630+000	635+000	19	34
LHS	635+000	640+000	17	29
LHS	640+000	646+000	20	30
RHS	646+000	640+000	20	30
RHS	640+000	635+000	16	27
RHS	635+000	630+000	14	23
RHS	630+000	625+000	15	24
RHS	625+000	620+000	18	31
RHS	620+000	615+000	14	23
RHS	615+000	610+000	14	24
RHS	610+000	605+000	10	16
RHS	605+000	601+000	14	21

Table 80. FWD results

The graphical representations of these values are presented in the following figures.

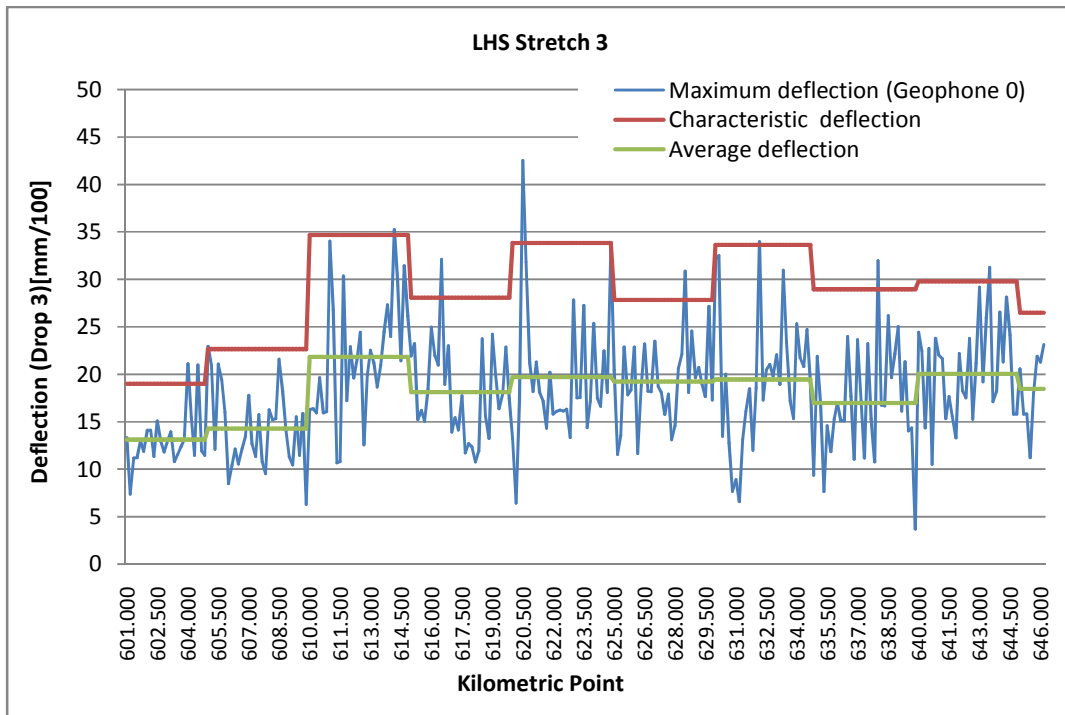


Figure 63.FWD results. LHS

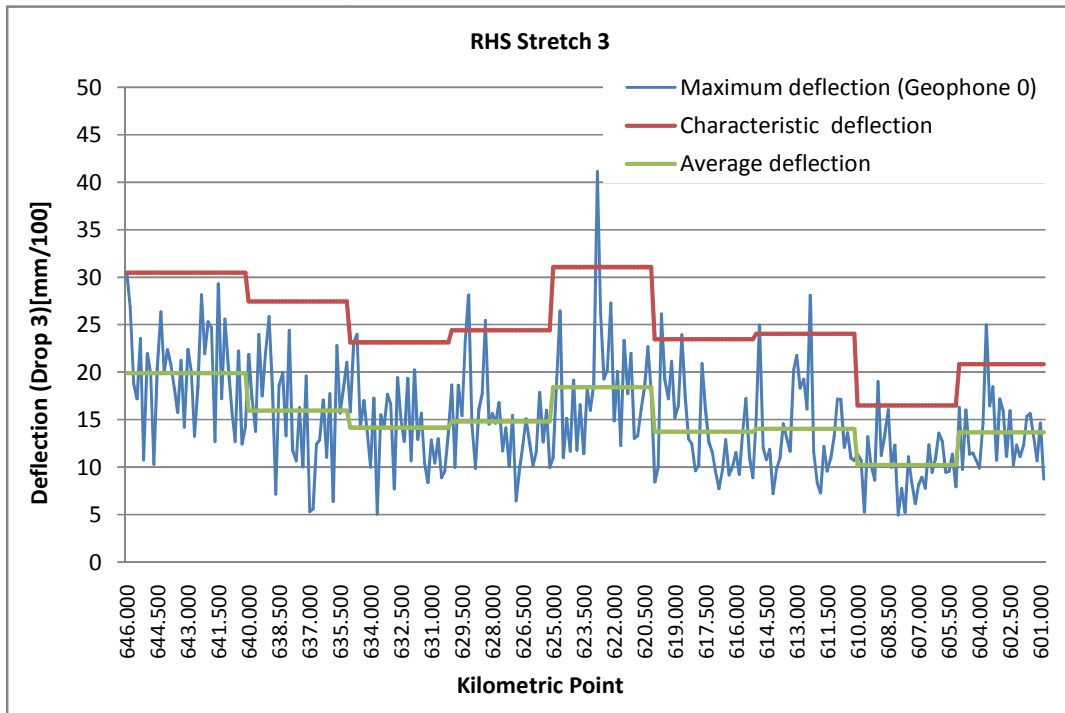


Figure 64. FWD results. RHS

4.7. PAVEMENT STRUCTURAL EVALUATION AND OVERLAYS REQUIREMENT

The evaluation of the structural condition of an in-service pavement is made by following the guidelines detailed by IRC: 115-2014 and using deflection (FWD) data as well as other pavement data as inputs to a back calculation model for determining the elastic moduli of pavement layers, and, thereafter, using these moduli as inputs to a pavement design model for estimating the overlay requirement.

4.7.1. BACKCALCULATION OF LAYERS ELASTIC MODULI

Measured surface deflections are normalized to a standard load of 40 kN. Based on these normalized surface deflections, and the thicknesses and physical characteristics of the different pavement layers of this highway stretch, we did the back calculation of the elastic moduli for existing pavement layers and then applied the subsequent corrections based on temperature and seasonal variations.

Correction factors have been applied after back calculated by KGPBACK with deflection point's carriageway wise.

- Correction for Temperature
- Correction for Seasonal Variation

Based on these correction factors corrected values of Bituminous/Granular/Subgrade values were used for final calculation of elastic moduli.

4.7.1.1. DATA ANALYSIS

Moduli of each layer have been calculated using KGPBACK for each test point. The calculated modulus values for each layer are presented in the form of graph, for LHS and RHS of the Project Stretch. The Elastic Modulus of Bituminous Layers is shown in the following figures:

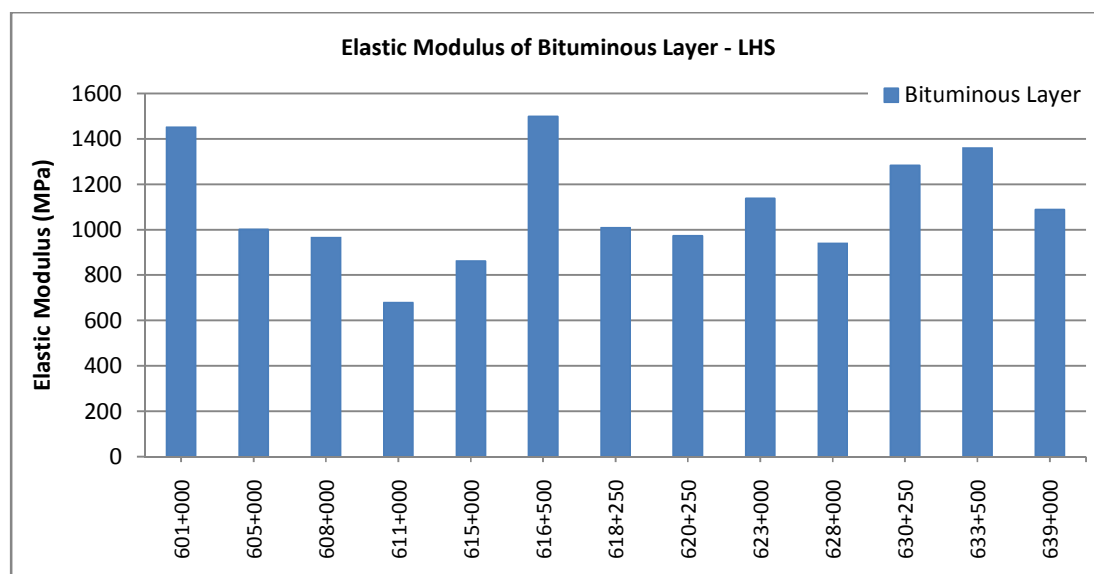


Figure 65. Elastic Moduli for Bituminous layer on LHS Carriageway

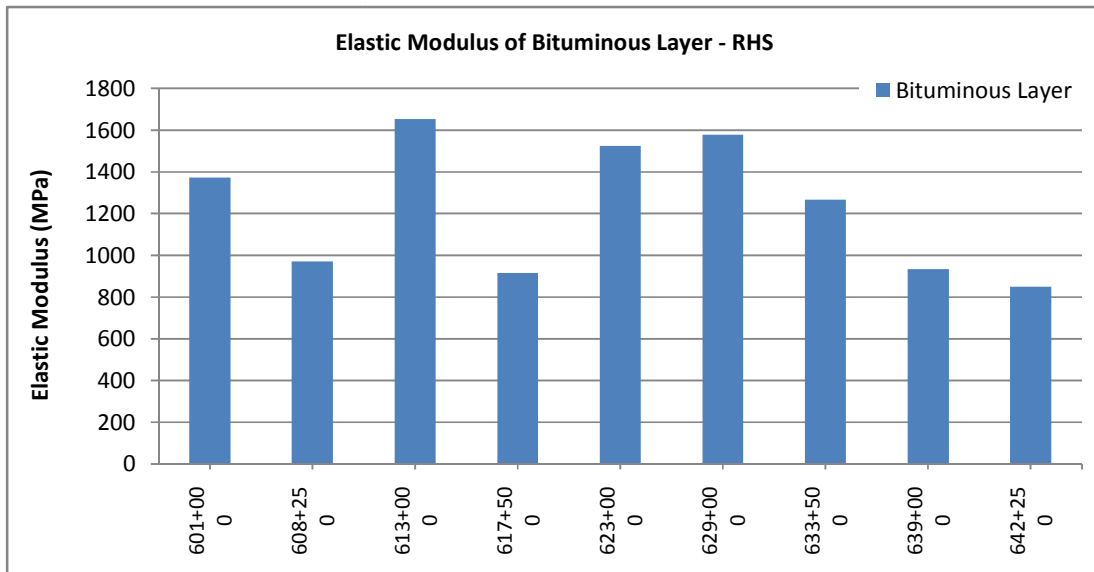


Figure 66. Elastic Moduli for Bituminous layer on RHS Carriageway

It is observed from the above graph the elastic moduli of the bituminous layer for LHS and RHS were found to be varying between 679 MPa to 1653 MPa. The elastic modulus values are slightly lower at some location at the start of the stretch. The similar trend was observed at the time of core cutting because of de-bonding of bituminous layers at multiple locations, from chainage 630+000 of the Project Stretch is having more than around 1000 (MPa) elastic modulus value were observed. The same trend is observed in other performance parameters wherein a comparison was made for the LHS and RHS elastic modulus values of the bituminous layer of the carriageway and is shown in the next figure.

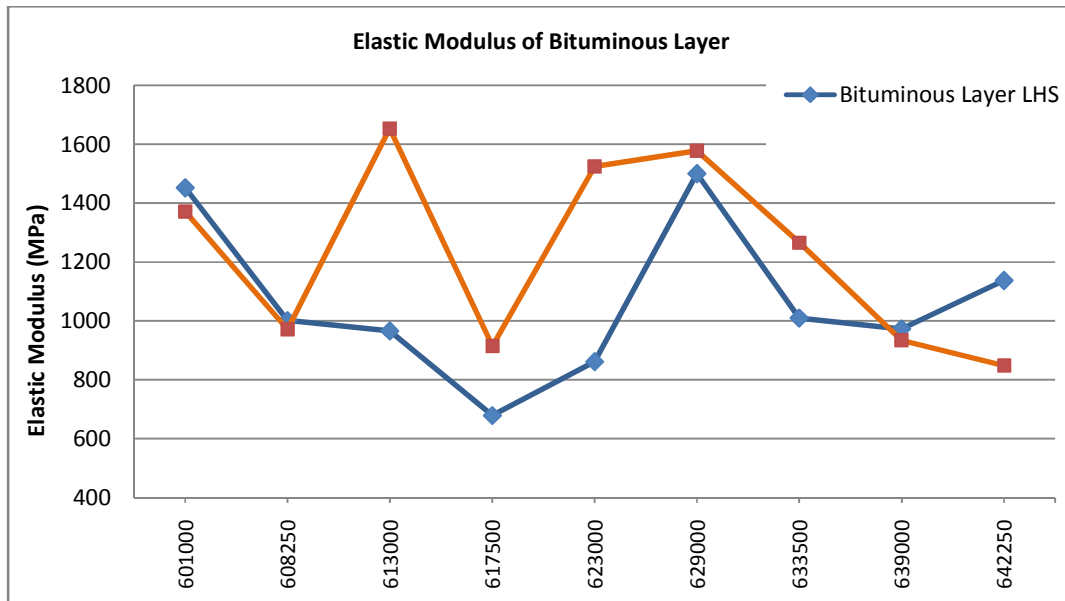


Figure 67. Elastic Modulus values of Bituminous layer for LHS and RHS carriageway

The Elastic Modulus of Granular Layers for LHS and RHS is shown in the following figures:

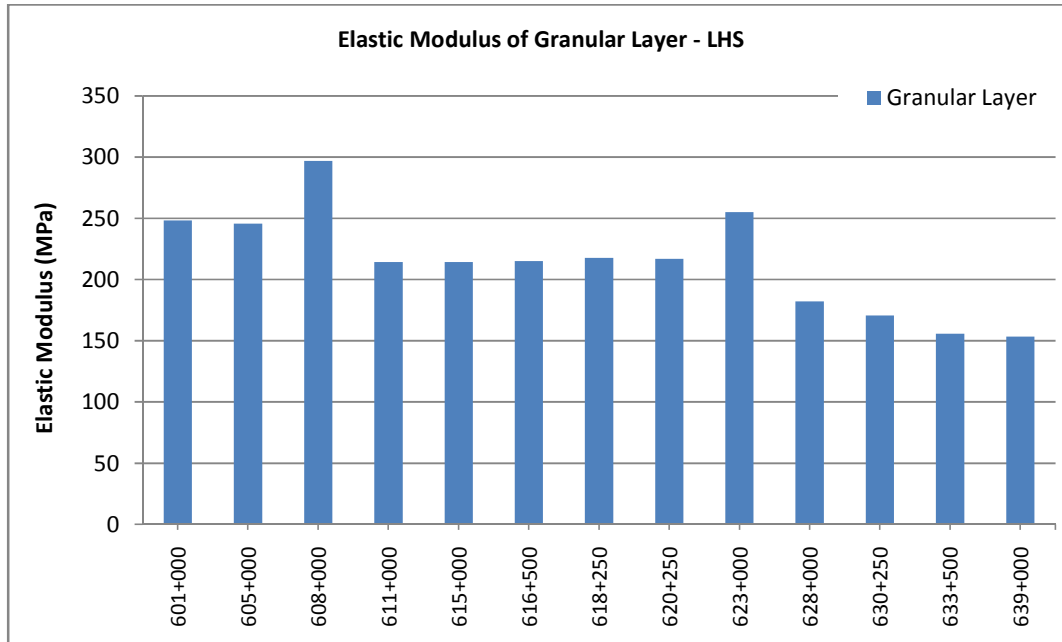


Figure 68. Elastic Moduli for Granular layer on LHS Carriageway

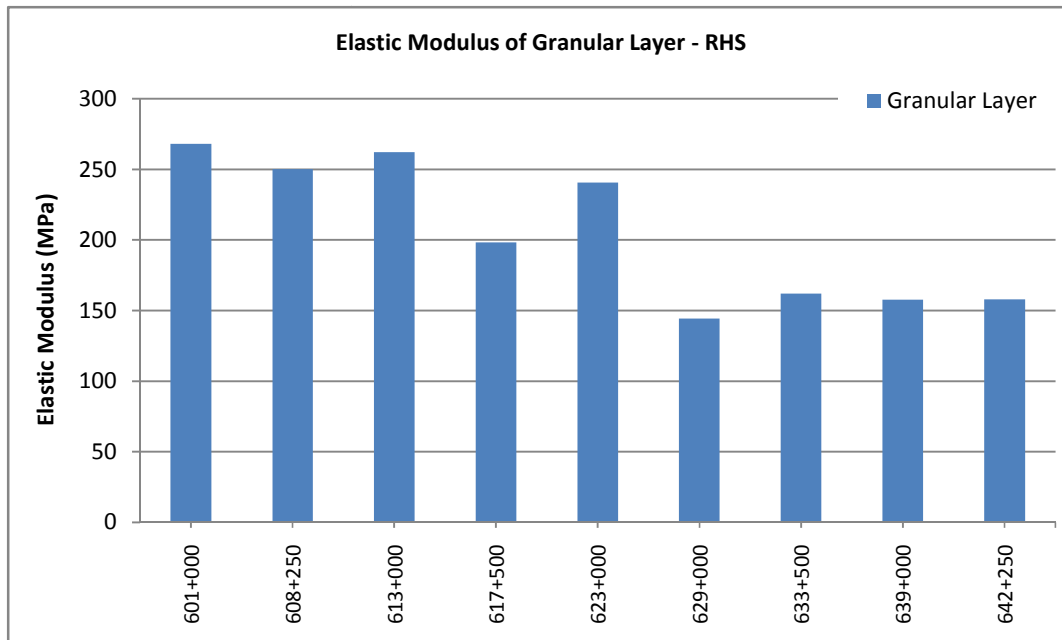


Figure 69. Elastic Moduli for Granular layer on RHS Carriageway

The elastic moduli of granular layer were found to be varying from 153 MPa to 297 MPa as shown in the figures above. The trend of the elastic modulus values seems to be similar to that of the trend shown by the elastic modulus values of the bituminous layer.

A comparison has been made for the LHS and RHS elastic modulus values of the granular layer of the carriageway and is shown in the next figure:

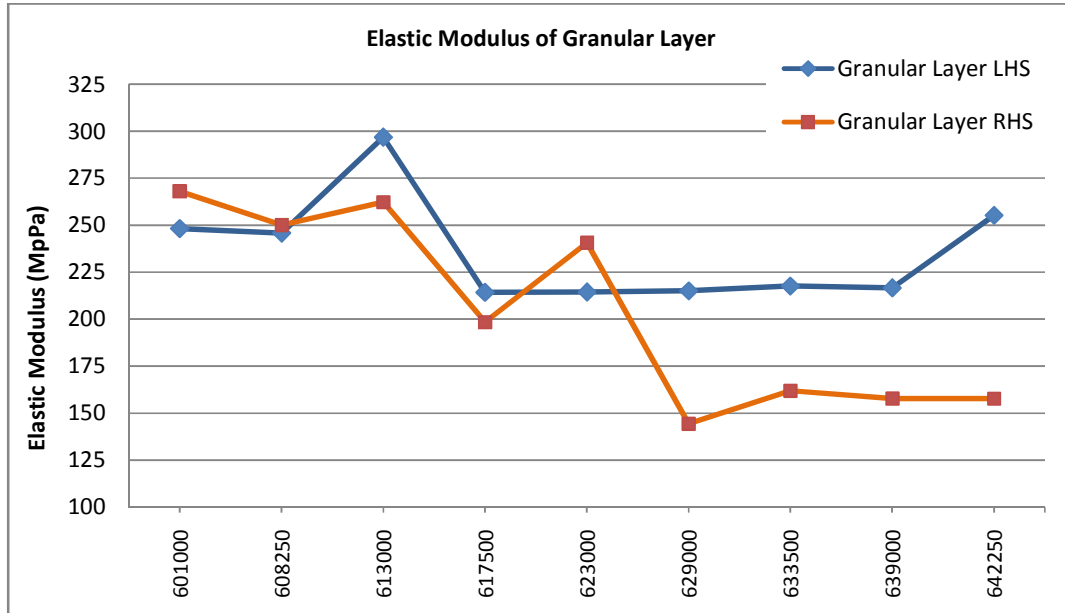


Figure 70. Elastic Modulus values of Granular layer for LHS and RHS carriageway

The Elastic Modulus of Subgrade Layers for LHS and RHS is shown in the following figures:

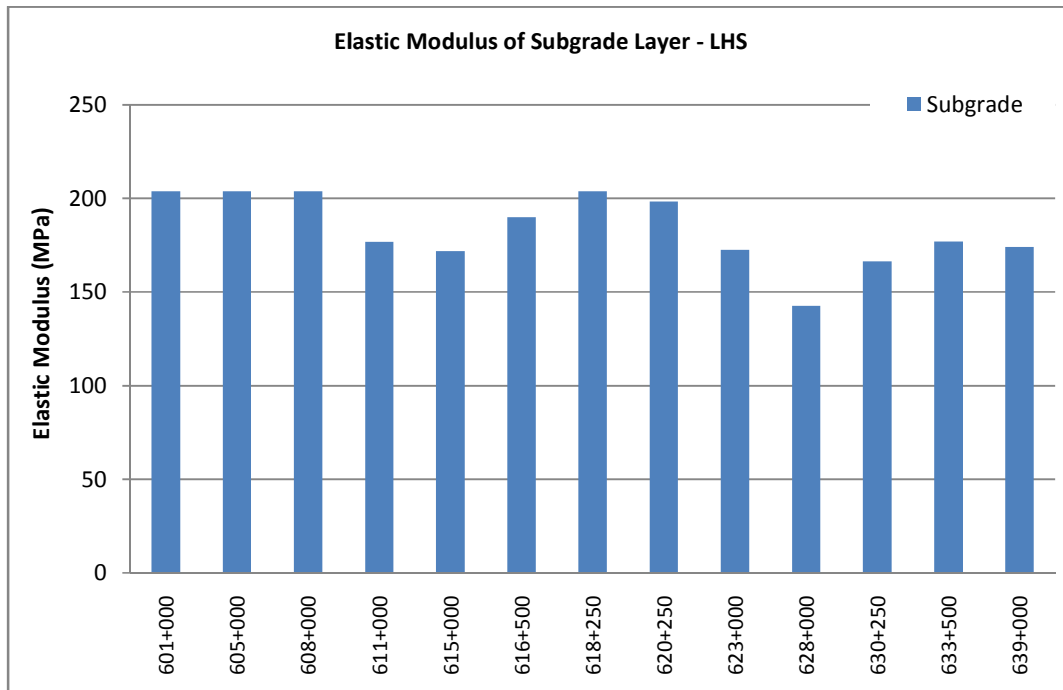


Figure 71. Elastic Moduli for Subgrade layer on LHS Carriageway

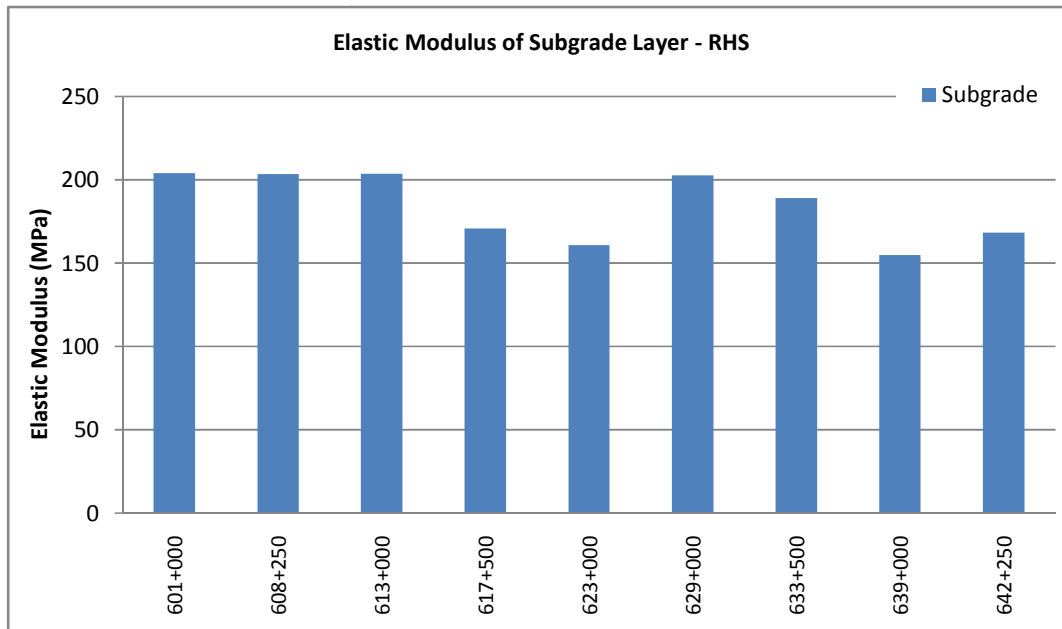


Figure 72. Elastic Moduli for Subgrade layer on RHS Carriageway

The elastic moduli of subgrade layer were found to be varying from 143MPa to 204MPa as shown in the figures above. The elastic modulus of the subgrade layer is greatly dependent on the CBR of subgrade soil. The pattern of the moduli seems to be similar with the CBR.

A comparison has been made for the LHS and RHS elastic modulus values of the subgrade of the carriageway and is shown in the figure below.

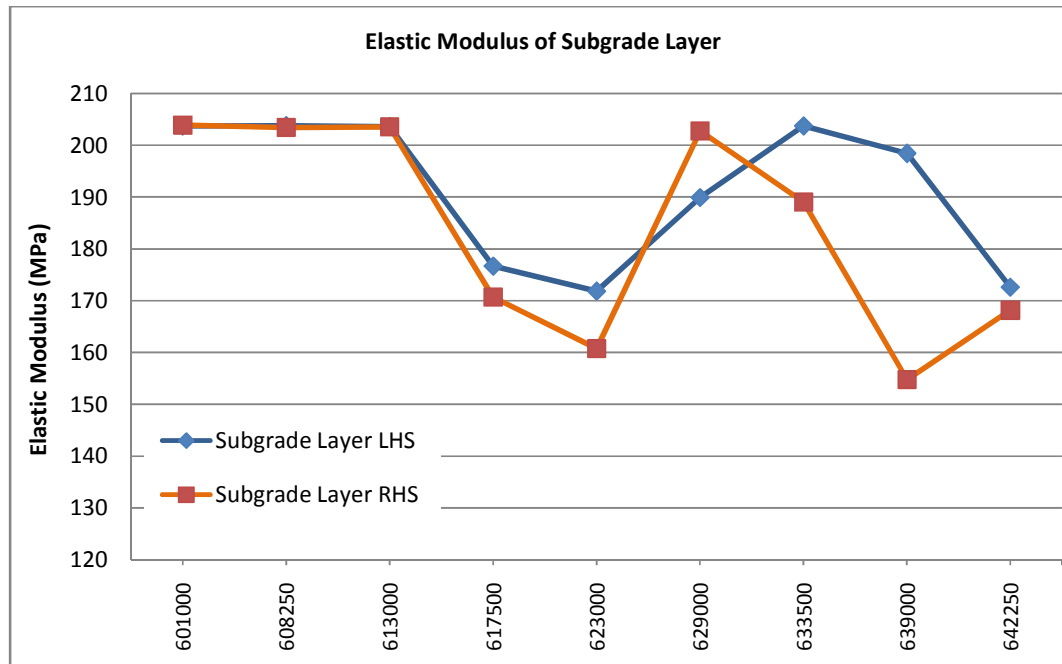


Figure 73. Elastic Modulus values of sub-grade layer for LHS and RHS carriageway

The subgrade modulus of LHS and RHS of the carriageway is similar from the above graph.

The elastic moduli for each layer have been categorized as Poor, Fair and Good based on the range obtained from FWD analysis for each layer. Moduli condition ranges of different layers for both directions have been summarized in the next table:

Layer	Condition	Modulus Range	Length in km	
			LHS	RHS
Bituminous	Good	More than 3000	-	-
	Fair	3000 - 750	41.00	45.00
	Poor	Less than 750	4.00	-
Granular	Good	More than 500	-	-
	Fair	500 - 100	45.00	45.00
	Poor	Less than 100	-	-
Sub-grade	Good	More than 298	-	-
	Fair	75 - 298	45.00	45.00
	Poor	Less than 75	-	-

Table 81. Moduli condition ranges

As per above table the range of Elastic Modulus values of Bituminous/Granular and Subgrade layer (Good/Fair/Poor) for LHS and RHS carriageway are presented below in pie charts.

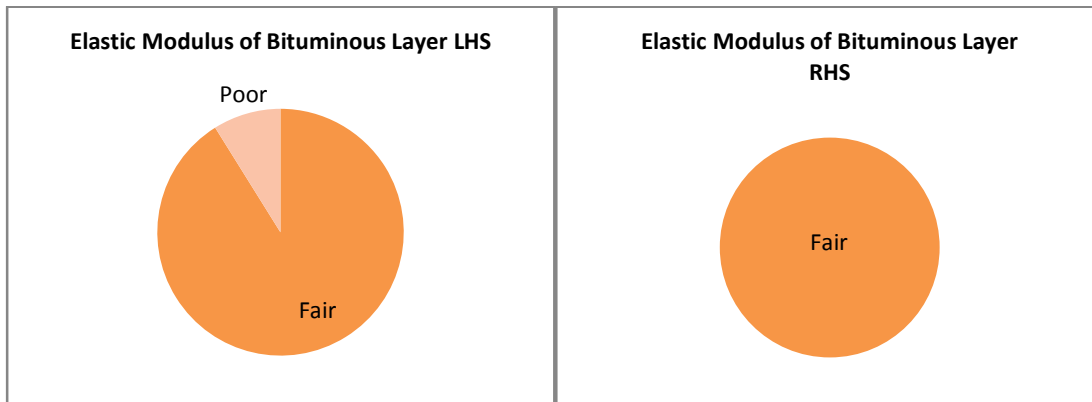


Figure 74. Variation of Elastic moduli of bituminous layer for LHS and RHS carriageway

As shown in Figure 74, the bituminous layer moduli are in fair conditions on both sides in around 100%.

According to values collected in Table 81, the granular layer modulus for the whole stretch has found to be in fair condition. The pie chart figure is shown below.

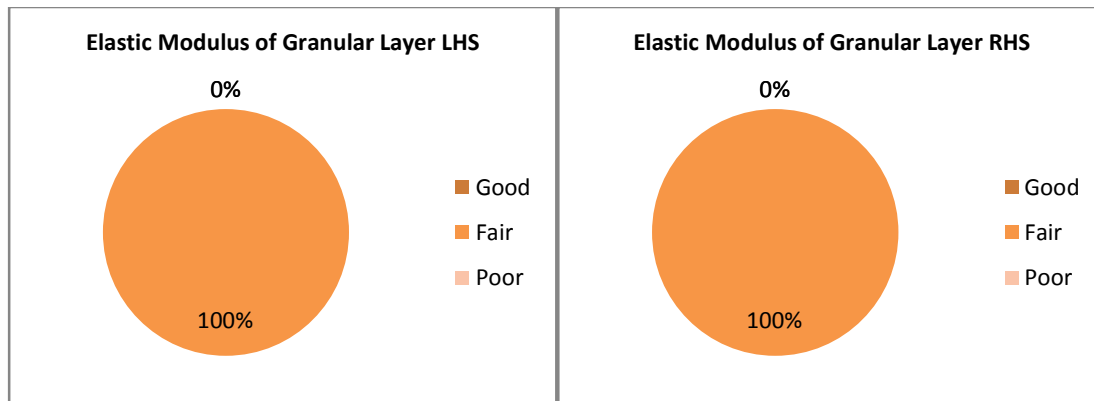


Figure 75. Variation of Elastic moduli of bituminous layer for LHS and RHS carriageway

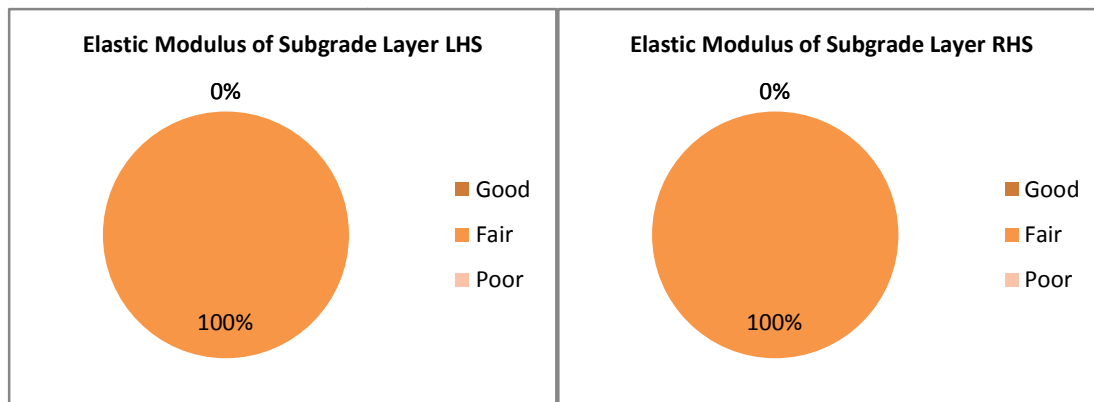


Figure 76. Variation of Elastic moduli range of sub-grade for LHS and RHS carriageway

It can be observed from the above charts, the sub-grade moduli for the whole stretch are in fair condition of Project Stretch.

4.7.2. SEGMENTATION (HOMOGENEOUS SECTIONS)

The Identification of homogeneous sections is done on the basis of the peak deflections/peak deflection bowl parameters, sub-grade strength, design traffic, layer thicknesses and extent and severity of distress.

Here in this section Surface Curvature Index (SCI) are used for identification of homogeneous sections. The statistical technique used for identification is the "Cumulative Difference" approach. The series of cumulative differences (zj) for the measured sequence of a given variable 'x' (SCI) is used to determine homogeneous sections.

Homogeneous section based on (SCI) index for LHS carriageway is as follows:

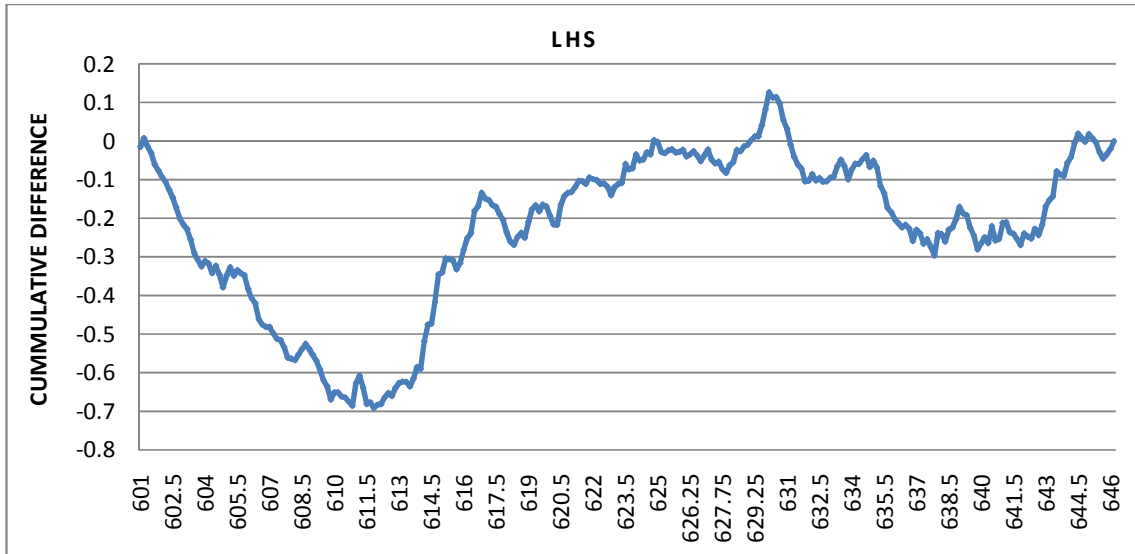


Figure 77. Variation of deflection point range of FWD for LHS carriageway for homogeneous section

Homogeneous section based on (SCI) index for RHS carriageway is as follows:

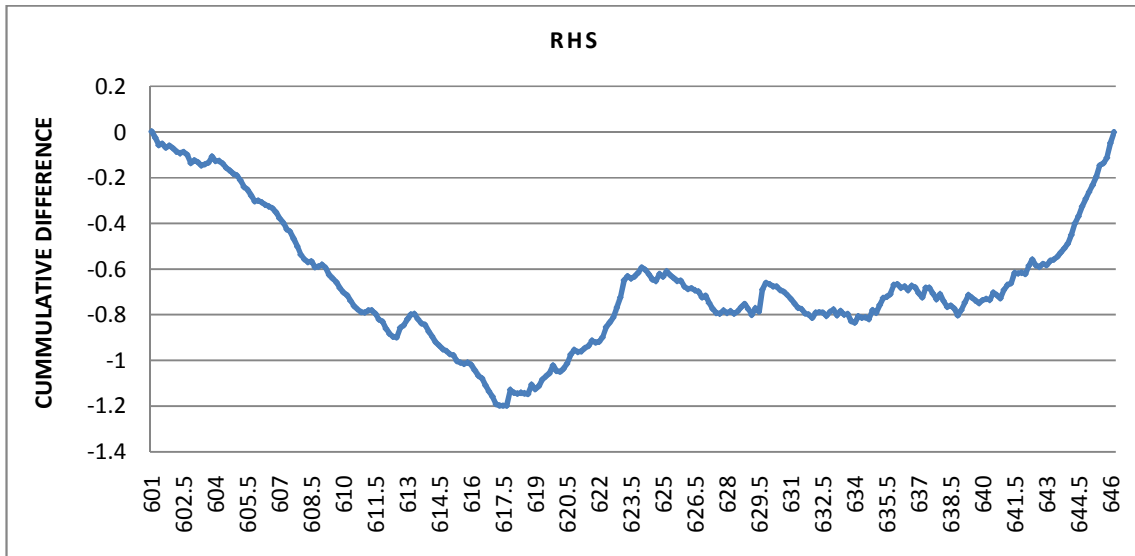


Figure 78. Variation of deflection point range of FWD for RHS carriageway for homogeneous section

Based on above graphs of homogeneous section of LHS and RHS carriageway it is clear that the sections are not the same for both carriageways, based on these homogeneous sections the overlay calculation was done.

4.7.3. REMAINING LIFE ANALYSIS

The structural condition of the pavement has been assessed by its Remaining Life which in this case is estimated from the critical strains computed for the present condition of the pavement.

Any method used to estimate the remaining life of a pavement will have its limitations and the results cannot automatically be accepted. It is, hence, very important that the estimations be compared with other indicators of the structural condition such as surface distress data, test pit inspection, coring data, etc., to check whether all these data give similar indications.

The layer moduli of in-service pavement backcalculated from FWD deflection data are used to analyze the pavement for critical strains which are indicators of pavement performance in terms of rutting and fatigue cracking failure. This criterion follows IRC: 115-2014 and IRC: 37-2012 and facilitates the estimation of the remaining life of the pavement and the subsequent design of overlays.

▪ **FATIGUE IN BITUMINOUS LAYER:**

Following IRC: 115-2014, it is used the fatigue model for 90% reliability as below:

$$Nf = 0.711 \times 10^{-4} \times \left(\frac{1}{\epsilon t}\right)^{3.89} \times \left(\frac{1}{Mr}\right)^{0.854}, \text{ For 90\% Reliability}$$

Where:

Nf = fatigue life in number of standard axles.

ϵt = Maximum Tensile strain at the bottom of the bituminous layer.

Mr = Resilient Modulus of the bituminous layer.

▪ **RUTTING IN PAVEMENT:**

Following IRC: 115-2014, it is used the rutting model for 90% reliability as below:

$$N = 1.41 \times 10^{-8} x \left[\frac{1}{\epsilon v}\right]^{4.5337}$$

Where:

N = Number of cumulative standard axles.

ϵv = Vertical strain in the subgrade.

Using the moduli values previously calculated, the remaining life of the pavement is estimated by using IIT PAVE.

Remaining Life in (Fatigue and Rutting) of Pavement section wise LHS Carriageway are presented below in Table 82.

Section	Length km	Chainage		Pavement		15th Percentile			Before overlay	
		From	To	BT	GR	BT Layer	GR Layer	SB Layer	Fatigue Life	Rutting Life
Sec - 01	4.0	601+000	605+000	240	490	1452	248	204	131.23	15086.88
Sec - 02	3.0	605+000	608+000	240	490	1001	246	204	81.97	10491.92
Sec - 03	3.0	608+000	611+000	210	500	965	297	204	66.34	8164.93
Sec - 04	4.0	611+000	615+000	210	500	679	214	177	23.98	3261.63
Sec - 05	1.5	615+000	616+500	230	500	862	214	172	44.01	4754.96
Sec - 06	1.8	616+500	618+250	230	500	1500	215	190	89.23	11094.83

Section	Length km	Chainage		Pavement		15th Percentile			Before overlay	
		From	To	BT	GR	BT Layer	GR Layer	SB Layer	Fatigue Life	Rutting Life
Sec - 07	2.0	618+250	620+250	230	500	1009	218	204	54.73	9548.61
Sec - 08	2.8	620+250	623+000	235	510	973	217	198	57.15	9889.71
Sec - 09	5.0	623+000	628+000	220	380	1137	255	173	67.46	1734.73
Sec - 10	2.3	628+000	630+250	200	380	940	182	143	19.49	274.52
Sec - 11	3.3	630+250	633+500	200	460	1283	171	166	26.45	2369.54
Sec - 12	5.5	633+500	639+000	200	420	1360	156	177	25.16	2128.50
Sec - 13	7.0	639+000	646+000	230	450	1088	153	174	29.85	3590.40

Table 82. Remaining Life (Fatigue and Rutting) of Pavement (LHS)

Remaining Life in (Fatigue and Rutting) of Pavement section wise RHS Carriageway are presented below, in Table 83.

Section	Length km	Chainage		Pavement		15th Percentile			Before overlay	
		From	To	BT	GR	BT Layer	GR Layer	SB Layer	Fatigue Life	Rutting Life
Sec - 01	7.25	601+000	608+250	225	420	1371	268	204	102.82	5894.75
Sec - 02	4.75	608+250	613+000	245	485	972	250	203	89.97	10367.97
Sec - 03	4.50	613+000	617+500	210	500	1653	262	204	93.20	11740.57
Sec - 04	5.50	617+500	623+000	210	480	915	198	171	27.51	2881.34
Sec - 05	6.00	623+000	629+000	180	460	1525	241	161	38.33	2019.23
Sec - 06	4.50	629+000	633+500	180	390	1578	144	203	18.07	2041.65
Sec - 07	5.50	633+500	639+000	210	390	1266	162	189	30.04	2226.16
Sec - 08	3.25	639+000	642+250	210	400	934	158	155	18.71	891.25
Sec - 09	3.75	642+250	646+000	250	400	848	158	168	36.87	2081.63

Table 83. Remaining Life (Fatigue and Rutting) of Pavement (RHS)

Both tables presented above show back calculation of each layer system with corrected values and remaining life of pavement.

4.7.4. OVERLAY REQUIREMENTS

The flexible pavements are designed as a three layered system consisting of typical component layers, namely sub-grade, sub-base & base course (granular) and binder & surface course (bituminous).

The Proposed overlay requirements are obtained from the calculated Remaining Rutting life and Fatigue Life of the pavement, based on elastic modulus of bituminous layer as determine by back calculations. IITPAVE is used to calculate the strain values (vertical/horizontal) based on elastic modulus of all pavement layers, and assists to evaluate the remaining life of pavement in accordance to the thickness of overlay design in structural and functional requirement.

Falling weight Deflectometer (FWD) Overlay Design Summary for Stretch 3 (LHS)										
Ch.	Length km	Section Details		Design Traffic (MSA)	After overlay		Overlay Thickness (mm)	Overlay Thickness Adopted (mm)		Remarks
		From	To		Fatigue Life	Rutting Life		BC	DBM	
Sec - 01	4.0	601+000	605+000	100	238	25694	30	30	0	Functional Overlay
Sec - 02	3.0	605+000	608+000	100	146	18138	30	30	0	Structural Overlay
Sec - 03	3.0	608+000	611+000	100	116	13973	30	30	0	Structural Overlay
Sec - 04	4.0	611+000	615+000	100	106	10831	70	30	40	Structural Overlay
Sec - 05	1.5	615+000	616+500	100	119	11741	50	50	0	Structural Overlay
Sec - 06	1.8	616+500	618+250	100	166	19372	30	30	0	Structural Overlay
Sec - 07	2.0	618+250	620+250	100	122	20046	40	40	0	Structural Overlay
Sec - 08	2.8	620+250	623+000	100	127	20586	40	40	0	Structural Overlay
Sec - 09	5.0	623+000	628+000	100	148	3861	40	40	0	Structural Overlay
Sec - 10	2.3	628+000	630+250	100	114	2561	80	40	40	Structural Overlay
Sec - 11	3.3	630+250	633+500	100	124	9661	70	30	40	Structural Overlay
Sec - 12	5.5	633+500	639+000	100	121	9222	70	30	40	Structural Overlay
Sec - 13	7.0	639+000	646+000	100	150	14212	70	30	40	Structural Overlay

Table 84. Proposed Overlay thickness of LHS

The survey investigations were conducted in the year 2018. Accordingly as per analysis requirement of overlay was as per mentioned in the table above. As per current status an overlay of 40 mm BC have been executed by present concessionaire in the year 2019.

Further, based on the findings in year 2018 pavement structural strengthening was recommended in certain stretches. Since present concessionaire executed an overlay of 40 mm BC on entire

stretch in year 2019, based on the findings including current overlay satisfies the MSA requirement till year 2024 (end of current concession period).

Remaining life of pavement in fatigue before overlay and after overlay of pavement in LHS:

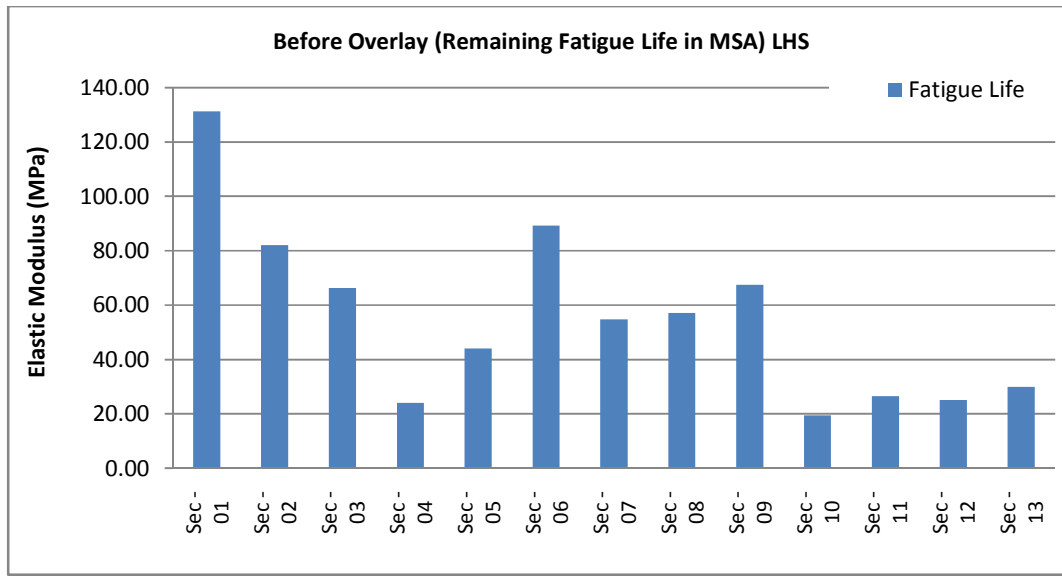


Figure 79.Remaining life before overlay (in MSA). LHS

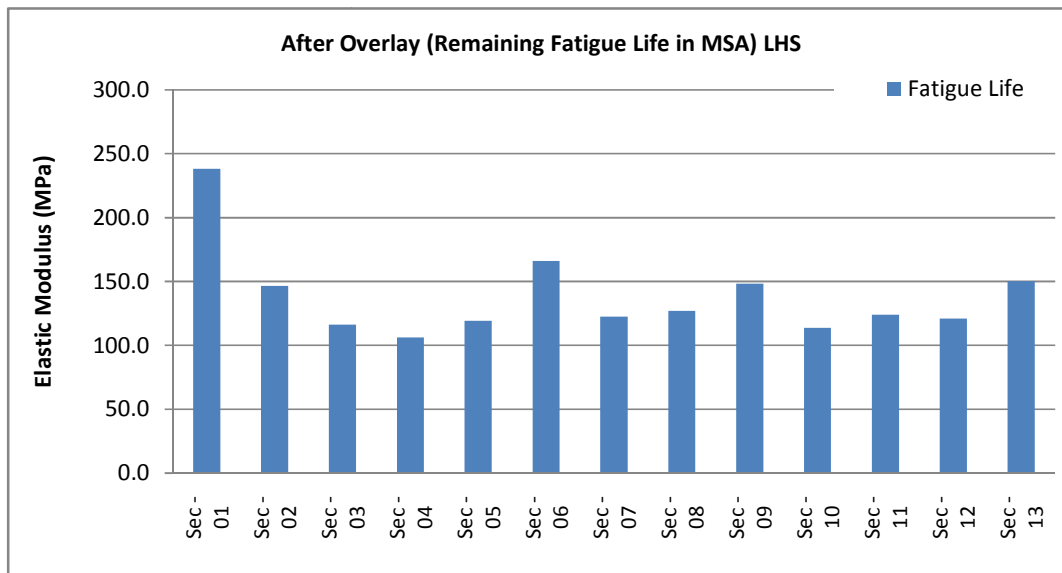


Figure 80.Remaining life after overlay (in MSA). LHS

Ch.	Length km	Section Details		Design Traffic (MSA)	After overlay		Overlay Thickness (mm)	Overlay Thickness Adopted (mm)		Remarks
		From	To		Fatigue Life	Rutting Life		BC	DBM	
Sec - 01	7.3	601+000	608+250	100	187	10409	30	30	0	Functional Overlay
Sec - 02	4.8	608+250	613+000	100	159	17896	30	30	0	Functional Overlay
Sec - 03	4.5	613+000	617+500	100	173	20128	30	30	0	Functional Overlay
Sec - 04	5.5	617+500	623+000	100	123	10576	70	30	40	Structural Overlay
Sec - 05	6.0	623+000	629+000	100	170	7664	70	30	40	Functional Overlay
Sec - 06	4.5	62+9000	633+500	100	117	11837	80	40	40	Functional Overlay
Sec - 07	5.5	633+500	639+000	100	140	9549	70	30	40	Functional Overlay
Sec - 08	3.3	639+000	642+250	100	112	4661	80	40	40	Structural Overlay
Sec - 09	3.8	642+250	646+000	100	103	5773	50	50	0	Structural Overlay

Table 85. Proposed Overlay thickness of RHS

Remaining life of pavement in fatigue before overlay and after overlay of pavement in RHS:

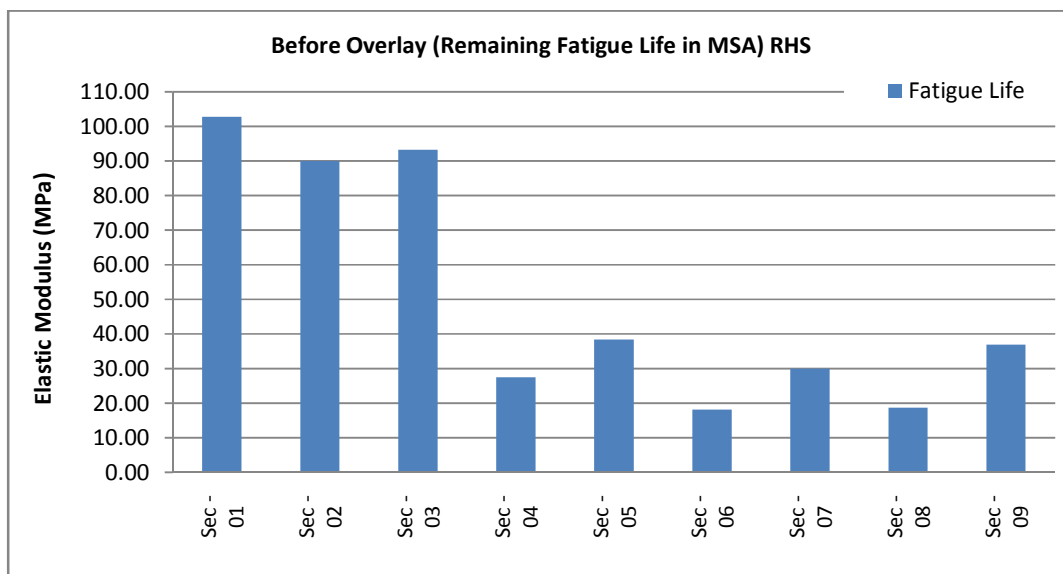


Figure 81. Remaining life before overlay (in MSA). RHS

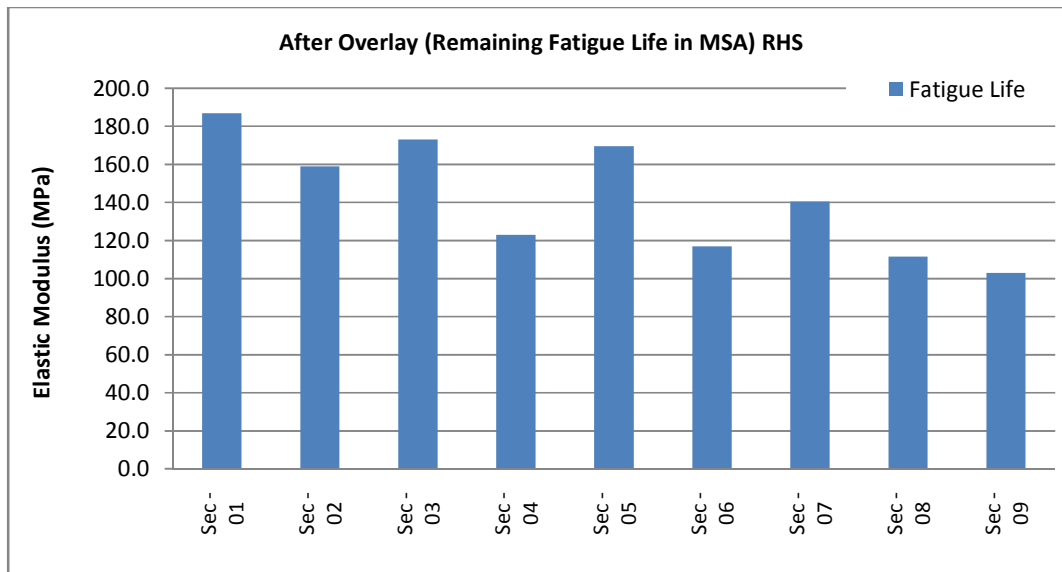


Figure 82.Remaining life before overlay (in MSA). RHS

		STRETCH -3					
Chainage	LHS						
	Outer				Inner		
	Structural		M&O	Structural		M&O	
	DBM	BC		DBM	BC		
601+000 to 646+000	Nil						

Table 87.Initial pavement works LHS

		STRETCH -3					
Chainage	RHS						
	Outer				Inner		
	Structural		M&O	Structural		M&O	
	DBM	BC		DBM	BC		
601+000 to 646+000	Nil						

Table 88.Initial pavement works RHS

Project has under annuity mode till period 2024, any deficiency in pavement regarding (Structural or functional) is directly under to the existing concessionaire. However, the detailed survey investigations were conducted in the year 2018. And accordingly as per based on analysis requirement of overlay was mentioned in the table above. As per current status an overlay of 40 mm BC have been executed by present concessionaire in the year 2019

4.8. MAINTENANCE STRATEGY AND HDM

The establishment of a Pavement Maintenance Plan should be determined through a balance choice of activities such as routine maintenance, periodic maintenance and extraordinary maintenance:

- **Routine Maintenance:** it is done with a preventive and permanent approach, whose purpose is to preserve the elements of the road, preserving the conditions that they had after the construction or rehabilitation. Among the usual activities of Routine Maintenance there are drainage cleaning, crack sealing, as well as patching works of wide cracking and potholes.
- **Periodic Maintenance:** it is done with a corrective approach, that is to say, in response to a problem that has already occurred. However, with the in-depth study of the pavement, the application of mathematical models and specialized technical staff, it is possible to foresee the problems that will arise, be anticipated to them minimizing the risk of severe deterioration of the road. The goal of the periodic maintenance is to recover the physical conditions of the deteriorated pavement, prevent the evolution of defects on it and preserve the surface characteristics. Among the usual activities are milling and replace of asphalt layer, reinforcement and overlays, as well as slurry seals.
- **Extraordinary Maintenance:** commonly referred to as rehabilitation, it is performed when the structural condition of the infrastructure suffers a deterioration that exceeds the admissible one, according to the designed life. The rehabilitation is to restore the structural and functional characteristics that the pavement had at the beginning.

The pavement is responsible for bearing the entire superstructure and external agents (traffic, weather conditions) on the road, so that one of the most important features of the roads is their bearing capacity.

However, other important factors such as comfort or road safety depend on the surface conditions of the pavement. To establish an optimal Maintenance Strategy through Rehabilitation and Periodic and Routine Maintenance and to preserve both functional and structural characteristics, it is necessary to know the behavior of the pavement. In this way it will be possible to predict more accurately what will happen in the long term, which will allow road managers to anticipate to the problems and define a successful Maintenance Strategy.

To know and to simulate the behavior of road pavement technical tools based on the so-called Pavement Deterioration Models are often used. Pavement Deterioration Models are created with an architectural structure based on mathematical equations that allow forecasting the behavior of pavement on the basis of certain data inputs, collected directly from the roads with high performance equipment (IRI, deflections, layers' thickness, etc.), or making reasonable assumptions in cases where data is not available.

One of the most well-known tools for the modeling of the deterioration pavements is the HDM-4 (Highway Development and Management System), a software developed by the World Bank - PIARC. Their models are widely recognized by the international scientific community in the field of roads, and are used in more than 100 countries and endorsed as a reference system at global level.

4.8.1. PRINCIPLES OF HDM-4

HDM-4 (Highway Development and Management) is a software package with supporting documentation, which can serve as the main tool for analysis, planning, management and evaluation of the maintenance, improvement and decision-making related to the investment in roads. [Source PIARC].

More in-depth, HDM-4 is a simulation model of the life-cycle behavior of the road pavement, which considers the relationship between road pavement, the environment and traffic within a national or regional economy that determines the composition and the cost structure of the variables. The model performs a detailed analysis based on the data provided by the user.

HDM-4 is not an optimization tool, since it is not able to find the absolute "optimum solution" of the problem, but it performs the calculations corresponding to each raised alternative and provides technical and economic (if desired) indicators for the user to sort the alternatives, and then select the optimal in accordance with considered objectives.

The general structure of HDM-4 is shown in Figure 83. HDM-4 operates under three different tools of analysis: Strategy, Programme and Project, depending on the level of detail and goals that are wished. It is composed of a series of databases that will be used or not, depending on the chosen analysis tool.

The three analysis tools operate on data defined in each of the four data managers [Source HDM-4 Manual]:

- **Vehicle Fleet:** defines the characteristics of the vehicle fleet that operate on the road network to be analyzed.
- **Road Network:** defines the physical characteristics of road sections in a network or sub-network to be analyzed.
- **Road Works:** defines maintenance and improvements standards which will be applied to the different road sections to be analyzed.
- **HDM Configuration:** defines the other data to be used in the applications, like environmental parameters or calibration factors.

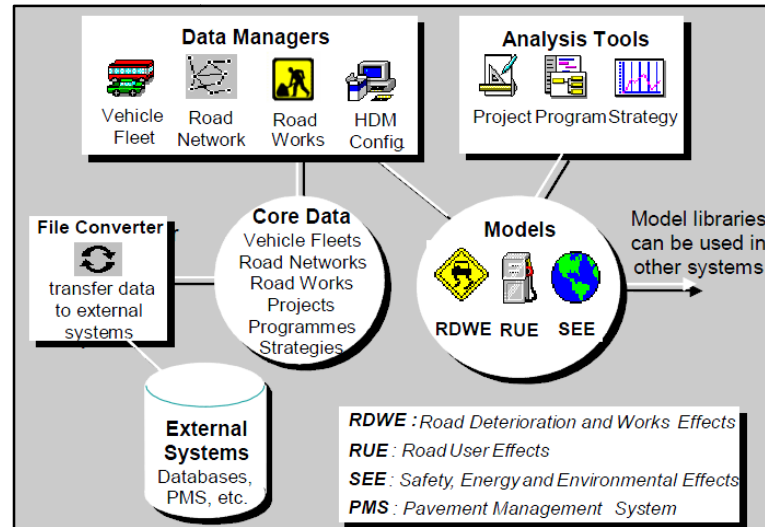


Figure 83. HDM-4 System Architecture (Source HDM-4 Manual)

In addition to the data managers, once the user has entered all the necessary data, there are three key concepts in the approach of HDM-4 for the simulation of the deterioration of roads:

- Road Deterioration Models (RD)
- Adjusted Structural Number (SPN)
- External agents

First, there is the so-called Road Deterioration Models (RD). In HDM-4 there are a total of 8 types of RD models for flexible pavements. Each one of them simulates the evolution of deterioration through a Surface Condition Index. The Table 89 shows the 8 models and indicators together with their units of measurement:

MODELS	INDEX	UNITS
Cracking	Wide cracking	% of total carriageway area
	Thermal cracking	% of total carriageway area
	Total cracking	% of total carriageway area
Ravelling	Ravelled area	% of total carriageway area
Potholing	Potholes	No/km
Edge-break	Edge-break area	% of total carriageway area
Rutting	Rut Depth	mm
Roughness	IRI	m/km
Texture Depth	Texture Depth	mm
Skid Resistance	SFC	%

Table 89. HDM-4 Models and indicators

In addition to the above, there is another key component: bearing capacity of the pavement. This is

represented through the Adjusted Structural Number (SNP), which is linked to the pavement design, that is to say, thickness and materials of the layers, and pavement deflectometric condition in operation phase.

MODELS	INDEX	UNITS
Pavement strength	SNP	-

Table 90. HDM-4 Bearing Capacity Index

The deterioration of the structural capacity of the pavement (SNP), as well as all the previous models, is influenced by external agents, which in HDM-4 are as following:

- Traffic Loads
- Environmental factors
- Effects of inadequate drainage

The previous three items explained (RD models, SNP and exogenous agents) have a dependency relationship between them. This implies, at the operational level, that initially it is necessary to enter a value for each one of them, regardless of the user wishes to take them into account for the analysis, or not.

The HDM-4 internal software programming of these three components, together with the initial data entered, makes it possible to get as a result a full simulation of the behavior of the pavement throughout his operation life. In this way, the Surface Condition Indexes will take values over the years that will represent the deterioration of the pavement.

By forecasting the pavement future deterioration, it will be possible to raise a number of Maintenance alternatives in order to maintain the desired Performance thresholds. Consequently, depending on the evolution of the pavement deterioration, and on how the deterioration values reach the performance thresholds, the user will prepare the Pavement Maintenance Plan, which determines which maintenance works are required and when.

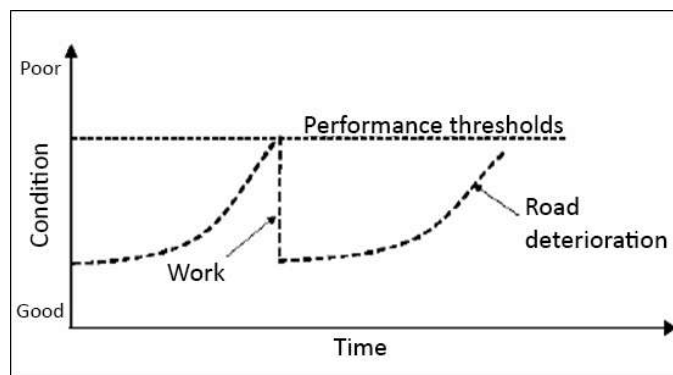


Figure 84. Road deterioration evolution model sketch

4.8.2. HDM-4 INPUT DATA

HDM-4 model performs a detailed analysis based on the data provided by the user. The following paragraphs show the system input data that has been considered.

First of all, it is necessary to introduce climatic data of the area under study. The figure below shows the climatic distribution used by HDM-4: Köppen climate classification. Stretch 3 belongs to Warm semi-arid

climate (BSH).

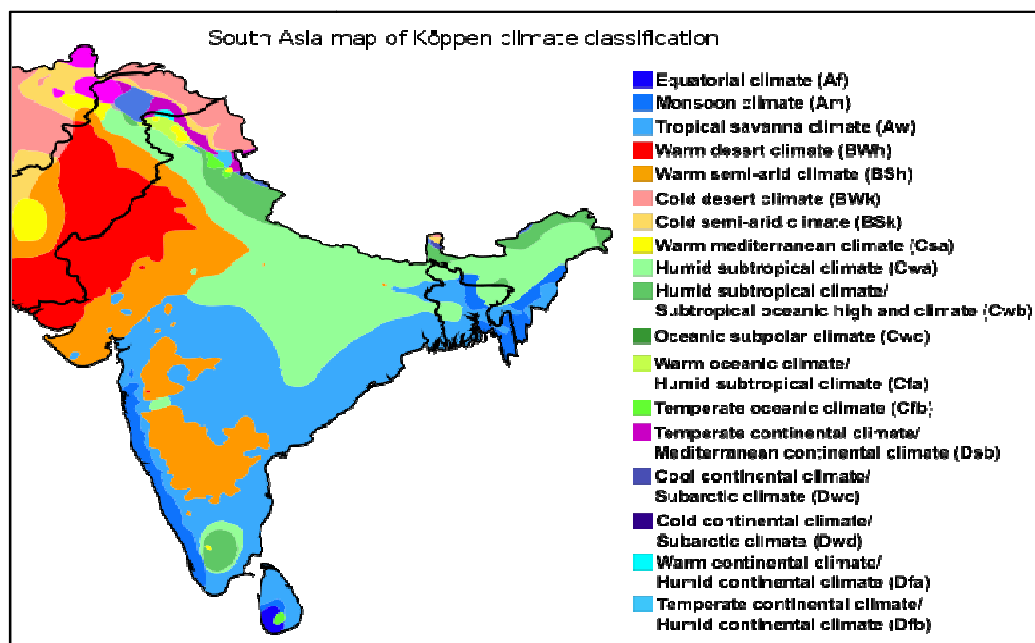


Figure 85. Stretch 3 Köppen climate classifications

It is also necessary to configure traffic of the stretch 3. The following tables show the traffic data used to run HDM and AASHTO calculations.

Year	MSA cumulated	SA Cumulated /day	MSA Increment	% Traffic Growth
2020	5.7	5747381	-	-
2021	11.7	5958314	5.96	-
2022	17.9	6179484	6.18	5%
2023	24.3	6411359	6.41	5%
2024	31.0	6654426	6.65	6%
2025	37.1	6114225	6.11	-12%
2026	42.3	5242258	5.24	-19%
2027	47.8	5521014	5.52	6%
2028	53.6	5818182	5.82	6%
2029	59.8	6134909	6.13	6%
2030	66.3	6472414	6.47	6%
2031	73.0	6777896	6.78	6%
2032	80.1	7100579	7.10	5%
2033	87.6	7441378	7.44	6%
2034	95.4	7801257	7.80	6%

Year	MSA cumulated	SA Cumulated /day	MSA Increment	% Traffic Growth
2035	103.6	8181232	8.18	6%
2036	112.1	8522097	8.52	6%
2037	121.0	8879294	8.88	5%
2038	130.2	9253564	9.25	5%
2039	139.9	9645683	9.65	5%
2040	149.9	10056460	10.06	5%
2041	156.9	6948504	6.95	5%
2042	164.1	7202687	7.20	5%
2043	171.5	7467243	7.47	5%
2044	179.3	7742574	7.74	5%
2045	187.3	8029097	8.03	5%
2046	195.6	8283224	8.28	5%
2047	204.1	8546242	8.55	4%
2048	213.0	8818444	8.82	4%
2049	222.1	9100134	9.10	4%
2050	231.4	9391626	9.39	4%

Table 91.LHS average annual traffic growth rate

Year	MSA cumulated	SA Cumulated /day	MSA Increment	% Traffic Growth
2020	7.8	7847044	-	-
2021	16.0	8169629	8.17	-
2022	24.5	8507500	8.51	5%
2023	33.4	8861359	8.86	5%
2024	42.6	9231939	9.23	6%
2025	51.4	8738261	8.74	-12%
2026	59.3	7922274	7.92	-19%
2027	67.7	8390603	8.39	6%
2028	76.6	8889111	8.89	6%
2029	86.0	9419698	9.42	6%
2030	96.0	9984388	9.98	6%
2031	106.5	10496897	10.50	6%
2032	117.5	11037609	11.04	5%
2033	129.1	11608042	11.61	6%
2034	141.3	12209795	12.21	6%
2035	154.2	12844555	12.84	6%

Year	MSA cumulated	SA Cumulated /day	MSA Increment	% Traffic Growth
2036	167.6	13415353	13.42	6%
2037	181.6	14012941	14.01	5%
2038	196.2	14638552	14.64	5%
2039	211.5	15293473	15.29	5%
2040	227.5	15979052	15.98	5%
2041	238.6	11061167	11.06	5%
2042	250.0	11486017	11.49	5%
2043	262.0	11927894	11.93	5%
2044	274.4	12387467	12.39	5%
2045	287.2	12865432	12.87	5%
2046	300.5	13290255	13.29	5%
2047	314.2	13729663	13.73	4%
2048	328.4	14184144	14.18	4%
2049	343.1	14654204	14.65	4%
2050	358.2	15140366	15.14	4%

Table 92.RHS average annual traffic growth rate

As can be seen, in Year 2040 it has been considered a decrease (-%) of traffic due to the expected widening of the road with 2 extra lanes (one per carriageway).

The following tables show the bearing capacity data required by HDM-4.

STRETCH 3. LHS # HDM-4 ID	Structural condition (2018) based			
	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 3-01 - LHS	16	20	8.93	240
Str 3-02 - LHS	17	21	8.06	240
Str 3-03 - LHS	18	22	7.68	210
Str 3-04 - LHS	25	31	6.96	210
Str 3-05 - LHS	24	30	6.85	230
Str 3-06 - LHS	19	23	7.12	230
Str 3-07 - LHS	20	25	7.07	230
Str 3-08 - LHS	22	27	6.80	235
Str 3-09 - LHS	20	25	6.85	220
Str 3-10 - LHS	25	31	7.12	200
Str 3-11 - LHS	21	26	7.07	200
Str 3-12 - LHS	21	26	6.80	200

STRETCH 3. LHS # HDM-4 ID	Structural condition (2018) based			
	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 3-13 - LHS	22	27	6.85	230

Table 93. Bearing capacity input data in HDM-4 software of LHS Stretch 4

STRETCH 3. RHS # HDM-4 ID	Current structural condition (2018)			
	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 3-01 - RHS	15	18	9.30	225
Str 3-02 - RHS	15	18	9.30	245
Str 3-03 - RHS	15	18	9.30	210
Str 3-04 - RHS	21	26	7.53	210
Str 3-05 - RHS	18	22	8.29	180
Str 3-06 - RHS	17	21	8.60	180
Str 3-07 - RHS	18	22	8.29	210
Str 3-08 - RHS	23	28	7.11	210
Str 3-09 - RHS	22	27	7.31	250

Table 94. Bearing capacity input data in HDM-4 software of RHS Stretch 3

The deflections values expressed in 40 kN load, have been normalized to values of 700 kPa, which is the format used by HDM-4.

The current SN (SNP_{def}) has been calculated in each homogeneous section with the equation below:

$$SNP_{def} = 3.2(DEF)^{-0.63}$$

Later on, to these current values of SNP_{def} have been added as the contribution to the bearing capacity of the recommended overlays described in previous sections, see point 4.7. For that, structural coefficients of $a_1=0.42$ and $a_2=0.41$ have been considered.

Finally, the SNP of the pavement under designed is obtained. It can be seen that some of SNP values are greater than 7. HDM-4 only accepts maximum SNP values of 7. For this reason, those SNP values greater than 7 have been introduced as $SNP = 7$.

Regarding the surface condition of the homogeneous sections, since the HDM-4 analysis starts right after recommended improvement overlay works are completed, the surface condition is considered as that of a new pavement.

4.8.3. MAINTENANCE STRATEGY (WORK STANDARD)

As indicated in above paragraphs, pavement bearing capacity, comfort and safety, are three key aspects in the operation and management of roads. Bearing capacity defines the capabilities of the pavement to absorb traffic loads in terms of strength. That is, designed pavement will have the capacity to support a determined volume of commercial traffic. In addition, pavement bearing capacity will decrease due to external agents (traffic loads, environmental factors and inadequate drainage), so that bearing capacity will last for a certain lifecycle which ends with the destruction of the pavement. Therefore, it is necessary to study how much traffic each homogeneous section is able to support, in order to know when it will be required to propose structural improvement works. As indicated above, the basic parameter that represents the pavement bearing capacity in the established methodology is the Structural Number.

In the other hand, user comfort and safety are related to the so-called functional capacity of the pavement. Regarding to road safety, in addition to the pavement functional capacity, other aspects are relevant too, such as the highway geometric layout (curves, slopes, camber, etc.), or users driving culture and behavior. Both aspects are not controllable by a pavement maintenance strategy. However, aspects such as skid resistance and potholes are also very important for safety, and these are controllable with a proper pavement maintenance strategy.

The user comfort when driving along a road, it is closely related to the pavement functional capacity, which is directly related to roughness, rutting, potholes, macro-texture (noise) and cracking. All these aspects of a road are directly controllable with an adequate pavement maintenance strategy.

To correctly evaluate both previous concepts, structural and functional capacity of a pavement, it is thus important to establish an adequate pavement maintenance strategy. And this is why it is recommendable to use a methodology such as the combination of AASHTO - HDM-4. On the one hand, with HDM-4 it is possible to predict the deterioration of the road pavement due to external agents including the evolution of its structural number (SN) and propose works to maintain the required functional capacity. And in the other hand, with AASHTO it is possible to estimate pavement structure/design according to the traffic that must be supported in order to maintain its structural bearing capacity.

The following methodology thus has combined and coordinated HDM-4 and AASHTO rules, so that every N number of years (in our case N is considered as 7 years) the required Structural Number (SN) has been checked according to AASHTO pavement design methodology and simultaneously HDM provides the evolution of surface distresses and structural number during the same period.

This combined methodology is described below considering the base year of analysis 2019, when recommended improvement works (overlays) should have been completed:

1. HDM calculation according to initial pavement condition after recommended overlays, in order to obtain expected SN on year 2019+5 (*).
2. AASHTO calculation of required SN on year 2019+5 to support the traffic of 10 following years, and in case that this SN is higher than previously calculated (expected SN on year 5th), determination of required structural overlay (**).
3. HDM analysis and calculation according to previous overlays calculated, in order to obtain expected SN on year 2019+12.
4. AASHTO calculation of required SN on year 2019+12 to support the traffic of 10 following years, and in case of this SN is higher than previously calculated (expected SN on year 12th), determination of required structural overlay (**).
5. HDM analysis and calculation according to previous overlays calculated, in order to obtain expected SN on year 2019+19.
6. AASHTO calculation of required SN on year 2019+19 to support the traffic of 10 following years, and in case of this SN is higher than previously calculated (expected SN on year 19th), determination of required structural overlay (**).

7. HDM analysis and calculation according to previous overlays calculated, in order to establish the required surface works to be done in the whole period.

(**) In the case of present Stretch (Stretch 3), initial overlays have been considered in 2019 and 2024 as this stretch is currently under (BOT) Annuity by NHAI terminating in 2024. Consequently, considering 2019 as the base year, the model is checking pavement requirements in 2024, and further on time, the model will continue the analysis of the pavement for every cycle of N=7 years.

(*) In case that a structural overlay is not required, it has been established a Milling and Overlay functional work of 3 cm in order to restore surface conditions.

It should be emphasized that all cycles(5 or 7 year) have been checked in order to assure that, according to AAHSTO, the pavement will support the expected traffic for the next 10 years.

The final overlay results have been recorded in HDM-4 so final evolution of surface characteristics and required works have been established. The strategy followed in HDM is described below:

- Mill and replace
 - Surface material: bituminous concrete
 - Depth of milling: 5 cm
 - Thickness of new surfacing (replacement): 5 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when Rut depth ≥ 15 mm
 - Road condition effects after works:
 - IRI = as per HDM-4 Work Effect Models
 - Rutting = as per HDM-4 Work Effect Models
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%
- Mill and replace
 - Surface material: bituminous concrete
 - Depth of milling: 3 cm
 - Thickness of new surfacing (replacement): 3 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when no work is required as per AASHTO calculation, but to restore functional conditions of the pavement
 - Road condition effects after works:
 - IRI = as per HDM-4 Work Effect Models
 - Rutting = as per HDM-4 Work Effect Models
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%
- Overlay 5 cm
 - Surface material: bituminous concrete
 - Thickness of new surfacing (overlay): 5 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when $IRI \geq 4$ m/km
 - Road condition effects after works:
 - IRI = as per HDM-4 Work Effect Models

- Rutting = as per HDM-4 Work Effect Models
- Skid Resistance= as per HDM-4 Work Effect Models
- Surface Texture = as per HDM-4 Work Effect Models
- Cracking = 0%
- Overlay 3 cm
 - Surface material: asphaltic concrete
 - Thickness of new surfacing (overlay): 3 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when $SFC \leq 0.40$
 - Road condition effects after works:
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%
- Patching
 - Intervention criteria: when Wide Structural Cracking $\geq 2\%$ OR potholing ≥ 1
 - Road condition effects after works:
 - Wide Structural Cracking = 0%
 - Potholing = 0
 - This work eliminates only Wide Structural Cracking (ACW), reducing total cracking (ACRA) in an amount identical to the removed ACW.

The strategy followed in AASHTO is described below:

- Reliability: 90%
- Standard Deviation: 0.43
- $P_0=4.20$
- $P_1=3.0$
- $a_i(BC)=0.42$
- $a_i(DBM)=0.40$

4.8.4. HDM-4 ANALYSIS CONCLUSIONS (2021)

HDM-4 analysis is revised & reviewed based on the renewal work taken up by the present concessionaire and The results of HDM-4 analysis can be seen in the tables shown below.

PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE
NATIONAL HIGHWAYS ON ROADS UNDER (InvIT) MODEL

Physical condition of NH27 (NH14) – Palanpur/Khemana – Abu
road)



X	Milling X and Replace X mm (functional)
X	Milling X and Replace X mm (structural)
X	Overlay X mm (functional)
X	Overlay X mm (structural)
X	Patching (X% area to patch)

STRETCH 4.LHS #HDM-4 ID	Section	From	To	Length (m)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
STR 4-01 - LHS	1	601+000	605+000	4000	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-02 - LHS	2	605+000	608+000	3000	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-03 - LHS	3	608+000	611+000	3000	40				4%	30						4%	3%	30				4%	3%	30					4%	3%	30			
STR 4-04 - LHS	4	611+000	615+000	4000	40				4%	40						4%	3%	40				4%	3%	40					3%	4%	40			
STR 4-05 - LHS	5	615+000	616+500	1500	40				4%	40						3%	4%	40				3%	4%	30					3%	4%	30			
STR 4-06 - LHS	6	616+500	618+250	1750	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-07 - LHS	7	618+250	620+250	2000	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-08 - LHS	8	620+250	623+000	2750	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-09 - LHS	9	623+000	628+000	5000	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-10 - LHS	10	628+000	630+250	2250	40				4%	50							4%	50					4%	40					4%	3%	40			
STR 4-11 - LHS	11	630+250	633+500	3250	40				4%	40						4%	3%	40				4%	3%	40					4%	3%	40			
STR 4-12 - LHS	12	633+500	639+000	5500	40				4%	40						4%	3%	40				4%	3%	40					4%	3%	40			
STR 4-13 - LHS	13	639+000	645+000	6000	40				4%	40						4%	3%	40				4%	3%	40					4%	3%	40			

LHS maintenance schedule by HDM-4 analysis

Table 95.LHS maintenance schedule by HDM-4 analysis (year 2021)

X	Milling X and Replace X mm (functional)
X	Milling X and Replace X mm (structural)
X	Overlay X mm (functional)
X	Overlay X mm (structural)
X	Patching (X% area to patch)

STRETCH 4.RHS #HDM-4 ID	Section	From	To	Length (m)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
STR 4-01 - RHS	1	601+000	608+250	7250	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-02 - RHS	2	608+250	613+000	4750	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-03 - RHS	3	613+000	617+500	4500	40				4%	30						3%	4%	30				3%	4%	30					3%	4%	30			
STR 4-04 - RHS	4	617+500	623+000	5500	40				4%	40						4%	3%	40				4%	3%	40					4%	3%	40			
STR 4-05 - RHS	5	623+000	629+000	6000	40				4%	40						4%	3%	40				4%	3%	40					4%	3%	40			
STR 4-06 - RHS	6	629+000	633+500	4500	40				4%	50							4%	50					4%	40					4%	3%	40			
STR 4-07 - RHS	7	633+500	639+000	5500	40				4%	40						4%	3%	40				4%	3%	40					4%	3%	40			
STR 4-08 - RHS	8	639+000	642+250	3250	40				4%	50						4%	40	50					4%	40					4%	3%	40			
STR 4-09 - RHS	9	642+250	645+500	3250	40				4%	40						3%	4%	40				4%	3%	30					3%	4%	30			

RHS maintenance schedule by HDM-4 analysis

Table 96.RHS maintenance schedule by HDM-4 analysis(year 2021)

In Annexure for HDM-4 Results the graphs obtained with the HDM-4 software are provided.

The AAHSTO-HDM results of Stretch 3 show that:

- During the whole period high traffic is expected in the Stretch
- For both LHS and RHS:
 - In 2019, different overlay works have been established in the whole stretch due to structural reasons in accordance to point 4.7 of present report.
 - In 2024 and 2038, overlay works (30to50 mm) have been established in the whole stretch due to structural reasons.
 - In 2031 and 2045, milling and overlay works (30 to 50 mm) have been established in the whole stretch due to functional improvement reasons.
 - Some patching works are required due to expected cracking in 2023, 2029, 2030, 2036, 2037, 2043 and 2044.

Note:-

After this, it's to be considered that in both side sides i.e for LHS and RHS, periodic renewal at every 6th years on 2030, 2036, and 2046, 40mm BC overlay in the whole stretch have been established, except the thickness for service/slip roads overlay of 30mm have been established due to functional reasons.

Detailed investigations have been conducted in year 2018. From 2018 to 2020 Concessioner has taken up below mentioned major maintenance works. However, considering these majormaintenance works,improvement proposals i.e. Initial Maintenance Costhas been taken accordingly and final estimate/BOQ is prepared.

Since only 40mm BC in overlay was laid by Concessionaire, therefore using IITPAVE considering 40mm BC, residual life for design MSA was calculated again for which 40mm bituminous concrete can sustain for next 5 years i.e 2024. Afterwards major maintenance is again required to maintain the structural strength of existing flexible stretch. Then, a successive periodical maintenance for every 6th year is recommended.

S No	Description	Remark
1	Renewal of BC overlay with 40 mm thickness without milling in entire stretch full carriageway width.	Executed in August 2019

*It should be noticed that this project road is under a BOT (Annuity) **Contract with tenure up to 24/03/2024**; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road.*

5. STRUCTURES

The present section refers to the inventory and condition survey of all the highway structures following the guidelines from IRC: SP-35.

The kilometric chainages that are showed in the following section correspond to those estimated and showed in the drawings prepared after a LiDAR survey of the stretch. For a reference between these kilometric chainages and the existing kilometric stones on site, please refer to Annexure 12.

5.1. FIELD WORKS AND INVESTIGATIONS

Field works included the collection of data to produce an inventory of all the structures and the inspection to evaluate their condition.

Data and photos of all the cross drainage and grade separated structures, such as culverts and minor/major bridges, were taken in order to complete the inventory.

In addition to minor (< 60 m length) and major bridges (>60m length) other categories of structures have been considered depending on their function, such as Vehicle Underpass (VUP), Pedestrian/Cattle Underpass, ROB/RUB, Flyovers. In case of their existence, Tunnels have also been considered.

All minor and major bridges were inspected by a bridge expert and the methodology adopted for that inspection was as follows.

- Collection of data from authority regarding details of the structure and study of previous inspection reports so that condition of the defects which were noticed earlier could be checked.
- Visual inspection of foundations, abutments, wing-walls/returns, piers, columns and bearings, soffits of the deck including beams, details under the deck, condition of road surface, drainage, parapets, expansion joints, condition of approaches, condition of protective works.
- Inspection of bridges using MBIU and taking photograph.
- In general and particularly in case of any important or major short coming/distress is noticed leading to doubt about structural adequacy, a detailed investigation using Nondestructive Test is carried out.
- Preparation of report and proposals for repair/rehabilitations/reconstruction of the structure as per site conditions.

5.1.1. COLLECTION OF INVENTORY DATA

Past records of this highway were collected from PIU Gandhidham and we were provided with Detailed Project Report, As Built Drawings and Inspection Reports.

After doing a scrutiny of the aforementioned provided data regarding locations, structural details and condition of the structures, a team of Engineers visited the site on 09/02/2018 to 10/02/2018 and an inventory of all the structures and visual condition survey was carried out as per IRC:SP:35.

Inventory records for the grade separated structures and major bridges were collected in the 22 column format given below:

S.No	Location (km)	Type of structure	Span arrangement (nos. and length)	Length of structure (m)	Carriageway width with P.S. m	Width of structure m	Protection				
							Type	Condition			
1	2	3	4	5	6	7	8	9			
Pier foundation material	Abutment material	Present Condition of various features of bridge							Presence of scour	Adequacy waterway	Remark
		Abutment	Piers	Slab	Bearing	Parapet	Slab Pipe	Return wall			

							Box Arch					
10	11	12	13	14	15	16	17	18	19	20	21	22

Table 97.Inventory format

5.1.2. INSPECTIONS

Based on the visual condition survey all the distresses were noted for each element of each and every structure and wherever required detailed investigations were carried out including NDT.

A Bridge Expert inspected minor and major bridges, and when required, and particularly for major bridges, the inspection was supported by an MBIU. In this stretch MBIU was required on 01/03/2018. Photographs of all major bridges were taken and present health condition of all the structures was recorded for all the elements of the bridges or culverts except foundations which are buried underground.

Photographs of Mobile Bridge Inspection Unit (MBIU) used for inspection are given below.



Figure 86. Mobile Bridge Inspection Unit used in inspections



Figure 87. Mobile Bridge Inspection Unit used in inspections (MBIU)

5.1.3. NDT

To evaluate the strength of the components of bridges/structures, the following Non Destructive Tests (NDT) was conducted.

5.1.3.1. REBOUND HAMMER

The Rebound Hammer Method was used for:

- Assessing the likely compressive strength of concrete with the help of suitable co-relations between rebound index and compressive strength.
- Assessing the uniformity of concrete.
- Assessing the quality of the concrete in relation to standard requirements.
- Assessing the quality of one element of concrete in relation to another.



Figure 88. Operators conducting rebound hammer test

5.1.3.2. ULTRASONIC PULSE VELOCITY

The ultrasonic pulse velocity method was used to establish:

- The homogeneity of the concrete.
- The presence of cracks voids and other imperfections.
- Changes in the structure of the concrete which may occur with time.
- The quality of the concrete in relation to standard requirement.
- The quality of one element of concrete in relation to another.
- The values of dynamic elastic modulus of the concrete.



Figure 89. Operators conducting ultrasonic pulse velocity test

5.2. INVENTORY

There are total of 100 structures on this Project Highway and a summary type of structure wise is given in Table 98 below:

S No.	Type of Structure	Nos.
1	Box Culvert	30
2	Slab Culvert	0
3	Pipe Culvert	43
4	Minor bridge	14
5	Vehicular Underpass/Pedestrian/cattle Underpasses	7
6	Major Bridge	4
7	Road Over Bridge	1
8	Flyover	1
9	Tunnel	0
Total		100

Table 98.Inventory of Structures

5.2.1. CULVERTS

There are 73 culverts on this project road from which, 30 are box type, 0 slabs and 43 pipes.

A summary of the inventory of all culverts is provided in below tables, for a more detailed inventory you can refer to Annexure Structures.

Sr.No.	Structure No.	Chainage	Span Arrangement
1	609/1	608+070	1 x 3.00
2	609/2	608+120	1 x 3.00
3	609/3	608+145	1 x 3.00
4	609/5	608+200	1 x 4.00
5	609/6	608+250	1 x 3.00
6	609/7	608+300	1 x 3.00
7	609/8	608+350	1 x 3.00
8	610/2	609+620	1 x 3.00
9	610/3	609+670	1 x 3.00
10	610/4	609+700	1 x 3.00
11	610/5	610+000	1 x 3.00
12	611/1	610+060	1 x 2.00
13	614/3	613+910	1 x 4.00
14	615/3	614+660	1 x 4.50
15	616/2	615+430	1 x 2.00
16	621/1	620+880	1 x 2.00
17	623/1	622+650	1 x 2.00
18	624/1	623+520	1 x 2.50
19	625/1	624+390	1 x 3.40
20	628/1	627+700	1 x 2.00
21	629/2	628+550	1 x 4.80
22	630/1	629+300	1 x 2.00
23	631/1	630+090	1 x 2.00
24	633/3	632+740	1 x 2.00
25	638/1	637+700	1 x 2.00
26	640/1	639+205	1 x 2.00
27	641/1	640+810	1 x 1.00
28	642/1	641+150	2 x 1.20 1 x 3.70
29	645/2	644+900	1 x 4.30
30	645/3	644+990	1 x 4.00

Table 99. Details of Culvert (Box Culverts)



Figure 90. Photographs of box culverts 609/1 and 609/2 respect.



Figure 91. Photographs of box culverts 609/3 and 610/3 respect.

Sr. No.	Structure No.	Chainage	Span Arrangement
NIL			

Table 100. Details of Culvert (Slab Culverts)

Sr.No	Structure No.	Chainage	Diametre
1	602/1	601+600	2 x 1.00
2	602/2	601+850	2 x 1.00
3	603/1	602+650	2 x 1.00
4	603/2	602+900	1 x 1.00
5	604/1	603+780	1 x 1.00
6	604/2	603+950	1 x 0.90
7	605/1	604+250	1 x 0.60 LHS 1 x 1.00 RHS
8	605/2	604+670	1 x 1.00
9	606/1	605+500	1 x 1.00
10	606/2	605+900	1 x 1.00
11	608/1	607+450	1 x 1.00

Sr.No	Structure No.	Chainage	Diametre
12	612/2	611+795	1 x 1.00
13	612/3	611+900	1 x 1.00
14	612/4	611+990	1 x 1.00
15	613/1	612+100	1 x 1.00
16	613/2	612+160	1 x 1.00
17	614/1	613+405	1 x 1.00
18	614/2	613+620	1 x 1.00
19	614/4	613+950	2 x 1.00
20	615/1	614+300	2 x 1.00
21	615/2	614+500	2 x 1.00
22	616/1	615+080	1 x 1.00
23	616/3	615+950	1 x 1.00
24	617/1	616+220	1 x 1.00
25	617/2	616+730	1 x 1.00
26	618/1	617+000	1 x 1.00
27	620/1	619+150	2 x 1.00
28	620/2	619+210	1 x 1.00
29	620/3	619+400	1 x 1.00
30	625/2	624+590	2 x 1.00
31	627/1	626+240	1 x 1.00
32	629/1	628+470	1 x 1.00
33	630/2	629+460	1 x 1.00
34	630/4	629+750	2 x 1.00
35	630/5	630+000	2 x 1.00
36	633/1	632+770	3 x 1.20
37	633/4	632+920	1 x 1.00
38	635/1	632+170	2 x 1.00
39	635/2	634+410	2 x 1.00
40	636/1	635+130	1 x 1.00
41	636/3	635+570	4 x 1.20
42	639/1	638+200	1 x 1.00
43	642/4	641+610	2 x 1.00

Table 101. Details of Culvert (Pipe Culverts)



Figure 92. Photographs of pipe culverts 602/1 and 602/2 respect.



Figure 93. Photographs of pipe culverts 603/1 and 603/2 respect.

5.2.2. MINOR BRIDGES AND VUP

There are 14 minor bridges and 7 Underpasses on this project road.

A summary of their inventory is provided in below tables, for a detailed inventory please refers to Annexure Structures.

S.No	Structure No.	Chainage	Type of Structures	Span Arrangement
1	608/2	607+801	Box	2 X 4.40
2	609/9	608+200	Box	1 X 9.900
3	612/1	611+100	T - Beam	1 X 16.180
4	613/3	612+910	T - Beam	1 X 13.60 (RHS) 2 X 14.20 (LHS)
5	619/1	618+460	T - Beam	2 X 15.00
6	620/4	619+780	T-Beam	4 X 6.70
7	622/1	621+822	T-Beam	3 X 12.30
8	626/1	625+020	Box	2 X 5.40
9	632/1	631+692	T-Beam	1 X 19.17
10	633/2	632+436	Box	1 X 12.00

S.No	Structure No.	Chainage	Type of Structures	Span Arrangement
11	634/1	633+110	T-Beam	1 X 9.00
12	634/2	633+960	Slab	3 X 9.00
13	635/3	634+996	Box	2 X 4.15
14	636/2	635+246	Box	3 X 3.80

Table 102. Structure Details of Minor Bridges



Figure 94. Photographs of Minor Bridges 608/2 and 609/9 respect.



Figure 95. Photographs of Minor Bridges 612/1 and 613/3 respect.

S.No.	Structure No.	Chainage	Structure	Type of Structures	Span Arrangement
1	607/1	606+100	VUP	Box	1 X 10.90
2	607/2	606+557	CUP/PUP	Box	1 X 5.00
3	611/3	610+648	VUP	Box	1 x 11.00
4	618/2	617+710	VUP	Box	1 X 11.00
5	630/3	629+700	VUP	Box	1 X 11.00
6	637/1	635+036	VUP	Box	1 X 11.00
7	642/2	641+200	VUP	Box	1 X 11.00

Table 103. Structure Details of VUP & LVUP



Figure 96. Photographs of VUPs 607/1 and 607/2 respect.



Figure 97. Photographs of VUPs 611/3 and 618/2 respect.

5.2.3. MAJOR BRIDGES AND ROB

There are 4 major bridges, no Flyovers and 1 ROB on this Project Highway. A summary of their inventory is given in table below. For detailed inventory please refer to Annexure Structures.

S. No.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width carriageway
1	609+455	610/1	LHS	T-Beam girder	(1*20.00) + (6*19.80) + (1*20.00)	158.8	10.25	8.5
			RHS		(1*10.45) + (8*19.80) + (1*10.45)	179.3	10.25	8.5
2	626+768	627/2	LHS	T-Beam slab	(5*13.50)	67.5	10.25	8.5
			RHS		(5*13.50)	67.5	7.5	6.5
3	638+755	639/2	LHS	T-Beam slab	(5*13.50)	67.5	10.00	8.5
			RHS	T-Beam	(5*13.50)	67.5	10.00	8.5
4	639+725	640/2	LHS	T-Beam slab	(3*33.20)	99.6	10.25	8.5
			RHS		(3*33.20)	99.6	10.25	8.5

Table 104. Structure Details of Major Bridges and ROB



Figure 98. Photographs of Major Bridge 610/2



Figure 99. Photographs of Major Bridge 640/2

S.No.	Chainage	S. No.	Side	Type of Structures	SpanArrangement	Length of Structure (m)	Deckwidth (m)	Widthcarriageway
1	610+340	611/2	LHS	T-Beamgirder	1 X 22.10 + 1 X 29.25 + 1 X 28.55	81	9.2	7
			RHS		1 X 22.10 + 1 X 29.25 + 1 X 28.55	81	9.2	7

Table 105. Structure Details of ROB



Figure 100. Photograph of ROB 898/4

S.No.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width carriageway
1	644+700	645/1	LHS RHS	Deck Slab	1 X 42.65 1 X 42.55 1 X 42.50 1 X 42.80	170.5	20.75	2 x 8.25

Table 106. Structure Details of Flyover



Figure 101. Photograph of Flyover 645/1

5.3. CONDITION

Condition of all structures was evaluated by visual inspection and NDT tests and is being reported below.

5.3.1. CULVERTS

There are 73 culverts whose condition at the time of inspection is given below .Details of the culvert have been given in Annexure Structures.

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. work	Condition of Structure	Remark
1	609/1	608+070	1 x 3.00	Good	Good	Cleaning of vegetation
2	609/2	608+120	1 x 3.00	Good	Good	Cleaning of vegetation
3	609/3	608+145	1 x 3.00	Good	Good	Cleaning of vegetation

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. work	Condition of Structure	Remark
4	609/5	608+200	1 x 4.00	Fair	Good	Stone pitching required And cleaning of vegetation
5	609/6	608+250	1 x 3.00	Good	Good	Cleaning of vegetation
6	609/7	608+300	1 x 3.00	Good	Good	Cleaning of water way & vegetation
7	609/8	608+350	1 x 3.00	Good	Good	Improvement of stone pitching and cleaning of vegetation
8	610/2	609+620	1 x 3.00	Good	Good	Cleaning of vegetation
9	610/3	609+670	1 x 3.00	Fair	Good	Stone pitching required And cleaning of vegetation
10	610/4	609+700	1 x 3.00	Fair	Good	Cleaning of water way ,vegetation and improvement of stone pitch
11	610/5	610+000	1 x 3.00	Fair	Fair	Stone pitching required And cleaning of vegetation
12	611/1	610+060	1 x 2.00	Fair	Fair	Improvement of stone pitching and cleaning of vegetation
13	614/3	613+910	1 x 4.00	Good	Good	Cleaning of vegetation
14	615/3	614+660	1 x 4.50	Good	Good	Cleaning of water way & vegetation
15	616/2	615+430	1 x 2.00	Good	Good	Cleaning of water way & vegetation
16	621/1	620+880	1 x 2.00	Good	Good	Cleaning of water way & vegetation
17	623/1	622+650	1 x 2.00	Good	Good	Cleaning of water way & vegetation
18	624/1	623+520	1 x 2.50	Good	Good	Cleaning of vegetation
19	625/1	624+390	1 x 3.40	Good	Good	Cleaning of water way & vegetation
20	628/1	627+700	1 x 2.00	Good	Good	Stone pitching required And cleaning of vegetation
21	629/2	628+550	1 x 4.80	Good	Good	Cleaning of water way & vegetation
22	630/1	629+300	1 x 2.00	Good	Good	Cleaning of vegetation
23	631/1	630+090	1 x 2.00	Good	Fair	Cleaning of water way & vegetation
24	633/3	632+740	1 x 2.00	Good	Fair	Stone pitching required And cleaning of vegetation
25	638/1	637+700	1 x 2.00	Good	Good	Stone pitching required And cleaning of vegetation

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. work	Condition of Structure	Remark
26	640/1	639+205	1 x 2.00	Good	Good	Cleaning of water way & vegetation
27	641/1	640+810	1 x 1.00	Good	Good	Stone pitching required And cleaning of vegetation
28	642/1	641+150	2 x 1.20 1 x 3.70	Good	Good	Cleaning of water way & vegetation
29	645/2	644+900	1 x 4.30	Good	Good	Stone pitching required And cleaning of vegetation
30	645/3	644+990	1 x 4.00	Fair	Fair	Improvement of stone pitching and cleaning of vegetation

Table 107. Condition of Box culverts



Figure 102. Photographs of the condition of box culverts 609/7 and 609/8 respect.



Figure 103. Photographs of the condition of box culverts 616/2 and 629/2 respect.

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
1	602/1	601+600	2 x 1.00	Poor	Fair	Improvement of stone pitching, cleaning of water way

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
2	602/2	601+850	2 x 1.00	Fair	Fair	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
3	603/1	602+650	2 x 1.00	Fair	Fair	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
4	603/2	602+900	1 x 1.00	Poor	Poor	Pipe fully choked by silt, need cleaning and also provide stone pitching
5	604/1	603+780	1 x 1.00	Fair	Good	Improvement of stone pitching
6	604/2	603+950	1 x 0.90	Poor	Good	Cleaning of water way, improvement of stone pitching
7	605/1	604+250	1 x 0.60 LHS	Fair	Good	Improvement of stone pitching and silt observed inside pipe need cleaning
			1 x 1.00 RHS	Good		Cleaning of water way & vegetation
8	605/2	604+670	1 x 1.00	Fair	Good	Cleaning of vegetation
9	606/1	605+500	1 x 1.00	Fair	Good	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
10	606/2	605+900	1 x 1.00	Fair	Fair	Cleaning of water way & vegetation
11	608/1	607+450	1 x 1.00	Fair	Fair	Improvement of stone pitching
12	612/2	611+795	1 x 1.00	Fair	Fair	Improvement of stone pitching, cleaning of water way
13	612/3	611+900	1 x 1.00	Good	Good	Improvement of stone pitching
14	612/4	611+990	1 x 1.00	Fair	Fair	Improvement of stone pitching
15	613/1	612+100	1 x 1.00	Fair	Good	Improvement of stone pitching, Cleaning of vegetation
16	613/2	612+160	1 x 1.00	Fair	Good	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
17	614/1	613+405	1 x 1.00	Poor	Fair	Cleaning of vegetation
18	614/2	613+620	1 x 1.00	Poor	Poor	Cleaning of vegetation
19	614/4	613+950	2 x 1.00	Poor	Poor	Cleaning of vegetation
20	615/1	614+300	1 x 1.00	Good	Fair	Cleaning of vegetation
21	615/2	614+500	2 x 1.00	Good	Fair	Improvement of stone pitching, cleaning of water way
22	616/1	615+080	1 x 1.00	Good	Good	Cleaning of water way, improvement of stone pitching

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
23	616/3	615+950	1 x 1.00	Fair	Good	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
24	617/1	616+220	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
25	617/2	616+730	1 x 1.00	Fair	Good	Cleaning of vegetation
26	618/1	617+000	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
27	620/1	619+150	2 x 1.00	Fair	Fair	Cleaning of water way, improvement of stone pitching
28	620/2	619+210	1 x 1.00	Fair	Fair	Cleaning of vegetation
29	620/3	619+400	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
30	625/2	624+590	2 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
31	627/1	626+240	1 x 1.00	Fair	Good	Cleaning of vegetation
32	629/1	628+470	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
33	630/2	629+460	1 x 1.00	Good	Good	Cleaning of vegetation
34	630/4	629+750	2 x 1.00	Good	Good	Cleaning of water way, improvement of stone pitching
35	630/5	630+000	2 x 1.00	Fair	Good	Cleaning of vegetation
36	633/1	632+770	3 x 1.20	Good	Good	Cleaning of water way, improvement of stone pitching
37	633/4	632+920	1 x 1.00	Good	Good	Cleaning of vegetation
38	635/1	632+170	2 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
39	635/2	634+410	2 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way
40	636/1	635+130	1 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way
41	636/3	635+570	4 x 1.20	Good	Good	Cleaning of vegetation
42	639/1	638+200	1 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way
43	642/4	641+610	2 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way

Table 108. Condition of Pipe culverts



Figure 104. Photographs of the condition of pipe culverts 605/1 and 608/1 respect.



Figure 105. Photographs of the condition of pipe culverts 612/2 and 614/1 respect.

5.3.2. MINOR BRIDGES AND VUP

Minor Bridges and Underpasses were inspected by a Bridge Engineer and findings of them are presented below:

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
1	608/2	607+801	2 X 4.40	Good	Good	Improvement of stone pitching
2	609/9	608+200	1 X 9.900	Good	Good	Improvement of stone pitching, cleaning of vegetation
3	612/1	611+100	1 X 16.180	Good	Good	Over all condition good
4	613/3	612+910	3 x 14.20 RHS 1 X 13.60 (LHS) 2 X 14.20 (LHS)	Good	Good	Over all condition good
5	619/1	618+460	2 X 15.00	Good	Good	Over all condition good
6	620/4	619+780	4 X 6.70	Good	Good	Over all condition good
7	622/1	621+822	3 X 12.30	Good	Good	Over all condition good
8	626/1	625+020	2 X 5.40	Good	Good	Over all condition good
9	632/1	631+692	1 X 19.17	Good	Good	Over all condition good
10	633/2	632+436	1 X 12.00	Good	Good	Over all condition good

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
11	634/1	633+110	1 X 9.00	Good	Good	Over all condition good
12	634/2	633+910	3 X 9.00	Good	Good	Over all condition good
13	635/3	634+996	2 X 4.15	Good	Good	Over all condition good
14	636/2	635+246	3 X 3.80	Good	Good	Over all condition good

Table 109. Structure Details of Minor Bridges



Figure 106. Photographs of the condition of Minor Bridge 620/4



Figure 107. Photographs of the condition of Minor Bridge 622/1



Figure 108. Photographs of the condition of Minor Bridge 626/1

Sr	Str. No	Chainage	Structure	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
1	607/1	606+100	VUP	Box	Good	Good	Over all condition is good
2	607/2	606+557	CUP/PUP	Box	Good	Good	Over all condition is good
3	611/3	610+648	VUP	Box	Good	Good	Over all condition is good
4	618/2	617+710	VUP	Box	Good	Good	Over all condition is good
5	630/3	629+700	VUP	Box	Good	Good	Over all condition is good
6	637/1	636+036	VUP	Box	Good	Good	Over all condition is good
7	642/2	641+200	VUP	Box	Good	Good	Over all condition is good

Table 110. Structure Details of VUP & LVUP



Figure 109. Photographs of the condition of VUP/LVUP 607/1 and 607/2 respect.

5.3.3. MAJOR BRIDGES AND ROB

There are 4 Major Bridges on this project highway and all these Bridges were inspected by the Senior Bridge Engineer using MBIU. Findings of the Bridge Engineer are given below and detailed report with NDT results is appended at Annexure Structures.

S.No	Str. No.	Chainage	Type of Structure	Side	Pier	No. of samples			Remarks
						UPV	RHT	Carbonation	
1	610/1	609+455	Major Bridge	LHS	II	4	3	1	Overall structure is in good condition
					V	4	3	2	Overall structure is in good condition
				RHS	III	4	3	3	Overall structure is in good condition
2	627/2	626+768	Major Bridge	LHS	I	4	3	1	Overall structure is in good condition
					III	4	3	2	Overall structure is in good condition
				RHS	II	4	4	3	Overall structure is in good condition
3	639/2	638+755	Major Bridge	RHS	III	1	1	-	Overall structure is in good condition
4	640/2	639+725	Major Bridge	RHS	II	1	1	-	Overall structure is in good condition

Table 111. Summary of Condition and NDT details of Major Bridges

S. No.		1
Structure No.		611/2
Chainage		610+340 (ROB)
Type of Structures		T – BeamGirder
Span Arrangements		1 x 22.10 + 1 x 29.25 + 1 x 28.55
Details of Protection Work	Type	Crash Barrier
	Condition	Good
Present Condition of the Bridge	Abutment	Good
	Piers	Good
	Slab	Good
	Bearings	Good
	Parapet	Good
Condition of various	Carriageway surface	Good
	Drainage Spout	Good

features of bridge	Return wall / Wing wall	-
Remarks		Debris observed in expansion joints , repair wearing coat , repaint structure ID , Maintain proper lightning facility

Table 112. Condition details of ROB



Figure 110. Photographs of the condition of ROB 611/2

S.No	Str. No.	Chainage	Type of Structure	Side	Pier	No. of samples			Remarks
						UPV	RHT	Carbonation	
1	645/1	644+700	Flyover	LHS	II	2	2	-	Overall structure is in good condition

Table 113. Condition details of Flyover



Figure 111. Photographs of test conducted in Flyover 645/1

5.4. REPAIR / IMPROVEMENT WORKS

5.4.1. GENERAL

As per condition survey findings it is evident that most of the structures are in good condition. Protection works and expansion joints, etc. are minimally distressed. All type of distresses and their solutions for repair and rehabilitation measures are given in Annexure Structure.

BOQ has been prepared for routine maintenance viz. greasing of bearings, cleaning of drainage ducts, repair of Parapet walls and crash barriers and repair of pitching and accidental damages.

5.5. DRAINS

As per condition survey findings it is evident that most of the existing drains are in fair/good condition. Details of existing drains on the project stretch 3.554 km median drain, 16.316 kms side drain exist on LHS side and RHS side including drains in service roads.

Note:-

Detailed investigations have been conducted in year 2018. However, latest inspection reports of structures carried out by authority between 2019 to 2020 is annexed at Annexure-B.

*It should be noticed that this project road is under a BOT (Annuity) **Contract with tenure up to 24/03/2024**; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road.*

6. ROAD SAFETY AUDIT

6.1. ROAD SAFETY AUDIT

Road Safety Audit (RSA) of the Project Stretch Palanpur/Khemana (Ch. 601+000 Km) – Abu Road (Ch. 646+000 Km) of total length 45.00km was carried out along the project stretch in order to assess the current situation and to suggest improvement measure.

This chapter covers the following issues:-

- Identifying issues related to Road Safety along the Project Stretch.
- Improvement Proposals for these identified issues/locations along the Project Stretch.

The first task was to collect and review the available historical data for the accidents that have occurred in the highway stretch since the commencement of its operation. The analysis of accident data can help to identify patterns that could be linked to safety deficiencies on the road. The accident data for the Project Stretch is given in the next table.

Accident Summary for April 2018- February 2020 Khemana Toll						
Month	Total Accidents Nos	Fatal Accident Nos	Major Nos	Minor Nos	Severity Index	No. of Persons Injured per 100 accidents
April	5	0	2	3	0.00	100
May	4	0	0	4	0.00	100
June	7	0	2	5	0.00	100
July	10	0	3	7	0.00	100
August	1	0	1	0	0.00	100
September	5	1	0	4	20.00	80
October	8	1	0	7	13.00	87.50
November	5	0	0	5	0.00	100
December	6	1	1	4	17.00	83.33
January	4	0	0	4	0.00	100
February	8	1	2	5	13.00	87.50
March	2	0	1	1	0.00	100
Total	65	4	12	49	6.15	93.85

Table 114. Accident Data along Project Stretch (Source: NHAI)

Notes: - Year- 2018 includes from April to December.

- Year -2019 includes January and December.

- Year -2020 includes January and February.

- Severity Index: Number of Persons Killed per 100 accidents.

Accidents from **April 2018- February 2020** were studied, as location of accidents were not provided it was impossible to identify any particular black spot due to accidents on the highway.

Considering the Severity Index of this stretch the average of the period under study was 5.25, and the nationwide Severity Index for 2015 amounted to 29.1(road accident death per 100 accidents, source :- road accident in India-2018 published by morth). Consequently, this stretch of highway from Palanpur - Aburoad seems to present a relatively very low Severity Index when compared with the whole country.

As a result of the Road Safety Audit the following safety concerns were identified:

- Safety Issues on Junctions along the Project Stretch
- Deficiencies In Safety Barriers
- Curves Delineation
- U-Turn – Median opening
- Unauthorized Ramps along the Project Stretch
- Improper Pedestrian Crossing along the Project Stretch
- Improper Signage & Entry Boards
- Provision of Service Roads
- Provision of ATMS along the Project Stretch

6.2. MAJOR SAFETY ISSUES FOR IMPROVEMENT

6.2.1. SAFETY ISSUES ON MINOR JUNCTIONS ALONG PROJECT STRETCH

There are a total 24 junctions on this highway project (Palanpur/Khemana- Abu road) which needs to be improved, these can be classified as T- junctions, Y- junctions and Cross junctions.

Majority of minor junctions along the Project Stretch are meeting abruptly with the main carriageway. The main issues observed at minor junctions are as below:

- Minor junctions meeting main carriageway at steep gradient leaving no leveled space for vehicles waiting at junction, resulting in improper visibility at junction.
- Improper acceleration and deceleration lanes for traffic merging from minor road and traffic diverging to minor road respectively.
- Improper visibility of approaching minor junction for main carriageway traffic and vice a versa. As per the junction visibility requirement, visibility triangle at the junctions should be kept free from any obstructions blocking visibility.
- Road studs are absent making difficult to follow the path at night.
- Rumble strips on side road are not provided before the junction so as to slow down the speed of vehicles approaching the junction.
- Inadequate space and radius at the junctions for traffic movements.
- Inadequate lighting condition at crossings which makes the visibility at night very difficult.
- Maintenance of road marking and signage.
- Channelizing islands are absent to separate different traffic directions.

Some of the photographs showing the present condition of minor junctions along the Project Stretch are shown below.



Chainage : 622+300



Chainage : 633+600

Figure 112. Photographs of improper minor junctions

The following are the junctions which require improvement for safe movement of traffic:

S NO.	Chainage	Side	Type	Improvement Strategies
1	613+100	Both	T	Junction Improvement as per IRC:SP:84-2019. Improvement in at – grade Pedestrian crossing facility with improved stair case guardrails to protect falling of pedestrians on to main carriageway from stair case at median. Rumble strips, Lighting, Road, Studs, stop line marking and Stop Signage and Channelizing island) Acceleration and deceleration lane required
2	614+740	LHS	T	
3	617+100	BHS	+	
4	622+100	BHS	LHS(Y) RHS (T)	
5	623+450	LHS	T	
6	625+650	BHS	+	
7	633+390	BHS	+	
8	635+330	RHS	T	

Table 115. Identified Junctions for improvements

From the above photographs it is clear that:

- There are no Informatory sign boards of access roads meeting the Project Stretch.
- No provision for acceleration and deceleration lanes for merging and diverging traffic from minor road.
- Poor/ Improper visibility at junction due to steep gradient.

It is suggested that apart from desired geometric improvements, following provisions shall be provided at minor junctions for safety of road users:

- Stop and Give Way signs, as per IRC 67: 2012 as per Figure 113.
- Cautionary sign boards for identification of access roads, as per IRC 67: 2012 as per Figure 114.
- Speed Breakers on side roads as per IRC84: 2019 as per Figure 115.
- Proper Road Markings for turning Traffic, as per IRC 35: 1997 as per Figure 116.
- Provision of acceleration and deceleration lane.
- Availability of visibility tunnel as per Figure 117.

In addition to above design standards, relevant marking and sign board shall be provided for the speed breakers, as per IRC: 35 and IRC: 67 respectively. Typical marking for speed breakers and signboard of speed breaker is shown in the figures below:

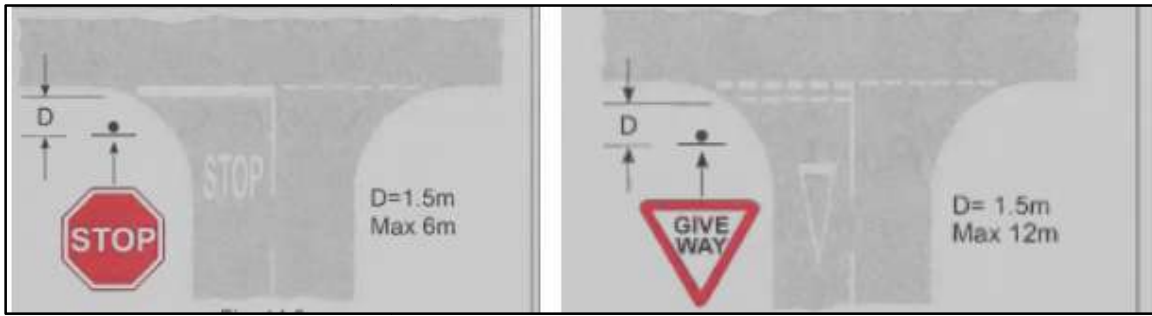


Figure 113. Stop and Give Way Sign boards as per IRC 67-201



Figure 114. Cautionary sign boards as per IRC: SP: 84-2019

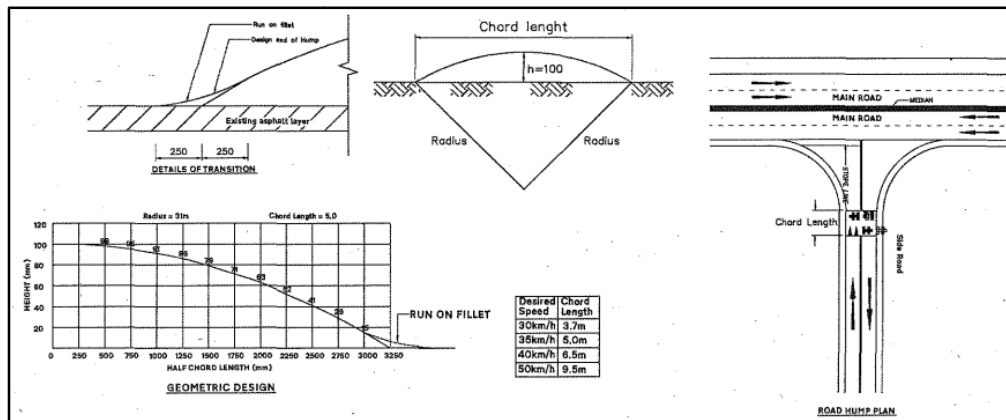


Figure 115. Design Details of Speed Breakers as per IRC: SP: 84-2019

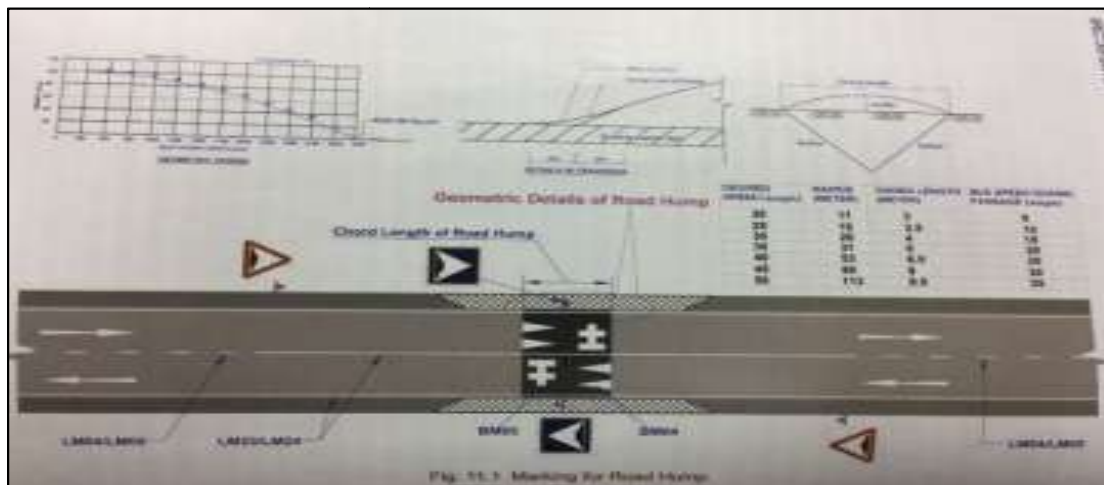


Figure 116. Proper Road Markings for turning Traffic, as per IRC 35: 1997

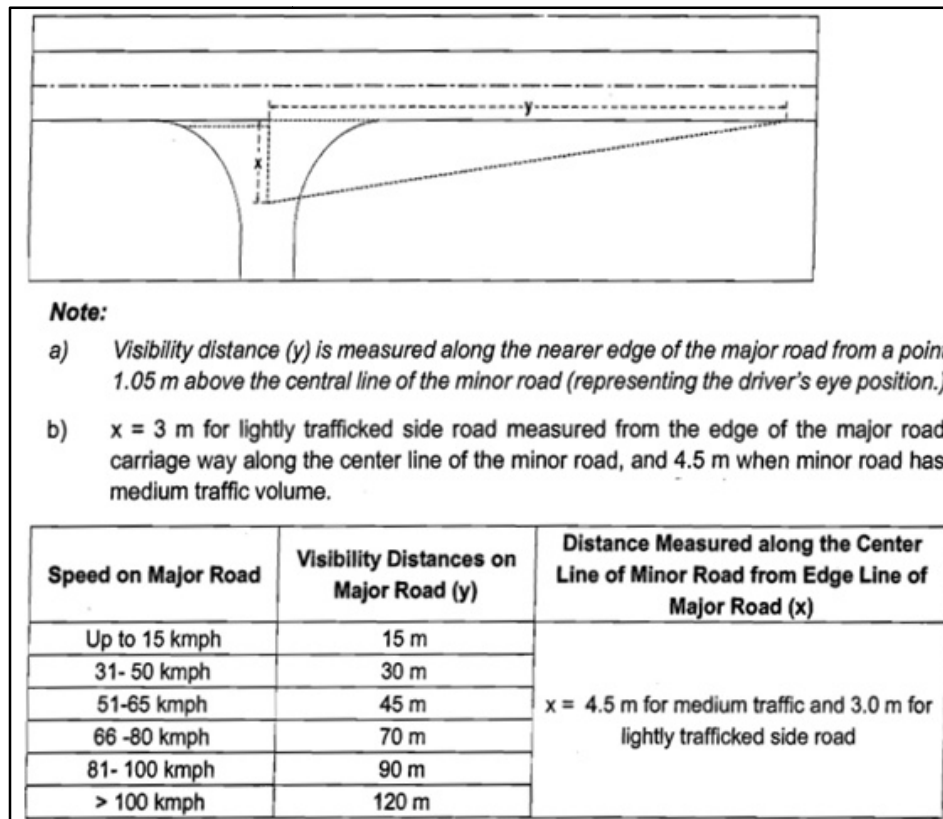


Figure 117. Present the visibility funnel

Note: - All shortcomings related to signages, Markings etc observed in year 2018 are under implementation at the level of authority and will be completed prior to handover to InvIT.

6.2.2. DEFICIENCIES IN SAFETY BARRIERS

The following are the various type of deficiencies found along the project stretch.

- Safety Barriers along high embankment sections:** As per the site visit, high embankments on stretch are present with no protection work done. So it is recommended that safety barrier as per IRC: 119-2015 shall be provided at these locations. Such locations are tabulated in Table 116.
- Safety Barriers along built-up areas sections:** As per the site visit, it observed that built-up areas on stretch are present with no protection work done. So it is recommended that safety barrier as per IRC: 84-2019 to be provided at these locations. Such locations are tabulated in Table 116.

Some of the Photographs related to deficiencies in safety barriers as observed presently are as follows:



Figure118. Photographs of deficiencies in safety barriers 604+400 and 622+300



Figure 119. Photograph of deficiencies in safety barriers 627+900

The details related to additional safety barriers are given in the next table.

Sl. No.	Chainage (km)		Length (m)	Location	Type of Barrier
	From	To			
1	634.4	638.6	4.2	BHS Shoulder	W-Beam Barrier
2	635	635.6	0.6	BHS Shoulder	W-Beam Barrier
3	632.3	632.7	0.4	BHS Shoulder	W-Beam Barrier
4	630.4	630.6	0.2	RHS Shoulder	W-Beam Barrier
5	628.7	628.9	0.2	LHS Shoulder	W-Beam Barrier
6	627.9	628	0.1	BHS Shoulder	W-Beam Barrier
7	622.3	622.8	0.5	RHS Shoulder	W-Beam Barrier
8	619.2	619.4	0.2	BHS Shoulder	W-Beam Barrier
9	615.6	615.8	0.2	RHS Shoulder	W-Beam Barrier
10	607	607.2	0.2	BHS Shoulder	W-Beam Barrier
11	604.4	605	0.6	LHS Shoulder	W-Beam Barrier
12	601.18	602.4	1.22	LHS Shoulder	W-Beam Barrier
13	604.15	605	0.85	LHS Shoulder	W-Beam Barrier
14	605.3	605.8	0.5	LHS Shoulder	W-Beam Barrier
15	607.43	607.7	0.27	LHS Shoulder	W-Beam Barrier
16	609.78	610.4	0.62	LHS Shoulder	W-Beam Barrier

Sl. No.	Chainage (km)		Length (m)	Location	Type of Barrier
	From	To			
17	612.75	613.4	0.65	LHS Shoulder	W-Beam Barrier
18	613.98	614.4	0.42	LHS Shoulder	W-Beam Barrier
19	616.45	617	0.55	LHS Shoulder	W-Beam Barrier
20	619.7	620.75	1.05	LHS Shoulder	W-Beam Barrier
21	626.9	627.3	0.4	LHS Shoulder	W-Beam Barrier
22	631.5	631.85	0.35	LHS Shoulder	W-Beam Barrier
23	632.75	633	0.25	LHS Shoulder	W-Beam Barrier
24	638.62	639	0.38	LHS Shoulder	W-Beam Barrier
25	639.4	639.7	0.3	LHS Shoulder	W-Beam Barrier
26	621.6	621.7	0.1	LHS Shoulder	W-Beam Barrier

Table 116. Identified Locations along the Project Stretch for Safety Barriers

The next figure given below, shows configuration/layout of crash barrier as per IRC- SP: 84 -2019.

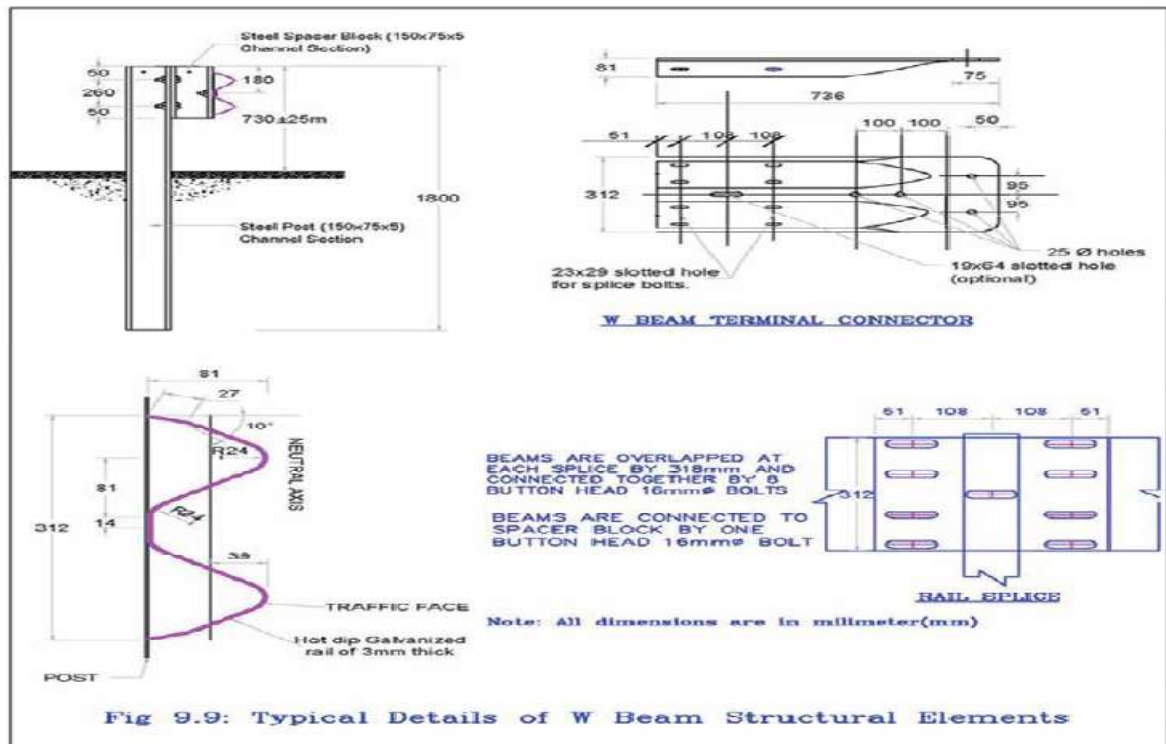


Figure 120. Typical Details of W-Beam as per IRC 84-2019

6.2.1. CURVES DELINEATION

It was also observed that along the length of curve portion delineators/Sign board/ and Chevron marking have not been properly provided. It is recommended that proper sign marking shall be provided in accordance with IRC: 79-1981.

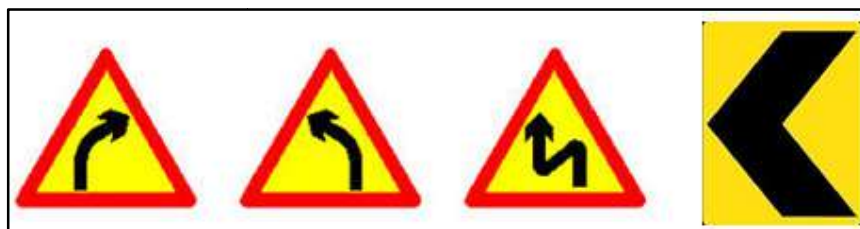


Figure 121. Curve sign boards and Chevron sign boards

Some of the photographs related to visibility (as mentioned above) along curves as observed are as follows:



Chainage : 604+720

Chainage : 611+450



Chainage : 615+600

Chainage : 628+130

Figure 122. Photographs of deficiencies in curves delineation

The details related to the locations of such curves with are given in Table 117.

Sr. No	Chainage	Reason
1	604+720	No signage
2	608+420	No signage
3	611+450	No signage
4	615+600	No signage
5	628+130	No signage

Table 117. Locations of Curves along the Project Stretch

6.2.1. U-TURN AND MEDIAN OPENING

Median Opening should generally be limited to intersections with public streets or major generators of traffic and should not be accepted for individual business needs. Their number should be kept to the minimum. During road safety audit improper u-turn and median opening have been observed.

Some of the Photographs showing Improper/Unauthorized Median Cuts along the Project Stretch are shown below.



Chainage : 642+000

Chainage : 643+700

Figure 123. Photographs of improper medians cuts



Figure 124. Photograph of improper medians cuts at 634+200

The details related to the locations of such cuts are given in the next table.

S.No.	Chainage (km)	Problems and Improvement Strategies
1	634+200	Improper layout cut (Needs to be closed)
2	642+000	Improper layout cut (Needs Design Improvement)
3	642+900	Improper layout cut (Needs Design Improvement)

Table 118. U-Turn – Median opening

These type of Improper Median Cuts along the Project Stretch should be reconstructed as per IRC:84 by reconstructing the median to ensure the safety of road users. If necessary then proper median cuts should be provided as per IRC 84: 2019.

6.2.1. UNAUTHORIZED RAMPS AND ACCESSES

Number of unauthorized ramps was observed along the project stretch at places where the majority of farmers access to their fields and un-paved road have been developed. Most of the unauthorized ramps are leading towards agricultural fields, local residences, roadside restaurants, etc.

Some of the Photographs showing Unauthorized Ramps are shown below.



Figure 125. Photographs of unauthorized ramps

The details related to the locations of such ramps are given in the next table below.

Chainage (km)	Side	
	LHS	RHS
601+000	4	4
602+000	3	4
603+000	2	2
604+000	2	3
605+000	2	2
606+000	2	2
607+000	3	2
608+000	2	3
609+000	1	0
610+000	0	0
611+000	0	2
612+000	0	1
613+000	0	0

Chainage (km)	Side	
	LHS	RHS
614+000	0	1
615+000	0	3
616+000	1	5
617+000	3	4
618+000	1	2
619+000	1	1
620+000	2	2
621+000	1	2
622+000	3	2
623+000	2	3
624+000	1	5
625+000	2	1
626+000	0	1
627+000	0	2
628+000	3	3
629+000	2	1
630+000	1	1
631+000	2	1
632+000	3	3
633+000	2	3
634+000	1	2
635+000	2	2
636+000	0	0
637+000	2	1
638+000	1	1
639+000	1	1
640+000	2	1
641+000	0	0
642+000	0	0
643+000	0	0
644+000	0	0
645+000	0	0
646+000	0	0

Table 119. Number of Unauthorized Ramps

A properly designed T or Y-Junction might be recommended for those ramps which lead to small habitations and groups of agriculture fields where the number and type of vehicles can justify their cost. Also, some of those ramps should be closed if alternatives are identified to access to and from the highway. In any case, no particular works related to this issue will be recommended in this study.

6.2.1. IMPROPER PEDESTRIAN CROSSINGS

It is observed that required pedestrian crossing facilities have not been provided and in the absence of these, the local population devise their own unauthorized ways to facilitate crossing the highways affecting the safety of road users and their own safety.

Some of the Photographs showing lack of Pedestrian Crossing along the Project Stretch are shown below:



Chainage : 642+000



Chainage : 616+800



Chainage : 627+300



Chainage : 629+000



Chainage : 637+800

Figure 126. Photographs of Improper Pedestrian Crossing along the Project Stretch

According to IRC SP 88-2010 there is a strong necessity and desire for pedestrians to cross the road all along it and suitable provision must be designed to allow for it at appropriate locations with proper pedestrian crossing marking. Controlled form of crossing shall be achieved through provision of Zebra Crossings, whether at signalized intersection or pedestrian actuated signal. When located and used correctly, these can be effective in reducing pedestrian-vehicular traffic conflicts.

S. No.	Chainage (km)	Side	Reason
1	601+400	BHS	Open Median (Pedestrian Crossing not provided)
2	603+650	BHS	Open Median (Pedestrian Crossing not provided)
3	604+950	BHS	Open Median (Pedestrian Crossing not provided)
4	611+300	BHS	Open Median (Pedestrian Crossing not provided)
5	613+100	BHS	Open Median (Pedestrian Crossing not provided)
6	616+800	BHS	Open Median (Pedestrian Crossing not provided)
7	618+700	BHS	Open Median (Pedestrian Crossing not provided)
8	620+500	BHS	Open Median (Pedestrian Crossing not provided)
9	622+100	BHS	Open Median (Pedestrian Crossing not provided)
10	623+800	BHS	Open Median (Pedestrian Crossing not provided)
11	625+650	BHS	Open Median (Pedestrian Crossing not provided)
12	627+300	BHS	Open Median (Pedestrian Crossing not provided)
13	629+000	BHS	Open Median (Pedestrian Crossing not provided)
14	633+400	BHS	Open Median (Pedestrian Crossing not provided)
15	634+700	BHS	Open Median (Pedestrian Crossing not provided)
16	637+800	BHS	Open Median (Pedestrian Crossing not provided)
17	642+000	BHS	Open Median (Pedestrian Crossing not provided)
18	643+700	BHS	Open Median (Pedestrian Crossing not provided)

Table 120. Location of Improper Pedestrian Crossing along the Project Stretch

6.2.2. DEFICIENT SIGNAGE ALONG THE HIGHWAY

Provision of proper signage throughout the highway stretch at various chainages is required showing

- Exit and Entry Sign
- Directional Sign Boards for Important places such as Hospitals, Hotels, Petrol pump, etc.
- Warning Sign Boards for U-turn, sharp curves, etc.



Chainage : 623+800

Chainage : 629+000

Figure 127. Photographs of Improper signage

The details related to the locations of such improper signage are given in the next table below.

Sr. No	Chainage	Signage improvement	Side
1	609+600	Entry and exit sign board	BHS
2	610+750	Exit sing board	RHS

Sr. No	Chainage	Signage improvement	Side
3	616+600	Entry sign board	RHS
4	616+900	Exit sign board	LHS
5	617+800	Entry and exit sign board	BHS
6	623+800	Built up area	RHS
7	629+000	Entry and exit sign board	BHS
8	629+900	Entry and exit sign board	BHS
9	635+200	Entry and exit sign board	BHS
10	636+300	Entry and exit sign board	BHS
11	639+900	Entry and exit sign board	BHS

Table 121. Location of Improper signage and entry boards

6.3. PROVISION OF SERVICE ROADS/SLIP LANES

Service road is necessary in built up area to segregate slow moving & fast moving vehicle. It is also required to achieve the access to the highway. A service road with properly designed entry and exit ramp from service road and from highway avoid direct conflict of merging of traffic.

- Slow /local moving traffic creating hindrance to the free movement of vehicles.
- Substantial wrong side movement which can be dangerous on a highway stretch with the vehicles coming at high speed.
- Substantial pedestrian movements.
- Unavailability of street lights creating these portions highly dangerous at night.



Chainage : 640+400

Chainage : 606+400

Figure 128. Service road required

Considering the above safety hazards, the construction of a service road is recommended for the following chainages as per Table 122.

S. No.	Chainage (km)		Side	Length (m)	Reason
	From	To			
1	606+400	606+450	LHS	50	Service road need extension
2	636+900	637+500	RHS	600	Service Road Required Built up area ahead
3	636+900	637+500	LHS	600	Service Road Required Built up area ahead
Total Length				1250	

Table 122. Service Road Requirement

6.4. PROVISION OF ATMS

The following Specifications and Standards shall be applied in addition to 'Manual on Specifications and Standards for Highways' published as IRC: SP: 99-2013 with all amendments and additions till date. Provision of ATMS in latest NHAI policy in vogue (currently, NHAI Policy Circular-Technical (214/2016) dt.15.09.2016 is being practiced which may be amended in due course of time) will govern the implementation. Latest Policy / Circular at the time of execution shall prevail.

The ATMS implementation shall cover design, supply, installation, commissioning and operation and maintenance of Advanced Traffic Management Systems.

The system would include out-door equipment including variable message sign systems, vehicle detection speed system, close circuit TV camera (CCTV) system, and transmission system. The indoor equipment would comprise a large display board, central computer (with Network Management System – NMS), CCTV monitor system, call center system in a control center with uninterrupted power supply. The systems shall meet following objectives:

- Smooth and uninterrupted traffic flow
- Enhance road safety
- Real time information and guidance to users
- Emergency assistance round the clock
- Alerts for abnormal road and weather conditions
- Reduced journey time and inconvenience

The system configuration shall have the following sub-system:

- Variable Message Sign system
- Video Surveillance system
- Video Incident Detection System (VIDS)
- Network /Communication Infrastructure
- ATMS Control Centre

ATMS shall provide the following facilities to Highway users:

- Make emergency calls to Control Centre in case of accidents, breakdown, fire and ambulance.
- Pre-warn the Highway users about unusual condition on the road.

ATMS shall provide the following information/data to traffic managers for efficient and effective handling of traffic:

- Information regarding location of any incident, incoming calls, help required and messages to be passed to third parties.
- Information regarding traffic congestion, speed and weather conditions.

ATMS shall provide the following controls to traffic managers:

- Change the variable message signs from the Control Centre.
- Mobilize the movement of ambulances, cranes & patrolling vehicles.

ATMS shall provide online recording and reviewing of the voice & visual information for record and analysis.

Value Added Systems in information dissemination to users of the Project may be taken up in future. These shall include the following:

- Value Added Systems in the form of real time information on traffic conditions, unusual events, congestion levels, weather conditions etc.; to facilitate project users as also the operator.
- Through relevant websites including that for the Project SPV/Concessionaire.
- Subscription based alert systems.

- Dedicated TV channels pertaining to traffic movement.
- Tie ups with FM radio channels or creation of dedicated AM radio channel.
- Dedicated Toll Free Telephone Systems.

6.4.1. VIDEO SURVEILLANCE SYSTEM (CCTV)

6.4.1.1. PURPOSE AND GENERAL INFORMATION

The purpose of the Video surveillance system is to monitor specific areas of the Highway remotely from the CCR by use of cameras installed at such critical junctions. This shall help in managing incidents.

The system shall also record and store video for analysis and future reference.

The functional and technical requirement of the Closed Circuit Television (CCTV) System to be used as a sub-system of ATMS Implementation shall include fixed cameras and PTZ cameras.

6.4.1.2. LOCATION

The system monitors vehicular and other road related activity along the highway stretch. CCTV system is required to ensure effective surveillance of the target road section and related surrounding areas and generate a tamperproof record for post event analysis.

The software supplied and installed at the ATMS Control Centre to operate the CCTV systems shall be able to integrate with/Export data to and import data from the ATMS unified database located in ATMS Control Centre.

6.4.2. VIDEO INCIDENT DETECTION SYSTEM (VIDS)

6.4.2.1. PURPOSE AND GENERAL INFORMATION

The purpose of the VIDS is to sense, detect and record the incident. The system shall be an intelligent image detection using camera. The VIDS shall have inbuilt intelligence to ascertain when the image has meaningfully deviated from the standard image originally recorded. A pilot run for VIDS is suggested before implementation.

The specification, functional and technical requirement of the CCTV based VIDS to be used as a sub-system of ATMS implementation, for automatic detection of incidents and generation of local visual alerts. It also includes the associated visual alerts in the form of flashing lights which are connected to and activated by the VIDS. The system offered shall have the capability to also operate in low light conditions normally experienced during night. In very poor visibility conditions such as during winter fog/smog, the system shall detect the condition of poor visibility and generate visual alerts. Further it shall raise an alarm if signal/image quality is too poor to reliably process.

6.4.2.2. LOCATION

VIDS is established at strategic locations. The software supplied and installed at the ATMS Control Centre to operate the CCTV-based VIDS shall be able to integrate with/Export data to and import data from the ATMS unified database located in ATMS Control Centre.

6.4.3. OFC BACKBONE

6.4.3.1. PURPOSE AND GENERAL INFORMATION

The purpose of the OFC backbone is to transport voice, data, LAN and video services between the field equipment and CCR.

As the transmission system would be used as a backbone network, the system shall have following characteristics:

- High Availability
- High Reliability
- Dual ring configuration
- Easy to install and operate
- Scalability
- High degree of flexibility with respect to the types of interfaces

6.4.3.2. LOCATION

OFC shall be laid all through the Highway. It may be laid on RHS or LHS of the main carriageway or in the median. Lateral elements shall be connected on OFC or copper.

6.4.4. NETWORK MANAGEMENT SYSTEM (NMS)

6.4.4.1. PURPOSE AND GENERAL INFORMATION

This system provides connectivity between ATMS Control Centre and outdoor equipment such as Emergency Roadside Phones, Variable Message Signs, Mobile and fixed CCTV cameras, Speed Displays, ATCC, Mobile Weigh in motion Stations, etc.

It also provides the external data connectivity required between the ATMS control centre and the NHAI ATMS Cloud as well as between the ATMS control centre and the NHAI ATMS Master & relevant Regional Control Centers.

The Fiber Optic Transmission System shall be equipped with a user friendly, Microsoft, Windows-based Network Management System (NMS). The NMS shall allow the operator to manage and monitor multiple sub-networks in an efficient way.

The NMS shall have the following functionality: network configuration, configuration of services, monitoring, diagnostics, activation-deactivation of interface modules, bandwidth allocation, alarms and event logging and graphical network representation.

The network management hardware shall consist of a Personal Computer, which at the time of installation is the current industry standard. The NMS architecture shall be based on Employer-server technology. It shall be possible to connect multiple active Employers to the NMS server allowing network management from multiple and/or remote locations or by multiple users.

6.4.4.2. LOCATION

Software at CCR.

6.4.5. CENTRAL CONTROL ROOM (CCR)

6.4.5.1. PURPOSE AND GENERAL INFORMATION

The purpose of the CCR is to monitor the Highway and to provide information to the road user. The CCR also houses the central servers and data processing equipment.

The CCR shall provide the real-time information and assistance to the Highway users, collect data for the use of Highway authorities and to monitor and control the Traffic on the Highway as per the requirements.

The CCR shall be designed for round the clock operations of monitoring, on-line information acquisition and processing the same for decision making. The CCR shall be the repository of all the data acquired from the field and their processing, storing, and archiving. All the information for real time monitoring of Highway shall be generated at the CCR and the relevant information shall be disseminated to the users through VMS, and to O&M teams through mobile radio.

ATMS Control Centre would be the facility from where all the activities of the ATMS would be controlled. ATMS Control Centre would primarily comprise of the in-door portion of CCTV, VMS, and other support systems. All the aforementioned subsystems shall preferably reside in a dedicated permanent structure with adequate floor area to house the required man power and equipment. Where ever such a permanent floor/building/structure cannot be made available, the ATMS Control Centre shall be housed in temporary portable cabins.

6.4.5.2. LOCATION

There shall be one CCR located in any toll plaza.

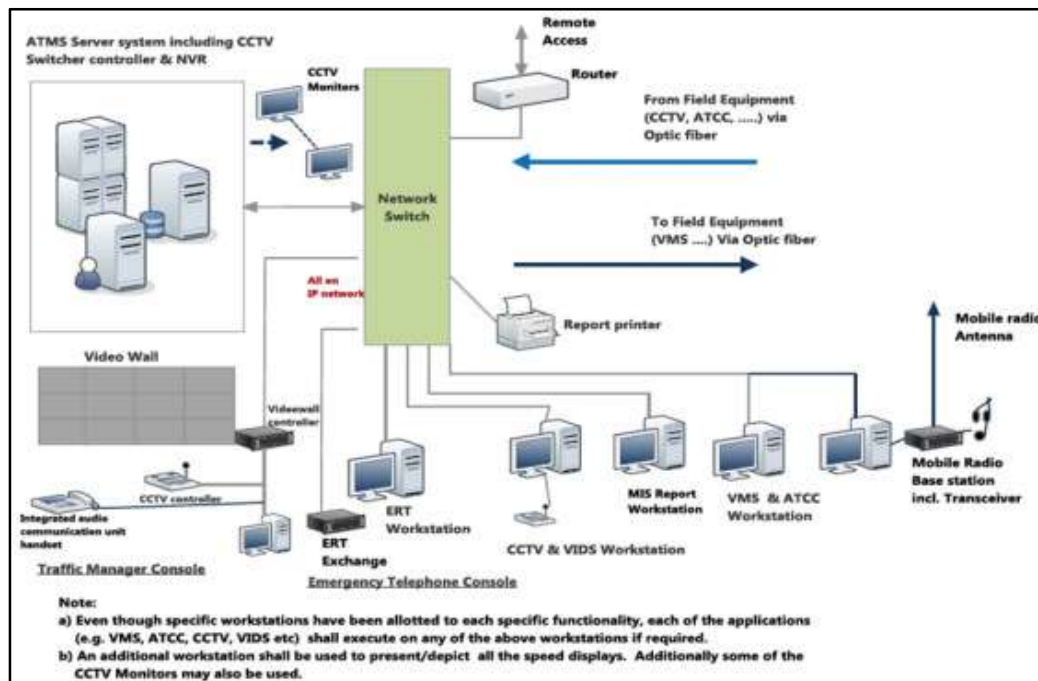


Figure 129. CCR System Schema

6.4.6. CONCLUSIONS AND RECOMMENDATIONS

ATMS system should be provided as per its requirement is shown below in the following table:

S.No	Item Description	Unit	Req. Qty	Requirement
1	Video Surveillance system	Nos.	45	<p>Requirement:-To monitor traffic conditions (Day & Night) on the highway including junctions with considerable traffic, populated village town sections / road junctions and vulnerable sections of the highway. Range of 1 km on the highway (i.e. 1 km on either side).</p> <p>Location:-Closed Circuit Television (CCTV) System to be used as a sub-system of ATMS Location of CCTV Cameras shall be within the stretch as verified by NHAI.</p> <p>1. Built up sections 2. Major Junction 3. Toll Plaza 4. Built up section</p>
2	Video Incident Detection System (VIDS)	Nos.	5	<p>Requirement:-Detection range from Camera location: 200 m (Day and night) Provision of warning with flashing lights: a) 100 m before the area of detection b) 200 m before the area of detection to warn arriving vehicles To be located such that detection range is 200 m or less</p> <p>Location:- Blind corner of highways, highway locations such as vulnerable merger points of Service road with the main carriageway and Junctions. (Location can be finalized in consultation with IE and NHAI at the time of execution).</p>
3	Network /Communication Infrastructure	Nos.	1	<p>Requirement:-Communications System utilizing Optic fiber, point-to-point wireless links, GSM/GPRS and Wi-Fi Communications linked to ATMS Control Centre shall be provided depending on equipment communication criteria.</p> <p>Location:-At plaza location</p>
4	ATMS Control Centre	Nos.	1	<p>Requirement:-One ATMS Control Centre including the equipment (hardware, software, and local networking) shall be developed on Project Stretch</p> <p>Location:-At plaza location</p>
5	Vehicle Actuated Speed Display	Nos.	6	<p>Requirement:-Detection range from Camera location: 200 m (Day and night) Provision of warning with flashing lights: a) 100 m before the area of detection b) 200 m before the area of detection to warn arriving vehicles To be located such that detection range is 200 m or less</p> <p>Location:-At entry and exit of highway (with VMS) (Location can be finalized in consultation with IE and NHAI at the time of execution).</p>
6	Power supplies for field equipment	Nos.	1	<p>Requirement:-Working on Mains power supported with back-up (largely on renewable energy) to facilitate 24 X 7 operation and for the ATMS Control Centre working on Mains power supported by UPS and Diesel generator set of adequate capacities, to facilitate 24 x 7 operation.</p> <p>Location:-Toll plaza and Stretch portion</p>

Table 123.ATM requirements (as per ATMS policy 2020)

Note:-

Additional financial implications due to improvement of road safety features are considered in Cost estimate/BOQ for various items viz: safety issues on minor junctions along project stretch, deficiencies in safety barriers, curves delineation, u-turn and median opening, unauthorized ramps and accesses, deficient signage along the highway, Provision of service road/slip lanes and Provision of ATMS .

7. TOLL PLAZA

7.1. TOLL SURVEY

Toll on this Project stretch of NH 27 is currently being collected at one location – km 602+750, Khemana Toll Plaza. This stretch has been constructed under BOT (Annuity) tenure up to 24/03/24, and toll is being collected by NHAI through open competitive bidding.

The project stretch of this Plaza starts from km 601+000 and ends at km 646+000 with total length of 45.000 km.

TMS and ETC System

Toll Management System (TMS) is installed and operated.

Toll Lanes

There are total 8 operational lanes with (6) are ETC lanes.

TMS application is used to generate toll slip for the customers and weekly & monthly reports.

Equipment like OHLS, UFD and Barrier are present in the lanes and lanes are in working condition.

The booth condition is okay.

Exemption log is maintained by the TC.

Toll lane controller (TLC) is situated in the tunnel below each toll booth.

Paper smart cards are used and monthly passes are verified by vehicle number.

ETC Lanes

There are ten ETC lanes at toll plaza RFID readers are used to detect ETC tags.

AVC - There is AVC at the toll plaza; hence, transactions are validated

FASTAG

FasTag is a device that employs Radio Frequency Identification (RFID) technology for making toll payments directly from the prepaid account linked to it. It is affixed on the windscreen of your vehicle and enables you to drive through toll plazas. FasTag has validity of 5 years and after purchasing it, it need to recharge/ top up the FasTag as per requirement.

FasTag offers near non-stop movement of vehicles through toll plazas and the convenience of cashless payment of toll fee with nation-wide interoperable Electronic Toll Collection Services.

Presently existing toll plaza having 06 ETC dedicated lanes (with RFID) and 2 lane (for cash and RID transitions)

7.2. CURRENT CONDITION

7.2.1. KHEMANA TOLL PLAZA

Existing toll plaza including infrastructure, toll management system and operational activities were reviewed during site visit. Photographs of toll plaza are given below:



Figure 130. Photograph of Khemana Toll Plaza



Figure 131. Aerial photograph of Khemana Toll Plaza

- It is situated at km 602+750 on NH27. There are 4+4 (total 8) tolling lanes including two extra wide lanes at the sides. Two lanes are hybrid (semi-automatic+ETC) and Six are ETC-dedicated lanes one in each direction with RFID readers and electronically operated boom barriers with synchronized traffic lights.
- Traffic islands exist as per specifications. Width of toll lanes are adequate and traffic islands accommodate toll booth with protective barrier as per codal provisions i.e. IRC SP-84.
- There are eight toll booths with adequate space for operator seating, computer, printer, cash box, etc., and CCTV cameras are installed.
- Canopy has been provided covering toll booths with adequate vertical clearance.
- Weigh in motion facilities have been provided in four lanes. Static weigh bridges have been provided in each direction.
- Traffic signs, road markings, lighting, water supply, and firefighting system have been provided as per relevant codes.
- There is an Administrative Toll Office with an adequate control room.
- TMS (Toll Management System) has been installed and is working well.
- There is a tunnel under the lane system for movement between Administrative building and toll booths in each toll lane and all electric connection, cabling etc. are adequate.

7.2.2. TOLL COLLECTION AND MANAGEMENT SYSTEM

The toll collection is manual and ETC. The system shall include:

- Dedicated ETC lanes with RFID based system
- Manual Collection/Cash collection in Hybrid lanes and Through RFID in ETC lanes
- Cash Reconciliation module
- Transaction Validation and Audit
- Management Information System (MIS) and Reports
- CCTV Surveillance System on Lanes, Booths, Plaza area
- Real Time connectivity with the Toll plaza office through dedicated and secured internet connection
- Real Time video monitoring display facilities along with network connectivity
- RFID Lane with Automated Vehicle Classification System
- Lane software integrated with all equipment
- Lane system having allowing Toll collectors to Log In and process transactions
- Lane system record and track all transactions shift wise / collector wise
- Lane system store all transactions in Lane controller, independent AVC (iAVC) with inbuilt memory and battery and send all transactions to Plaza server

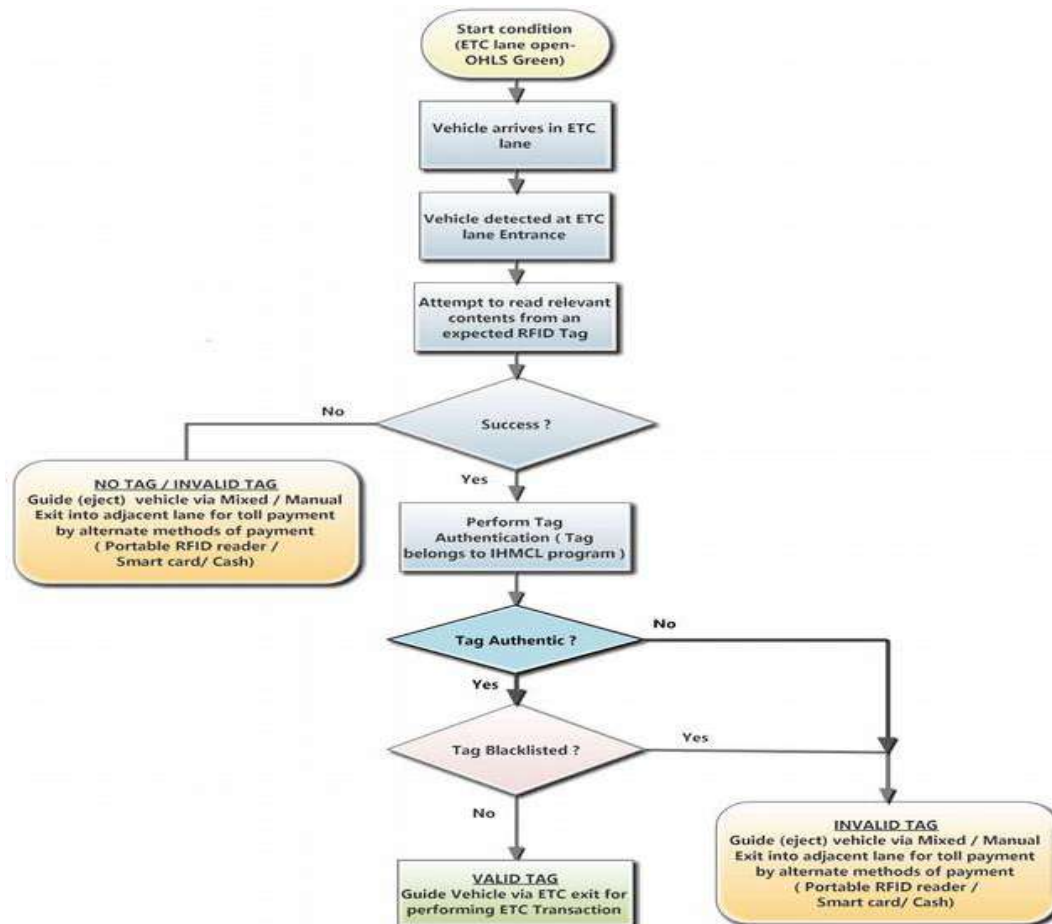


Figure 132. A. Toll Collection System through ETC lane with RFID system

Indicative List of Equipment / Software / Licenses

a) Plaza and Lane level are Specific Equipment (Common)

- Plaza Server
- Adequate Server Rack, with fans and adequate power points and cable management
- Admin / Audit Workstation – 6 Nos.
- Network Laser Printer (Black & White) - 2
- Network Switches for Lane & Plaza system(s)
- Intercom Slave units
- UPS for plaza system
- Provision of Dedicated Internet connection (minimum 2Mbps link) with Data Center.
- Firewall, IPS etc as per requirement for data security
- PTZ and Dome Cameras

b) Software/ Licenses

- Toll Management System with all features fully integrated with all other systems / peripherals.
- Server Operating Systems – Preferably Open Source (Linux / Unix)
- Lane / Admin Workstations Operating System Licenses
- MS-Office on Admin Workstations.
- Relational Data Base Management System (RDBMS)
- Antivirus and Anti-Spam
- Integration with Control Center for Real Time Data & Video Feed Transfer

c) Toll Lane Equipment for Hybrid Lane

- Toll Lane Controller with required software/ licenses.
- Readers for prescreening and Tag identification
- Readers for transaction processing
- Independent Automatic Vehicle Classification System (iAVC)
- Lane Software and Licenses
- Transaction Signal / Traffic Light
- Overhead Lane Signal (OHLS)
- Toll Fare Indicator / User Fare Display ix. Automatic Boom Barrier
- Incident Capture Camera xi. Lane and Booth Camera
- License Plate / Automatic Number Plate Reader Camera
- Toll Lane PC / Workstation
- Fog Light
- Violation Light & Violation Alarm
- UPS for Toll Lane Equipment
- Toll Lane Monitor
- Customized Key Board
- Thermal Receipt Printer
- Intercom Slave Unit
- Cash Tray
- Networking & Cabling for data and power
- Data storage, backup and retrieval of entire data being created on the plaza

7.3. PROBLEMS

- ETC-dedicated lanes are installed side by side at the center of the Plaza (inner lanes), consequently it would make more difficult to provide reversible lanes to this Plaza.

- Toll plazas have been provided with WIM system for checking and preventing overloading of vehicles but separate space for holding off loaded goods from overloaded vehicles is not available.

7.4. SEGMENTATION OF VEHICLES ACCORDING TO TYPE OF RATES

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commercial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
No. of Monthly Passes	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
All types of Single Entry	58.8%	79.9%	83.0%	81.2%	96.1%	76.1%
Multiple Entry	2.4%	8.8%	12.1%	8.2%	2.3%	17.4%
Reuse of Multiple Entry Ticket	0.1%	0.3%	0.1%	0.0%	0.0%	0.0%
Reuse of Monthly Passes	2.8%	0.0%	0.1%	0.0%	0.0%	0.0%
Concession Entry/LDV's	0.5%	2.7%	2.5%	2.9%	0.9%	4.4%
Exempted	35.4%	8.3%	2.2%	7.7%	0.6%	2.1%

Table 124. Segmentation of vehicles according to Type of Rates (Khemana)

Source: Past toll collection data from PIU

7.5. CONSIDERATIONS ABOUT TOLL PLAZA CAPACITY

The number of existing lanes in the toll plaza together with their level of automation allows estimating the service time and thus the capacity of the plaza to manage present and future traffic.

An important parameter to determine traffic capacity of toll plazas is the actual number of vehicles that can be serviced by a particular lane in one hour. According to IRC: SP:84-2019 the following capacities are suggested:

- Semi-Automatic lane: 240 vehicles/hour
- ETC dedicated lane: 1200 vehicles/hour

But the experience indicates that above figures are difficult to meet even when the systems are working at perfection. In fact, drivers and tolling staff behavior and the level of efficiency of the systems at every moment will substantially reduce those figures.

Considering a complete manual process of tolling (that still can be seen at certain plazas and at certain times) up to the most efficient ETC system the following range of capacities could be considered for different scenarios:

- Manual/Semi-automatic lanes: 80 – 130 – 180 – 240 vehicles/hour
- ETC dedicated lanes: 600 – 750 – 900 – 1200 vehicles/hour

In the present study, it was observed that tolling systems in general are operating at normal level, but to be on conservative side, the estimations will not consider the maximum number of vehicles from above ranges.

Consideration is also given to current usage of ETC lanes/system at toll plazas as there is no clear statistic about the number of vehicles that are currently using ETC at each and every toll plaza; however, nationwide estimations arrive to maximum range of ETC usage of 60-75% with FASTAG. NHAI has recently instructed to convert all normal lanes to ETC mode through Radio Frequency Identification Device (RFID). In any case, it is important that the percentages of ETC users increase rapidly with time

as it will permit to the existing toll plazas to manage growing traffic more efficiently and without continuous increases of the number of lanes.

In the present study, it is considered that current usage of ETC is 75% and it will be growing at an additional 0.25% for the following years to reach 85 to 95% usage of ETC in 20 years. It should be noted that it is not considered any change/improvement of efficiency due to the conversion of lanes to ETC mode, which will make the following estimations to be conservative.

Final consideration refers to another recommendation from IRC: SP: 84-2019 which states that toll plazas shall be designed for projected peak hour traffic of 20 years.

KHEMANA TOLL PLAZA		2020	2040
AADT (tollable n° vehicles)		15028	31089
Estimated Peak Hour Traffic (n° vehicles)		799	2,006
Percentage of ETC users		75%	95%
Number of vehicles passing normal lanes		200	100
Number of Vehicles using ETC dedicated lane		599	1906
N° of ETC lanes required based on capacity (vehicles/hour)	600	1	3
	900	1	2
N° of normal lanes required based on capacity (vehicles/hour)	80	3	2
	130	2	1
	180	1	1

Table 125.Khemana Toll Plaza lanes capacity estimation

According to above table, current number of lanes (6 ETC dedicated lanes + 2 Normal lanes) is practical to cope up with the potential peak hour traffic, estimated for 2020 and it may face a short term capacity problem if tolling systems do not work at an adequate level. In case we consider the directional split of the peak hour traffic, 55% and 45%, one of the directions could compromise to meet appropriate service times with current lanes configuration. For year 2040, and considering traffic estimations and a 95% usage of ETC lanes by drivers.

7.6. RECOMMENDATIONS

- Today, this toll plaza is closed to its capacity to manage peak hour traffic at a reasonable service level. Consequently, an expansion of the number of lanes is recommendable; moreover, as per NHAI guidelines, the minimum number of toll lanes must be six in each direction (total 12), therefore at least two lanes in each direction are required to be added. But considering a design period of 20 years (till 2040),
- it is recommended to have maximum number of ETC lanes. It can be noted that the location of the toll plaza is not suitable to accommodate extra lanes and all other required facilities and structures for its expansion. Consequently, to anticipate its expansion requirements, it is also recommendable to start as soon as possible the acquisition of land (Minimum area of land to be acquired is 6,000 sqm).
- It is recommendable that for 12 lanes of the plaza, 2 (5+5) will be ETC dedicated, and the 2 center lanes (1+1) to be reversible, which will force to shift the ETC dedicated lanes from their current position. Installation and/or upgrading of ETC systems in all lanes is recommended.
- Since overloading of vehicles has been identified as a major problem of road failures it is recommended that separate space for unloading of goods from overloaded vehicles should be provided.

- Since the existing TMS is old and its liability period is to over at the time of handover of toll plaza to the new concessionaire in year 2024 therefore, fully new system for operation of toll plaza TMS is recommended.

7.7. SUMMARY OF IMPROVEMENT PROPOSALS

Immediate investment requirements have been identified for the toll plaza as follows:

- Provision of two extra toll lane and toll booth in each direction (total 4), and modification of the two central lanes (1+1) to be reversible, shifting the position of currently existing ETC dedicated lanes.
- Up - gradation of Toll Information Systems including the installation and/or upgrading of ETC system in 12 lanes (6+6).

Bill of Quantities for the above works has been prepared and incorporated in cost estimates. And item consider for TMS for the year 2020 is as following:-

Sr No	Equipment for (12 Lane Plaza)	No. of Lanes as per proposal
1	RFID Lane Reader for Pre-screening and Tag Identification	12
2	Automatic Vehicle Classification (AVC) incl Sensors, loop and detector	12
3	Traffic Light/Transaction Signal	12
4	Overhead Lane Sign	12
5	User Fare Display	12
6	Automatic Boom Barrier	12
7	Barrier IR Sensor	12
8	Fog Light	12
9	Violation Light & Violation Alarm	12
10	Lane Incident Capture Camera	12
11	License Plate Capture Camera	12
12	Loop with Detector	24
13	Light curtain	12
14	Hand held RFID Reader	4
15	Toll Lane Monitor	12
16	Customized Key Board	12
17	Toll Fee Reciept Printer	12
18	UPS for Toll Lane Equipment	12
19	Intercom Slave	12
20	Electronic Enclosure	12
21	Toll Lane Controller	12
22	AVC Controller	12
23	Booth Camera	12
24	Plaza Server	2
25	SAN	1

Sr No	Equipment for (12 Lane Plaza)	No. of Lanes as per proposal
26	Video Server	1
27	Server Rack	1
28	POS Rfid Reader/Writer	1
29	Admin/Audit Workstation	6
30	Network Laser Printer (B&W)	2
31	Network Switch (Layer 2) for Lane and Plaza	2
32	Intercom Master	1
33	UPS for Plaza System	1
34	BarCode Reader	1
35	Internet Connectivity	2
36	Plaza Control Room Display Monitor	1
37	PTZ Camera	2
38	POS/Cashup high resolution Dome camera	4
39	MPLS Connectivity	2
40	Firewall with IPS	1
41	USB Camera for Workstation	6
42	Copier and Scanner	1
43	Wireless Router (2nos. On each side)	2
44	Set of maintenance tools including Laptop computer and other tools	1
45	Oracle database	1
46	MS-Office @ 5000 for 6 Workstations at each site (Reporting Terminal, POS, Validation and Cashup	6
47	Windows Server	2
48	Windows for Workstation	6
49	Anti-Virus and Anti-Spam @ 5000 for 6 Workstations	6
50	Lane Software	12
51	Plaza Software	1
52	IPS - Gateway	1
53	Video Management Software	16

8. MATERIAL INVESTIGATIONS

The material investigation has been carried out to identify the potential of construction materials and to assess their general availability and properties. For improvement works, the list of materials includes the following materials:

- Granular materials for lower sub-base works
- Crushed stone aggregates for upper sub-base base surfacing and cement concrete works
- Sand for filter materials and cement concrete works, sub-base and filling material
- Borrow materials for embankment, sub-grade and filling.

The information on material sources was carried out with the following basic objectives.

- Location of sources indicating chainage and location (place)
- Access to source, indicating the direction i.e. left/right of Project Stretch, approximate lead distance from the Project Stretch and type of access road.
- The quality of material along with its results and classification

During the process of investigation, due consideration has been given to the locally available materials for reducing the cost of construction. The samples from various identified sources have been collected for laboratory testing as per IRC/MORT&H 5th Revision Specifications/BIS standards.

8.1. BORROW AREA SOILS

The potentials borrow area location for sub-grade and embankment construction has been identified. Tests were performed on the samples collected from these Borrow areas for their suitability to be used in the construction of sub-grade.

The required laboratory testing was conducted as in Table 126.

S.No	Type of sample	Sampling criteria	Testing Criteria	
			Description of Test	Std code Applicable
1	Borrow Area Soil	Representative samples of various borrow area soils were collected within the reasonable lead distance	Soil Classification	IS 1498
			Sieve Analysis	IS 2720 (Part-IV)
			Atterberg Limits	IS 2720 (Part-V)
			Laboratory Compaction test	IS 2720 (Part –VIII)
			4-days soaked CBR test	IS 2720 (Part-XVI)
2	Coarse aggregate	Representative samples of various sizes of stone	Specific Gravity and Water Absorption	IS 2386 (Part-III)
3	Crushers / Quarries	Including stone dust were collected from quarries	Description of Test	Std code Application
			Aggregate impact values (AIV) Test	IS 2386 (Part-IV)
			Stripping and coating value Test	IS 6241
			Los Angles Abrasion Value (LAV) Test	IS 2386 (Part-IV)
			Combined Flakiness and Elongation index Test	IS 2386 (Part-I)

Table 126. Site Sampling and Testing Criteria

Borrow areas soils available near the project stretch fulfill the requirement to be used for construction and all the values are within the acceptable limits as per MoRT&H 5th Revision Specifications.

8.2. COARSE AGGREGATE (STONE)

Coarse aggregate samples were collected from the nearby available quarries and the required laboratory tests were carried out on the collected samples. The summary of the test results are tabulated below. The physical requirement of coarse aggregates to be adopted in road construction is also tabulated below for all pavement layers as per MoRT&H 5th Revision Specifications.

S.No	Name of Stone Quarry Area	Lead Distance up to Project road	Location Direction of Crusher
1	Ambaji - Abu road	5 km at junction Ambaji - Abu road crossing	Left side of Abu road to Palanpur
2	Shiava mines	9 km at junction Ambaji - Abu road crossing	Left side of Ambaji – Abu road crossing
3	Near Morthala on SH-11	It is located on 6.9 km away from Abu road	6.9 km right side of Abu to Palanpur road
4	Near Akrahbhatta on SH-11	It is located on 6.6 km away from Abu road to Pindwara	6.6 km right side of Abu to Palanpur NH-27

Table 127.Details showing stone source and lead

AQ. No.	Source/Location	Specific Gravity	Water Absorption (%)	AIV (%)	Coating values (%)	Soundness Test (%)
1	Ambaji-Abu road	2.74	0.30	25.6	>95%	1.95
2	Shiava mines	2.72	0.32	26.5	>95%	2.10
3	Near morthala	2.71	0.29	27	>95%	1.96
4	Near akrabhhatta	2.72	0.30	25.5	>95%	2.00

Table 128. Test Results summary of Course Aggregate (stone)

S.No	Test	GSB	WMM	Pavement Layer		
				BM	DBM	BC
1	Water Absorption	2% (max)*	2% (max)	2% (max)	2% (max)	2% (max)
2	Los Angeles Abrasion Value	-	40% (max)	40% (max)	35% (max)	30% (max)
3	Aggregate Impact Value	40% (max)	30% (max)	30% (max)	27% (max)	24% (max)
4	Combined Flakiness and Elongation Index	-	35% (max)	35% (max)	35% (max)	35% (max)
5	Striping/ Coating	-	-	95% (min)	95% (min)	95% (min)
*If Water absorption value is more than 2, the aggregate is to be tested for soundness test						

Table 129. MoRT&H 5th Revision Specifications for Coarse Aggregate in road construction

- Aggregate Impact Value (AIV), Los Angeles Abrasion Value (LAV) and Combined Flakiness and Elongations Index Value are within the limit as per MoRT&H 5th Revision Specifications to be used in granular layers and in surface layers of BC/DBM for both the sources AQ-1 and AQ-2.

- Water absorption is within the specified limit.

8.3. LEAD CHART

Following Figure shows the lead chart for the Borrow Area, Aggregate Quarry and Sand Quarry of the Project Stretch.

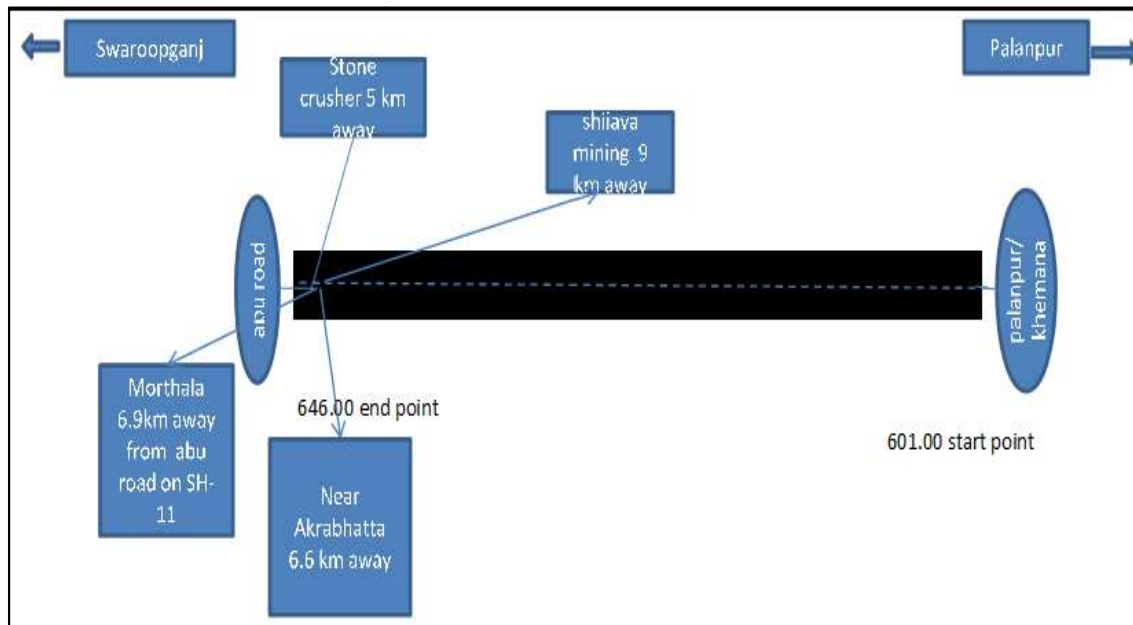


Figure 133. Lead Chart

9. COST ESTIMATE

9.1. GENERAL

The Project cost estimates have been prepared based on various items of works required such as:

- Toll Plaza Widening
- Intersections improvements
- Traffic Signs & Markings
- Service Roads/Service Lane
- Structures (Culvert)
- Bus bays & Truck Lay Bays
- New Installation of ATMS & TMS

Provision of granular sub base and WMM base courses has been considered for the service roads, Truck lay bays, Bus bays and Toll plaza. Provision of 'bituminous courses', has been considered of DBM and Bituminous Concrete for service roads, Overlaying in carriageway, pavement for Truck Terminals, Bus bays and provision of Cement Concrete pavement kept for Toll plaza lanes. Repair and Rehabilitations of existing culverts, bridges & other structures is also proposed based on the NDT Tests and Inventory of the structures.

9.2. ESTIMATION OF QUANTITIES

The quantities of major items of works have been worked out based on following:

- Site Clearance: The area considered for Site Clearance is the area within the proposed Right of Way.
- Earth Works: This item provides for roadway excavation, earthwork in embankment, sub-grade and shoulders, medians, islands including disposal of surplus earth and unsuitable material. In this stage, the construction of embankment height has been taken as per site condition. Sub-grade soil having a CBR $\geq 10\%$ will be taken from borrows area.
- The pavement quantities like GSB, WMM & Bituminous items etc. have been worked out based on Typical Cross Sections, pavement design is done based on traffic and with 10% CBR.
- The estimation of quantities for Repair & Rehabilitation is based on NDT Tests and site conditions of structures and have been worked out as per site requirement in order to maintain durability of structures and natural drainage system of project area.
- Traffic Signs and Markings: Proposed as per site requirement and the quantities have been calculated as per Design Plan and IRC standard.
- The quantities for junctions, bus bays, traffic appurtenances and other miscellaneous items have been calculated from the standard drawings.
- Based on typical cross section estimates of new construction for service road/slip roads has been prepared.
- A study of the existing structures has been carried out to ascertain the structure to be retained or reconstructed. Cost of the Repairs, Rehabilitation, and up-gradation of stretches are worked out by experienced bridge engineers.

9.3. PROJECT COST

Cost estimate was made for the following proposal suggested.

1. The pavement quantities like GSB, WMM & Bituminous items etc. have been worked out based on Typical Cross Sections, pavement design for Service roads/slip roads, Truck lay bays/bus bays done based on minimum requirement of traffic MSA.
2. Proposed Base and Sub-Base and surface Courses for Service road/service lanes.

Sub-grade	GSB	WMM	DBM	BC
500 mm	200 mm	250 mm	60 mm	40 mm

Table 130. Proposed Base and Sub-Base and surface Courses for Service road/service lanes

3. Proposed Base and Sub-Base and surface Courses for Bus bays & Truck lay byes.

Sub-grade	GSB	WMM	DBM	BC
500 mm	200 mm	250 mm	80 mm	40 mm

Table 131. Proposed Base and Sub-Base and surface Courses for Bus bays & Truck lay byes

9.4. IMPROVEMENTS PROPOSALS

Following improvement proposals have been considered based on site requirement and Road Safety Chapter.

9.4.1. IMPROVEMENT EXISTING BUS BAYS/NEW PROPOSED

- No. of new proposed Bus Bays with shelter to provide: 07nos.

Sl. No	Chainage (km)	Side	Location/Existing Facility	Improvements Required
1	606+100	LHS	Bus Shelter	Bus Bay with Shelter
2	610+050	LHS	Bus Shelter	Bus Bay with Shelter
3	617+370	RHS	Bus Shelter	Bus Bay with Shelter
4	617+570	LHS	Bus Shelter	Bus Bay with Shelter
5	629+400	LHS	Bus Shelter	Bus Bay with Shelter
6	629+700	RHS	Bus Shelter	Bus Bay with Shelter
7	635+600	LHS	Bus Shelter	Bus Bay with Shelter

Table 132 A. Proposed Bus bays with shelters

9.4.2. NEW PROPOSED SERVICE ROAD/SLIP LANES

S. No.	Chainage		Side	Total (m)	Remarks
	From	To			
1	606+400	606+450	LHS	50	Service road
2	636+900	637+500	BHS	600	Service road

Table 133. Location of proposed road/slip lane

9.4.3. REPAIR OF SAFETY BARRIERS

Safety barrier is provided in accordance with RSA.

- Length of safety barrier in RHS: 6,600 m.
- Length of safety barrier in LHS: 14,410 m.
- Total length of safety barrier: 21,010 m.

9.4.4. CURVE SIGNAGE (NEW)

Curve informatory signage is provided in accordance with RSA and site condition.

- No. of curves: 5 nos.
- Total length of Curved stretch: 370 m.
- Total no. of signage provided: 47 nos.

9.4.5. REPAIR OF MEDIAN KERB

Kerb maintenance is taken in accordance with RSA. Median improvement quantities are carried out with standard median opening drawings.

- Total no. of locations where median closing is required: 7 nos.
- Length of proposed kerb: 350 m.
- No. of median improvements: 3 nos.

9.4.6. SOLAR BLINKER (NEW)

Solar blinkers are provided in accordance with RSA at Unauthorized ramps, Junctions, Toll plaza, Bus bays/Truck lay bays.

- Total of solar blinkers provided: 199 nos.

9.4.7. SIGNAGE (NEW) STOP / GIVE WAY, ROUTE MARKER AND JUNCTION SIGN

Signage are provided in accordance with RSA at Junctions, Toll plaza, Bus bays/Truck lay bays, Exit & entry of service roads/service lane.

- Total of signage provided: 144nos.

9.4.8. JUNCTIONS IMPROVEMENTS

Quantities of Junction improvements such as Acceleration & De-Acceleration lane and junction flaring are determined from standard drawings and in accordance with RSA.

- No. of Acceleration lanes: 13nos.
- No. of Decelerationlanes: 13nos.
- No. of junction flaring: 0 nos.

9.4.9. SERVICE ROADS/SLIP ROADS

Construction of New Service Roads

Service Roads shall be constructed at the locations and for the lengths indicated below:

Sl.No.	Chainage (km)		Length (m)	Side	Proposed Width (m)
	From	To			
1	606+400	606+450	50	LHS	7.0
2	636+900	637+500	600	BHS*	7.0
Total Length (m)			1250		

* BHS – Both Hand Sides i.e. - Both along LHS and RHS of the Project Highway.

Note: - Service road pavement shall be designed for minimum 10 MSA. Concessionaire shall construct service road with adequate acceleration, deceleration lanes as per IRC: SP: 84-2019 at beyond the lengths mentioned above. All existing structures shall be widened to match the new road cross section at above sections.

9.4.10. CONSTRUCTION OF NEW STRUCTURES/WIDENING/RECONSTRUCTION OF STRUCTURES

Widening of Existing Culverts

Following culverts shall be widened to match the proposed new road cross section:

S.No	Chainage (km)	Details of existing culvert			Improvement Proposal			
		Type of structure	Span (m)	Width (m)	Improvement*	Proposed Culvert		
						Type	No. of Vents	Span (m)
1	637+485	Box Culvert	1 x 2.00	2x10.75	Widening	RCC Box	1	2

*Note: - All Existing Culverts shall be widened and improved to match with the proposed new road cross section of culvert locations.

9.4.11. DRAIN LOCATION

New Reinforced Cement Concrete drains cum footpath shall be provided as below:

Sl. No.	Chainage (km)		Side	Length (m)	Improvement Proposal
	From	To			
1	606+400	606+450	LHS	50	Covered Drain cum footpath

2	636+900	637+500	BHS	600	Covered Drain cum footpath
---	---------	---------	-----	-----	----------------------------

9.4.12. ROAD FURNITURE RELATED ITEMS

The following additional road furniture shall provide along the Project Highway as per standards and specifications mentioned. Details of the items are provided.

Sl.No.	Description	Unit	Quantity
1	Solar Blinkers	Nos.	199
2	Street Lights	Nos.	64
3	High Mast Lights	Nos.	Nil
4	Transverse Bar Makings / Thermoplastic Bar Markings	-	-
5	New installation of Safety Barriers	-	-
i	W-Beam Safety Barriers	Length, in m	21,010
6	Guard Posts	Length, in m	Nil
7	Pedestrian Guard Rails	Length, in m	1450
8	Road Studs / Raised Pavement Markers	As per Section-9 of IRC:SP:84-2019 (Quantity shall be as per site requirement)	
9	Road Markings		
10	Traffic Delineators		
11	Kilometre / Hectometre / Boundary Stones		
12	Additional Sign Boards		
i	Gantry Sign Boards	Nos.	Nil
ii	Cantilever Sign Boards	Nos.	Nil
	Shoulder Mounted Dual Post Sign Boards	As per Section-9 of IRC:SP:84-2019 (Quantity shall be as per site requirement)	
	Shoulder / Median Mounted Single Post Sign Boards		

In addition to above new installation, any deficient road furniture, kerb item shall be replaced / repaired as per provisions of applicable standards and specifications as mentioned.

9.4.13. PROJECT FACILITIES

Following Project Facilities shall be provided in accordance with provisions mentioned.

1. Toll plazas;
2. Landscaping and tree plantation;
3. Rest areas / Wayside Amenities;
4. Truck lay-byes;

5. Bus-bays and Bus shelters;

6. Others

(i) Highway Lighting

(ii) Highway Patrol

(iii) Ambulances

(iv) Cranes

(v) ATMS& TMS

9.4.13.1 Toll Plaza

Widening/Upgrading of Toll plaza shall be constructed at km 602+750 near Khemana with total 12 toll lanes including 2 extra wide lanes (one lane on each side) as per Specifications and along with other requirements at the toll plazas.

Providing and fixing of static-weigh bridges, Medium speed Weigh In Motion, Slow speed Weigh InMotion in accordance with Manual IRC S : 84:2019.

Toilet blocks (one in each direction) with adequate parking facility near Toll Plaza Area shall be provided as per existing NHAI Policy.

9.4.13.2 Landscaping and Tree Plantation

Landscaping and Tree Plantation shall be as per IRC SP- 84-2019:

- At grade islands of intersection locations
- Toll Plaza Area

In order to improve safety of road users, latest technologies for watering to median plantation and avenue plantation shall be used. Preferably in place of conventional methods of watering such as – by tankers, etc drip irrigation is recommendable.

9.4.13.3 Rest Areas / Wayside Amenities

As per the plan of Ministry, i.e. - “Development of Wayside Amenities along National Highways across the Country”, NHAI will come up with Wayside Amenities along the Project Highway in due course of time. The same will be operated and maintained by NHAI. However, Concessionaire shall provide necessary support during operations of the same.

9.4.13.4 Truck Lay Bys

Truck Lay Bys along with required facilities as per clause 12.4 of the Manual of Specifications and standards shall be provided. Toilet block shall be provided at each Truck Lay Bye location as per existing NHAI Policy.

9.4.13.5 Bus Bays and Bus Shelters

Bus bays / Bus Shelters shall be improved / provided nearby following locations in accordance with clause 12.5 of IRC:SP:84-2019.

Note: The Authority shall finalize the number/location of these facilities as per site requirement.

9.4.13.6 Highway Patrol

Highway Patrol units in adequate number as per the provision of IRC SP-84-2019 and to comply with Operational Requirements should be provided.

9.4.13.7 Ambulances

Ambulance units in adequate number shall be continuously available along the Project Highway as per the provision of IRC SP-84-2019 and to comply with Operational Requirements.

9.4.13.8 Cranes

Adequate Cranes shall be continuously available along the Project Highway as per the provision of IRC SP-84-2019 and to comply with Operational Requirements. In addition, crane having capacity of 50T shall be made available, whenever required.

9.4.13.9 ATMS

The Concessionaire is required to design, install, operate and maintain Advanced Traffic Management System (ATMS) as part of the project facilities. The standard ATMS provisions as contained in NHAI Policy Circular-2020.

9.4.14. RAINWATER HARVESTING

As per Notification of Ministry of Environment and Forests, New Delhi dated 14.01.1997 (as amended on 13.01.1998, 05.01.1999 & 6.11.2000), the construction of Rain water harvesting structure is mandatory in and around Water Crisis area, notified by the Central Ground Water Board.

9.5. METHODOLOGY

In this report estimation of preliminary cost, a primary pre-requisite for financial evaluation, has been carried out. The process involved in the preliminary cost estimation has been described under the following sections.

9.5.1. RATE ANALYSIS

To develop a thorough understanding of the prevailing construction rates the Consultant reviewed the following:

Basic Schedule Rates 2019 as per NH Circle Udaipur (Rajasthan) has been considered for cost estimates. Following the review, some items not available in SOR, have been considered as per prevailing industry /Market rates. Cost Estimates have been escalated @5% for every year for the consecutive year 2020.

9.5.2. COST ABSTRACT

Abstract of estimated initial costs for the Project Stretch is given below.

Initial Cost for Engineering and Safety Improvements for Base year 2020:

Palanpur/Khemana - Aburoad Section (from km 601+000 to km 646+000) of NH-27 in the State of Rajasthan			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Toll Plaza	49332367	4.93
2	Intersections Improvements	26340092	2.63
3	Miscellaneous Items (Road Marking, Drain, Street Light etc.	105960270	10.6
4	Service Roads/Service Lanes	24412372	2.44
5	Culverts	1460273	0.15
6	Bus Bays	13554723	1.36
7	ATMS & TMS	172993854	17.3
	Total	394053952	39.41
	Escalation 5% per Annum for 1 year	19702698	1.97
	Total Amount with Escalation =	413756650	41.38
	Contingency charges @ 5%	20687832	2.07
	Total Amount =	434444482	43.44

Table 134. Abstract of estimated initial costs

Operation and Maintenance Cost for Base year 2020:

The Project Operation and Maintenance cost estimates have been prepared based on various circulars and analysis:

FOR ROUTINE MAINTENANCE WORKS:

- Routine Maintenance for BT works at MCW consider as @ 7lacs/km/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 $7 \times 1.05^{10} = 11.40$ lacs/km/year) circular NHAI/11033/CGM(Fin)/2011
- Routine Maintenance for BT works at Service/Slip roads consider as 60% of @ 7lacs/km/year for 2010-2011

- Equipment Based Survey Works (Annual/Periodic as per Maintenance Schedule) based on market rate
- Contingency @ 3 %
- Toll Plaza operation and maintenance charges @ 32.5 lacs/lane/year
- System Integrator maintenance charges @ 5.04 lacs/lane/year
- Electricity & Patrolling expenses @ 2.03 lacs/km/year
- Additional RPV(Route patrolling vehicle) for state police department and Ambulance services for state government health authority to be provided
- The ATMS systems shall cover design, supply, installation, commissioning and operation and maintenance including charges for electricity to be provided
- SPV charges or Other Office expenses @ 407 lacs/year
- Insurance cost
- And GST @ 12% on all above item has been added in total Operation and Maintenance cost

FOR PERIODIC MAINTENANCE WORKS:

- Periodic maintenance works for main carriageway and service road is proposed as per MoRTH circular (RW/NH-33044/10/2022-S&R dated 21-August-2018)
- Periodic renewal is proposed at every 6th year after completion of existing annuity period i.e 2024. For Main carriageway 40mm BC and for Service/Slip roads/bus bays/ truck lay bay/junction etc. 30mm BC is proposed for every successive renewal period.

Total Operation and Maintenance cost for (30 Years)	
Particular	Str-3
Routine Maintenance	159.77
Toll Plaza Operation and Maintenance	127.06
Electricity & Patrolling expenses	56.19
Other office expenses	144.56
Insurance	35.50
GST @ 12%	62.77
Total Routine Maintenance cost	585.86
Major Maintenance :- (Cycles)	
2029-2030	39.02
2035-2036	39.02
2045-2046	46.91
Construction Period (2038-2040) DLP Period 5 years (2040-2045)	

Table 135. Abstract of Operation and Maintenance costs

All cost are mentioned in this report are based on year 2020. And the cost for Major Maintenance Work/Routine maintenance and Operational maintenance works would be escalated for their consecutive appearance years on the basis of Price index.

Capacity Augmentation Cost: Based on Year 2020

Palanpur/Khemana to Abu road Section (from km 601+000 to km 646+000) of NH-27 in the State of Rajasthan)			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Bituminous Courses	567608580.00	56.76
2	Repair & Rehabilitation of Existing Structures	22375451.78	2.24
3	Clearing and Grubbing	82768369.38	8.28
4	Toll Plaza	33932366.65	3.39
5	Widening of Road 4 Lane to 6 Lane	1592519505.10	159.25
6	Widening of Structure 4 Lane to 6 Lane	791138820.00	79.11
7	Intersections Improvements	98731537.00	9.87
8	Miscellaneous Items	601658483.89	60.17
9	Service Roads/Service Lanes	327973309.41	32.80
10	RE Wall And Approaches	570662446.80	57.07
11	Bus/ Truck Lay Bays	45726634.13	4.57
12	Drain	131025379.83	13.10
13	Land Escaping and Tree Plantation	9083363.00	0.91
14	ATMS & TMS	294252955.78	29.43
	Total	5169457202.74	516.95
	Escalation @ 5% per Annum for 1 year	258472860.14	
	Cost for Capacity Augmentation	5427930062.88	542.79

Table 135. Abstract of costs Capacity Augmentation

Base year is considered as 2020, all rate and estimates for improvement proposal are escalated @5% for every year. All cost are mentioned in this report are based on year 2020 which is escalated @5% for every year from 2019-2020. Also the cost for Capacity Augmentation and Major Maintenance Work would be escalated for their consecutive appearance years on the basis of Price index.

10. COMPLEMENTARY DATA

10.1. TOPOGRAPHIC SURVEY

10.1.1. MOBILE LIDAR TECHNOLOGY

10.1.1.1. INTRODUCTION

The basic objective of the topographic survey would be to capture the essential ground features along the alignment in order to consider improvements and for working out improvements and rehabilitation costs. The detailed topographic surveys should normally be taken up after the completion of reconnaissance surveys.

The following are the set of deliverables which should be submitted after completion of survey:

- Raw DGPS data for the entire highway length and adjoining areas of interest
- Point cloud data/Data of points captured for the entire highway length and adjoining areas of interest
- Topographic map of scale 1:1000 of the entire highway length and adjoining areas of interest
- Contour map of 50 cm of entire highway length and adjoining areas of interest
- Cross section of the highway at every 100 m in *.dwg format.

For land based surveys, Network Survey Vehicle/ Mobile LiDAR (Light Detection and Ranging) shall be adopted.

The detailed field surveys would essentially include the following activities:

- Topographic Surveys along the Existing Right of Way (ROW): Carrying out topographic survey using LiDAR or equivalent technology along the existing road, wherever required and properly referencing the same with reference pillars fixed on either side of the centre-line at safe places within the ROW.
- Collection/ Extraction of details for all features such as structures (bridges, culverts etc.) utilities, existing roads, electric and telephone installations (both O/H as well as underground), huts, buildings, fencing and trees (with girth greater than 0.3metre) oil and gas lines etc. falling within the extent of survey.

The width of the survey corridor should take into account the layout of the existing alignment including the extent of embankment and cut slopes and the general ground profile. While carrying out the field surveys, the topographic surveys should cover sufficient width beyond the centre line of the carriageway. Normally the surveys should extend a minimum of 30 m beyond either side of the centre line of the carriageway or land boundary whichever is more.

10.1.1.2. LIDAR TECHNOLOGY OVERVIEW

LiDAR (Light Detection and Ranging) is a new survey technique which has the advantage of collecting the survey data at very high rate and getting a 3D point cloud of the area being mapped. It has wide ranging applications in 3D mapping, robotics, autonomous vehicles, infrastructure planning and monitoring, mining etc. This document briefly reviews the methodology and steps to be conducted for LiDAR Survey.

10.1.1.3. WORKS METHODOLOGY

In addition to LiDAR data, most highway projects in India also require establishing Primary Ground Control Points. GPS is used to establish primary control points at an interval of approximately 5 km.

The data collected using these is processed and checked for errors if they are within acceptable limits. The error is adjusted so that it does not propagate in the long route. These control points also serve as check points to assess the accuracy of LiDAR data.

The data collected on the site have to be processed in order to get the accurate georeferenced coordinates by combining various data obtained through LiDAR, IMU and GPS sensors. There no standard software for this. Every LiDAR manufacturer creates its own software for creating the point cloud. The result is a dense point cloud. This point cloud is adjusted with TBMs to get best accuracy levels.

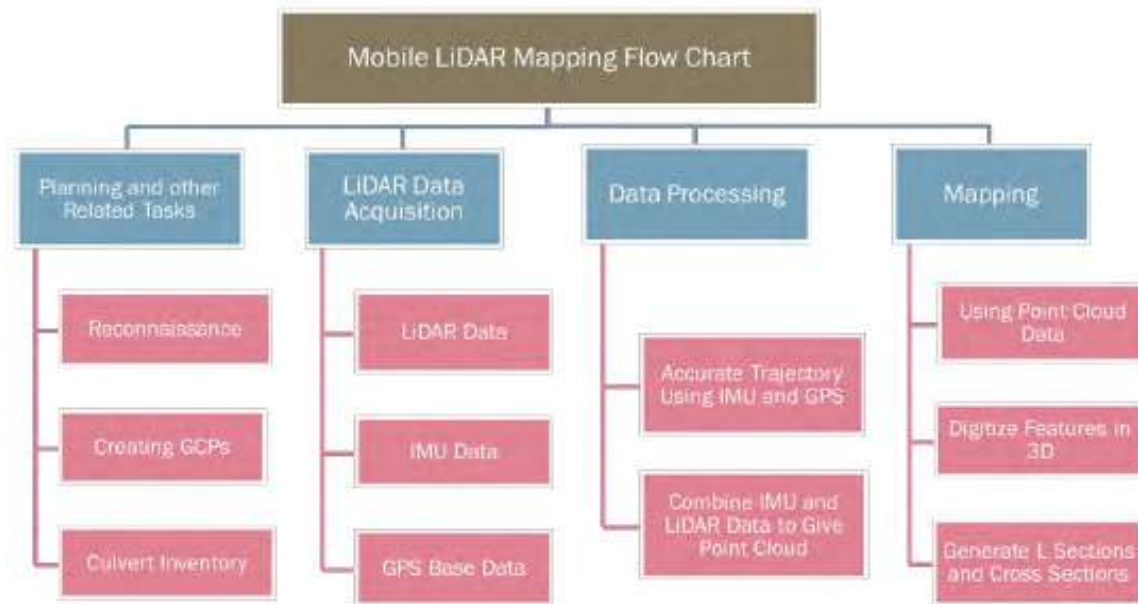


Figure 134. Mobile LiDAR mapping Flow Chart

10.1.1.4. EQUIPMENT

In this kind of survey, the LiDAR equipment is mounted on top of a vehicle along with Inertial Measurement Unit (IMU) and GPS. The data is collected on the go and generally about 100 KM of data can be collected in a day depending upon the terrain conditions.

There are two major components of a mobile LiDAR scanner: LiDAR and Inertial Measurement Unit (IMU). A standard picture of the mobile scanner is given in Fig 1; IMU further consist of Inertial Navigation System (INS) and GNSS receivers. GNSS provides location of the sensor on the surface of the earth using signals from satellites.



Figure 135. Equipment

Depending upon the quality of the GNSS receiver (single or dual frequency), the location accuracy can vary from 2 cm to a few meter even under visible sky.

More than often, road survey projects involve surveying through dense canopy of trees. Here a standalone GNSS systems performs poorly due to limited visibility of the satellites. Here, Inertial Navigation System, consisting of Gyroscopes and accelerometers, enables users to get quality location data. Standard software like Inertial Explorer from Novatel is used to fuse GNSS data with inertial data.

In addition to this equipment, a static GPS is also placed on a fixed control point within suitable range of the survey area to provide more accuracy when processed with vehicle mounted GPS data. This technique is called differential-GNSS. To ensure better accuracy, GNSS data is collected in good sky visibility during the LiDAR survey work. This data is then used to correct the error in the positioning.

Laser scanner used in the LiDAR system also varies quite a lot. Major differentiating factors are range and measurements per second. Industry standards are Z+F, Riegl, Velodyne, Quanergy etc. All of these have a line of sight range of 100m or more. Scanning speeds range from 500,000 points per second to 1,000,000 per second. All of these sensors are better than 1 cm at 100 m range.

10.1.1.5. DATA COLLECTION AND ANALYSIS OF DATA

Mobile mapping is the process of collecting geospatial data from a mobile vehicle. Typically fitted with a LiDAR remote sensing systems, such systems are composed of an integrated array of time synchronized navigation sensors (survey grade DGPS) and imaging sensors mounted on a mobile platform. Primary output after pre-processing of data includes geo-referenced 3D point cloud data, digital maps, images and videos. Further, after post processing, output in desired format like AutoCAD*.dwg or Arc GIS*.shp files are obtained.

After the LiDAR data is processed, it is used to classify features. All the desired features are identified and classified using standard software such as Bentley Microstation. A topographic map along with contours can be provided in CAD format. L section and cross sections can also be generated using LiDAR data as required by the client.

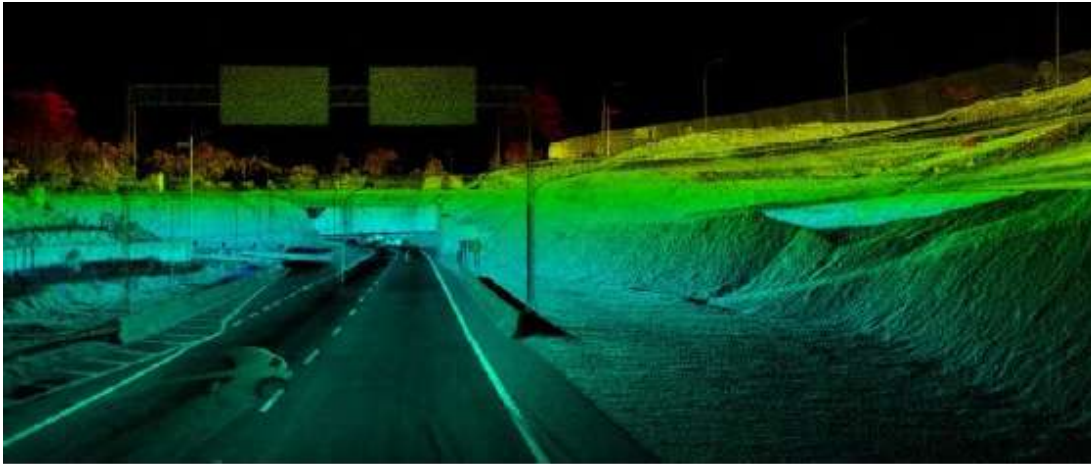


Figure 136. LiDAR point cloud sample – colors by height

10.1.1.6. GENERAL DELIVERIES

- Detailed Topographical Map of total ROW minimum 60m, i.e. 30 m on either side of the road centerline with standard feature mapping
- Cross Section at every 10 m along the centerline and L-section every 10 m in AutoCAD format.
- Contour map at 50 cm contour interval.
360 degree panoramic images of the entire highway length and adjoining areas of interest shall be submitted.
- 3D drawings in CAD format with lines features as 3D polyline.

10.1.2. AERIAL DRONE VIDEOGRAPHY

It has been carried out a High Definition video captured by drone as per ToR requirements. The work flow to be followed has been:

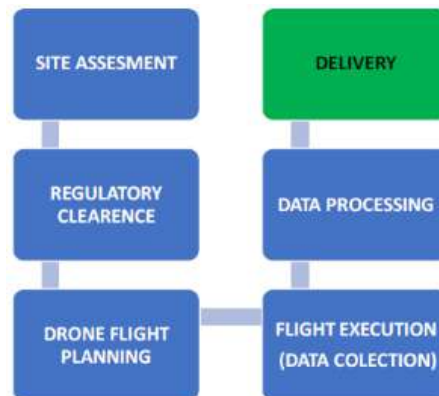


Figure 137. Flow chart drone

10.1.2.1. SITE ASSESSMENT

The Drone Agency will undertake a preliminary site assessment in each stretch to understand the environment where have to operate its drone. The objectives of the site-visit are to:

- Understand the topography, weather conditions, and general environment in which the land-survey needs to be undertaken.
- Know obstructions and hazards posed by natural, or man-made structures for drones to fly in the survey area.
- Plan for contingency measures to deal with the hazards.
- Gather inputs for detailed flight planning of the drone taking into consideration the topography, weather conditions, general environment, obstructions, and hazards.
- Determine the logistical needs, and time-frame required for conducting the video recording in the roads.
- Plan the project execution from start to finish accurately so as to meet the customer's timeframe without delays
- Collect the X-Y/Lat-Long co-ordinates of start and end points, ascertain whether additional inputs or work is required to be done.



Figure 138. Sample of Software of Flight Planification

10.1.2.2. DRONE FLIGHT PLANNING

Drone Agency will make use of the detailed requirements defined by ToR, along with the information gathered from the site assessment to create the drone flight plan. The flight plan defines how, when, and where the drone will fly and what data will be gathered by the drone in the process of surveying the land.

10.1.2.3. DATA COLLECTION AND TRANSFER

On site operations will involve data collection on board the drone. Transfer of data for presentation and analysis will be done as and when data connectivity is available to the onsite team.

10.1.2.4. DATA PROCESSING AND DELIVERY

The data collected by the drone will be processed to generate the HD Video as per ToR. Each road will be delivered in a separated file and a sheet of data of the flight and road recorded. This sheet will includes: drone characteristics (controlling unit, processing unit ...), camera used (Lents ...), GPS (if any), planning software, processing software and height of flight.

ANNEXURES– A (SURVEY YEAR 2018)

- ▣ ANNEXURE 1 NSV EQUIPMENT
- ▣ ANNEXURE 2 PAVEMENT MATERIAL INVESTIGATION
- ▣ ANNEXURE 3 LABORATORY INVESTIGATION
- ▣ ANNEXURE 4 DEFLECTIONS
- ▣ ANNEXURE 5 IRI AND RUT RESULTS
- ▣ ANNEXURE 6 HDM-4 RESULTS
- ▣ ANNEXURE 7 AAHSTO-HDM CALCULATIONS RESULTS
- ▣ ANNEXURE 8 STRUCTURES
- ▣ ANNEXURE 9 NDT RESULTS
- ▣ ANNEXURE 10 TRAFFIC PROJECTIONS
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- ▣ ANNEXURE 12 STRIP PLAN& KILOMETRIC REFERRAL

ANNEXURES – B (DATA PROVIDED BY AUTHORITY)

ANNEXURES – C TRAFFIC DATA & COST ESTIMATES (YEAR 2020)

- ▣ ANNEXURE 1 TRAFFIC PROJECTIONS
- ▣ ANNEXURE 2 OPERATION AND MAINTANANCE COST
- ▣ ANNEXURE 3 INITIAL IMPROVEMENT COST



■ QUALITYCONTROLSHEET					
DOCUMENT	Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana – Abu Road (Stretch 3)				
PROJECT	PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE NATIONAL HIGHWAYS ON ROADS UNDER (THE NATIONAL HIGHWAYS INFRA TRUST)				
CODE	IM4663-FR-STRETCH_4-Ed2 (Annexure)				
AUTHOR	INITIALS	RFS			
	DATE	2/07/2018			
VERIFIED	INITIALS	GAA			
	DATE	2/07/2018			
RECIPIENT	NationalHighwaysAuthorityofIndia				
NOTES					

ANNEXURES

- ▣ ANNEXURE1NSVEQUIPMENT
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- ▣ ANNEXURE6HDM-4RESULTS
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- ▣ ANNEXURE9NDTRESULTS
- ▣ ANNEXURE10TRAFFICPROJECTIONS
- ▣ ANNEXURE11MAJORMINORJUNCTIONS
- ▣ ANNEXURE12STRIPPLAN&KILOMETRICREFERENCE

ANNEXURE 1 NSV EQUIPMENT

1 NSV DATA

It has been operated a NSV equipment, which has collected at the same time Inventory, Cracking, IRI, Rutting and Geometry (Slope, Cross slope and Radius of curvature) data, including corresponding images (front and pavement).

COMPONENTS OF THE SYSTEM

EXTERIOR GPS VISION SYSTEM

The GPS Vision system consists of a high grade Differential Global Positioning System (DGPS), Rocketgrade Inertial Measurement Unit (IMU), sub centimeter Distance Measuring Instrument (DMI), six 1600 x 1200 optical cameras mounted in stereo pairs viewing forward front, left and right, a house front camera, two optical to infrared downward pavement facing cameras. Two sets of line lasers mounted behind the rear wheels projecting to rear of vehicle and point lasers in the wheel path projecting down and several computers and mass storage devices and user interface system.



Figure 1 GPS vision system



Figure 2: GPS vision system components

The high resolution stereo cameras are mounted within their in secure, climate controlled and waterproof pods and the pods are affixed to the roof rack. Wider camera positions are possible outside the width of the interior of the survey vehicle providing a longer base distance between the stereo pairs which adds to the exceptional accuracy of the GPS Vision system. The roof rack is permanently marked for consistent alignment without the risk of bumping or interference that can occur with cameras mounted inside the vehicle. Positioning the cameras on top of the vehicle also creates an excellent viewing height to see both the roadway in front of the vehicle and see over adjacent vehicles. In addition the same perspective is maintained throughout the project without the image and accuracy degradation that can occur from viewing through curved, tempered and possibly tinted auto windshield glass. As stated previously the standard GPS Vision system consists of 1600x1200 optical cameras mounted in a stereo pair forward front, two optical infrared downward pavement facing cameras.

Images will be collected at a camera (CCD) resolution of 1600x 1200 pixels (approximately 2 megapixels) as captured and in 3D point of view essentially doubles those megapixel resolutions as an overlapped or interlaced view.

INTERIOR GPS VISION SYSTEM

The GPS Vision Systems™ is integrated with GPS/INS solutions for accurate positioning of mobile mapping data. The integrated GPS/INS solution produces continuous, smooth position and orientation of the GPS Vision™ data. The system has the capability to provide accurate positional data for several minutes even when the GPS signals are lost due to obstructions such as bridges, trees, tunnels or high-rise buildings.

The GPS Vision Distance Measure Instrument (DMI) is integrated with the GPS/INS system and used to provide distance pulses and velocity to the various data collection modules. Information from the DMI is used in one of two methods; the first is for distance based data where data is collected at a set distance intervals and the second for time based systems that require the distance or speed information associated with the data captured at the defined time interval. The DMI consists of an encoder tracking

revolution of the vehicle tire. The DMI is very accurate meeting the requirements of ASTM E-950, 0.02% of the distance traveled, and California Test Method 1001-S, 1 foot in 528 feet. The images below represent examples of typical vehicle equipment configurations.



Figure 3 NSV Control Systems and Data Storage

GPS VISION LASER SCAN™

The GPS Vision Laser Scan™ system consists of:

- Downward facing Point lasers - for a wheel path IR assessment of the road surface.
- Downward facing infrared cameras - for a hi-resolution view of the road lane surface profile. The images are combined to give a 4m wide continuous pavement view. This is used both for crack detection and cross lane profiling.
- Line projecting lasers – Through the Laser Scan™ software, pavement rutting and cross profiles are automatically measured to sub-centimeter accuracy.
- Laser gauges – these are mounted in the wheel path and take >1kHz measurements of the road surface to <0.05mm resolution. This allows us to exceed ASTM E950 recommendations for a class 1 longitudinal profiler for a wheel path at up to highway speeds.
- 4-axis accelerometers – these are mounted directly above each laser gauge. They provide an inertial basis for the Laser Scan™ system.

GPS Vision™ Imaging system integration – the Laser Scan™ system incorporates measurements from the wheel counters, GPS, and INS and imaging systems on the vehicle to provide precise distance and location readings for developing a complete 3D model of the roadway.

DISTANCE MEASUREMENT INDICATOR (DMI)

A Distance Measurement Indicator (DMI) is used to aid in the GPS/INS positioning solution and used to measure the distance (log mile) and trigger image sets at a predetermined image distance. GPS Vision system uses a proprietary Kalman algorithm that calibrates the DMI automatically in post processing. Our DMI is typically configured for 4000 counts per wheel revolution or less than 1 mm accuracy. The DMI needs to be checked and calibrated prior to each project and the system checks that the spacing is meeting the required length automatically with each image to keep the image distance correct. In a similar

procedure the GPS satellites and inertial measurements are automatically checked and validated and any out of bounds reading is turned to the operator.

Camera lens calibration includes and internal software adjustment to account for lens distortions. The initial calibration of the lens to the camera and the cameras to one another is part of the overall system design and quality control and is performed when a system is commissioned. The camera settings are generated by the program parameters at the end of a system build and checked at the start of every survey or every 3 months whichever is sooner. Periodic calibration checks may be performed during defined routine maintenance inspections. Therefore, standard field procedures do not require adjustment of the physical equipment.

BASE STATION

We generally use a base station for our surveys to maintain better data reliability. A base station antenna is set in an open area, so that the GPS data is as complete and accurate as possible. If surveying for multiple days within a certain area, the antenna is located in the same position each day, thereby assuring consistency of the local GPS data.

FEATURES OF GPS VISION SYSTEM

The components of GPS Vision System contribute to the following features:

- The external hardware is interfaced with a central data logger unit which stores the collected location, image and laser data for transfer to processing software. This system is integrated with Inertial Navigation System (having pitch and roll accuracy of <0.4 degrees, Acceleration Input Range ± 4 g or ± 10 g), a differentially corrected Global Positioning system (GPS) and a Distance Measuring Instrument (DMI) for highly accurate vehicle positioning.
- Laser profilometers utilize a class I profiler to collect roughness measurements in the form of the International Roughness Index (IRI). This system utilizes data from point lasers and accelerometers to output IRI at most posted speeds.
- Transverse profile of the pavement surface is generated based on the actual rut depth when compared to the pavement surface level outside the wheel path. The central data logger captures the transverse profile data for decoding into the profile and rutting measurements of the roadway.
- Rutting profile of the pavement surface is generated using two line lasers mounted at each wheel path and two thermal cameras mounted at the roof of the vehicle over each wheel path laser enclosure to capture full lane rutting profile. The system can detect the overall rut profile and the maximum depth even with the vehicle deviating slightly from the wheel path.
- Cross Profile Straight Edge is used for quality control checks of the Transverse profile. GPS Vision uses this method to calibrate the continuous cross profile and can provide the transverse profile view in the image at each summary reading at multiple locations during an actual project.
- 3D profiles of the road are provided by stereo pair cameras which will be similar to the view that is required by the Pavement Condition Index (PCI) survey methodology. The images provide measurements of not only any cracks or pavement distresses but also the location and vital measurements of any right of way object that is in the image view.
- Pavement right of way image logs are captured which are geometrically correct to quickly locate and measure any roadway feature and extract that data for further plotting on maps or to populated databases. The Stereo pair images are very similar to how the operator sees the world and it is intuitive to use to capture road right of way information user friendly way to virtual visit the roadway and make measurements from the computer which is beneficial than only viewing the video based images.

- Road geometry measurement is done using built-in high resolution Inertial Navigation System to calculate the radius of curvature, cross-fall and etc.
- A GPS system with a $\pm 1\text{cm} + 2\text{ppm}$ Horizontal accuracy and $\pm 2\text{cm} + 2\text{ppm}$ Vertical accuracy of the vehicle location is utilized. GPS Vision is also integrated with a GPS Base Station to provide differential correction to the rover unit. The GPS is tightly integrated with the inertial navigation system and distance measuring system using the Kalman filter to calculate the position. When the proper numbers of satellites are not available this system is able to operate on the INS for up to 5 minutes.
- Inventory and rating for pavement condition and right of way asset data are done using manual visual input through the keyboard. The number of keys available to the vehicle system operator is programmable.
- Calibration for roughness meter is done using on known pavement sections where the profile ground truth is measured with a ASTM Class 1 and World Bank Standard Class 1 profiler. This reference pavement profile and the mobile IRI point laser are compared. Adjustments to the point laser are made to better correlate with the test section.
- The system has a built-in Distance Measuring Instrument (DMI) with less than 1 mm accuracy. The DMI is tightly integrated with the GPS and INS through a Kalman filter.
- The data acquisition software has a spatial data viewing feature to plan the survey and monitor the cameras and lasers during the survey. Feature logger includes image processing options which are used to define the attributes of the roadways collected and apply changes in brightness, color saturation to the real-time captured images for optimum viewing. The software stores the location data and images in a structured way based on the planned survey routes.
- GPS Vision System has desktop based software for extracting distresses and road right of way features (in the form of spatial features-point, line and polygon) and their related attributed data from the stereo-pair images captured during the survey. The extracted spatial features and their attributes are easily exportable in GIS format and any standardized RDBMS format.

PAVEMENT CONDITION AND RIGHT OF WAY DATA COLLECTION

The data collection process will involve following activities to ensure collection of accurate and quality data during the survey

- Field data collection personnel preparedness: The driving routine plan will be provided to the dedicated personnel for optimal viewing and consistent pattern driving on the roadway. The maps and support materials are checked and verified.
- Field data collection equipment preparation: Prior to field data collection, the GPS Vision system will be set up for optimum viewing and data collection efficiency based on data collection features desired. This calibration camera setting will be tested the day before safe operation and that all equipment is well maintained and in working order.
- Data collection procedure: During data collection, one driver and one navigator will operate the GPS Vision system following the project and safety procedures. The procedure will capture high resolution stereo-pair images to record the road distresses and right of way features. The point and line laser assembly along with high-end infrared cameras will record the transverse and longitudinal profile of the road for roughness, rutting and etc. One of the critical procedures is the automated image quality tools that provide a “dashboard” view of the actual images during the field survey. These are monitored during the entire data collection schedule. The broadcast GPS locations and rates will be checked for operation and monitored throughout the drive. Our staff will also establish and set up GPS base stations throughout the project according to the established drive pattern in pre-

Designated open areas established by the project manager. The use of both of these correction procedures are critical for the most accurate if ferentially correct data.

Highlightsofthedatacollectionprocess:

- TheGPSVisionsystemwillcollectimageryperlaneinbothdirections.
- The images will be captured at a user defined interval along the roadway. This will ensure that allfeatures along the roadway will have good coverage and can be extracted accurately from images. Thisisespeciallyimportantforroadswithtwoorthreelanesinonedrivingdirections.
- High-resolution (1380x1024, 1600x1200 possible) cameras will be used to capture detailed imagesoftheroadways.
- At the end of each data collection day, digital image data will be reviewed for quality, GPS data ischeckedforsufficientcoveragefromthebasestationanddataisprocessedtocheckthecompleteness.
- Before the data collection is finished, all data will be compared with the required highways to makesureallrequiredroadshavevaliddata.
- The data will be combined and edited to clean overlaps or extra sections. The roadway informationwill be attached to image point data. Digital images will be reorganized based on their roadwayattribute,likename.
- The attributed image point data will then serve as the database for web-based viewer software andcanbeaccessedas drivingdownaspecifiedstreetfromitsbeginningtoitsend.
- Imageswillbe includedinICARORMS.
- Field data collection QC: At the end of each day, collected data are processed and images arereviewed. Theprocesseddatawillbecomparedwiththeplannedroadtoseeifanyroadis missing.

FEATUREEXTRACTIONPROCESSMETHODOLOGY

The images collected by GPS Vision system are used to obtain International Roughness Index (IRI), Pavement Condition Index (PCI) and other asset data of the road. These images organized based on the survey planned will be used in desktop based feature extraction software for extracting road distresses and right of way features and its attributes and storing them in industry standard RDBMS.

ROADDISTRESSFEATUREEXTRACTION

The distresses on the roads will be identified and captured in a virtual environment through viewing of stereo-pair high resolution images.



Figure4Snapshotoffeatureextractionsoftwarewindow



Figure5Snapshotoffeatureextractionsoftwarewindow



Figure6.Snapshotoffeatureextractionofpotholes



Figure7.Snapshottoffeatureextractionofpotholes

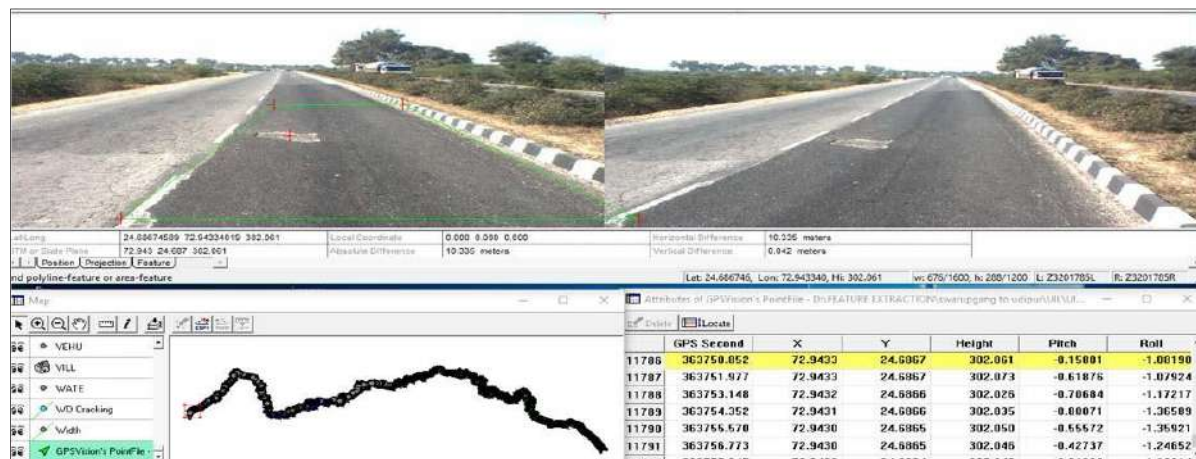


Figure8.Snapshottoffeatureextractionofpotholes



Figure9.Snapshottoffeatureextractionofcracking



Figure10.Snapshotoffeatureextractionofcracking

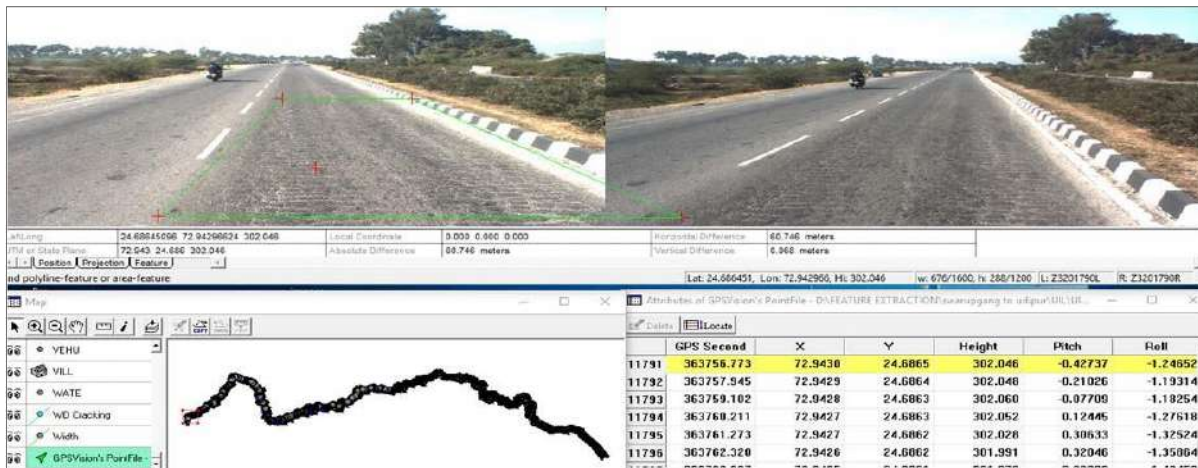


Figure11.Snapshotoffeatureextractionofcracking



Figure12.Snapshotoffeatureextractionofwidecracking



Figure13.Snapshotoffeatureextractionofwidecracking

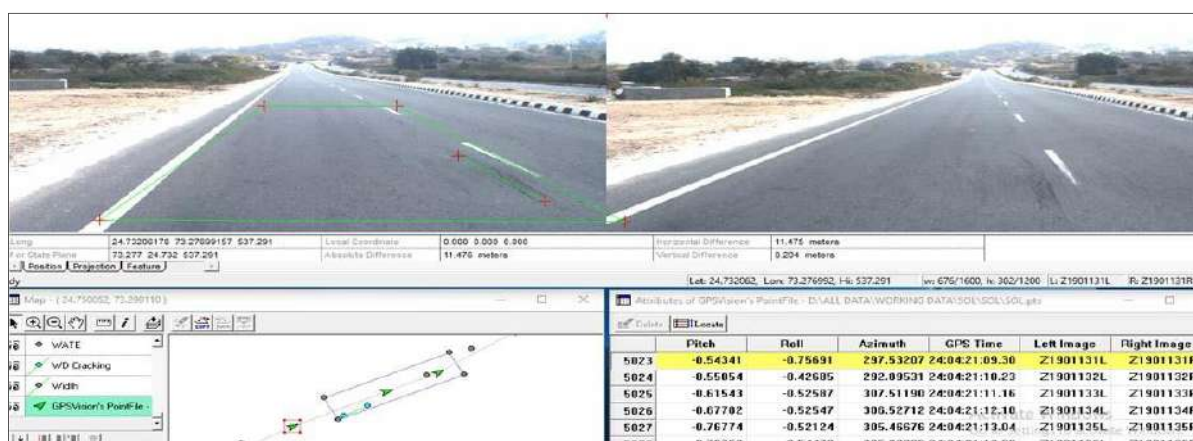


Figure14.Snapshotoffeatureextractionofwidecracking

The images of the pavement captured are used to identify sample units. Multiple sample units are marked along the road and each sample unit are recorded with road distresses based on the surface type i.e., Asphalt, PCC and etc.

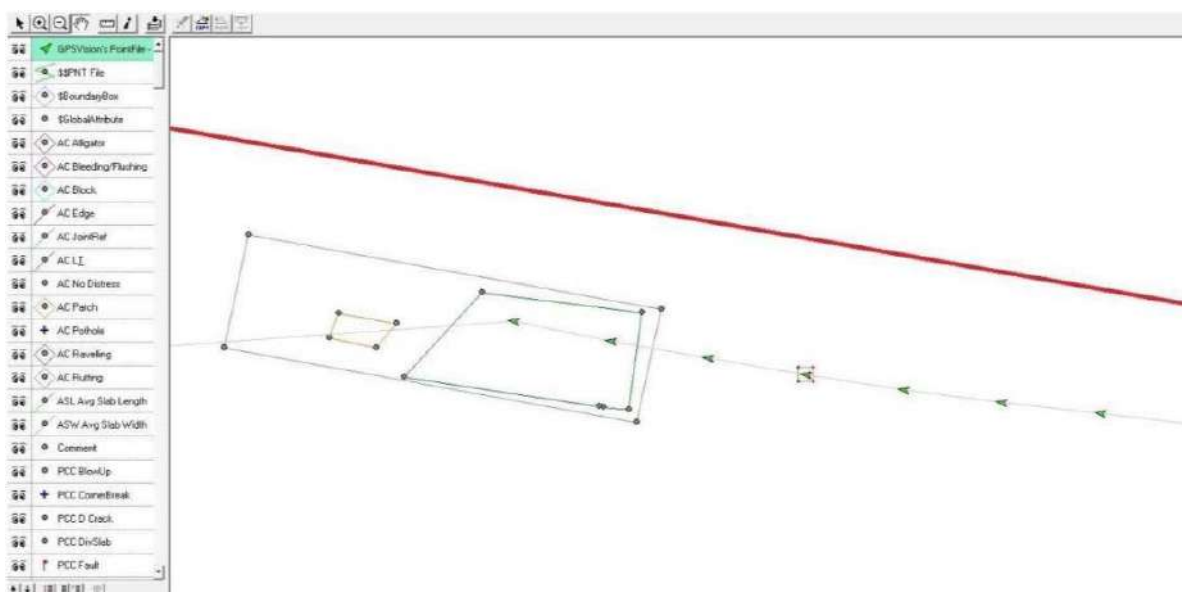


Figure 15 Window showing simple unit

The type and severity of pavement distress is assessed by visualizing the processed digital image in the feature extraction software and then marking the distresses in the sample unit.

The distress data are used to calculate the PCI for each sample unit using ASTM methodology. The PCI of the pavement section is determined based on the PCI of the inspected sample units within the section.

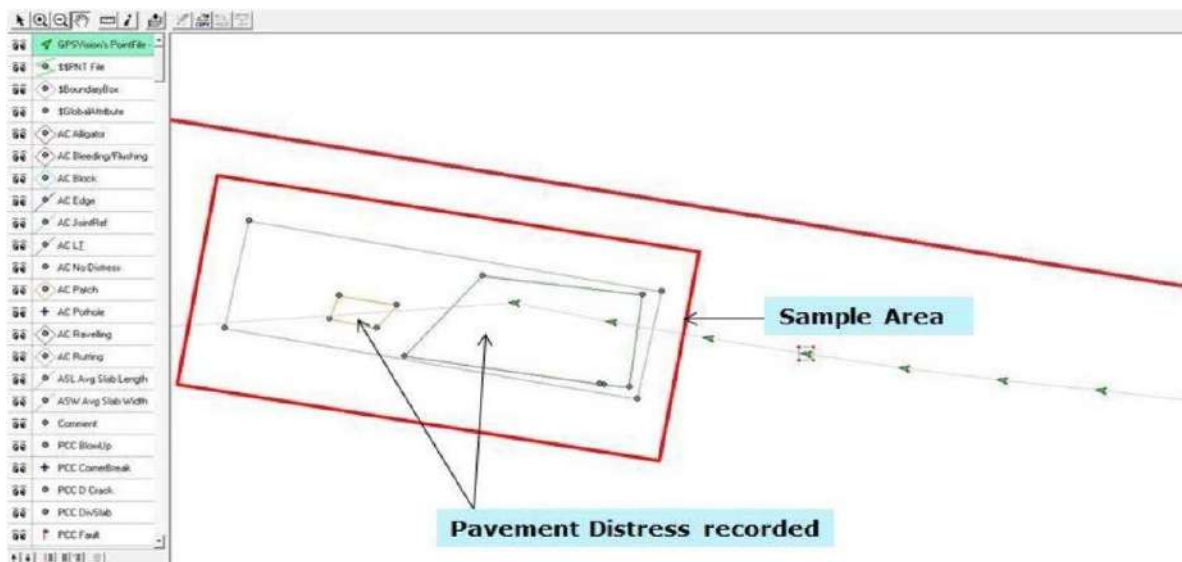


Figure 16 Snapshot showing captured simple units and recorded distresses

The data obtained from Lasers along the transverse and longitudinal profiles will be used to generate IRI and rutting. The PCI and IRI rating for the roads will be done based on the required standards of road condition.

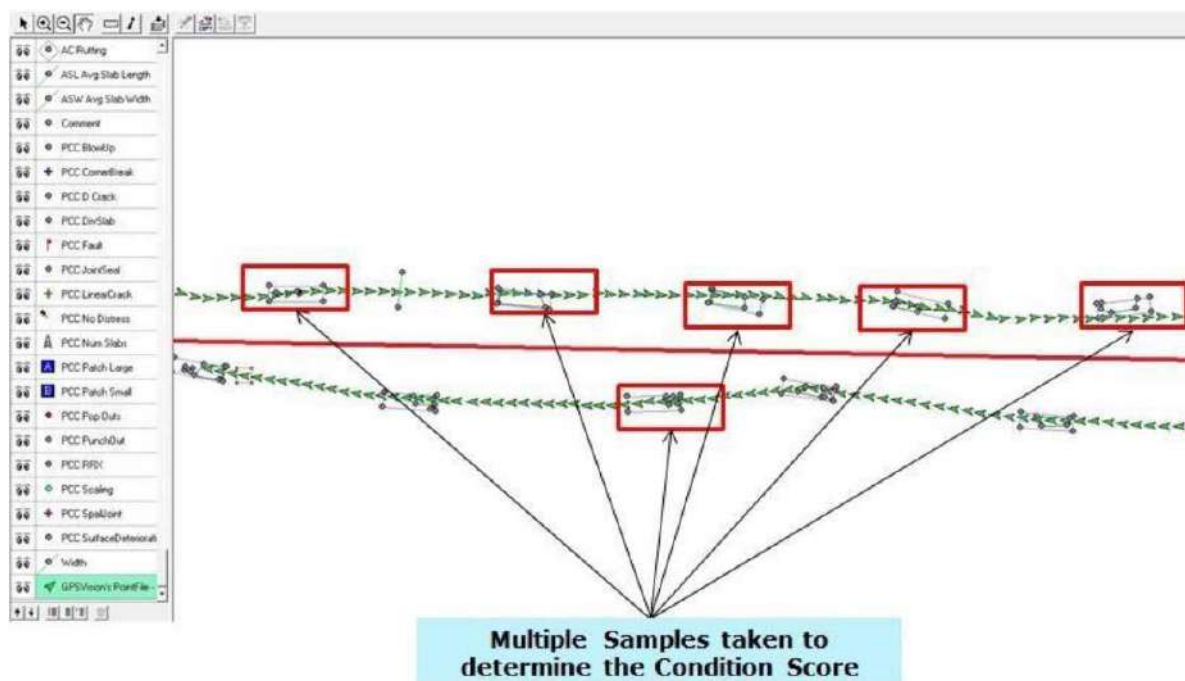


Figure17Windowshowingmultiplesamples

ROADRIGHTOFWAYFEATUREEXTRACTION

As in the road distress feature extraction process stereo pair images will be used in feature extraction software to extract right of way inventory.

As shown below, any element that is identified from the images can be extracted within the software. Additionally, when the element is located a record table is associated with each feature location which allows the user to populate the attribute database on the fly. Feature extraction will be done by simply clicking on the image itself to capture all relevant GIS, GPS and attribute data. Each feature could be assigned a separate symbol based on its type.

This process of inventory is repeated for all items on the inventory list that can be developed for the client. A final list of features to be inventoried and positioned along the right of way can be discussed and finalized with the client.

After the feature extraction process is completed, the output files including center lines and related inventory feature data can be formatted to match specifications in a number of GIS and CAD systems.

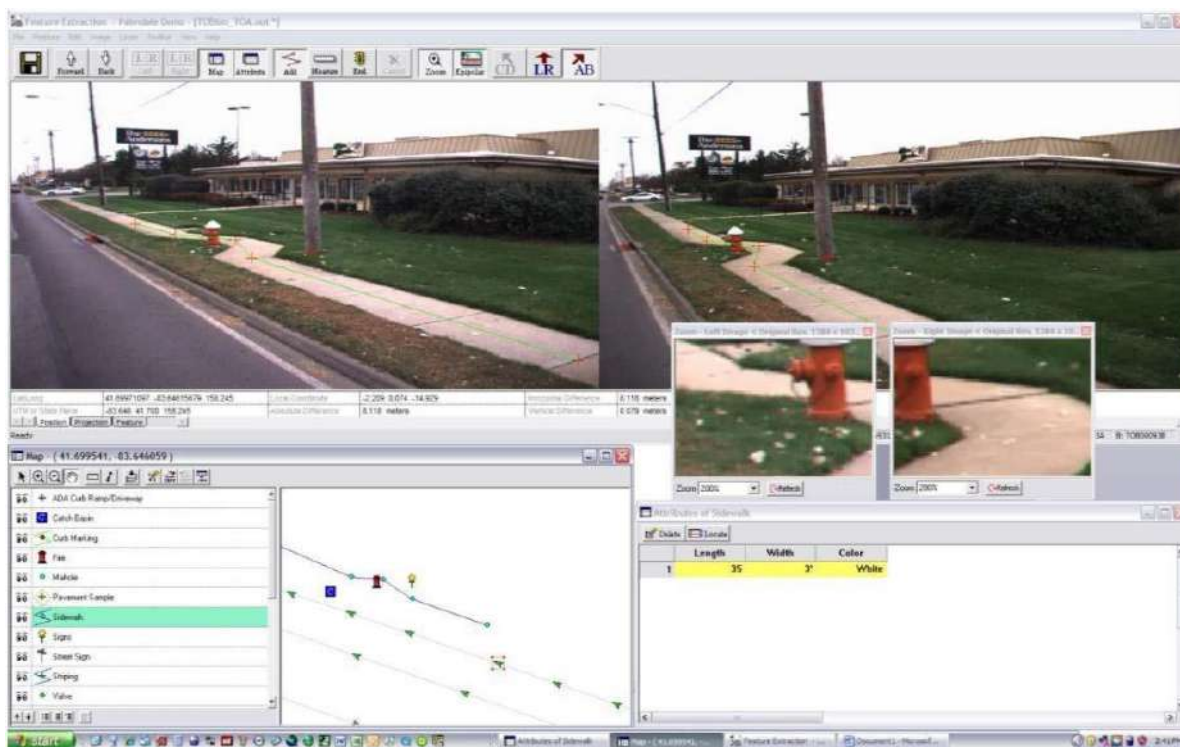


Figure 18 Snapshots showing extraction of Right of Way features

TYPE OF FEATURE EXTRACTED

The Feature Extraction software captures various types of features which are broadly categorized into road distresses and road right-of-way features.

FOR PAVEMENT CONDITION

The feature extraction software extracts pavement condition data such as distress features, its quantity and severity based on the surface type i.e., asphalt or PCC. The distress list for each surface type is as per the IRC per ASTM defined distresses for each of the surface types, according to NHAI requirements.

FOR PAVEMENT RIGHT OF WAY

The extraction of pavement right-of-way data can be for the following, but not limited to, asset and its subtypes. The software can extract any right-of-way asset visible in the images based on the following.

- Affected service
- Bypass
- Carriageway
- Culvert (asset in inventory included in further section)
- Delineator post
- Embankment
- Flyover
- Fuel station

- Guardpost
- Guidepost
- Hectometer stone
- Highmastlights
- Junction
- Kilometrestone
- Landuse
- Linedrain
- Longitudinalroadmarking
- Majorbridge(assetinventoryincludedinfurthersection)
- Medianopening
- Median
- MinorBridge(assetinventoryincludedinfurthersection)
- Pedestriancattleunderpass
- Pedestrianguardrail
- Punctualroad marking
- Retainingstructure
- Rightofway
- Roadsidearboriculture
- Safetybarrier
- Shoulder
- Sign
- Slip-Serviceroad
- Solarblinker
- Streetlight
- Toiletblock
- Tollplaza
- Trucklaybye
- Urbansection
- Vehicularunderpass
- Villagetown
- Waterbody
- Waysideamenity

The minimum aspects to be collected from each asset areas follows:

- Road
- Section (LHS/ RHS)
- Kilometric Point (initial and final)
- Latitude and Longitude
- Date
- Margin (LEFT/RIGHT/BOTH (LEFT AND RIGHT))

Special and additional details/attributes of some assets have been collected. They are described below.

- Affected service
 - Type (ELECTRICITY/TELEPHONE/WATER)
- Carriageway
 - Type (BITUMINOUS/CONCRETE/ER/GRANULAR)
- Embankment
 - Height (m)
 - Hectometre stone
 - N^o
 - High mast lights
 - N^o of lamps
 - Junction
 - Type (X/Y/T)
 - Name of road leading to left
 - N^o of road leading to left
 - Name of road leading to right
 - N^o of road leading to right
 - Kilometre stone
 - N^o
 - Land use
 - Type (AGRICULTURAL/BARREN/COMMERCIAL/FOREST/RESIDENTIAL)
 - Longitudinal road marking
 - Location
 - Type (According to Indian types and codes)
 - Code (According to Indian types and codes)
 - Color (WHITE/YELLOW)
 - Median
 - Width (m)
 - Median opening
 - Width (m)
 - Pedestrian guard rail
 - Height (m)
 - Punctual road marking
 - Location
 - Type (According to Indian types and codes)
 - Code (According to Indian types and codes)
 - Color (WHITE/YELLOW)
 - Right of way
 - LHS (m)

- RHS(m)
 - Safetybarrier
 - Type
 - Height(incm)
 - Shoulder
 - Type(ES/GS/PS)
 - Sign
 - Type(AccordingtoIndiantypes, codesanddimensions)
 - Code(AccordingtoIndiantypes, codesanddimensions)
 - Value(speedlimit)
 - Dimensions(SMALL/MEDIUM/LARGE)
 - Condition(FAIR/GOOD/POOR/VERYPOOR)
 - Streetlight
 - N°oflamps
 - Terrain
 - Type(PLAIN/ROLLING/HILLY)
- Tollpla
 - z
 - a
- Name
 - Villagetown
 - Name
 - Waterbody
 - Type(LAKE/RIVER/STREAM)

DATAACCURACY

The integrated GPS/INS solution produces continuous, smooth position and orientation of the GPSVision™ system even when the GPS signals are lost due to obstructions such as bridges, trees, tunnels or high-rise buildings.

An Inertial Navigation System (INS) is needed for measuring Camera location. Combining GPS, INS and Distance Measurement Indicator (DMI) data is a very efficient and accurate method to determine position (lat/long/height), azimuth, pitch and roll angles. The measurements of the inertial system come from two sensor triads, an accelerometer block and a gyro block. They are defined as three components of the specific force vector and three components of the body rotation rate. Integrated with GPS data, the system geometry data are recalculated using the Kalman method.

The absolute accuracy that can be obtained for terrestrial data positions is sub-meter. If other companies are not specifying an absolute accuracy they most likely cannot meet sub-meter accuracy. The GPSVision™ system was designed to deliver sub-meter RMS positions when visible features are within the camera field of view at distances closest to the front of the camera lenses. The closer to the lenses the more accurate they become. See accuracy profile below:

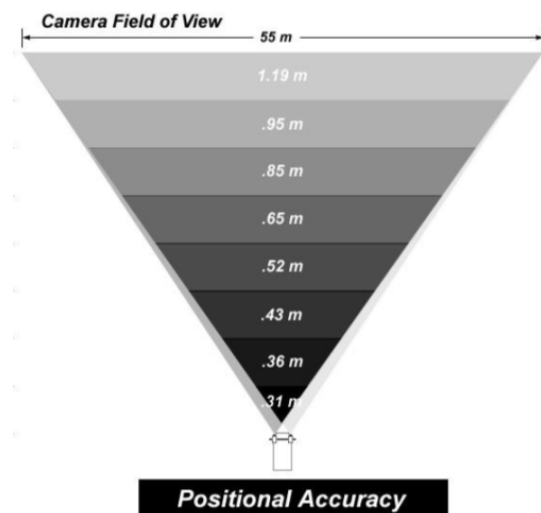


Figure19Positionalaccuracy

Theentiresystemhasmainlythreecomponentsthe dataaccuracyofwhichiscrucial:

Component	Dataaccuracy
Opticalcamera	Submeterlevelaccuracywithin5meterdistanceawayfromvehic clefieldofview
GPSSystem	Centimeterlevelaccuracy
Lasers	ResolutionZ(mm):0.006-0.413
	ResolutionX(mm):0.044-1.100

Table1Accuracy

ANNEXURE 2 PAVEMENT MATERIAL INVESTIGATION

S.No.	Chainage	Direction	Test Pit No.	Coordinates	
				X	Y
1	601+000	RHS	19	241511	2682022
2	603+500	LHS	18	-	-
3	605+700	RHS	17	244151	268542
4	608+000	LHS	16	245512	2687064
5	611+250	RHS	15	297489	2689409
6	613+500	LHS	14	248243	2591534
7	616+000	RHS	13	249627	2693483
8	618+500	LHS	12	251763	2695026
9	621+000	LHS	11	253710	2696372
10	623+500	LHS	10	255747	2697913
11	624+800	RHS	9	257697	2699047
12	628+500	LHS	8	-	-
13	631+000	RHS	7	262286	2701178
14	633+500	LHS	6	264553	2702182
15	635+000	RHS	5	265645	2703043
16	637+500	LHS	4	267832	2703846
17	640+000	RHS	3	270151	2704573

Table I. Test Pits Locations

TEST PIT REPORT

Location::PALANPUR/KHEEMANA-ABUROAD


S.No.	Chainage	Direction	Test PitNo	Description of EachLayerMaterial	RoadSide
					Thickness(mm)
1	640+000	RHS	3	BituminousLayer	250
				WBM/WMM(Base)	210
				GSB(Sub-base)	190
				TOTALCRUST	650
2	637+500	LHS	4	BituminousLayer	230
				WBM/WMM(Base)	220
				GSB(Sub-base)	230
				TOTALCRUST	680
3	635+000	RHS	5	BituminousLayer	230
				WBM/WMM(Base)	220
				GSB(Sub-base)	230
				TOTALCRUST	680
4	633+500	LHS	6	BituminousLayer	210
				WBM/WMM(Base)	230
				GSB(Sub-base)	190
				TOTALCRUST	630
5	631+000	RHS	7	BituminousLayer	270
				WBM/WMM(Base)	170
				GSB(Sub-base)	220
				TOTALCRUST	660
6	628+500	LHS	8	BituminousLayer	200
				WBM/WMM(Base)	220
				GSB(Sub-base)	240
				TOTALCRUST	660
7	624+800	RHS	9	BituminousLayer	180
				WBM/WMM(Base)	270
				GSB(Sub-base)	190
				TOTALCRUST	640
8	623+500	LHS	10	BituminousLayer	220
				WBM/WMM(Base)	180
				GSB(Sub-base)	200
				TOTALCRUST	600
9	621+000		11	BituminousLayer	220
				WBM/WMM(Base)	270
				GSB(Sub-base)	210
				TOTALCRUST	700
10	618+500	LHS	12	BituminousLayer	235
				WBM/WMM(Base)	260
				GSB(Sub-base)	250
				TOTALCRUST	745
11	616+000	RHS	13	BituminousLayer	210
				WBM/WMM(Base)	280
				GSB(Sub-base)	220
				TOTALCRUST	710

TESTPITREPORT

Location::PALANPUR/KHEEMANA-ABUROAD

S.No.	Chainage	Direction	Test PitNo	Description of EachLayerMateri al	RoadSide
					Thickness(mm)
12	613+500	LHS	14	BituminousLayer	230
				WBM/WMM(Base)	250
				GSB(Sub-base)	250
				TOTALCRUST	730
13	611+250	RHS	15	BituminousLayer	245
				WBM/WMM(Base)	250
				GSB(Sub-base)	255
				TOTALCRUST	750
14	608+000	LHS	16	BituminousLayer	210
				WBM/WMM(Base)	240
				GSB(Sub-base)	260
				TOTALCRUST	710
15	605+700	RHS	17	BituminousLayer	270
				WBM/WMM(Base)	235
				GSB(Sub-base)	250
				TOTALCRUST	755
16	603+500	LHS	18	BituminousLayer	240
				WBM/WMM(Base)	230
				GSB(Sub-base)	260
				TOTALCRUST	730
17	601+000	RHS	19	BituminousLayer	225
				WBM/WMM(Base)	200
				GSB(Sub-base)	220
				TOTALCRUST	645

TEST RESULTS						
FIELD DENSITY AND MOISTURE CONTENT						
S.No.	Chainage	Direction	Test Pit No.	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)
1	640+000	RHS	3	1.89	11.24	1.70
2	637+500	LHS	4	1.70	7.44	1.58
3	635+000	RHS	5	1.82	9.42	1.66
4	633+500	LHS	6	1.75	8.59	1.61
5	631+000	RHS	7	1.61	7.92	1.49
6	628+500	LHS	8	1.78	8.09	1.65
7	624+800	RHS	9	1.86	5.12	1.77
8	623+500	LHS	10	1.74	2.13	1.70
9	621+000	LHS	11	1.93	3.20	1.87
10	618+500	LHS	12	1.70	1.70	1.67
11	616+000	RHS	13	1.91	3.02	1.85
12	613+500	LHS	14	1.72	2.43	1.68
13	611+250	RHS	15	1.86	5.06	1.77
14	608+000	LHS	16	1.50	1.80	1.47
15	605+700		17	1.87	4.25	1.79
16	603+500	LHS	18	1.68	2.48	1.64
17	601+000		19	1.87	4.75	1.79

TestResults						
CBRvaluesusingDCPT						
S.No.	CH	Dirxn	DCPT No.	TestPit No.	Layer	CBRValue (%)
1	640+000	RHS	3	3	ExposedBase	32
					SubgradeBase	16
2	637+500	LHS	4	4	ExposedBase	37
					SubgradeBase	32
3	635+000	RHS	5	5	ExposedBase	38
					SubgradeBase	8
4	633+500	LHS	6	6	ExposedBase	51
					SubgradeBase	30
5	631+000	RHS	7	7	ExposedBase	16
					SubgradeBase	34
6	628+500	LHS	8	8	ExposedBase	31
					SubgradeBase	15
7	624+800	RHS	9	9	ExposedBase	63
					SubgradeBase	15
8	623+500	LHS	10	10	ExposedBase	12
					SubgradeBase	13
9	621+000	LHS	11	11	ExposedBase	32
					SubgradeBase	14
10	618+500	LHS	12	12	ExposedBase	47
					SubgradeBase	16
11	616+000	RHS	13	13	ExposedBase	22
					SubgradeBase	23
12	613+500	LHS	14	14	ExposedBase	36
					SubgradeBase	16
13	611+250	RHS	15	15	ExposedBase	61
					SubgradeBase	21
14	608+000	LHS	16	16	ExposedBase	22
					SubgradeBase	27
15	605+700		17	17	ExposedBase	60
					SubgradeBase	18
16	603+500	LHS	18	18	ExposedBase	20
					SubgradeBase	19
17	601+000		19	19	ExposedBase	45
					SubgradeBase	26
<div><div></div><div><div>BibekKumarJhaM.Tech.(Geotechnical Engineering)</div><div>AuthorizedSignatory</div></div></div>						

APPENDIX-I

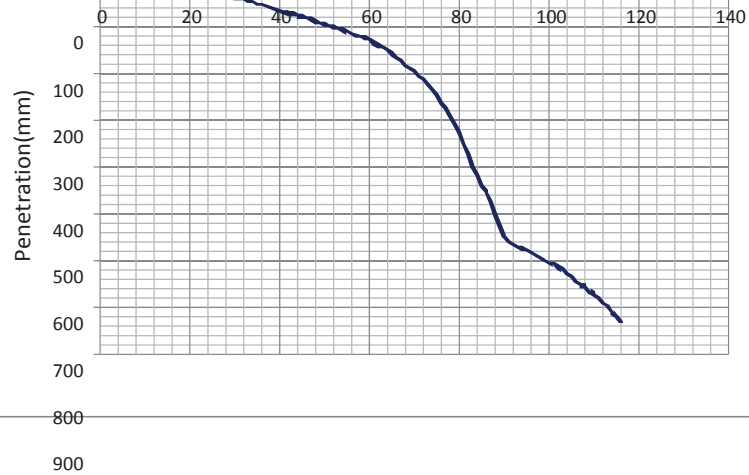
DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 640+000 RHS

Test NO. DCPT-3 **KHEMANATOABU ROAD** **Date:** 17.02.18

X: 270151.00 **Y:** 2704573.00 **Exposed Base**

Depth (mm)	Cumulative No. of blows
12	1
20	2
26	3
30	4
36	5
41	6
49	7
56	8
62	9
69	10
74	11
79	12
82	13
84	14
87	15
91	16
94	17
96	18
99	19
100	20
103	21
106	22
109	23
112	24
116	25
119	26
122	27
126	28
130	29
135	30
137	31
139	32
142	33
145	34
148	35



Number of blows

asperRoadNote31


Rate of Settlement = **7.147**
mm/blow CBR = **32** %

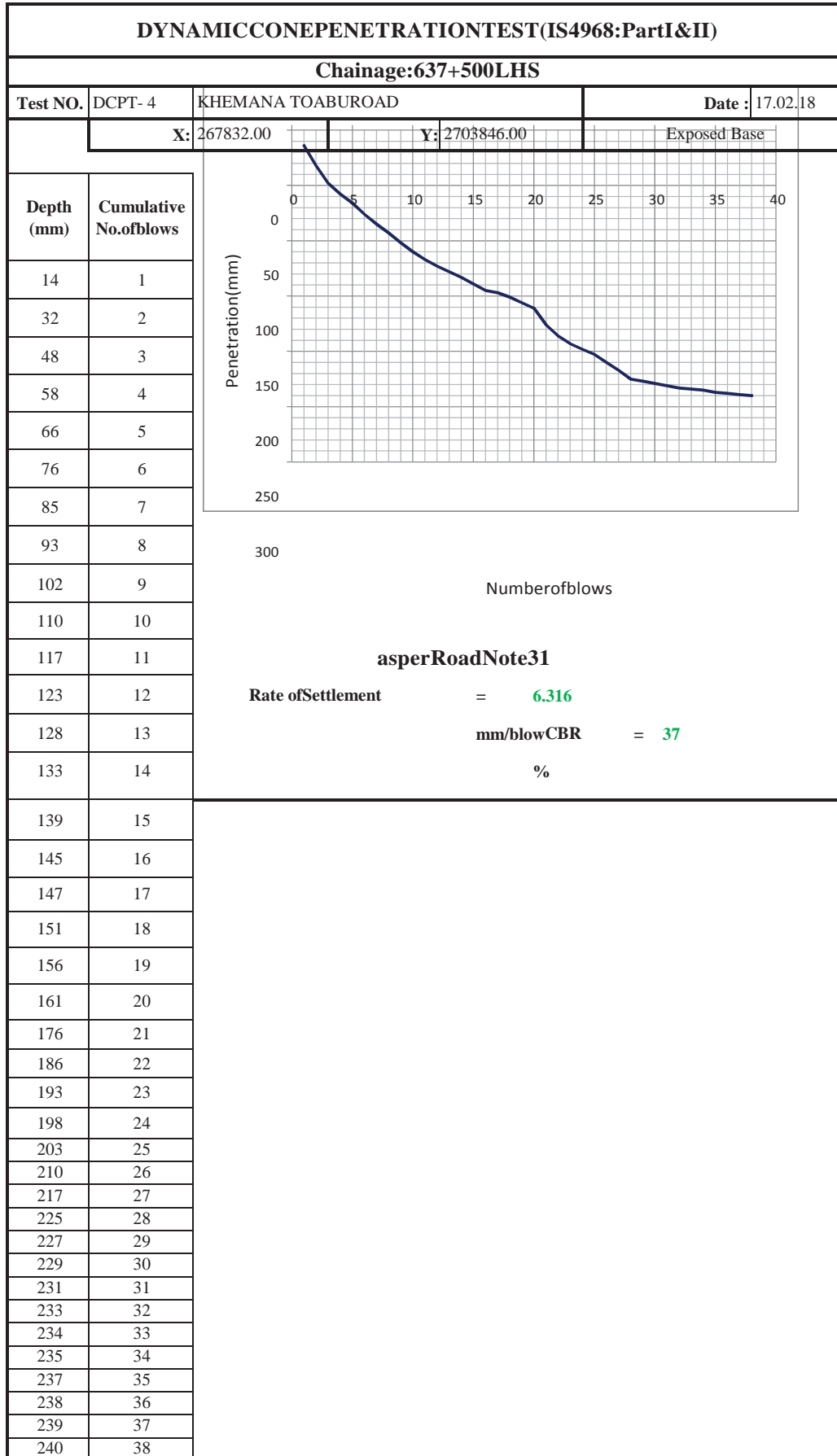
Chainage:640+000RHS				
TestNO.	DCPT-3	KHEMANATOABUROAD		Date: 17.02.18
	X:	270151.00	Y: 2704573.00	ExposedBase
150	36			
153	37			
157	38			
160	39			
163	40			
166	41			
168	42			
170	43			
174	44			
176	45			
179	46			
182	47			
186	48			
189	49			
193	50			
195	51			
198	52			
201	53			
205	54			
208	55			
213	56			
216	57			
219	58			
221	59			
225	60			
232	61			
238	62			
242	63			
248	64			
255	65			
263	66			
272	67			
279	68			
285	69			
294	70			
303	71			
309	72			
320	73			
331	74			
345	75			
361	76			
374	77			
389	78			
408	79			
425	80			
448	81			
470	82			
498	83			
517	84			
538	85			
551	86			
572	87			
599	88			
623	89			
647	90			
656	91			
662	92			

Chainage:640+000RHS				
TestNO.	DCPT-3	KHEMANATOABUROAD		Date: 17.02.18
	X:	270151.00	Y: 2704573.00	ExposedBase
668	93			
672	94			
674	95			
679	96			
684	97			
691	98			
698	99			
702	100			
704	101			
711	102			
716	103			
724	104			
732	105			
743	106			
750	107			
752	108			
763	109			
769	110			
777	111			
788	112			
793	113			
808	114			
816	115			
829	116			

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

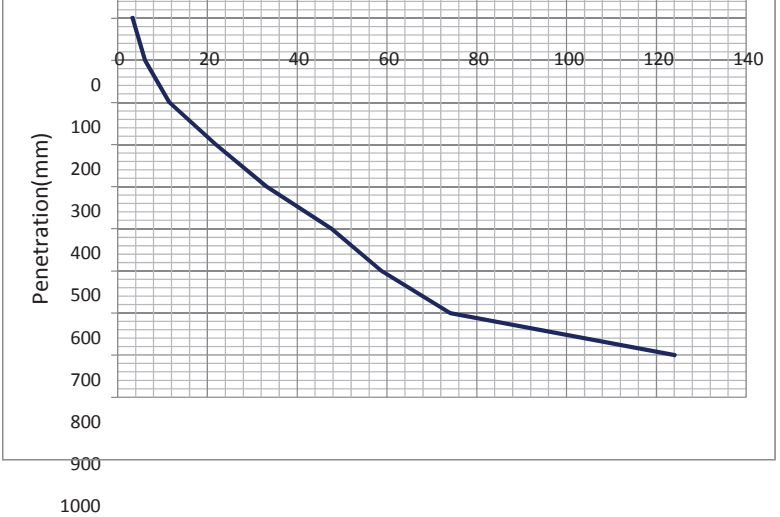
Chainage: 640+000 RHS

TestNO.	DCPT-3	Location:	KHEMANATOABUROAD			Date:	17.02.18
		X:	270151.00	Y:	2704573.00	SubgradeBase	
Depth (mm)	Cumulative No.ofblows	No.ofblows per 10 cmpenetrati on					
100	11	11					
200	19	8					
300	28	10					
400	35	7					
500	42	7					
600	49	7					
700	57	9					
800	62	5					
900	67	4					
			asperRoadNote31				
			RateofSettlement = 13.485				
			mm/blowCBR =				
			16 %				



DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 637+500 LHS

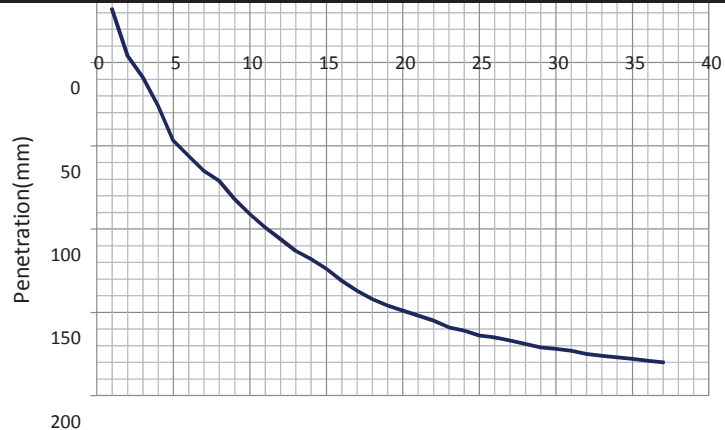
Test NO.	DCPT-4	Location:	KHEMANATOABU ROAD		Date:	17.02.18
		X:	267832.00	Y:	2703846.00	Subgrade Base
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration				
100	3	3				
200	6	3				
300	12	5				
400	22	10				
500	33	11				
600	48	14				
700	59	11				
800	74	15				
900	124	50				
			<p>asperRoadNote31</p> <p>Rate of Settlement = 7.258</p> <p>mm/blow CBR =</p> <p>32 %</p>			

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 635+000 RHS

Test NO.	DCPT-5	KHEMANATOABU ROAD	Date:	17.02.18
	X: 265645.00	Y: 2703043.00	Exposed Base	

Depth (mm)	Cumulative No. of blows
18	1
46	2
59	3
76	4
97	5
106	6
115	7
121	8
132	9
141	10
149	11
156	12
163	13
168	14
174	15
181	16
187	17
192	18
196	19
199	20
202	21
205	22
209	23
211	24
214	25
215	26
217	27
219	28
221	29
222	30
223	31
225	32
226	33
227	34
228	35
229	36
230	37



250

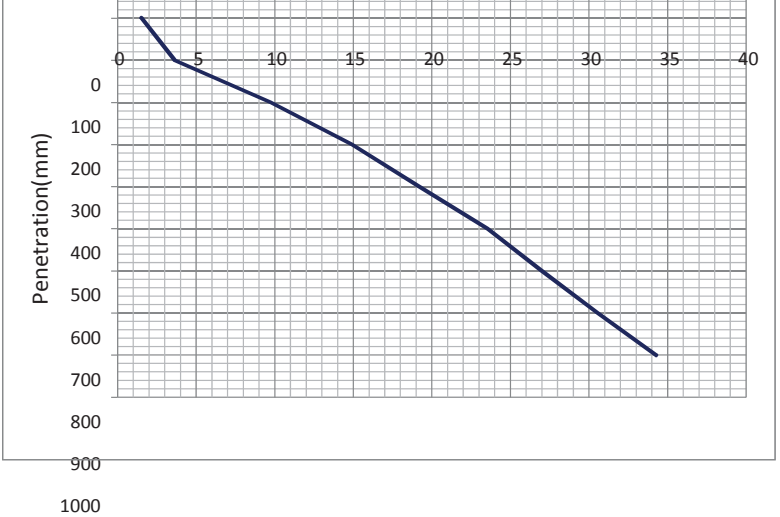
Number of blows

asperRoad Note 31

Rate of Settlement = 6.216
mm/blow CBR =
38 %

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 635+000 RHS

Test NO.	DCPT-5	Location:	KHEMANATOABU ROAD	Date:	17.02.18
		X:	265645.00	Y:	2703043.00
				Subgrade Base	
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
100	2	2			
200	4	2			
300	10	6			
400	15	5			
500	19	4			
600	24	4			
700	27	3			
800	31	4			
900	34	4			
			<p>asperRoadNote31</p> <p>Rate of Settlement = 26.270</p> <p>mm/blow CBR =</p> <p>8 %</p>		

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 633+500 LHS

Test NO.	DCPT-6	KHEMANATOABUROAD	Date:	18.02.18
	X:	264553.00	Y:	2702182.00
			Exposed Base	

Depth (mm)	Cumulative No. of blows
12	1
20	2
27	3
34	4
45	5
51	6
57	7
64	8
69	9
75	10
81	11
88	12
92	13
96	14
99	15
102	16
106	17
110	18
113	19
117	20
122	21
127	22
132	23
136	24
139	25
142	26
145	27
148	28
150	29
152	30
155	31
156	32
157	33



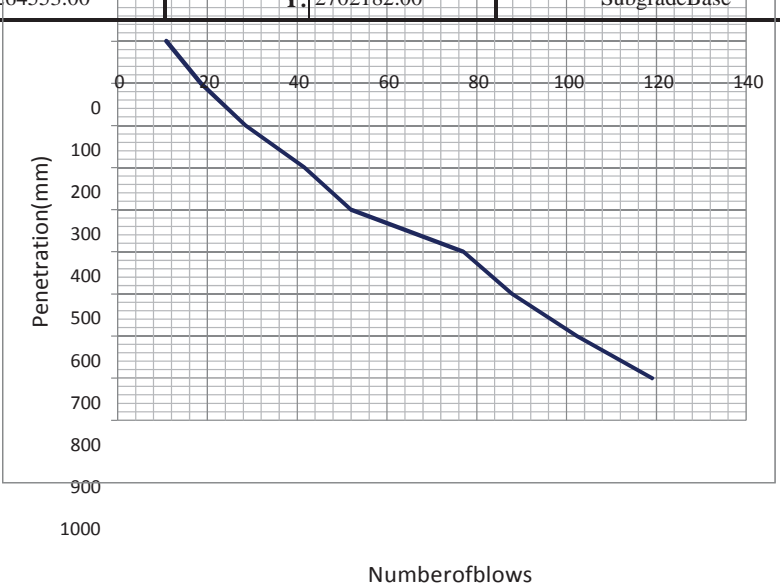
Number of blows

asperRoadNote31

Rate of Settlement = 4.758
mm/blow CBR = 51 %

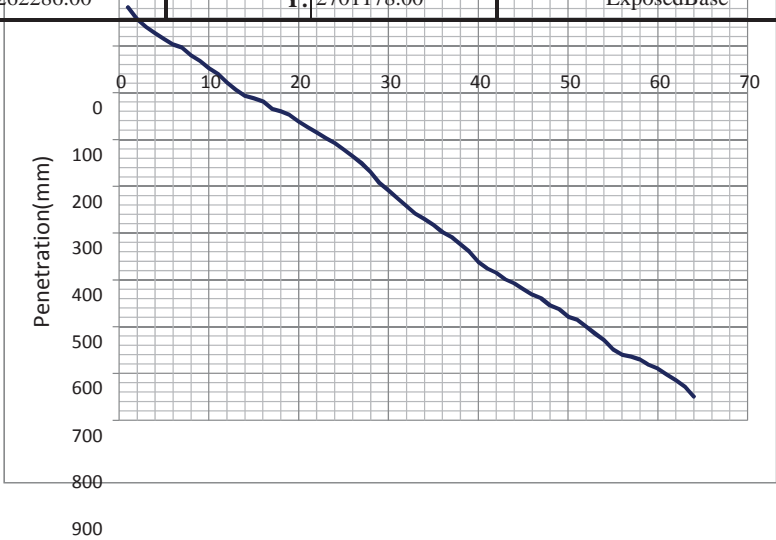
DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 633+500 LHS

Test NO.	DCPT-6	Location:	KHEMANATOABU ROAD		Date:	18.02.18
		X:	264553.00	Y:	2702182.00	Subgrade Base
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration				
100	11	11				
200	19	8				
300	29	10				
400	42	13				
500	52	10				
600	77	25				
700	88	11				
800	102	15				
900	119	17				
			<p>asperRoadNote31</p> <p>Rate of Settlement = 7.563</p> <p>mm/blow CBR =</p> <p>30 %</p>			

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 631+000 RHS

Test NO.	DCPT-7	KHEMANATOABUROAD	Date:	18.02.18
	X:	262286.00	Y:	2701178.00
			Exposed Base	
Depth (mm)	Cumulative No. of blows			
18	1			
43	2			
60	3			
73	4			
86	5			
97	6			
104	7			
120	8			
132	9			
148	10			
160	11			
179	12			
194	13			
207	14			
212	15			
219	16			
235	17			
240	18			
248	19			
262	20			
274	21			
285	22			
297	23			
308	24			
322	25			
336	26			
351	27			
370	28			
394	29			
410	30			
426	31			
442	32			
459	33			
470	34			
483	35			
498	36			

Number of blows

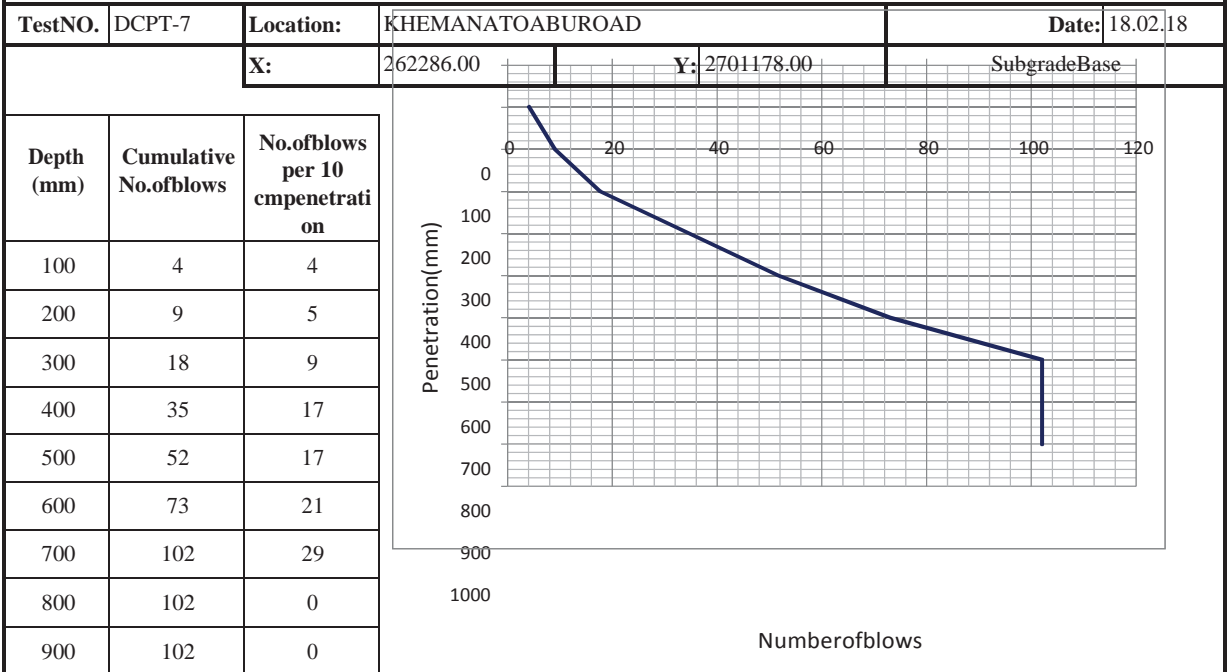
asperRoadNote31

Rate of Settlement = 13.266
mm/blow CBR =
16 %

Chainage:631+000RHS				
TestNO.	DCPT-7	KHEMANATOABUROAD		Date: 18.02.18
	X:	262286.00	Y: 2701178.00	ExposedBase
509	37			
524	38			
540	39			
562	40			
576	41			
585	42			
599	43			
608	44			
620	45			
632	46			
640	47			
655	48			
663	49			
679	50			
685	51			
700	52			
715	53			
729	54			
749	55			
760	56			
764	57			
770	58			
782	59			
790	60			
803	61			
815	62			
829	63			
849	64			

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 631+000 RHS

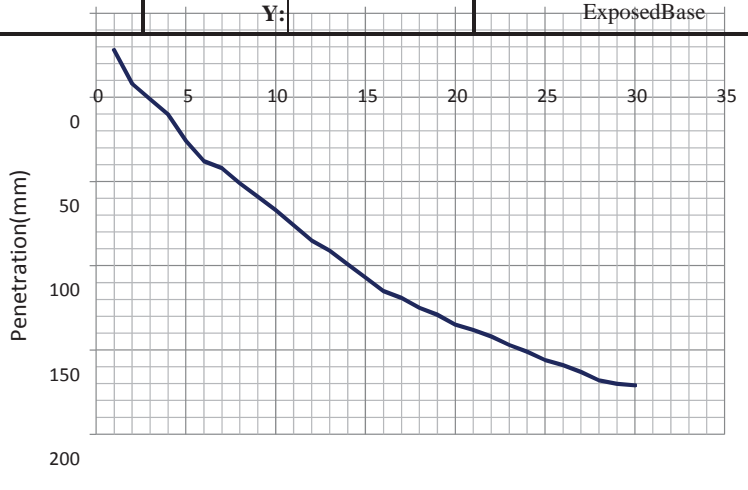


asper Road Note 31

Rate of Settlement = 6.863
mm/blow CBR =
34 %

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 628+500 LHS

TestNO.	DCPT-8	KHEMANATOABUROAD		Date:	18.02.18
	X:		Y:	ExposedBase	
Depth (mm)	Cumulative No.ofblows				
22	1				
42	2				
51	3				
60	4				
76	5				
88	6				
92	7				
101	8				
109	9				
117	10				
126	11				
135	12				
141	13				
149	14				
157	15	<p>asperRoadNote31</p> <p>RateofSettlement = 7.367</p> <p>mm/blowCBR = 31 %</p>			
165	16				
169	17				
175	18				
179	19				
185	20				
188	21				
192	22				
197	23				
201	24				
206	25				
209	26				
213	27				
218	28				
220	29				
221	30				

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 628+500 LHS

Test NO.	DCPT-8	Location:	KHEMANATOABU ROAD	Date:	18.02.18
		X:		Y:	Subgrade Base

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	4	4
200	10	6
300	15	5
400	23	8
500	31	8
600	37	6
700	45	8
800	54	10
900	62	8

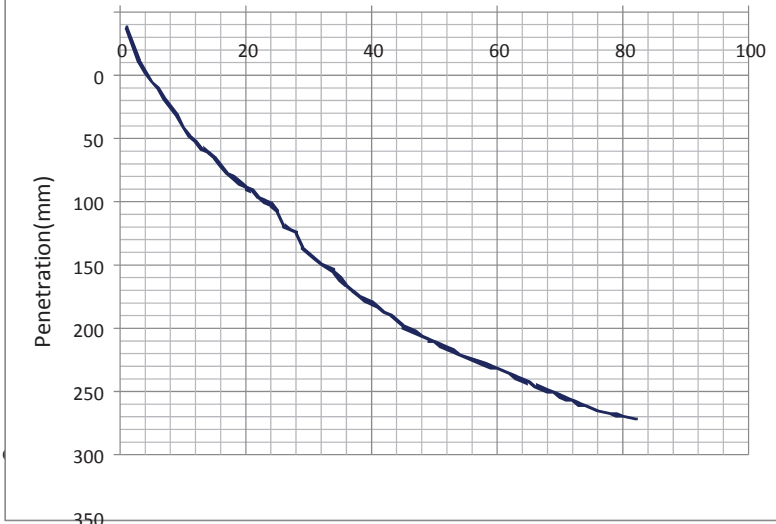
Penetration (mm)

Number of blows

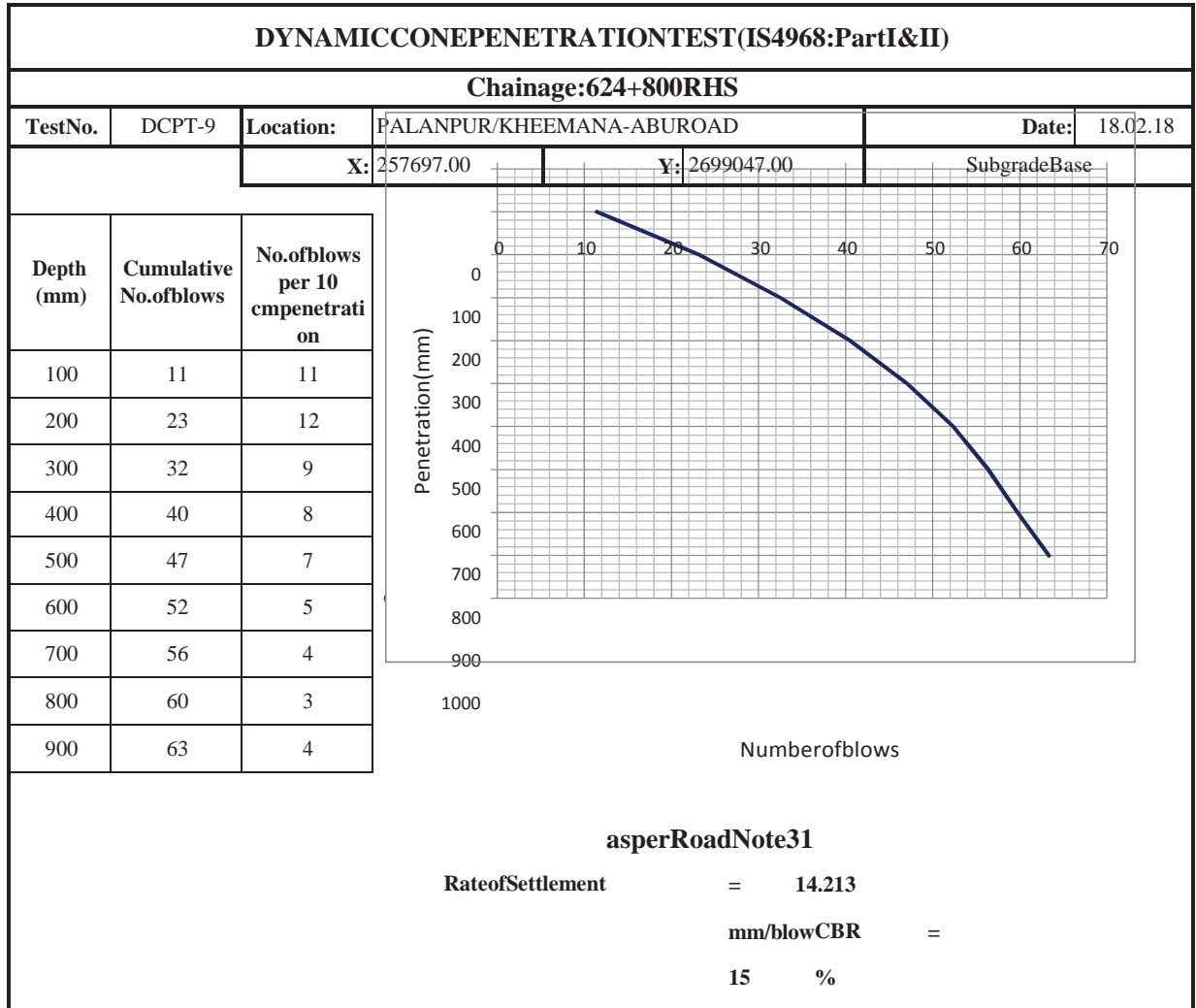
asperRoadNote31

Rate of Settlement = 14.480

mm/blow CBR = 15 %

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)				
Chainage: 624+800 RHS				
Test No.	DCPT-9	PALANPUR/KHEEMANA-ABU ROAD		Date: 18.02.18
	X:	257697.00	Y: 2699047.00	Exposed Base
Depth (mm)	Cumulative No. of blows	 <p>Penetration (mm)</p> <p>Number of blows</p> <p>asperRoadNote31</p> <p>Rate of Settlement = 3.915 mm/blow CBR = 63 %</p>		
12	1			
25	2			
38	3			
47	4			
54	5			
60	6			
67	7			
74	8			
81	9			
90	10			
97	11			
101	12			
107	13			
110	14			
114	15			
121	16			
127	17			
130	18			
134	19			
138	20			
140	21			
146	22			
149	23			
151	24			
157	25			
168	26			
171	27			
174	28			
185	29			
190	30			
194	31			
198	32			
201	33			
204	34			
210	35			
216	36			

Chainage:624+800RHS				
TestNo.	DCPT-9	PALANPUR/KHEEMANA-ABUROAD		Date: 18.02.18
	X:	257697.00	Y: 2699047.00	ExposedBase
219	37			
224	38			
227	39			
229	40			
233	41			
236	42			
239	43			
243	44			
248	45			
250	46			
252	47			
255	48			
258	49			
260	50			
263	51			
265	52			
267	53			
270	54			
272	55			
274	56			
276	57			
278	58			
280	59			
281	60			
283	61			
285	62			
288	63			
290	64			
292	65			
295	66			
297	67			
298	68			
300	69			
303	70			
305	71			
306	72			
309	73			
310	74			
312	75			
314	76			
315	77			
316	78			
318	79			
319	80			
320	81			
321	82			

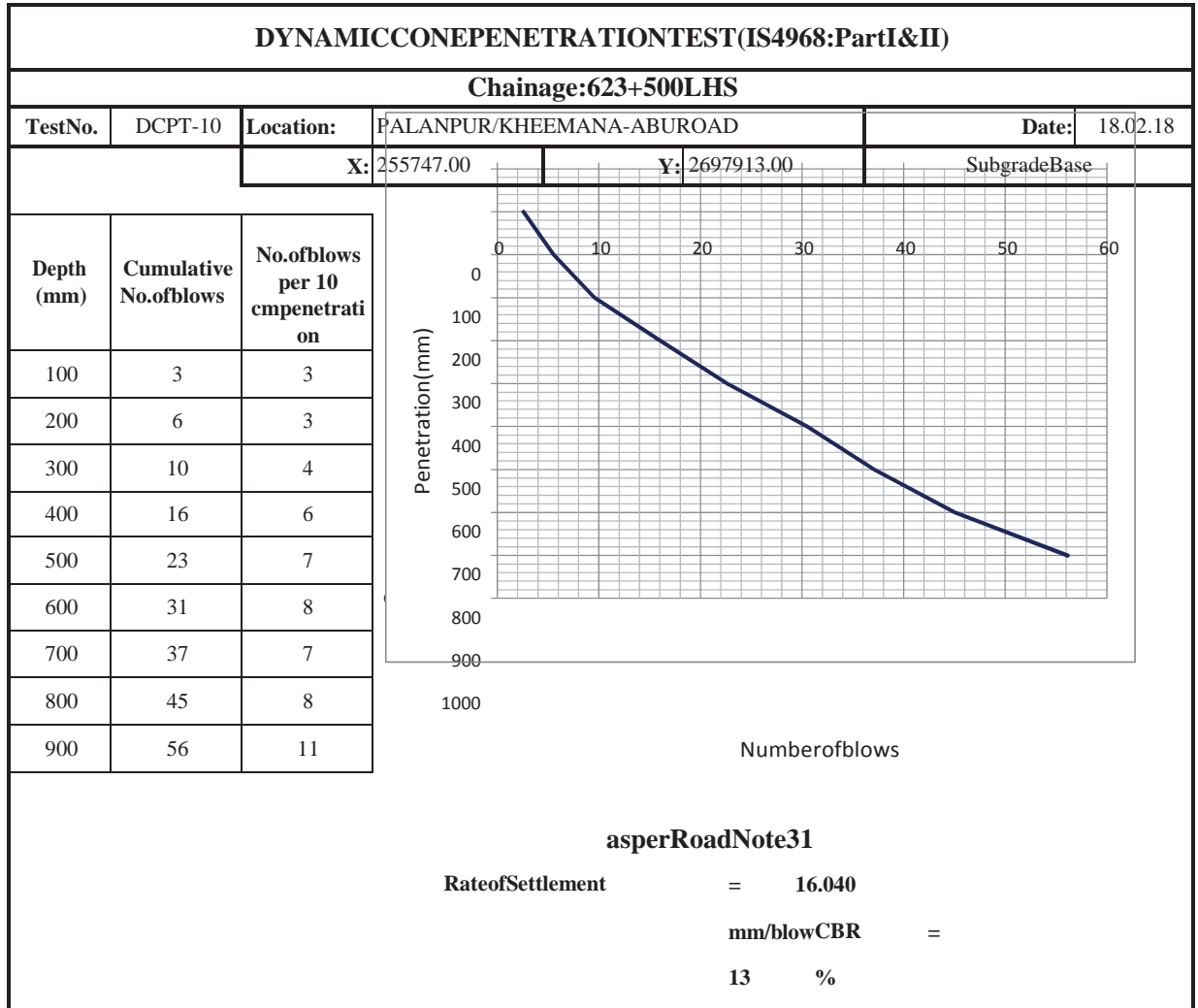


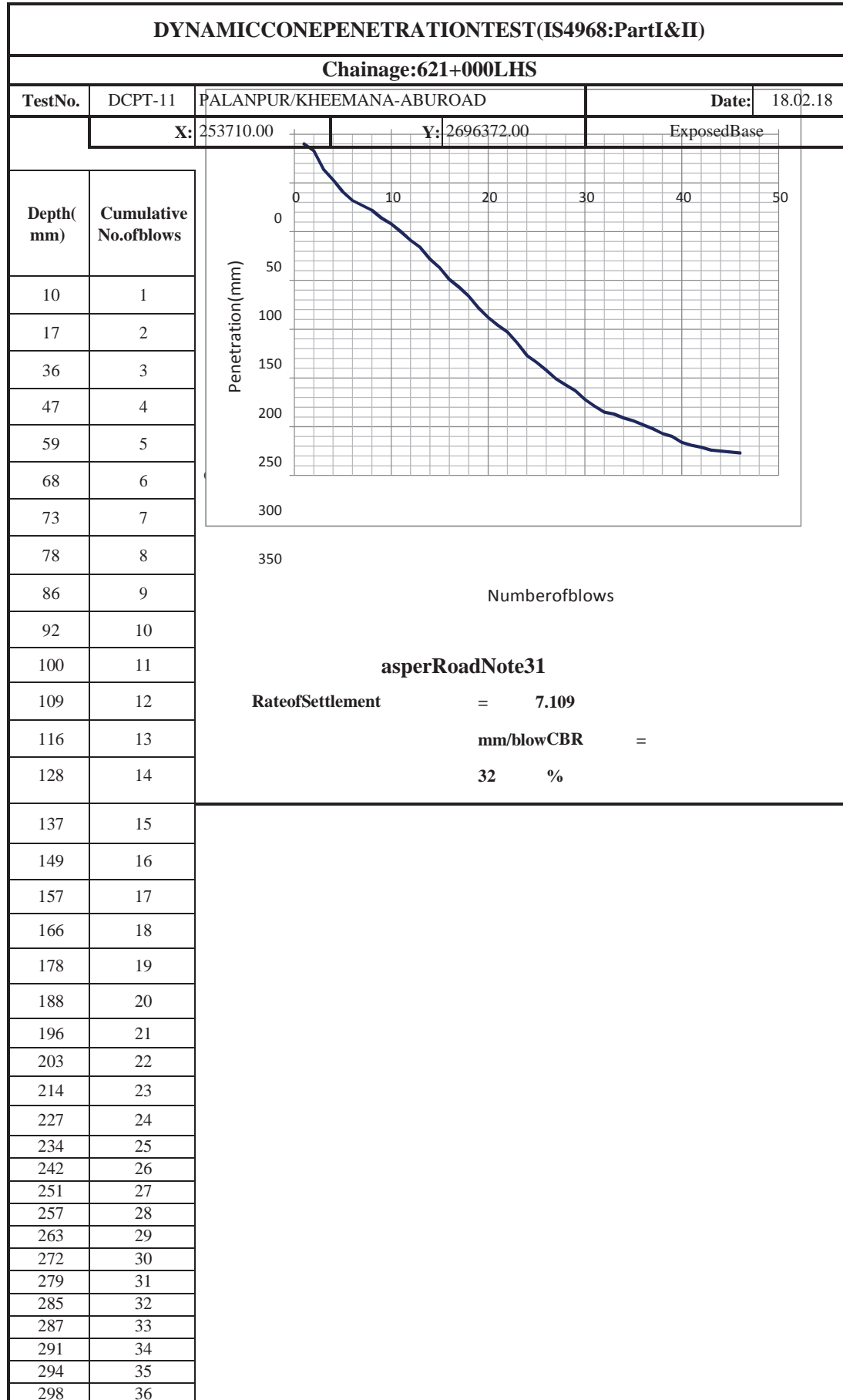
DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 623+500 LHS

TestNo.	DCPT-10	PALANPUR/KHEEMANA-ABUROAD		Date:	18.02.18
		X: 255747.00	Y: 2697913.00	ExposedBase	
<div><div>Depth(mm)</div><div>Cumulative No.ofblows</div></div>	47	1	<div><div><div>Penetration(mm)</div><div>Numberofblows</div></div><div><div>asperRoadNote31</div><div>RateofSettlement = 17.128 mm/blowCBR = 12 %</div></div></div>		
	75	2			
	105	3			
	124	4			
	157	5			
	182	6			
	205	7			
	228	8			
	242	9			
	260	10			
	273	11			
	296	12			
	312	13			
	330	14			
	350	15			
	377	16			
	399	17			
	420	18			
	441	19			
	457	20			
	470	21			
	494	22			
	510	23			
	527	24			
	543	25			
	557	26			
	571	27			
	587	28			
	598	29			
	611	30			
	628	31			
	637	32			
	650	33			
	667	34			
	675	35			
	691	36			

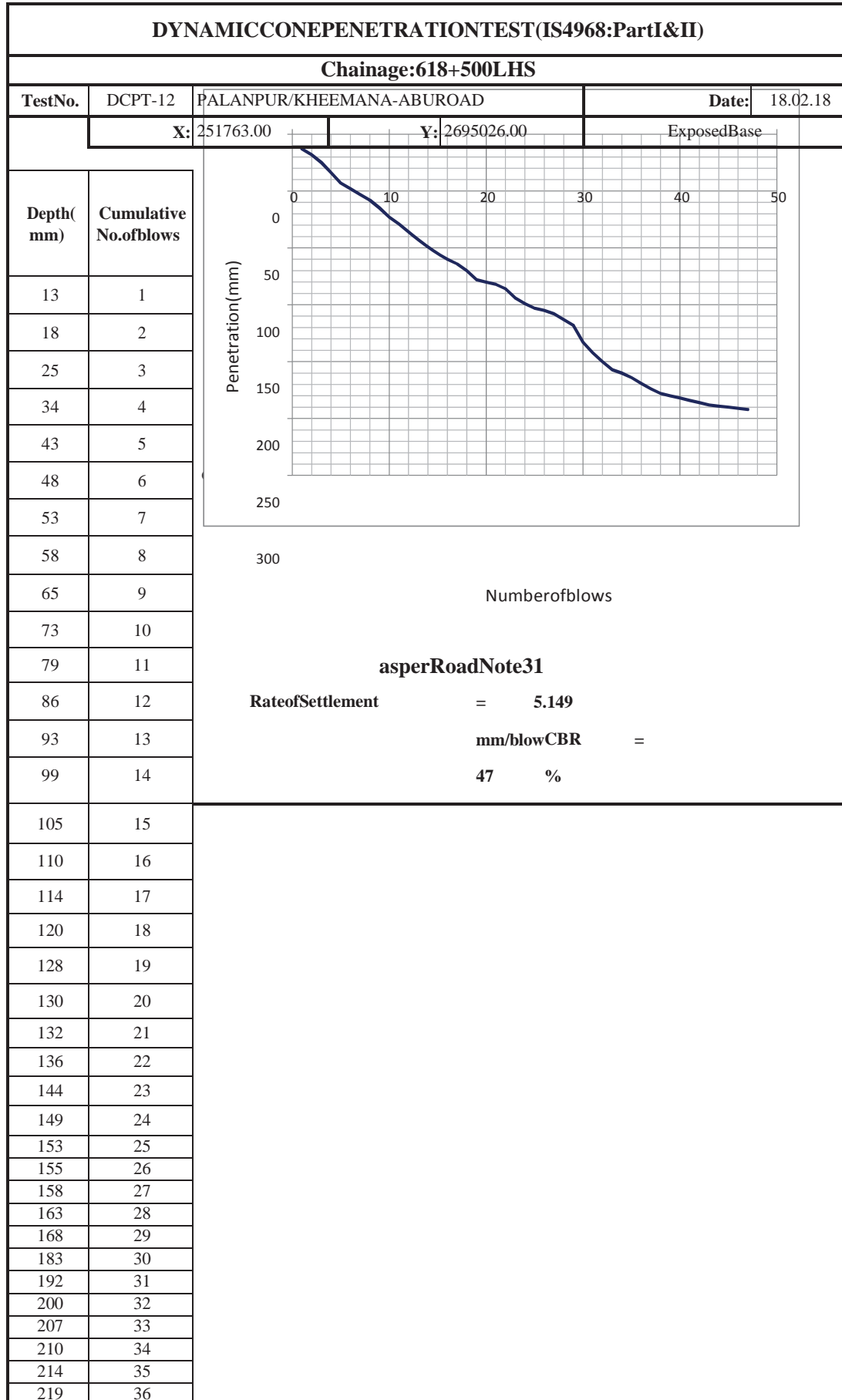
Chainage:623+500LHS				
TestNo.	DCPT-10	PALANPUR/KHEEMANA-ABUROAD		Date: 18.02.18
	X:	255747.00	Y: 2697913.00	ExposedBase
701	37			
712	38			
720	39			
731	40			
740	41			
756	42			
765	43			
773	44			
780	45			
795	46			
805	47			



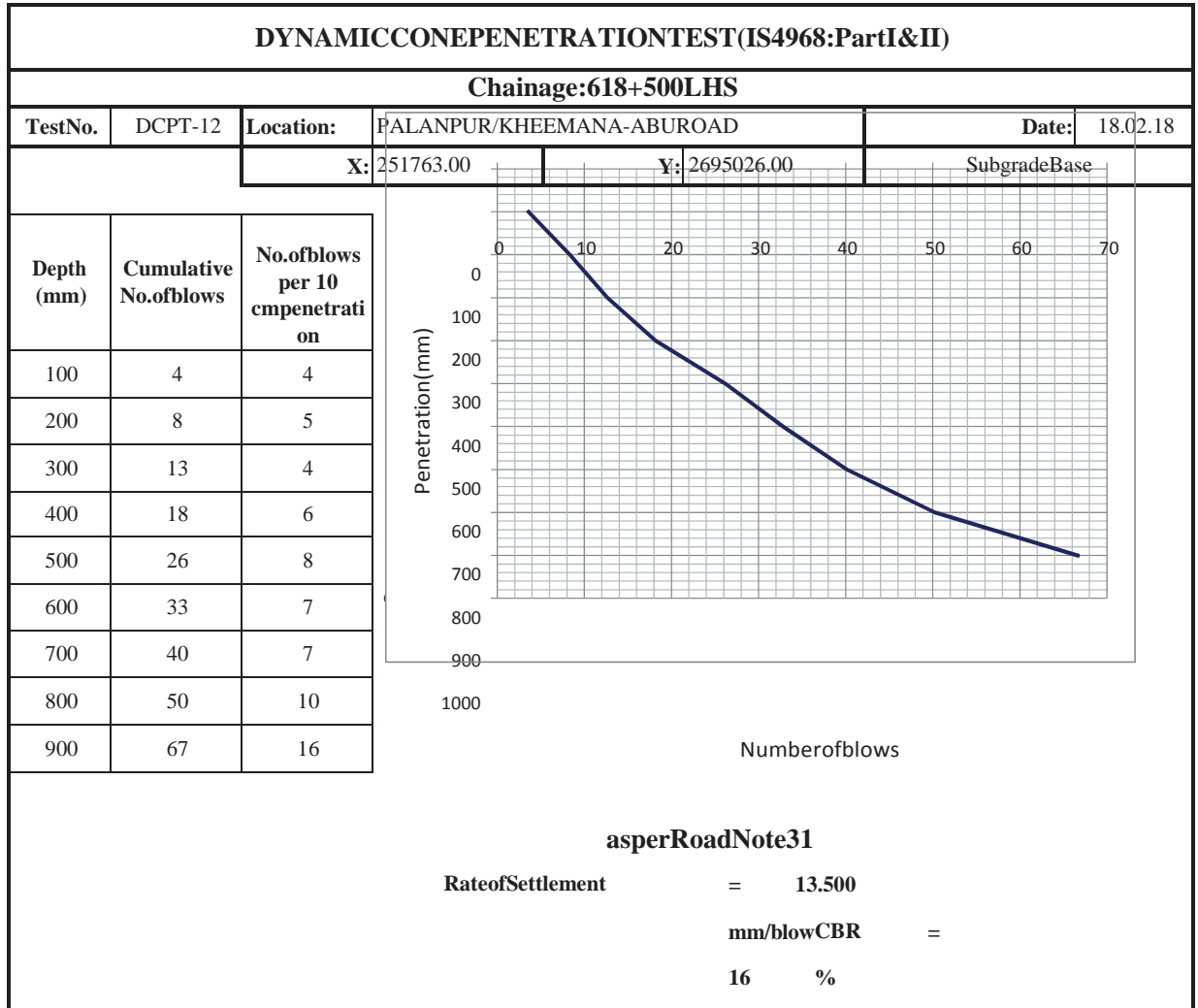


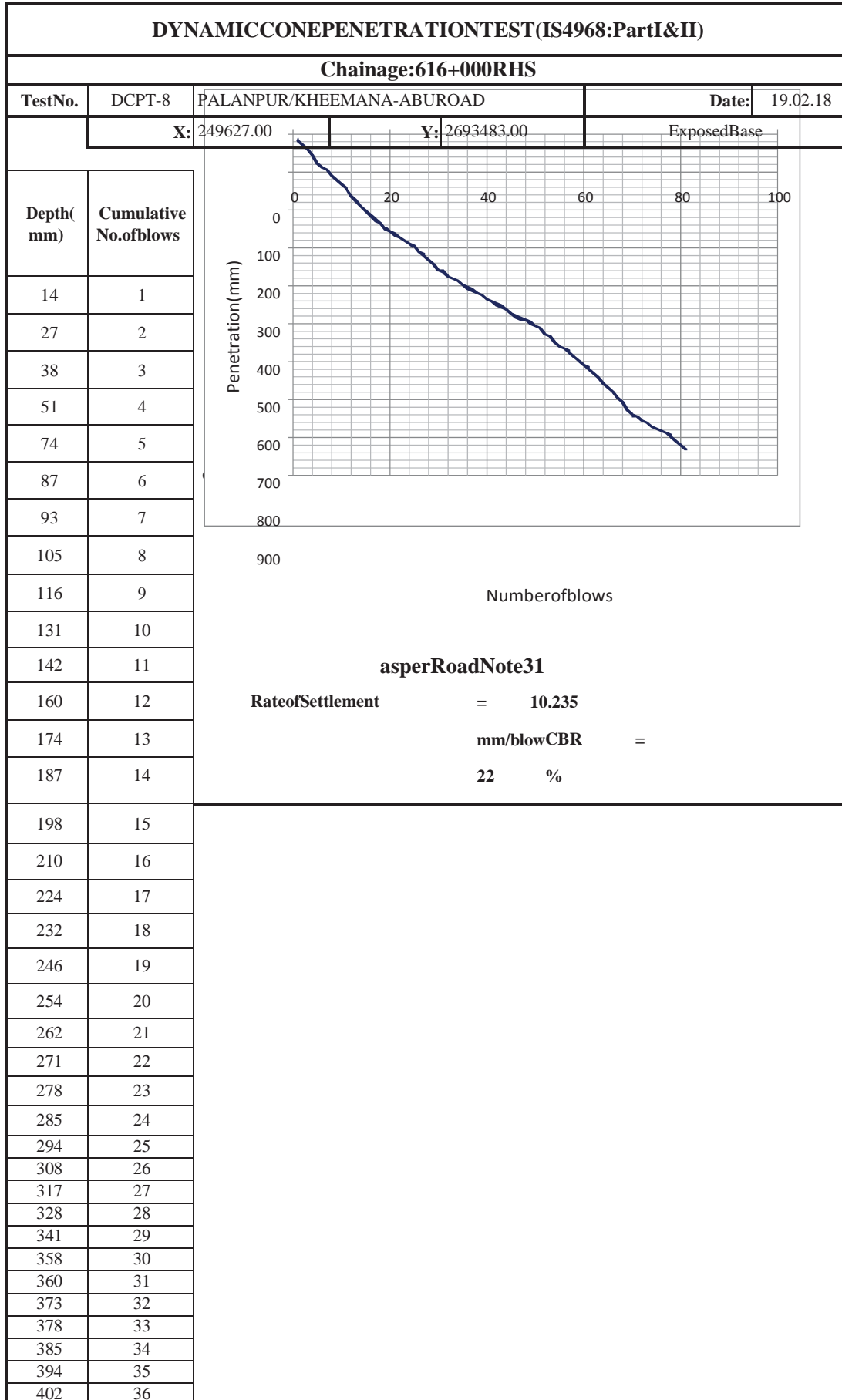
Chainage:621+000LHS				
TestNo.	DCPT-11	PALANPUR/KHEEMANA-ABUROAD		Date: 18.02.18
	X:	253710.00	Y: 2696372.00	ExposedBase
302	37			
307	38			
310	39			
316	40			
319	41			
321	42			
324	43			
325	44			
326	45			
327	46			

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)				
Chainage: 621+000 LHS				
Test No.	DCPT-11	Location:	PALANPUR/KHEEMANA-ABU ROAD	Date: 18.02.18
		X: 253710.00	Y: 2696372.00	Subgrade Base
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration		
100	9	9		
200	17	7		
300	25	9		
400	33	8		
500	39	6		
600	44	5		
700	49	5		
800	54	5		
900	61	7		
<p>asper Road Note 31</p> <p>Rate of Settlement = 14.806</p> <p>mm/blow CBR =</p> <p>14 %</p>				

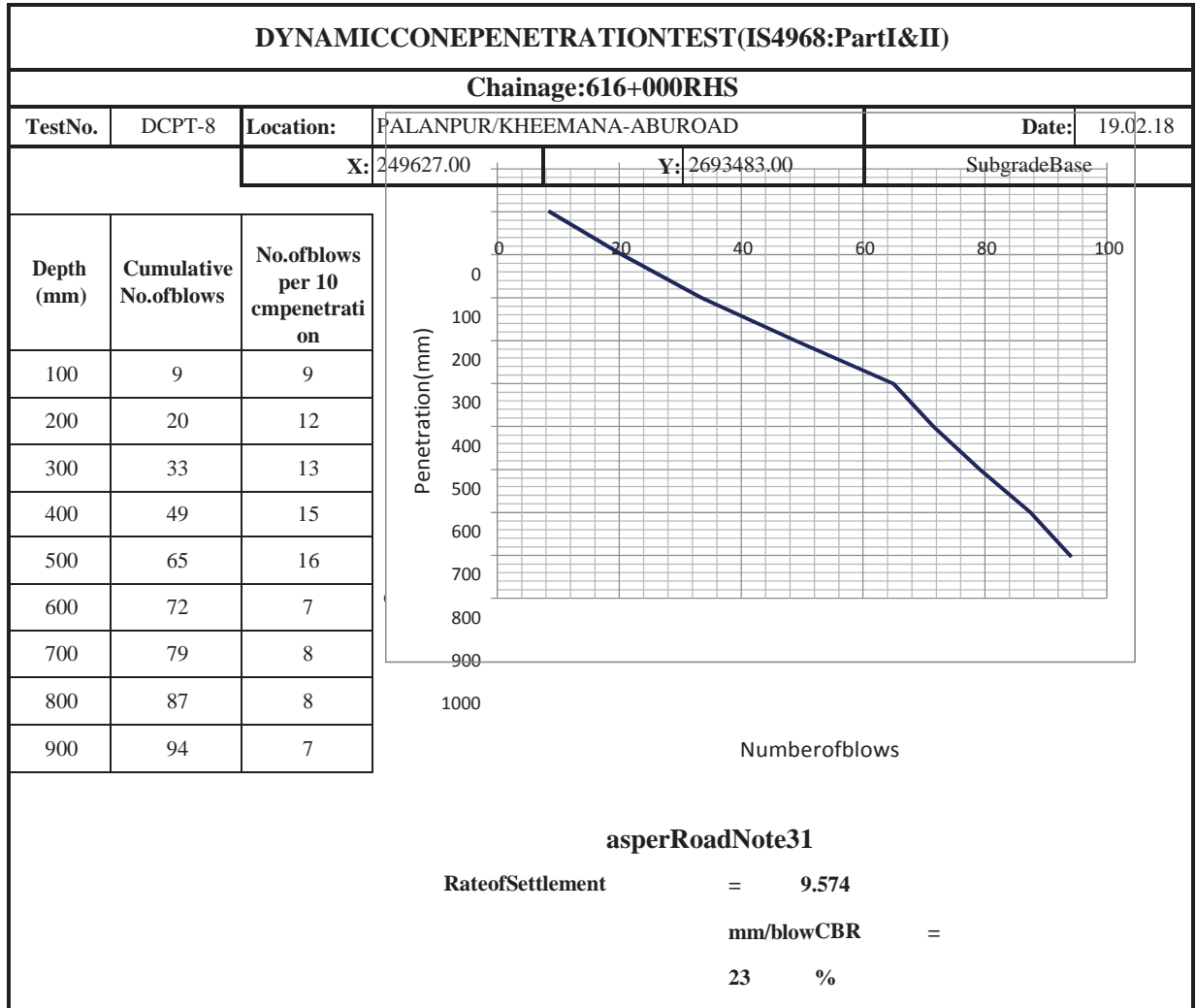


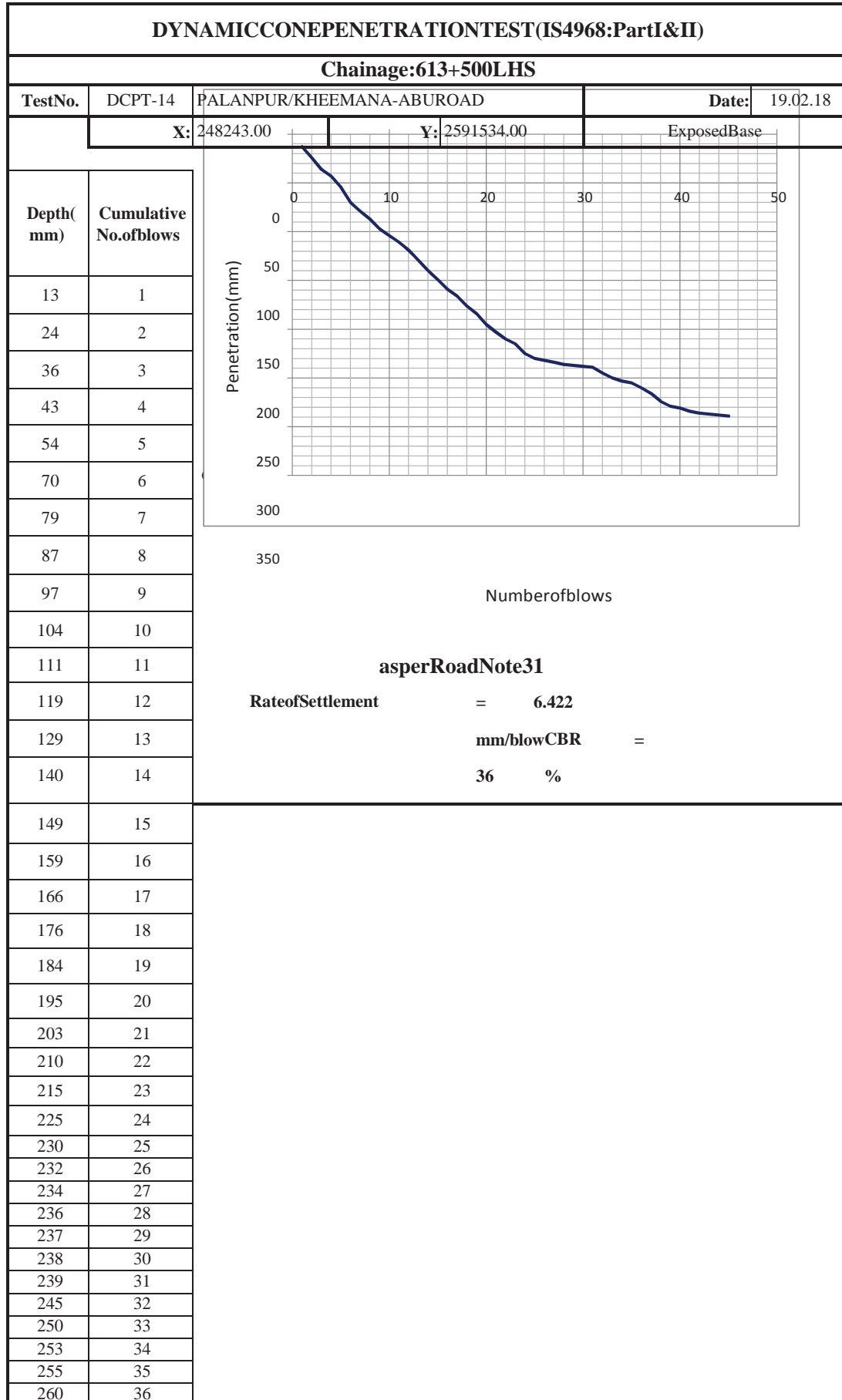
Chainage:618+500LHS				
TestNo.	DCPT-12	PALANPUR/KHEEMANA-ABUROAD		Date: 18.02.18
	X:	251763.00	Y: 2695026.00	ExposedBase
224	37			
228	38			
230	39			
232	40			
234	41			
236	42			
238	43			
239	44			
240	45			
241	46			
242	47			





Chainage:616+000RHS				
TestNo.	DCPT-8	PALANPUR/KHEEMANA-ABUROAD		Date: 19.02.18
	X:	249627.00	Y: 2693483.00	ExposedBase
408	37			
416	38			
422	39			
431	40			
438	41			
446	42			
452	43			
460	44			
471	45			
479	46			
484	47			
488	48			
496	49			
502	50			
510	51			
525	52			
532	53			
548	54			
558	55			
564	56			
572	57			
586	58			
594	59			
606	60			
615	61			
628	62			
641	63			
657	64			
668	65			
677	66			
691	67			
705	68			
726	69			
738	70			
742	71			
753	72			
759	73			
767	74			
774	75			
781	76			
787	77			
794	78			
805	79			
818	80			
829	81			





Chainage:613+500LHS				
TestNo.	DCPT-14	PALANPUR/KHEEMANA-ABUROAD		Date: 19.02.18
	X:	248243.00	Y: 2591534.00	ExposedBase
266	37			
274	38			
279	39			
281	40			
284	41			
286	42			
287	43			
288	44			
289	45			

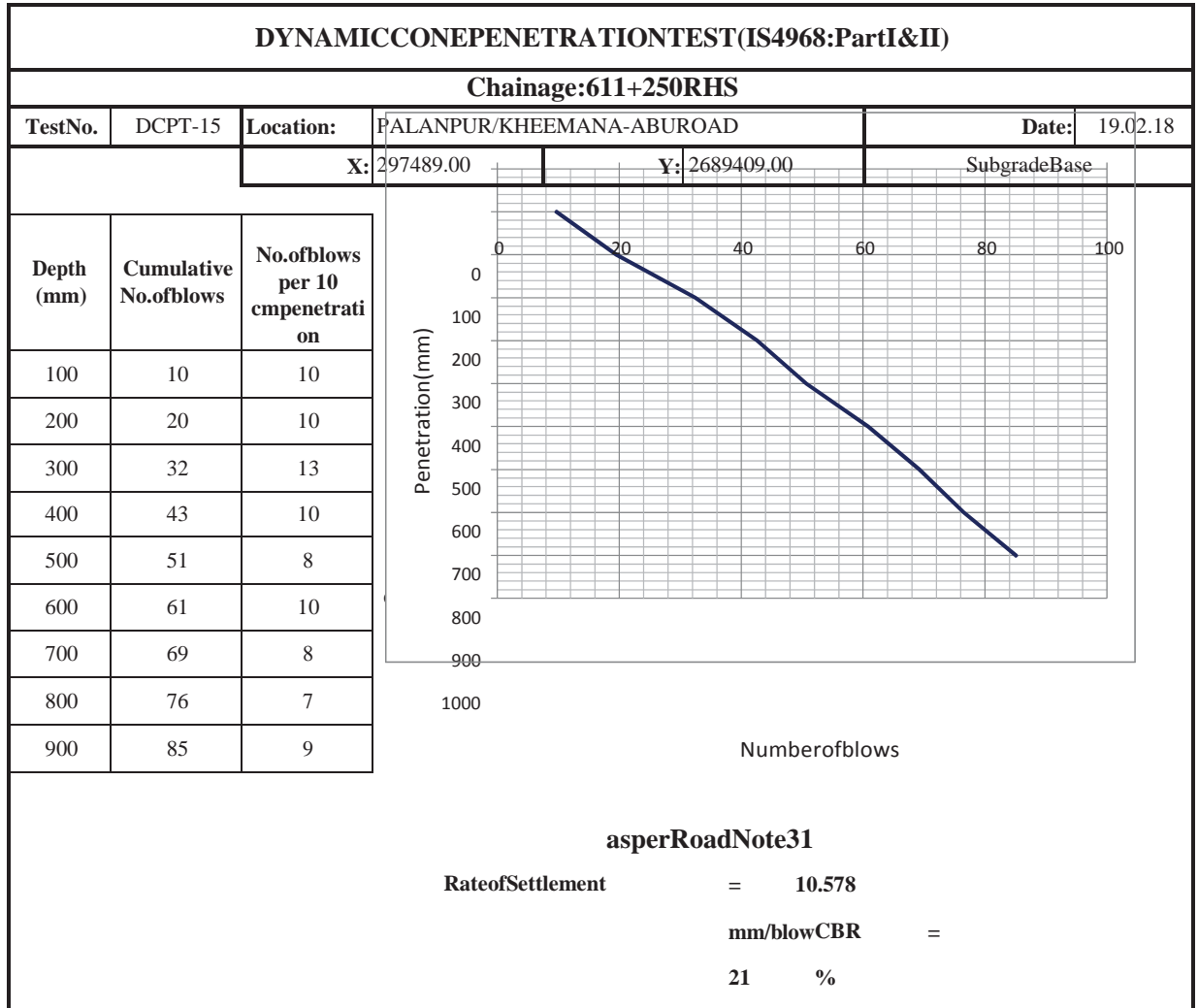
DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)				
Chainage: 613+500 LHS				
Test No.	DCPT-14	Location:	PALANPUR/KHEEMANA-ABU ROAD	Date: 19.02.18
		X: 248243.00	Y: 2591534.00	Subgrade Base
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration		
100	4	4		
200	11	6		
300	18	7		
400	26	8		
500	32	6		
600	38	7		
700	47	9		
800	57	10		
900	67	10		
			Number of blows	
asper Road Note 31 Rate of Settlement = 13.433 mm/blow CBR = 16 %				

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 611+250 RHS


TestNo.	DCPT-15	PALANPUR/KHEEMANA-ABUROAD		Date:	19.02.18
		X: 297489.00	Y: 2689409.00	ExposedBase	
<div>Depth(mm)</div> <div>Cumulative No.ofblows</div> <div>9120283742465153596268737985909398104109113117122126131134137140145149156163169176183186191</div>	<div><div>Penetration(mm)</div><div>050100150200250300</div><div>01020304050607080</div><div>Numberofblows</div><div>asperRoadNote31</div><div>RateofSettlement = 4.045</div><div>mm/blowCBR =</div><div>61 %</div></div>				

Chainage:611+250RHS				
TestNo.	DCPT-15	PALANPUR/KHEEMANA-ABUROAD		Date: 19.02.18
	X:	297489.00	Y: 2689409.00	ExposedBase
198	37			
202	38			
209	39			
215	40			
218	41			
221	42			
226	43			
229	44			
230	45			
234	46			
237	47			
240	48			
243	49			
245	50			
247	51			
249	52			
250	53			
252	54			
255	55			
256	56			
258	57			
259	58			
261	59			
262	60			
263	61			
265	62			
266	63			
267	64			
269	65			
270	66			
271	67			

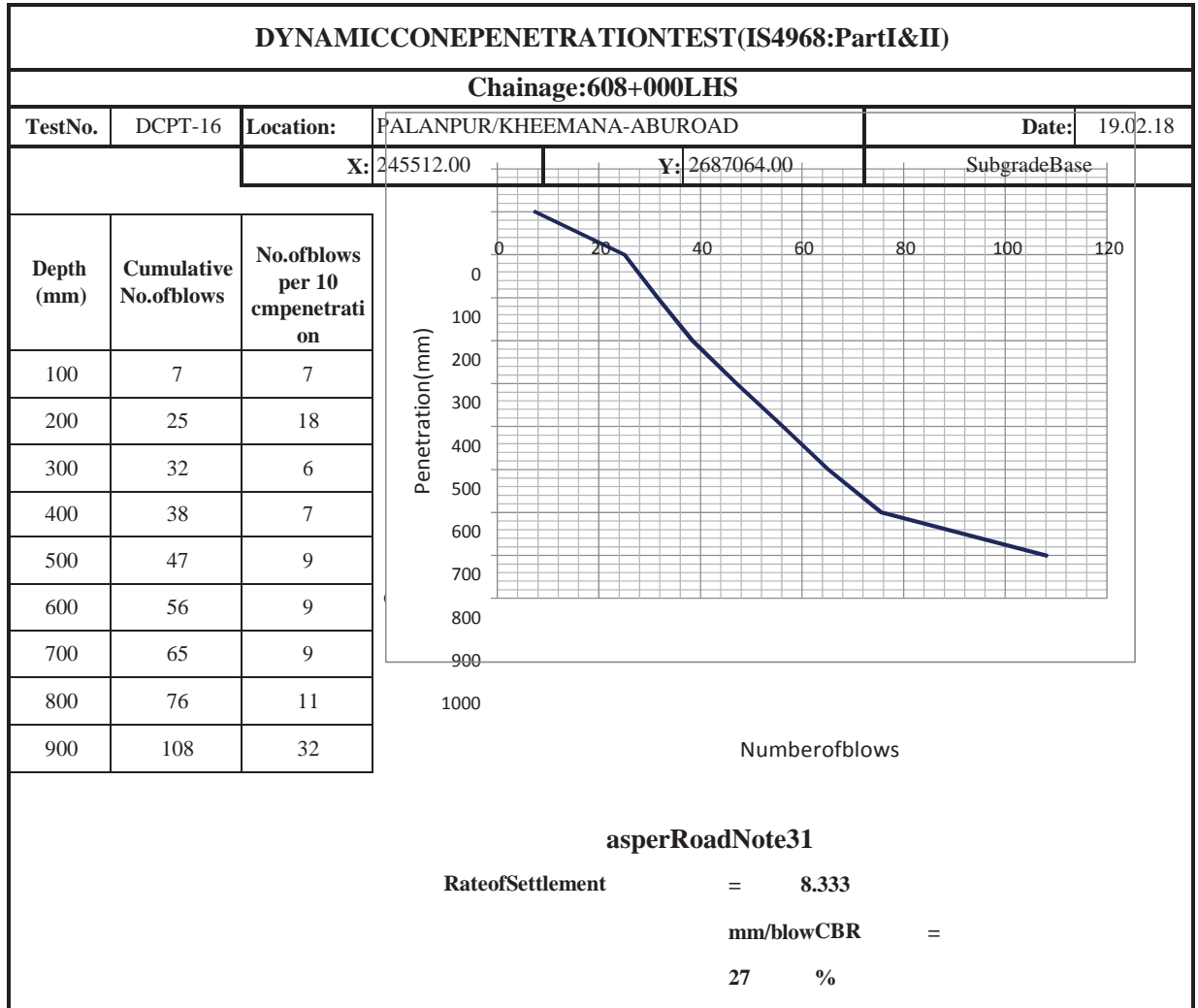


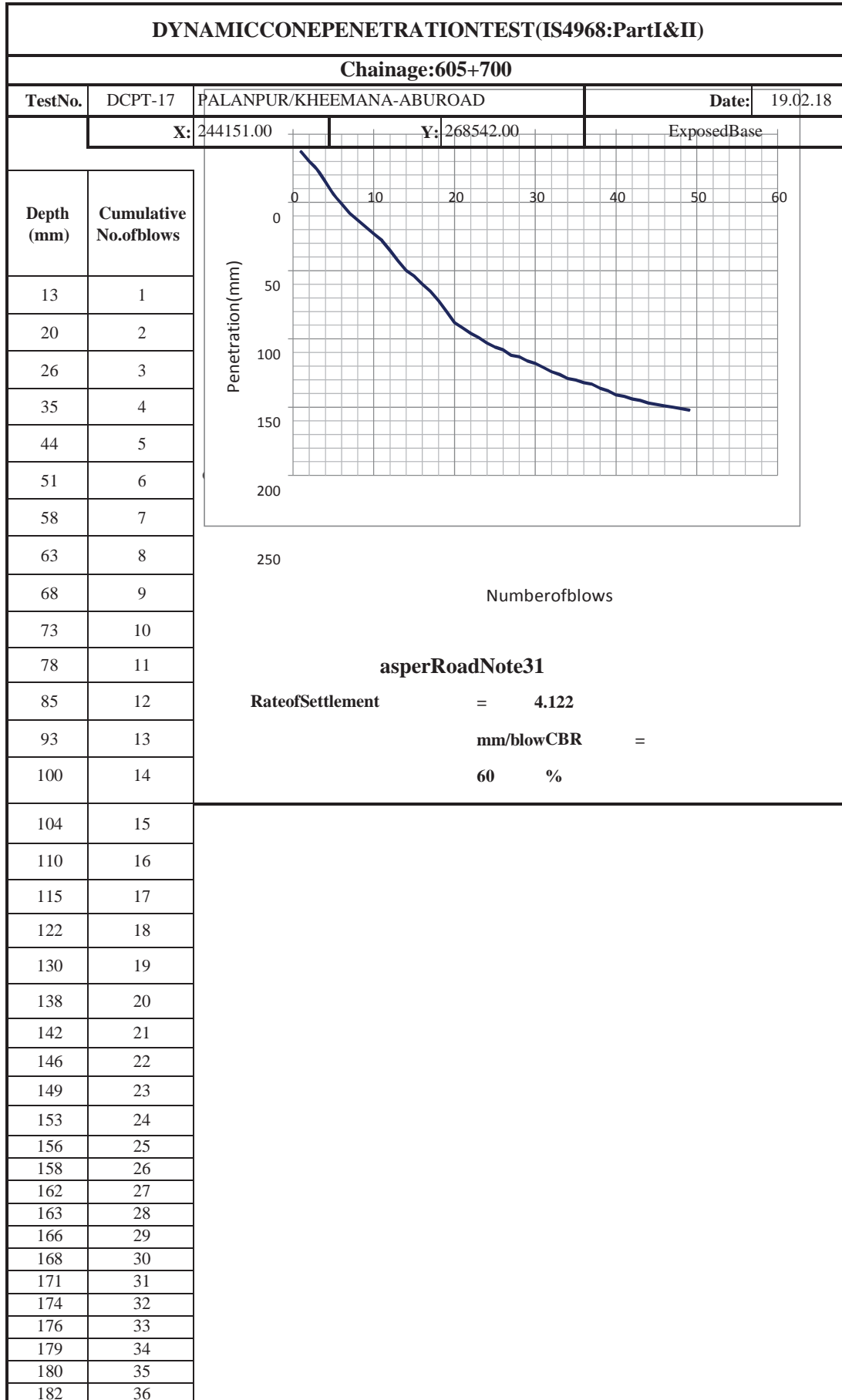
DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 608+000 LHS

TestNo.	DCPT-16	PALANPUR/KHEEMANA-ABUROAD		Date:	19.02.18
	X: 245512.00	Y: 2687064.00	ExposedBase		
Depth(mm)	Cumulative No.ofblows	<div><p>Penetration(mm)</p><p>Numberofblows</p><p>asperRoadNote31</p><p>RateofSettlement = 9.950 mm/blowCBR = 22 %</p></div>			
8	1				
15	2				
20	3				
25	4				
30	5				
35	6				
38	7				
89	8				
98	9				
110	10				
119	11				
128	12				
138	13				
148	14				
160	15				
168	16				
175	17				
183	18				
189	19				
198	20				
213	21				
225	22				
238	23				
252	24				
265	25				
278	26				
291	27				
303	28				
313	29				
328	30				
335	31				
342	32				
348	33				
358	34				
365	35				
371	36				

Chainage:608+000LHS					
TestNo.	DCPT-16	PALANPUR/KHEEMANA-ABUROAD		Date:	19.02.18
	X:	245512.00	Y:	2687064.00	ExposedBase
378	37				
387	38				
392	39				
398	40				

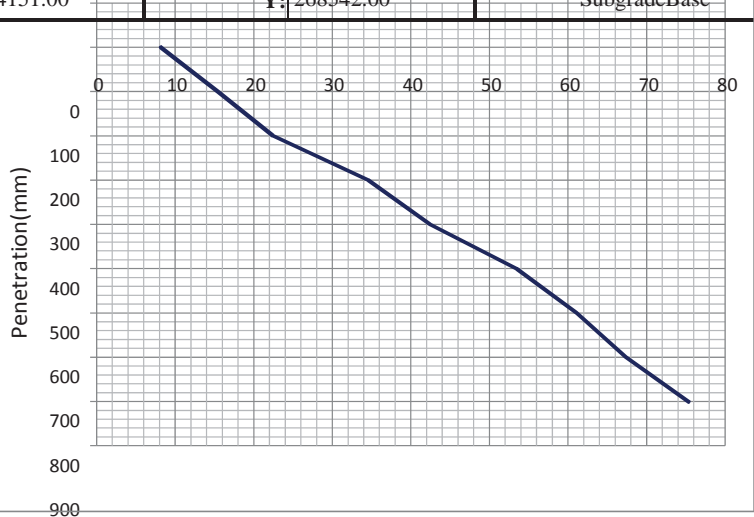




Chainage:605+700				
TestNo.	DCPT-17	PALANPUR/KHEEMANA-ABUROAD		Date: 19.02.18
	X:	244151.00	Y: 268542.00	ExposedBase
183	37			
186	38			
188	39			
191	40			
192	41			
194	42			
195	43			
197	44			
198	45			
199	46			
200	47			
201	48			
202	49			

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 605+700

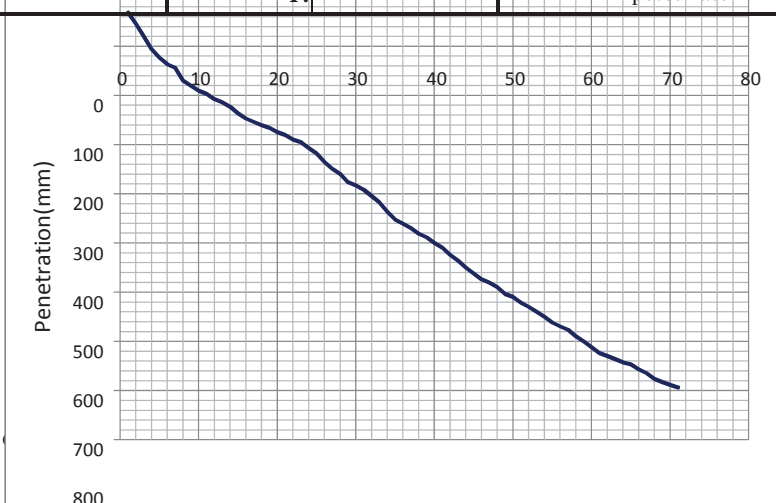
Test No.	DCPT-17	Location:	PALANPUR/KHEEMANA-ABU ROAD	Date:	19.02.18
		X:	244151.00	Y:	268542.00
					Subgrade Base
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
100	8	8			
200	15	7			
300	22	7			
400	35	12			
500	42	8			
600	53	11			
700	61	8			
800	67	6			
900	75	8			

asper Road Note 31

Rate of Settlement = 11.951
mm/blow CBR =
18 %

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 603+500 LHS

TestNo.	DCPT-18	PALANPUR/KHEEMANA-ABUROAD		Date:	19.02.18
		X:	Y:	ExposedBase	
Depth(mm)	Cumulative No.ofblows	<div></div> <div>asperRoadNote31</div> <div>RateofSettlement = 11.183</div> <div>mm/blowCBR =</div> <div>20 %</div>			
32	1				
55	2				
80	3				
106	4				
124	5				
137	6				
144	7				
170	8				
181	9				
191	10				
197	11				
208	12				
215	13				
224	14				
237	15				
247	16				
254	17				
261	18				
266	19				
275	20				
281	21				
290	22				
295	23				
307	24				
318	25				
336	26				
350	27				
360	28				
377	29				
384	30				
392	31				
405	32				
418	33				
437	34				
453	35				
461	36				

Chainage:603+500LHS					
TestNo.	DCPT-18	PALANPUR/KHEEMANA-ABUROAD			Date: 19.02.18
	X:		Y:		ExposedBase
470	37				
481	38				
489	39				
500	40				
510	41				
524	42				
536	43				
550	44				
562	45				
574	46				
581	47				
590	48				
604	49				
610	50				
622	51				
630	52				
640	53				
650	54				
662	55				
670	56				
677	57				
690	58				
700	59				
712	60				
724	61				
730	62				
736	63				
743	64				
747	65				
757	66				
765	67				
777	68				
783	69				
789	70				
794	71				

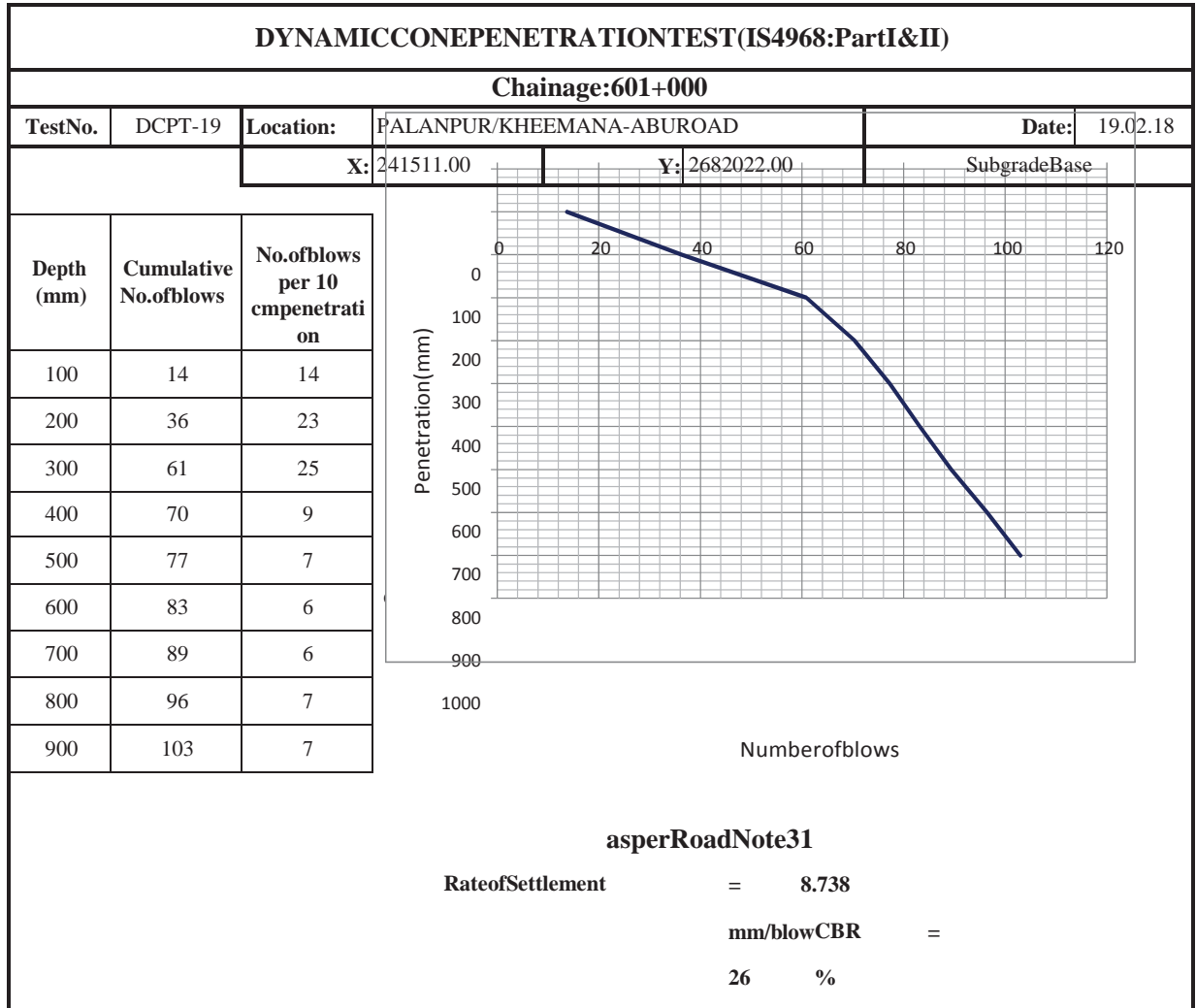
DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)				
Chainage: 603+500 LHS				
Test No.	DCPT-18	Location:	PALANPUR/KHEEMANA-ABU ROAD	Date: 19.02.18
		X:	Y:	Subgrade Base
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration		
100	5	5		
200	10	5		
300	17	7		
400	25	8		
500	32	7		
600	40	8		
700	49	9		
800	58	9		
900	78	20		
			<p>asper Road Note 31</p> <p>Rate of Settlement = 11.509</p> <p>mm/blow CBR =</p> <p>19 %</p>	

DYNAMIC CONE PENETRATION TEST (IS 4968: Part I & II)

Chainage: 601+000

TestNo.	DCPT-19	PALANPUR/KHEEMANA-ABUROAD		Date:	19.02.18
		X: 241511.00	Y: 2682022.00	ExposedBase	
<div><div>Depth(mm)</div><div>Cumulative No.ofblows</div><div><div>25</div><div>1</div></div><div><div>43</div><div>2</div></div><div><div>56</div><div>3</div></div><div><div>64</div><div>4</div></div><div><div>73</div><div>5</div></div><div><div>80</div><div>6</div></div><div><div>85</div><div>7</div></div><div><div>93</div><div>8</div></div><div><div>108</div><div>9</div></div><div><div>115</div><div>10</div></div><div><div>120</div><div>11</div></div><div><div>134</div><div>12</div></div><div><div>136</div><div>13</div></div><div><div>146</div><div>14</div></div><div><div>149</div><div>15</div></div><div><div>156</div><div>16</div></div><div><div>159</div><div>17</div></div><div><div>164</div><div>18</div></div><div><div>168</div><div>19</div></div><div><div>175</div><div>20</div></div><div><div>179</div><div>21</div></div><div><div>188</div><div>22</div></div><div><div>195</div><div>23</div></div><div><div>198</div><div>24</div></div><div><div>203</div><div>25</div></div><div><div>205</div><div>26</div></div><div><div>209</div><div>27</div></div><div><div>216</div><div>28</div></div><div><div>219</div><div>29</div></div><div><div>226</div><div>30</div></div><div><div>232</div><div>31</div></div><div><div>238</div><div>32</div></div><div><div>246</div><div>33</div></div><div><div>249</div><div>34</div></div><div><div>253</div><div>35</div></div><div><div>258</div><div>36</div></div></div>	<div><div><div>Penetration(mm)</div><div>0</div><div>50</div><div>100</div><div>150</div><div>200</div><div>250</div><div>300</div><div>350</div><div>400</div></div><div><div>0</div><div>10</div><div>20</div><div>30</div><div>40</div><div>50</div><div>60</div><div>70</div></div></div> <div><div>Numberofblows</div><div>asperRoadNote31</div><div><div>RateofSettlement</div><div>=</div><div>5.349</div><div>mm/blowCBR</div><div>=</div><div>45</div><div>%</div></div></div>				

Chainage:601+000				
TestNo.	DCPT-19	PALANPUR/KHEEMANA-ABUROAD		Date: 19.02.18
	X:	241511.00	Y: 2682022.00	ExposedBase
263	37			
266	38			
269	39			
275	40			
283	41			
288	42			
291	43			
294	44			
296	45			
297	46			
299	47			
303	48			
308	49			
313	50			
316	51			
319	52			
323	53			
325	54			
326	55			
328	56			
329	57			
331	58			
332	59			
333	60			
335	61			
336	62			
337	63			



ANNEXURE3LABORATORYINVESTIGATION

S.No.	Chainage	Direction	TestPitNo.	Coordinates	
				X	Y
1	640+000	RHS	3	270151.00	2704573.00
2	637+500	LHS	4	267832.00	2703846.00
3	635+000	RHS	5	265645.00	2703043.00
4	633+500	LHS	6	264553.00	2702182.00
5	631+000	RHS	7	262286.00	2701178.00
6	628+500	LHS	8	.	.
7	624+800	RHS	9	257697.00	2699047.00
8	623+500	LHS	10	255747.00	2697913.00
9	621+000	LHS	11	253710.00	2696372.00
10	618+500	LHS	12	251763.00	2695026.00
11	616+000	RHS	13	249627.00	2693483.00
12	613+500	LHS	14	248243.00	2591534.00
13	611+250	RHS	15	297489.00	2689409.00
14	608+000	LHS	16	245512.00	2687064.00
15	605+700	RHS	17	244151.00	268542.00
16	603+500	LHS	18	.	.
17	601+000	RHS	19	241511.00	2682022.00

Table1.TestPitsLocations

ANNEXURE																							
TEST RESULTS OF SOIL LAYER																							
Location: Palanpur/Khemana/Abu Road																							
S.No.	CHAINAGE	Side	Soil Description	IS Classification	Gradation: Percent by weight retained on the Sieve (IS:2720-IV)						Clay & silt content %	Atterberg Limits [IS:2720-Pt-V]			FSI [IS:2720-Pt-XXXX]	Modified Proctor Test (IS:2720-Pt-VIII)		SOAKED CBR AT 3 ENERGY LEVEL			UNSOAKED CBR AT 3 ENERGY LEVEL		
					19mm	10mm	4.75mm	2.0mm	425micron	75micron		Liquid Limit (t(LL)) %	Plastic Limit (t(PL)) %	Plasticity Index (PI)		Max. dry density (gm/cc)	OMC (%)	15 No. Of Blows	35 No. Of Blows	65 No. Of Blows	15 No. Of Blows	35 No. Of Blows	65 No. Of Blows
1	640+000	RHS	Clayey Sand	SC	0.00	5.40	6.90	8.30	15.50	16.00	47.90	28	16	12	10	2.13	10.0	4	6	9	7	10	15
2	637+500	LHS	Sandy Silt of Low Plasticity	CL	0.00	3.20	5.60	7.80	17.40	14.00	52.00	32	17	15	17.12	2.10	11.0	3	5	8	5	7	11
3	635+000	RHS	Clayey Sand	SC	0.00	7.40	9.90	6.10	15.10	14.00	47.50	30	18	12	11.25	2.11	10.0	4	6	9	7	10	14
4	633+000	LHS	Clayey Sand	SC	0.00	4.60	15.40	7.80	10.50	13.90	47.80	31	19	12	14	2.11	10.0	3	5	9	6	10	13
5	631+000	RHS	Sandy Silt of Low Plasticity	CL	0.00	5.20	10.20	6.00	8.90	11.20	58.50	32	18	14	15.58	2.10	11.0	4	6	8	7	9	12
6	628+500	LHS	Sandy Silt of Low Plasticity	CL	0.00	13.40	10.90	5.50	7.50	12.30	50.40	31	19	12	12.63	2.08	10.0	5	7	10	8	11	14
7	624+800	RHS	Silty Sand	SM	0.00	1.00	2.30	1.20	4.80	66.30	24.40	25	NIL	NP	NIL	1.81	9.5	7	11	15	11	15	22
8	623+500	LHS	Silty Sand	SM	0.00	17.50	8.90	3.50	4.30	55.80	10.00	24	NIL	NP	NIL	1.87	11.0	8	13	19	13	18	28
9	621+000	RHS	Silty Sand	SM	0.00	2.10	1.90	1.70	2.60	73.50	18.20	25	NIL	NP	NIL	1.76	11.0	5	8	11	8	13	16
10	618+500	LHS	Silty Sand	SM	0.00	1.90	2.20	1.60	2.10	79.00	13.20	25	NIL	NP	NIL	1.75	12.0	6	9	12	8	13	17
11	616+000	RHS	Silty Sand	SM	0.00	3.60	2.00	1.80	2.40	70.00	20.20	26	NIL	NP	NIL	1.79	11.0	6	8	13	9	12	16
12	613+500	LHS	Silty Sand	SM	0.00	2.10	5.40	2.60	6.40	74.50	9.00	26	NIL	NP	NIL	1.76	12.0	5	8	12	8	12	17
13	611+050	RHS	Silty Sand	SM	0.00	3.50	10.40	5.70	16.50	31.70	32.20	24	NIL	NP	NIL	1.81	11.0	7	12	16	12	18	24
14	608+000	LHS	Silty Sand	SM	0.00	6.70	23.70	12.90	20.50	22.90	13.30	25	NIL	NP	NIL	1.80	11.0	9	15	20	14	22	31
15	605+700	RHS	Silty Sand	SM	0.00	1.20	2.50	2.60	1.40	75.60	16.70	24	NIL	NP	NIL	1.89	9.5	8	13	15	12	15	21
16	603+500	LHS	Silty Sand	SM	0.00	1.10	2.30	1.90	2.80	78.50	13.40	24	NIL	NP	NIL	1.86	11.0	7	12	15	11	16	20
17	601+000	RHS	Silty Sand	SM	0.00	8.50	2.30	0.90	5.90	67.50	14.90	25	NIL	NP	NIL	1.89	9.5	9	14	19	13	20	25

ANNEXURE																			
TEST RESULT OF GRANULAR SUB-BASE MATERIAL																			
Location: Palanpur/Khemana-Abu Road																			
Sl.No.	Location/Name of Quarry	Side	Gradation: Percent by weight passing the Sieve (Close graded) (MORTH)								Atterberg limits (IS:2720-Part V)			Modified Proctor Test (IS:2720-Part VIII)		CBR Value at 98% dry density (Soaked) %	Specific Gravity	W.A. (%)	Impact Value (%)
			75 mm	53 mm	26.5 mm	9.5 mm	4.75 mm	2.36 mm	425 micron	75 micron	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Maximum Dry Density (gm/cc)	OMC %				
1	640+000	RHS	100.00	96.12	82.71	63.18	51.80	39.02	14.03	3.85	24	NIL	NP	2.24	6.0	36	2.79	0.60	23
2	637+500	LHS	100.00	100.00	91.10	68.02	54.21	44.16	13.84	1.48	23	NIL	NP	2.20	6.5	38	2.81	0.64	25
3	635+000	RHS	100.00	100.00	90.12	67.24	53.78	43.52	14.05	1.32	24	NIL	NP	2.21	6.0	39	2.80	0.61	24
4	633+000	LHS	100.00	96.46	76.08	45.86	32.36	24.52	14.10	1.04	23	NIL	NP	2.20	6.0	35	2.77	0.63	26
5	631+000	RHS	100.00	97.11	74.84	61.60	34.43	29.16	31.02*	0.83	23	NIL	NP	2.19	6.5	37	2.79	0.62	24
6	628+500	LHS	100.00	81.90	65.08	51.10	44.76	38.56	33.20*	0.66	24	NIL	NP	2.17	6.5	36	2.81	0.66	23
7	624+800	RHS	100.00	100.00	88.54	69.94	56.88	49.26	35.18*	0.58	24	NIL	NP	2.17	7.0	37	2.79	0.65	25
8	623+500	LHS	100.00	100.00	84.98	72.12	57.04	41.71	33.20*	0.72	22	NIL	NP	2.19	7.0	39	2.81	0.62	21
9	621+000	RHS	100.00	88.86	70.92	59.62	53.24	39.10	31.10*	1.24	22	NIL	NP	2.16	6.0	36	2.81	0.63	23
10	618+500	LHS	100.00	96.21	71.40	61.31	52.13	38.41	30.91*	0.97	23	NIL	NP	2.20	6.5	39	2.83	0.59	20
11	616+000	RHS	100.00	94.30	69.68	59.96	51.96	39.10	33.10*	1.20	23	NIL	NP	2.20	6.5	36	2.76	0.68	26
12	613+500	LHS	100.00	94.56	72.20	54.54	43.16	36.31	29.96*	0.94	23	NIL	NP	2.18	7.0	35	2.76	0.68	25
13	611+050	RHS	100.00	93.60	71.50	50.30	40.70	35.70	25.10*	0.62	24	NIL	NP	2.21	6.0	37	2.79	0.63	22
14	608+000	LHS	100.00	94.60	73.20	51.28	46.70	36.17	32.20*	1.08	23	NIL	NP	2.20	6.5	37	2.81	0.60	22

15	605+700	RHS	100.00	81.82	66.76	52.14	45.48	39.10	24.59*	1.10	23	NIL	NP	2.20	6.0	37	2.82	0.59	21
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Location:Palanpur/Kheemana-AbuRoad																			
Sl.No.	Location/Nameof Quarry	Side	Gradation:PercentbyweightpassingtheSieve(Closegraded)(MORTH)								Atterberg limits(IS:2720-PartV)			Modified Proctor Test(IS:2720-PartVIII)		CBR Value at98%dryden sity(Soaked) %	Specific Gravity	W.A. (%)	Impact Value(%)
			75 mm	53 mm	26.5 mm	9.5 mm	4.75 mm	2.36 mm	425 micron	75 micron	LiquidLim it(LL) %	PlasticLi mit(PL) %	Plasticity Index(PI)	Maximum DryDensity(gm /cc)	OMC %				
16	603+500	LHS	100.00	83.65	58.46	52.16	48.30	39.84	23.87*	2.83	24	NIL	NP	2.19	7.0	36	2.80	0.65	24
17	601+000	RHS	100.00	82.16	59.07	51.82	47.07	37.80	22.69*	3.60	22	NIL	NP	2.20	7.0	34	2.81	0.61	22

ANNEXURE

TEST RESULT OF WET MIX MACADAM

Location: Palanpur/Khemana-Abu Road

Sl.No.	Location /Name of Quarry	Side	Gradation: Percent by weight passing the Sieve (Close graded)(MORTH)								Atterberg limits(IS:2720-PartV)			Modified Proctor Test(IS:2720- PartVIII)		Specific Gravity	W.A. (%)	Impact Value(%)
			53 mm	45 mm	22.4 mm	11.2 mm	4.75 mm	2.36 mm	600 micron	75 micron	Liquid Limit(LL)%	Plastic Limit(PL)%	Plasticity Index(PI)	Maximum Dry Density (gm/cc)	OMC %			
1	640+000	RHS	100.00	97.25	77.3	58.23	37.40	28.84	18.30	2.08	23	NIL	NP	2.25	6.0	2.83	0.62	22
2	637+500	LHS	100.00	97.90	79.25	57.53	37.93	29.25	17.10	1.90	24	NIL	NP	2.23	6.5	2.81	0.64	23
3	635+000	RHS	10.00	97.05	79.24	57.22	38.98	29.05	17.31	2.02	24	NIL	NP	2.24	6.5	2.83	0.59	21
4	633+000	LHS	100.00	96.54	79.42	57.82	39.05	28.95	18.92	1.38	22	NIL	NP	2.24	6.0	2.85	0.59	20
5	631+000	RHS	100.00	97.60	78.94	56.20	33.88	29.10	16.96	1.28	23	NIL	NP	2.26	6.0	2.85	0.61	21
6	628+500	LHS	100.00	96.35	74.44	56.87	39.14	29.29	21.16	1.94	23	NIL	NP	2.26	6.0	2.84	0.59	20
7	624+800	RHS	100.00	97.21	75.12	56.98	39.39	29.12	20.24	2.81	23	NIL	NP	2.24	6.5	2.83	0.60	20
8	623+500	LHS	100.00	96.11	76.78	59.02	39.19	28.23	21.43	2.52	22	NIL	NP	2.25	6.0	2.81	0.59	21
9	621+000	RHS	100.00	96.01	78.16	58.67	37.84	29.10	20.44	2.02	22	NIL	NP	2.24	6.5	2.80	60.00	22
10	618+500	LHS	100.00	95.56	74.22	58.44	37.98	29.04	21.10	1.92	24	NIL	NP	2.27	6.0	2.85	0.57	18

11	616+000	RHS	100.00	97.31	73.41	57.61	39.01	29.05	20.43	1.81	24	NIL	NP	2.26	5.5	2.85	0.57	19
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TEST RESULT OF WET MIX MACADAM																		
Location: Palanpur/Khemana-Abu Road																		
Sl.No.	Location /Name of Quarry	Side	Gradation: Percent by weight passing the Sieve (Close graded)(MORTH)								Atterberg limits(IS:2720-PartV)			Modified Proctor Test(IS:2720- PartVIII)		Specific Gravity	W.A. (%)	Impact Value(%)
			53 mm	45 mm	22.4 mm	11.2 mm	4.75 mm	2.36 mm	600 micron	75 micron	Liquid Limit(LL)%	Plastic Limit(PL)%	Plasticity Index(PI)	Maximum Dry Density (gm/cc)	OMC %			
12	613+500	LHS	100.00	96.39	76.24	58.78	38.24	28.77	20.46	1.86	23	NIL	NP	2.23	6.5	2.79	0.63	23
13	611+050	RHS	100.00	97.18	75.34	59.78	37.14	28.56	20.95	1.95	23	NIL	NP	2.24	6.5	2.82	0.61	22
14	608+000	LHS	100.00	95.34	73.39	57.31	39.21	27.94	21.06	2.16	23	NIL	NP	2.25	6.0	2.80	0.61	23
15	605+700	RHS	100.00	96.18	74.41	59.46	38.98	28.98	21.21	2.05	24	NIL	NP	2.24	6.5	2.79	0.63	25
16	603+500	LHS	100.00	95.52	75.23	58.43	37.95	29.35	20.95	1.87	23	NIL	NP	2.25	6.5	2.82	0.60	23
17	601+000	RHS	100.00	96.64	73.3	59.42	38.04	28.18	21.14	1.83	23	NIL	NP	2.26	6.5	2.84	0.57	22

TestResultforBitumenCore																								
Location:Palanpur/Kheemana-AbuRoad																								
S.No.	Chainage	Side	Density (gm/cc)	Binder Content (%)	Thickness (mm)	BitumenConcrete-Gradation(%Passing)										DenseBitumenMacadam-Gradation%Passing								
						26.5 mm	19 mm	13.2 mm	9.5 mm	4.75 mm	2.36 mm	1.18 mm	0.6 mm	0.3 mm	0.15 mm	0.075 mm	37.5 mm	26.5 mm	19 mm	13.2 mm	4.75 mm	2.36 mm	0.3 mm	0.075 mm
1	601+000	RHS	2.412	4.720	58.320	100	100	97.56	79.69	49.58	36.69	26.67	18.78	14.28	11.1	4.69								
2	601+000	RHS	2.374	3.840	178.240												100	100	91.24	72.36	40.97	33.63	15.57	3.85
3	603+500	LHS	2.432	3.590	20.320	100	100	95.68	77.26	48.12	35.51	25.25	19.78	13.49	10.09	4.44								
4	603+500	LHS	2.569	3.610	186.420												100	100	89.17	70.16	38.94	35.87	13.48	2.99
5	605+000	RHS	2.491	3.960	93.360												100	100	86.26	64.55	33.49	29.93	14.44	3.61
6	608+350	LHS	2.461	3.580	28.750	100	98.82	86.16	82.59	47.71	33.19	24.47	19.19	13.57	9.99	5.21								
7	608+350	LHS	2.524	3.720	109.130												100	100	91.27	62.28	36.64	30.39	15.24	1.6
8	610+000	RHS	2.347	3.440	23.510	100	100	96.66	85.52	49.9	34.42	25.56	20.22	13.55	10.69	4.66								
9	610+000	RHS	2.491	3.990	139.370												100	100	88.28	67.18	33.52	31.29	16.14	3.31
10	613+500	LHS	2.504	4.230	19.900	100	97.11	89.56	78.26	48.88	35.72	27.77	19.93	14.14	10.52	5.03								
11	613+500	LHS	2.584	3.610	175.790												100	100	86.16	62.85	33.67	25.55	13.39	2.88
12	615+000	RHS	2.493	3.850	24.340	100	100	93.63	87.74	49.36	34.48	23.39	18.82	14.06	11.09	5.49								
13	615+000	RHS	2.546	4.240	150.370												100	100	97.7	75.9	48.1	36.12	13.36	4.02
14	618+500	RHS	2.405	4.110	76.990	100	100	95.35	87.45	48.15	30.21	21.09	17.12	13.05	9.26	5.14								
15	618+500	RHS	2.529	3.120	123.490												100	100	89.26	61.4	32.38	24.51	11.87	2.82
16	620+000	RHS	2.390	3.950	55.260	100	100	97.49	80.14	47.16	35.59	24.49	18.19	13.57	11.27	4.89								
17	620+000	RHS	2.365	3.650	129.780												100	100	96.26	76.18	33.31	34.87	15.57	3.94
18	623+500	LHS	2.418	4.110	20.750	100	98.69	86.69	83.49	48.82	36.69	25.58	20.11	13.69	11.07	4.03								
19	623+500	LHS	2.545	3.920	212.290												100	100	88.14	60.78	36.17	28.71	13.39	2.61
20	625+000	RHS	2.539	4.510	68.820	100	97.2	84.12	77.93	48.07	35.51	25.08	19.25	13.51	8.64	4.35								
21	625+000	RHS	2.574	3.550	154.320												100	100	96.33	74.41	38.11	28.58	16.46	5.01
22	628+500	LHS	2.518	3.790	79.500	100	96.62	82.36	76.95	46.66	33.17	23.35	16.88	16.78	10.24	3.33								
23	628+500	LHS	2.550	3.560	158.150												100	100	96.16	68.52	36.61	27.18	15.58	3.67
24	630+000	RHS	2.530	3.810	88.300	100	96.23	84.49	75.68	48.8	36.61	27.19	18.84	14.06	10.49	5.58								
25	630+000	RHS	2.543	3.660	81.170												100	100	92.25	71.34	39.11	28.55	16.36	4
26	633+500	LHS	2.501	4.020	69.530	100	100	92.36	73.34	47.19	35.12	25.24	17.73	15.19	11.49	4.97								
27	633+500	LHS	2.571	3.780	157.780												100	100	88.63	66.37	35.52	26.68	13.33	2.07
28	635+000	RHS	2.501	3.920	17.100	100	100	93.47	75.26	48.11	36.66	26.17	19.47	14.48	11.05	5.16								
29	635+000	RHS	2.550	3.590	232.320												100	100	90.66	69.48	38.5	27.18	14.52	3.59
30	638+500	LHS	2.491	3.820	30.740	100	97.28	91.14	73.36	46.65	35.17	25.58	17.26	15.44	11.61	3.39								
31	638+500	LHS	2.558	3.610	55.060												100	100	89.92	65.29	37.18	25.81	13.44	2.05
32	640+000	RHS	2.480	3.850	49.440	100	96.26	73.47	64.78	33.89	19.07	15.98	13.16	11.66	8.49	0.6								
33	640+000	RHS	2.577	3.640	175.050												100	100	96.33	74.41	38.11	28.58	16.46	5.01
34	643+500	LHS	2.515	3.920	59.330	100	97.76	88.1	68.94	36.63	21.18	16.86	15.52	13.36	10.48	1.2								
35	643+500	LHS	2.603	3.880	137.930												100	100	86.14	62.37	31.02	21.48	11.25	0.7
36	646+000	RHS	2.596	3.900	144.510	100	96.53	66.23	53.99	30.08	24.27	19.29	16.58	13.69	8.67	3.79								

ANNEXURE4DEFLECTIONS

1. DEFLECTIONSDATA

In following tables and graphs are represented original at a collected from Falling Weight Deflectometer.

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	LHS	IL	24°13.796'	72°27.271'	26/02/2018	10:22:27	601,000	3	13	19	13	10	7	5	3	2	2	30,1	30,8
4	LHS	OL	24°13.796'	72°27.271'	24/02/2018	12:05:27	601,000	3	13	19	7	6	4	3	2	2	1	29,9	31,2
4	LHS	OL	24°13.982'	72°27.338'	24/02/2018	12:08:51	601,250	3	13	19	11	9	5	3	2	2	1	30,0	31,2
4	LHS	IL	24°13.989'	72°27.464'	26/02/2018	10:24:31	601,500	3	13	19	11	8	6	4	2	2	1	30,2	30,7
4	LHS	OL	24°13.989'	72°27.464'	24/02/2018	12:10:16	601,500	3	13	19	13	10	6	3	2	1	1	30,0	31,2
4	LHS	OL	24°14.074'	72°27.464'	24/02/2018	12:11:43	601,750	3	13	19	12	8	5	3	2	2	1	30,0	31,1
4	LHS	IL	24°14.137'	72°27.509'	26/02/2018	10:26:02	602,000	3	13	19	14	10	7	4	2	2	2	30,1	30,8
4	LHS	OL	24°14.137'	72°27.509'	24/02/2018	12:12:59	602,000	3	13	19	14	9	6	3	2	2	2	29,9	30,9
4	LHS	OL	24°14.261'	72°27.496'	24/02/2018	12:14:43	602,250	3	13	19	11	9	5	3	2	2	2	30,0	31,3
4	LHS	IL	24°14.338'	72°27.686'	26/02/2018	10:28:11	602,500	3	13	19	15	11	7	4	3	2	2	30,3	30,9
4	LHS	OL	24°14.338'	72°27.686'	24/02/2018	12:16:12	602,500	3	13	19	13	9	6	4	3	2	2	30,1	31,2
4	LHS	OL	24°14.466'	72°27.743'	24/02/2018	12:17:36	602,750	3	13	19	12	9	5	4	2	2	2	30,1	31,2
4	LHS	IL	24°14.596'	72°27.838'	26/02/2018	10:31:27	603,000	3	13	19	13	13	8	4	3	2	2	30,3	31,1
4	LHS	OL	24°14.596'	72°27.838'	24/02/2018	12:19:20	603,000	3	13	19	14	10	6	3	2	1	1	29,9	31,1
4	LHS	OL	24°14.706'	72°27.917'	24/02/2018	12:20:59	603,250	3	13	19	11	8	5	3	2	2	1	29,7	30,9
4	LHS	IL	24°14.816'	72°27.985'	26/02/2018	10:33:39	603,500	3	13	19	12	10	7	4	3	2	2	30,3	31,2
4	LHS	OL	24°14.816'	72°27.985'	24/02/2018	12:22:33	603,500	3	13	19	12	8	5	3	2	2	2	30,0	31,2
4	LHS	OL	24°15.943'	72°28.046'	24/02/2018	12:24:04	603,750	3	13	19	13	10	6	4	3	2	2	30,1	31,5
4	LHS	IL	24°15.071'	72°28.119'	26/02/2018	10:34:34	604,000	3	13	19	21	12	8	4	3	2	1	30,3	31,2
4	LHS	OL	24°15.071'	72°28.119'	24/02/2018	12:25:39	604,000	3	13	19	15	11	6	3	2	1	1	30,2	31,5
4	LHS	OL	24°15.167'	72°28.240'	24/02/2018	12:27:52	604,250	3	13	19	11	8	6	4	3	3	3	30,1	31,3
4	LHS	IL	24°15.228'	72°28.345'	26/02/2018	10:35:38	604,500	3	13	19	21	13	8	5	3	2	2	30,3	31,2
4	LHS	OL	24°15.228'	72°28.345'	24/02/2018	12:29:24	604,500	3	13	19	12	10	6	3	1	1	1	30,2	31,5
4	LHS	OL	24°15.281'	72°28.476'	24/02/2018	12:30:52	604,750	3	13	19	11	9	6	4	3	2	2	30,5	31,8
4	LHS	IL	24°15.360'	72°28.609'	26/02/2018	10:41:29	605,000	3	14	23	23	15	8	4	2	1	1	30,4	31,2
4	LHS	OL	24°15.360'	72°28.609'	24/02/2018	12:32:28	605,000	3	14	23	21	14	8	4	3	2	2	30,4	31,5
4	LHS	OL	24°15.432'	72°28.666'	24/02/2018	12:34:04	605,250	3	14	23	12	10	6	4	3	2	1	30,4	31,5
4	LHS	IL	24°15.459'	72°28.688'	26/02/2018	10:43:38	605,500	3	14	23	21	15	9	5	3	2	2	30,5	31,2
4	LHS	OL	24°15.459'	72°28.688'	24/02/2018	14:51:27	605,500	3	14	23	19	14	9	5	3	2	2	31,5	31,8
4	LHS	OL	24°15.582'	72°28.765'	24/02/2018	14:53:21	605,750	3	14	23	16	11	7	4	3	2	2	30,6	31,3
4	LHS	IL	24°15.868'	72°28.813'	26/02/2018	10:45:44	606,000	3	14	23	8	7	5	3	2	2	1	30,4	31,4
4	LHS	OL	24°15.868'	72°28.813'	24/02/2018	14:55:53	606,000	3	14	23	10	8	5	3	2	2	1	30,7	31,9
4	LHS	OL	24°16.009'	72°29.835'	24/02/2018	14:57:46	606,250	3	14	23	12	8	6	3	2	2	2	30,8	32,0
4	LHS	IL	24°16.126'	72°29.905'	26/02/2018	10:48:05	606,500	3	14	23	11	8	5	3	2	2	1	30,4	31,5
4	LHS	OL	24°16.126'	72°29.905'	24/02/2018	14:59:44	606,500	3	14	23	12	9	5	3	2	2	2	30,8	32,0
4	LHS	OL	24°16.212'	72°29.018'	24/02/2018	15:00:49	606,750	3	14	23	13	9	6	3	2	1	1	30,9	30,6

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	LHS	IL	24°16.267'	72°29.116'	26/02/2018	10:49:46	607,000	3	14	23	18	11	6	3	2	2	2	30,4	31,3
4	LHS	OL	24°16.267'	72°29.116'	24/02/2018	15:02:23	607,000	3	14	23	13	9	5	3	2	2	2	30,9	32,2
4	LHS	OL	24°16.345'	72°29.253'	24/02/2018	15:04:11	607,250	3	14	23	11	8	5	3	2	1	1	31,1	32,2
4	LHS	IL	24°16.412'	72°29.372'	26/02/2018	10:52:33	607,500	3	14	23	16	11	7	4	2	2	2	30,6	31,4
4	LHS	OL	24°16.412'	72°29.372'	24/02/2018	15:05:44	607,500	3	14	23	11	8	4	3	2	1	1	31,1	32,3
4	LHS	OL	24°16.485'	72°29.497'	24/02/2018	15:07:19	607,750	3	14	23	10	7	5	3	2	2	1	30,9	32,1
4	LHS	IL	24°16.596'	72°29.596'	26/02/2018	10:54:26	608,000	3	14	23	16	12	7	4	3	2	2	30,4	31,3
4	LHS	OL	24°16.596'	72°29.596'	24/02/2018	15:08:53	608,000	3	14	23	15	10	6	4	3	2	2	30,8	31,9
4	LHS	OL	24°16.760'	72°29.642'	24/02/2018	15:10:58	608,250	3	14	23	15	11	7	4	3	2	1	30,9	32,1
4	LHS	IL	24°16.878'	72°33.661'	26/02/2018	10:56:30	608,500	3	14	23	22	15	9	5	3	2	2	30,4	31,4
4	LHS	OL	24°16.878'	72°33.661'	24/02/2018	15:12:36	608,500	3	14	23	18	11	7	3	3	2	2	31,1	32,4

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature	
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
4	LHS	OL	24°17.024'	72°33.685'	24/02/2018	15:15:16	608,750	3	14	23	14	10	6	4	3	2	1	31,3	32,6
4	LHS	IL	24°17.122'	72°33.725'	26/02/2018	10:59:19	609,000	3	14	23	11	8	5	3	2	1	1	30,5	31,5
4	LHS	OL	24°17.122'	72°33.725'	24/02/2018	15:16:40	609,000	3	14	23	10	7	6	3	2	2	1	31,3	32,6
4	LHS	OL	24°17.223'	72°33.829'	24/02/2018	15:19:03	609,250	3	14	23	16	12	8	5	3	2	2	31,4	32,4
4	LHS	IL	24°17.290'	72°33.937'	26/02/2018	10:59:55	609,500	3	14	23	11	8	5	4	2	2	2	30,5	31,5
4	LHS	OL	24°17.290'	72°33.937'	24/02/2018	15:20:23	609,500	3	14	23	16	11	8	4	3	2	2	31,4	32,4
4	LHS	OL	24°17.372'	72°30.056'	24/02/2018	15:21:24	609,750	3	14	23	6	5	3	3	2	2	1	31,6	32,8
4	LHS	IL	24°17.451'	72°30.180'	26/02/2018	11:01:28	610,000	3	22	35	16	14	5	4	3	2	2	30,5	31,5
4	LHS	OL	24°17.451'	72°30.180'	24/02/2018	15:23:57	610,000	3	22	35	16	11	6	4	3	2	2	31,6	32,7
4	LHS	OL	24°17.520'	72°30.303'	24/02/2018	15:24:44	610,250	3	22	35	16	12	8	4	3	2	1	31,6	32,7
4	LHS	IL	24°17.561'	72°30.426'	26/02/2018	11:02:47	610,500	3	22	35	20	16	9	5	3	2	2	30,5	31,5
4	LHS	OL	24°17.561'	72°30.426'	24/02/2018	15:25:49	610,500	3	22	35	16	12	8	4	3	2	1	31,6	32,7
4	LHS	OL	24°17.612'	72°30.574'	24/02/2018	15:27:23	610,750	3	22	35	16	12	8	4	3	2	1	31,6	32,7
4	LHS	IL	24°17.699'	72°30.675'	26/02/2018	11:04:57	611,000	3	22	35	34	24	13	6	3	2	2	30,6	31,1
4	LHS	OL	24°17.699'	72°30.675'	24/02/2018	15:29:02	611,000	3	22	35	27	18	11	6	4	3	3	31,3	32,6
4	LHS	OL	24°17.844'	72°30.717'	24/02/2018	15:31:56	611,250	3	22	35	11	9	6	5	4	3	2	31,2	32,4
4	LHS	IL	24°17.973'	72°30.744'	26/02/2018	11:06:57	611,500	3	22	35	11	9	7	5	3	2	2	30,5	30,9
4	LHS	OL	24°17.973'	72°30.744'	24/02/2018	15:33:26	611,500	3	22	35	30	24	13	6	4	3	2	31,2	32,4
4	LHS	OL	24°18.112'	72°30.771'	24/02/2018	15:36:00	611,750	3	22	35	17	12	7	4	3	2	2	31,2	32,6
4	LHS	IL	24°18.246'	72°30.794'	26/02/2018	11:09:04	612,000	3	22	35	23	15	8	5	3	2	2	30,5	31,6
4	LHS	OL	24°18.246'	72°30.794'	24/02/2018	15:37:43	612,000	3	22	35	20	13	7	4	2	2	1	31,1	32,3
4	LHS	OL	24°18.394'	72°30.830'	24/02/2018	15:39:26	612,250	3	22	35	22	14	8	4	2	1	1	31,1	32,3
4	LHS	IL	24°18.515'	72°30.838'	26/02/2018	11:11:05	612,500	3	22	35	24	17	11	6	3	2	2	30,6	31,6
4	LHS	OL	24°18.515'	72°30.838'	24/02/2018	15:40:51	612,500	3	22	35	13	11	6	3	2	1	1	30,9	32,2
4	LHS	OL	24°18.622'	72°30.855'	24/02/2018	15:42:24	612,750	3	22	35	20	13	7	4	3	2	1	30,9	32,2
4	LHS	IL	24°18.764'	72°30.955'	26/02/2018	11:13:06	613,000	3	22	35	23	16	10	6	4	3	2	30,4	31,5
4	LHS	OL	24°18.764'	72°30.955'	24/02/2018	15:45:17	613,000	3	22	35	21	15	10	6	4	3	2	31,1	32,3
4	LHS	OL	24°18.870'	72°31.051'	24/02/2018	15:47:56	613,250	3	22	35	19	12	7	5	3	3	2	31,1	32,2
4	LHS	IL	24°18.981'	72°31.123'	26/02/2018	11:15:04	613,500	3	22	35	21	17	11	6	4	3	2	30,5	31,8
4	LHS	OL	24°18.981'	72°31.123'	24/02/2018	15:49:19	613,500	3	22	35	25	16	10	6	4	3	3	31,1	32,2
4	LHS	OL	24°19.062'	72°31.188'	24/02/2018	15:51:56	613,750	3	22	35	27	18	11	6	3	2	2	30,9	32,1
4	LHS	IL	24°19.214'	72°31.279'	26/02/2018	11:17:06	614,000	3	22	35	24	21	13	6	3	2	2	30,7	31,9
4	LHS	OL	24°19.214'	72°31.279'	24/02/2018	15:54:40	614,000	3	22	35	35	24	13	6	3	2	1	31,2	32,3
4	LHS	OL	24°19.337'	72°31.352'	24/02/2018	15:56:30	614,250	3	22	35	30	20	11	6	4	4	4	31,2	32,4
4	LHS	IL	24°19.435'	72°31.410'	26/02/2018	11:19:01	614,500	3	22	35	21	16	9	4	2	1	1	30,6	31,8
4	LHS	OL	24°19.435'	72°31.410'	24/02/2018	15:57:57	614,500	3	22	35	31	21	13	7	3	3	2	31,1	32,2
4	LHS	OL	24°19.582'	72°31.497'	24/02/2018	15:59:17	614,750	3	22	35	26	14	10	5	3	3	2	31,1	32,2
4	LHS	IL	24°19.688'	72°31.560'	26/02/2018	11:22:06	615,000	3	18	28	22	16	9	6	4	3	3	30,5	31,6
4	LHS	OL	24°19.688'	72°31.560'	24/02/2018	16:00:47	615,000	3	18	28	23	15	8	4	3	2	2	31,2	32,4
4	LHS	OL	24°19.807'	72°31.631'	24/02/2018	16:02:34	615,250	3	18	28	15	11	6	3	2	2	2	30,9	32,2
4	LHS	IL	24°19.933'	72°31.729'	26/02/2018	11:24:06	615,500	3	18	28	16	12	7	4	2	2	2	30,6	31,9
4	LHS	OL	24°19.933'	72°31.729'	24/02/2018	16:04:25	615,500	3	18	28	15	11	7	4	2	2	1	30,7	31,9
4	LHS	OL	24°20.005'	72°31.833'	24/02/2018	16:05:53	615,750	3	18	28	18	12	6	4	2	2	1	30,8	32,1
4	LHS	IL	24°20.082'	72°31.947'	26/02/2018	11:26:42	616,000	3	18	28	25	17	10	5	4	4	3	30,7	31,9
4	LHS	OL	24°20.082'	72°31.947'	24/02/2018	16:07:24	616,000	3	18	28	22	14	7	4	2	1	1	30,8	32,1
4	LHS	OL	24°20.172'	72°32.081'	24/02/2018	16:09:15	616,250	3	18	28	21	15	9	5	3	2	2	30,8	32,0



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– Abu Road (ANNEXURES)



Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	LHS	IL	24°20.239'	72°32.181'	26/02/2018	11:29:56	616,500	3	18	28	32	21	12	6	4	3	2	30,9	32,0

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature	
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
4	LHS	OL	24°20.239'	72°32.181'	24/02/2018	16:10:39	616,500	3	18	28	19	13	8	5	3	2	2	30,8	32,0
4	LHS	OL	24°20.316'	72°32.294'	24/02/2018	16:12:12	616,750	3	18	28	23	15	9	5	4	3	3	30,8	32,0
4	LHS	IL	24°20.411'	72°32.438'	26/02/2018	11:32:29	617,000	3	18	28	14	10	7	4	2	2	1	31,1	31,6
4	LHS	OL	24°20.411'	72°32.438'	24/02/2018	16:13:55	617,000	3	18	28	15	11	7	4	3	2	2	30,8	32,0
4	LHS	OL	24°20.491'	72°32.556'	24/02/2018	16:16:05	617,250	3	18	28	14	10	7	4	3	2	1	30,9	32,0
4	LHS	IL	24°20.567'	72°32.668'	26/02/2018	11:33:42	617,500	3	18	28	18	11	7	4	3	2	2	31,1	31,6
4	LHS	OL	24°20.567'	72°32.668'	24/02/2018	16:17:55	617,500	3	18	28	12	8	6	4	3	2	1	30,9	32,0
4	LHS	OL	24°20.640'	72°32.781'	24/02/2018	16:18:24	617,750	3	18	28	13	9	6	4	3	2	2	30,9	32,0
4	LHS	IL	24°20.726'	72°32.908'	26/02/2018	12:03:47	618,000	3	18	28	12	9	6	4	3	2	2	31,3	32,2
4	LHS	OL	24°20.726'	72°32.908'	24/02/2018	16:19:49	618,000	3	18	28	11	8	6	4	3	2	2	30,9	32,1
4	LHS	OL	24°20.821'	72°33.046'	24/02/2018	16:21:43	618,250	3	18	28	12	8	5	3	2	2	2	30,8	32,1
4	LHS	IL	24°20.898'	72°33.161'	26/02/2018	12:06:26	618,500	3	18	28	24	15	8	5	3	3	2	31,4	32,3
4	LHS	OL	24°20.898'	72°33.161'	24/02/2018	16:23:23	618,500	3	18	28	16	11	7	4	2	2	2	31,1	32,2
4	LHS	OL	24°20.970'	72°33.971'	24/02/2018	16:25:00	618,750	3	18	28	13	9	6	3	2	2	1	31,1	32,2
4	LHS	IL	24°21.045'	72°33.378'	26/02/2018	12:08:20	619,000	3	18	28	24	15	8	5	3	2	2	31,6	32,6
4	LHS	OL	24°21.045'	72°33.378'	24/02/2018	16:26:35	619,000	3	18	28	20	11	6	4	3	3	3	30,9	32,3
4	LHS	OL	24°21.125'	72°33.498'	24/02/2018	16:28:27	619,250	3	18	28	16	11	7	4	2	2	1	30,8	32,2
4	LHS	IL	24°21.201'	72°33.611'	26/02/2018	12:10:22	619,500	3	18	28	18	14	10	5	3	2	2	31,5	32,6
4	LHS	OL	24°21.201'	72°33.611'	24/02/2018	16:30:05	619,500	3	18	28	23	15	9	4	2	2	2	30,9	32,3
4	LHS	OL	24°21.268'	72°33.711'	24/02/2018	16:31:40	619,750	3	18	28	17	12	8	5	3	2	2	30,8	32,1
4	LHS	IL	24°21.385'	72°33.884'	26/02/2018	12:12:33	620,000	3	20	34	13	9	6	4	3	2	2	31,6	32,6
4	LHS	OL	24°21.385'	72°33.884'	24/02/2018	16:33:18	620,000	3	20	34	6	5	3	3	2	2	1	30,7	32,0
4	LHS	OL	24°21.447'	72°33.973'	24/02/2018	16:34:49	620,250	3	20	34	17	11	7	4	3	2	2	30,8	32,0
4	LHS	IL	24°21.519'	72°34.082'	26/02/2018	12:14:28	620,500	3	20	34	43	31	13	6	4	3	1	31,6	32,7
4	LHS	OL	24°21.519'	72°34.082'	24/02/2018	16:36:30	620,500	3	20	34	32	22	12	6	4	3	2	30,9	32,2
4	LHS	OL	24°21.569'	72°34.153'	24/02/2018	16:38:01	620,750	3	20	34	21	18	11	5	4	4	3	30,9	32,1
4	LHS	IL	24°21.686'	72°34.329'	26/02/2018	12:17:40	621,000	3	20	34	18	12	7	4	3	3	2	31,7	32,4
4	LHS	OL	24°21.686'	72°34.329'	24/02/2018	17:02:16	621,000	3	20	34	21	14	8	4	3	2	2	30,7	31,6
4	LHS	OL	24°21.788'	72°34.445'	24/02/2018	17:04:18	621,250	3	20	34	18	12	8	4	3	2	2	30,7	31,6
4	LHS	IL	24°21.885'	72°34.544'	26/02/2018	12:19:34	621,500	3	20	34	17	12	7	4	3	3	2	31,7	32,8
4	LHS	OL	24°21.885'	72°34.544'	24/02/2018	17:06:06	621,500	3	20	34	14	10	6	4	3	2	1	30,7	31,9
4	LHS	OL	24°21.952'	72°34.614'	24/02/2018	17:07:31	621,750	3	20	34	20	14	8	5	3	2	2	30,7	31,9
4	LHS	IL	24°.22.074'	72°34.748'	26/02/2018	12:21:38	622,000	3	20	34	16	11	8	4	3	2	1	31,7	32,8
4	LHS	OL	24°.22.074'	72°34.748'	24/02/2018	17:09:27	622,000	3	20	34	16	11	7	4	3	2	2	30,7	32,0
4	LHS	OL	24°.22.161'	72°34.879'	24/02/2018	17:11:23	622,250	3	20	34	16	11	7	5	4	3	3	30,6	31,5
4	LHS	IL	24°.22.216'	72°34.978'	26/02/2018	12:22:21	622,500	3	20	34	16	12	8	5	3	2	2	31,7	32,8
4	LHS	OL	24°.22.216'	72°34.978'	24/02/2018	17:12:51	622,500	3	20	34	16	11	7	5	3	3	3	30,6	31,8
4	LHS	OL	24°.22.287'	72°35.101'	24/02/2018	17:14:31	622,750	3	20	34	13	10	6	4	2	2	2	30,6	31,3
4	LHS	IL	24°.22.363'	72°35.237'	26/02/2018	12:24:55	623,000	3	20	34	28	14	9	7	5	3	2	31,7	32,8
4	LHS	OL	24°.22.363'	72°35.237'	24/02/2018	17:16:37	623,000	3	20	34	18	11	7	5	3	3	2	30,6	31,8
4	LHS	OL	24°.22.434'	72°35.363'	24/02/2018	17:18:09	623,250	3	20	34	18	12	7	5	3	3	3	30,6	31,6
4	LHS	IL	24°.22.518'	72°35.508'	26/02/2018	12:25:15	623,500	3	20	34	27	15	9	7	4	3	2	31,7	32,8
4	LHS	OL	24°.22.518'	72°35.508'	24/02/2018	17:19:53	623,500	3	20	34	14	10	7	4	3	2	2	30,6	31,8
4	LHS	OL	24°.22.576'	72°35.616'	24/02/2018	17:21:20	623,750	3	20	34	17	11	7	5	3	3	2	30,5	31,8
4	LHS	IL	24°.22.648'	72°35.744'	26/02/2018	12:26:24	624,000	3	20	34	25	13	6	5	2	2	2	31,7	32,8
4	LHS	OL	24°.22.648'	72°35.744'	24/02/2018	17:23:13	624,000	3	20	34	17	12	8	4	3	2	2	30,4	31,8



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Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	LHS	OL	24°.22.719'	72°35.869'	24/02/2018	17:24:52	624,250	3	20	34	17	12	7	4	3	2	1	30,5	31,8

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature	
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
4	LHS	IL	24°.22.782'	72°35.980'	26/02/2018	12:28:34	624,500	3	20	34	22	12	8	6	3	2	2	31,7	32,8
4	LHS	OL	24°.22.782'	72°35.980'	24/02/2018	17:26:26	624,500	3	20	34	18	15	10	7	5	4	4	30,3	31,3
4	LHS	OL	24°.22.843'	72°36.085'	24/02/2018	17:28:04	624,750	3	20	34	33	22	13	8	6	5	4	30,1	31,3
4	LHS	IL	24°.22.931'	72°36.240'	26/02/2018	12:30:44	625,000	3	19	28	20	12	9	6	4	2	2	31,7	32,8
4	LHS	OL	24°.22.931'	72°36.240'	24/02/2018	17:30:09	625,000	3	19	28	12	9	5	4	3	2	2	30,2	31,5
4	LHS	OL	24°23.014'	72°36.384'	24/02/2018	17:31:53	625,250	3	19	28	14	9	6	3	2	1	1	30,2	31,5
4	LHS	IL	24°23.082'	72°37.504'	26/02/2018	12:32:04	625,500	3	19	28	23	14	10	6	4	3	2	31,7	32,8
4	LHS	OL	24°23.082'	72°37.504'	24/02/2018	17:33:22	625,500	3	19	28	18	13	7	5	3	2	2	30,2	31,4
4	LHS	OL	24°23.154'	72°37.629'	24/02/2018	17:35:00	625,750	3	19	28	18	12	7	5	3	3	2	30,1	31,4
4	LHS	IL	24°23.221'	72°37.748'	26/02/2018	12:33:32	626,000	3	19	28	23	14	10	5	4	3	2	31,7	32,8
4	LHS	OL	24°23.221'	72°37.748'	24/02/2018	17:37:01	626,000	3	19	28	12	10	6	3	2	1	1	30,1	31,4
4	LHS	OL	24°23.302'	72°37.892'	24/02/2018	17:38:36	626,250	3	19	28	19	13	8	5	3	3	2	30,0	31,3
4	LHS	IL	24°23.356'	72°37.985'	26/02/2018	12:35:18	626,500	3	19	28	23	15	10	6	4	3	3	31,7	32,8
4	LHS	OL	24°23.356'	72°37.985'	24/02/2018	17:40:03	626,500	3	19	28	18	13	6	4	4	2	2	29,9	31,2
4	LHS	OL	24°23.439'	72°37.131'	24/02/2018	17:42:41	626,750	3	19	28	18	13	7	4	3	2	1	29,9	31,2
4	LHS	IL	24°23.509'	72°37.252'	26/02/2018	12:37:44	627,000	3	19	28	23	17	10	6	4	3	2	31,7	32,8
4	LHS	OL	24°23.509'	72°37.252'	24/02/2018	17:42:58	627,000	3	19	28	19	12	8	5	3	3	2	29,9	31,1
4	LHS	OL	24°23.586'	72°37.369'	24/02/2018	17:44:40	627,250	3	19	28	18	13	8	4	3	2	1	29,9	31,1
4	LHS	IL	24°23.681'	72°37.505'	25/02/2018	14:58:20	627,500	3	19	28	16	11	8	5	3	3	2	31,6	32,3
4	LHS	OL	24°23.681'	72°37.505'	24/02/2018	17:46:24	627,500	3	19	28	18	13	8	5	3	2	2	30,1	31,2
4	LHS	OL	24°23.732'	72°37.595'	24/02/2018	17:47:48	627,750	3	19	28	13	9	6	4	3	2	2	30,1	31,4
4	LHS	IL	24°23.806'	72°37.738'	25/02/2018	15:03:12	628,000	3	19	28	15	9	5	3	2	2	1	31,5	32,6
4	LHS	OL	24°23.806'	72°37.738'	24/02/2018	17:49:26	628,000	3	19	28	21	14	8	5	4	3	2	30,1	31,4
4	LHS	OL	24°23.827'	72°37.884'	24/02/2018	17:51:08	628,250	3	19	28	22	15	9	6	4	3	2	30,1	31,3
4	LHS	IL	24°23.820'	72°37.997'	25/02/2018	15:06:03	628,500	3	19	28	31	22	14	8	6	4	3	31,2	32,2
4	LHS	OL	24°23.820'	72°37.997'	24/02/2018	17:52:46	628,500	3	19	28	18	12	9	6	4	3	3	30,0	30,9
4	LHS	OL	24°23.809'	72°38.149'	24/02/2018	17:54:21	628,750	3	19	28	25	17	11	7	5	4	4	30,0	31,2
4	LHS	IL	24°23.815'	72°38.329'	25/02/2018	15:08:11	629,000	3	19	28	20	15	9	5	3	3	3	31,3	32,4
4	LHS	OL	24°23.815'	72°38.329'	24/02/2018	17:56:04	629,000	3	19	28	21	15	9	5	3	3	2	29,9	31,2
4	LHS	OL	24°23.874'	72°38.460'	24/02/2018	17:58:03	629,250	3	19	28	19	13	9	5	3	3	2	29,7	31,1
4	LHS	IL	24°23.925'	72°38.549'	25/02/2018	15:10:01	629,500	3	19	28	18	11	8	6	3	3	2	31,4	32,7
4	LHS	OL	24°23.925'	72°38.549'	24/02/2018	17:59:11	629,500	3	19	28	27	17	10	5	4	3	2	29,7	31,1
4	LHS	OL	24°24.010'	72°38.637'	24/02/2018	18:00:12	629,750	3	19	28	17	16	9	5	3	3	2	29,7	31,1
4	LHS	IL	24°24.080'	72°38.836'	25/02/2018	15:12:34	630,000	3	19	34	32	23	14	8	5	4	3	31,6	32,8
4	LHS	OL	24°24.080'	72°38.836'	24/02/2018	18:01:22	630,000	3	19	34	33	22	13	7	5	4	3	30,0	31,3
4	LHS	OL	24°24.172'	72°38.919'	24/02/2018	18:04:05	630,250	3	19	34	13	13	8	5	3	3	2	29,7	31,1
4	LHS	IL	24°24.238'	72°39.099'	25/02/2018	15:14:44	630,500	3	19	34	20	14	9	6	4	3	3	31,5	32,7
4	LHS	OL	24°24.238'	72°39.099'	24/02/2018	18:05:38	630,500	3	19	34	13	9	5	3	2	2	1	29,9	31,1
4	LHS	OL	24°24.317'	72°39.247'	25/02/2018	8:26:57	630,750	3	19	34	8	7	5	4	3	3	2	26,1	26,6
4	LHS	IL	24°24.378'	72°39.355'	25/02/2018	15:17:07	631,000	3	19	34	9	6	4	2	3	1	1	31,5	32,8
4	LHS	OL	24°24.378'	72°39.355'	25/02/2018	8:29:09	631,000	3	19	34	7	6	4	3	3	3	2	26,4	27,2
4	LHS	OL	24°24.455'	72°39.477'	25/02/2018	8:31:41	631,250	3	19	34	13	10	7	5	4	3	3	26,6	27,2
4	LHS	IL	24°24.506'	72°39.569'	25/02/2018	15:19:02	631,500	3	19	34	16	12	9	6	5	4	3	31,5	32,8
4	LHS	OL	24°24.506'	72°39.569'	25/02/2018	8:33:14	631,500	3	19	34	18	15	11	7	5	4	4	26,6	26,9
4	LHS	OL	24°24.595'	72°39.723'	25/02/2018	8:35:13	631,750	3	19	34	12	10	7	4	3	2	2	26,8	27,2
4	LHS	IL	24°24.647'	72°39.850'	25/02/2018	15:21:02	632,000	3	19	34	19	13	9	6	4	3	2	31,5	32,9



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Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	LHS	OL	24°24.647'	72°39.850'	25/02/2018	8:36:51	632,000	3	19	34	34	26	15	7	5	4	3	26,8	27,4

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature	
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
4	LHS	OL	24°24.671'	72°40.004'	25/02/2018	8:38:43	632,250	3	19	34	17	14	10	6	4	3	3	26,9	27,5
4	LHS	IL	24°24.714'	72°40.154'	25/02/2018	15:23:13	632,500	3	19	34	20	16	11	7	4	3	2	31,4	32,6
4	LHS	OL	24°24.714'	72°40.154'	25/02/2018	8:40:37	632,500	3	19	34	21	21	12	6	4	3	3	26,9	27,6
4	LHS	OL	24°24.739'	72°40.297'	25/02/2018	8:43:15	632,750	3	19	34	20	15	9	4	2	2	2	26,9	27,3
4	LHS	IL	24°24.762'	72°40.426'	25/02/2018	15:25:13	633,000	3	19	34	22	16	9	5	4	3	2	31,4	32,7
4	LHS	OL	24°24.762'	72°40.426'	25/02/2018	8:44:51	633,000	3	19	34	19	14	9	4	3	2	2	26,8	27,7
4	LHS	OL	24°24.840'	72°40.557'	25/02/2018	8:46:36	633,250	3	19	34	31	24	13	5	3	2	1	26,9	27,8
4	LHS	IL	24°24.988'	72°40.793'	25/02/2018	15:27:38	633,500	3	19	34	23	16	10	6	4	3	3	31,4	32,7
4	LHS	OL	24°24.988'	72°40.793'	25/02/2018	8:49:23	633,500	3	19	34	17	14	9	5	4	3	2	27,0	27,7
4	LHS	OL	24°25.001'	72°40.805'	25/02/2018	8:51:00	633,750	3	19	34	15	13	9	7	5	5	3	27,0	27,3
4	LHS	IL	24°25.069'	72°40.921'	25/02/2018	15:29:49	634,000	3	19	34	25	18	11	6	4	3	2	31,5	32,7
4	LHS	OL	24°25.069'	72°40.921'	25/02/2018	8:52:40	634,000	3	19	34	22	15	9	6	4	3	2	27,1	28,0
4	LHS	OL	24°25.149'	72°41.033'	25/02/2018	8:54:51	634,250	3	19	34	21	15	10	6	4	3	3	27,2	28,0
4	LHS	IL	24°25.257'	72°41.147'	25/02/2018	15:32:06	634,500	3	19	34	25	17	11	7	5	3	3	31,6	32,9
4	LHS	OL	24°25.257'	72°41.147'	25/02/2018	8:58:25	634,500	3	19	34	19	13	8	5	3	3	2	27,3	28,0
4	LHS	OL	24°25.348'	72°41.238'	25/02/2018	9:00:07	634,750	3	17	29	9	8	5	5	4	3	2	27,5	28,3
4	LHS	IL	24°25.450'	72°41.351'	25/02/2018	15:34:17	635,000	3	17	29	22	15	9	5	3	2	2	31,7	33,1
4	LHS	OL	24°25.450'	72°41.351'	25/02/2018	9:01:56	635,000	3	17	29	17	12	8	4	2	2	1	27,5	28,2
4	LHS	OL	24°25.556'	72°41.463'	25/02/2018	9:03:37	635,250	3	17	29	8	7	5	4	3	2	1	27,6	28,4
4	LHS	IL	24°25.620'	72°41.532'	25/02/2018	15:37:02	635,500	3	17	29	15	11	8	5	3	3	2	31,7	32,9
4	LHS	OL	24°25.620'	72°41.532'	25/02/2018	9:07:09	635,500	3	17	29	12	9	7	5	3	3	2	27,7	28,4
4	LHS	OL	24°25.697'	72°41.615'	25/02/2018	9:08:19	635,750	3	17	29	15	11	8	4	3	2	1	27,7	28,4
4	LHS	IL	24°25.774'	72°41.793'	25/02/2018	15:39:25	636,000	3	17	29	17	13	9	5	4	3	2	31,7	32,9
4	LHS	OL	24°25.774'	72°41.793'	25/02/2018	9:10:22	636,000	3	17	29	15	11	7	4	3	2	1	27,7	28,4
4	LHS	OL	24°25.788'	72°41.924'	25/02/2018	9:11:32	636,250	3	17	29	15	11	7	4	3	2	1	27,7	28,4
4	LHS	IL	24°25.801'	72°42.071'	25/02/2018	15:40:40	636,500	3	17	29	24	17	11	7	4	3	3	31,7	33,0
4	LHS	OL	24°25.801'	72°42.071'	25/02/2018	9:12:13	636,500	3	17	29	18	13	9	6	4	3	3	27,5	28,2
4	LHS	OL	24°25.817'	72°42.254'	25/02/2018	9:19:19	636,750	3	17	29	11	9	7	5	4	3	2	27,6	28,1
4	LHS	IL	24°25.829'	72°42.386'	25/02/2018	15:42:45	637,000	3	17	29	24	15	9	5	4	3	2	31,6	32,9
4	LHS	OL	24°25.829'	72°42.386'	25/02/2018	9:20:51	637,000	3	17	29	17	13	9	6	3	2	1	27,6	28,3
4	LHS	OL	24°25.842'	72°42.527'	25/02/2018	9:22:26	637,250	3	17	29	11	8	6	5	3	2	2	27,7	28,3
4	LHS	IL	24°25.852'	72°42.842'	25/02/2018	15:44:48	637,500	3	17	29	23	16	13	6	4	3	2	31,7	33,1
4	LHS	OL	24°25.852'	72°42.842'	25/02/2018	9:23:57	637,500	3	17	29	15	12	9	6	4	3	2	27,7	28,4
4	LHS	OL	24°25.868'	72°42.788'	25/02/2018	9:25:37	637,750	3	17	29	11	8	6	4	3	2	2	27,7	27,5
4	LHS	IL	24°25.941'	72°42.952'	25/02/2018	15:49:09	638,000	3	17	29	32	22	13	6	4	3	2	31,5	32,7
4	LHS	OL	24°25.941'	72°42.952'	25/02/2018	9:27:28	638,000	3	17	29	17	12	9	5	3	3	2	27,8	28,7
4	LHS	OL	24°26.004'	72°43.068'	25/02/2018	9:29:13	638,250	3	17	29	17	14	10	6	3	2	2	27,9	28,7
4	LHS	IL	24°26.080'	72°43.207'	25/02/2018	15:52:07	638,500	3	17	29	26	18	10	7	4	3	2	31,4	32,8
4	LHS	OL	24°26.080'	72°43.207'	25/02/2018	9:30:51	638,500	3	17	29	20	14	9	6	4	3	2	27,9	28,7
4	LHS	OL	24°26.168'	72°43.366'	25/02/2018	9:32:40	638,750	3	17	29	22	15	9	6	4	3	3	28,0	28,9
4	LHS	IL	24°26.219'	72°43.463'	25/02/2018	15:54:21	639,000	3	17	29	25	17	10	5	3	3	2	31,6	32,9
4	LHS	OL	24°26.219'	72°43.463'	25/02/2018	9:34:11	639,000	3	17	29	16	11	8	5	4	3	3	28,1	28,8
4	LHS	OL	24°26.287'	72°43.588'	25/02/2018	9:37:01	639,250	3	17	29	21	16	9	5	4	2	2	28,3	29,1
4	LHS	IL	24°26.335'	72°43.733'	25/02/2018	15:57:09	639,500	3	17	29	14	12	7	5	3	2	2	31,5	32,8
4	LHS	OL	24°26.335'	72°43.733'	25/02/2018	9:39:41	639,500	3	17	29	14	10	7	5	3	2	1	28,5	29,1
4	LHS	OL	24°26.297'	72°43.904'	25/02/2018	9:41:30	639,750	3	17	29	4	3	2	2	1	1	0	28,4	29,0



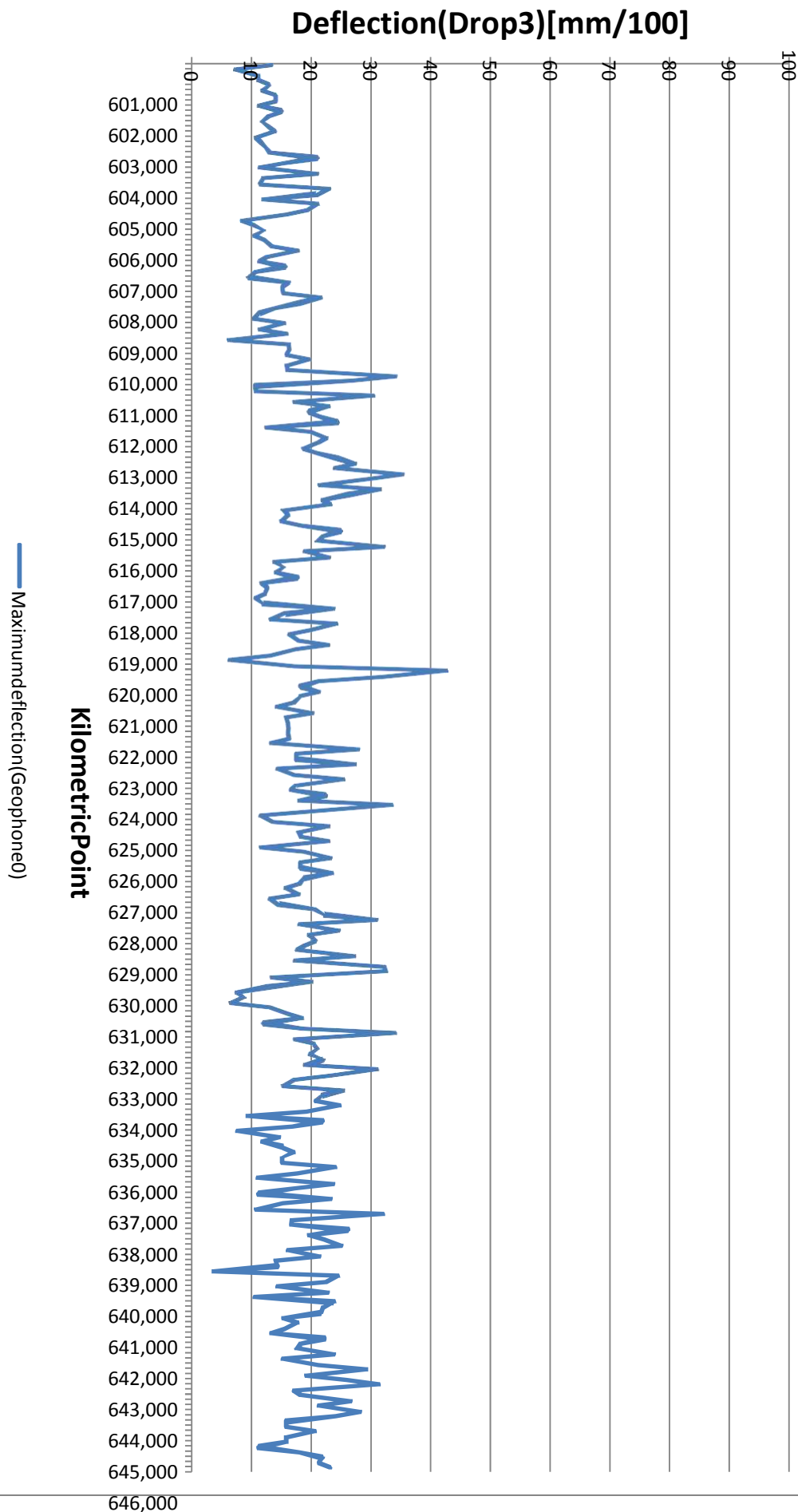
PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE
NATIONAL HIGHWAYS ON ROADS UNDER (The National Highways
Infra Trust)

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana
– Abu Road (ANNEXURES)



Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	LHS	IL	24°26.206'	72°44.045'	25/02/2018	16:00:18	640,000	3	20	30	24	18	12	7	5	4	3	31,4	32,7

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature	
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
4	LHS	OL	24°26.206'	72°44.045'	25/02/2018	9:43:07	640,000	3	20	30	22	16	10	6	4	3	2	28,3	28,9
4	LHS	OL	24°26.295'	72°44.169'	25/02/2018	9:44:49	640,250	3	20	30	14	11	7	5	3	3	2	28,2	29,0
4	LHS	IL	24°26.360'	72°44.270'	25/02/2018	16:03:18	640,500	3	20	30	23	14	9	5	4	3	2	31,4	32,7
4	LHS	OL	24°26.360'	72°44.270'	25/02/2018	9:46:20	640,500	3	20	30	11	8	6	3	2	2	1	28,4	29,2
4	LHS	OL	24°26.445'	72°44.367'	25/02/2018	9:47:52	640,750	3	20	30	24	19	9	5	3	3	2	28,5	29,3
4	LHS	IL	24°26.540'	72°44.500'	25/02/2018	16:05:27	641,000	3	20	30	22	14	9	5	3	3	2	31,4	32,7
4	LHS	OL	24°26.540'	72°44.500'	25/02/2018	9:49:12	641,000	3	20	30	22	15	9	5	3	3	2	28,5	29,3
4	LHS	OL	24°26.640'	72°44.623'	25/02/2018	9:50:24	641,250	3	20	30	15	10	8	5	3	3	2	28,5	29,3
4	LHS	IL	24°26.735'	72°44.752'	25/02/2018	16:07:16	641,500	3	20	30	18	12	9	5	4	3	3	31,5	32,8
4	LHS	OL	24°26.735'	72°44.752'	25/02/2018	9:52:14	641,500	3	20	30	16	12	8	5	3	3	2	28,7	29,3
4	LHS	OL	24°26.782'	72°44.816'	25/02/2018	9:54:37	641,750	3	20	30	13	9	6	4	3	2	2	28,4	29,2
4	LHS	IL	24°26.885'	72°44.956'	25/02/2018	16:09:17	642,000	3	20	30	22	14	8	5	3	3	2	31,5	32,7
4	LHS	OL	24°26.885'	72°44.956'	25/02/2018	9:56:29	642,000	3	20	30	18	13	8	5	3	3	2	28,5	29,5
4	LHS	OL	24°26.988'	72°45.095'	25/02/2018	9:58:40	642,250	3	20	30	18	13	7	5	4	2	2	28,5	29,5
4	LHS	IL	24°27.042'	72°45.168'	25/02/2018	16:11:33	642,500	3	20	30	24	16	10	6	4	4	3	31,6	32,9
4	LHS	OL	24°27.042'	72°45.168'	25/02/2018	10:00:56	642,500	3	20	30	15	12	8	5	3	3	2	28,5	29,3
4	LHS	OL	24°27.142'	72°45.301'	25/02/2018	10:02:31	642,750	3	20	30	21	14	8	5	3	2	2	28,7	29,3
4	LHS	IL	24°27.229'	72°45.421'	25/02/2018	16:13:32	643,000	3	20	30	29	19	10	6	4	3	2	31,5	32,9
4	LHS	OL	24°27.229'	72°45.421'	25/02/2018	10:04:22	643,000	3	20	30	19	15	9	5	4	3	2	28,8	29,7
4	LHS	OL	24°27.314'	72°45.534'	25/02/2018	10:05:51	643,250	3	20	30	26	18	10	6	4	3	2	29,0	29,7
4	LHS	IL	24°27.405'	72°45.655'	25/02/2018	16:16:30	643,500	3	20	30	31	19	11	6	4	3	2	31,5	32,8
4	LHS	OL	24°27.405'	72°45.655'	25/02/2018	10:07:24	643,500	3	20	30	17	13	8	5	3	2	2	29,0	29,6
4	LHS	OL	24°27.468'	72°45.748'	25/02/2018	10:08:58	643,750	3	20	30	18	16	10	6	4	3	3	29,0	29,7
4	LHS	IL	24°27.569'	72°45.377'	25/02/2018	16:19:48	644,000	3	20	30	27	18	12	7	5	4	3	31,5	32,8
4	LHS	OL	24°27.569'	72°45.377'	25/02/2018	10:10:45	644,000	3	20	30	21	16	10	5	3	3	2	29,0	29,6
4	LHS	OL	24°27.055'	72°45.992'	25/02/2018	10:12:57	644,250	3	20	30	28	23	11	7	3	3	2	29,0	29,7
4	LHS	IL	24°27.743'	72°46.112'	25/02/2018	16:20:55	644,500	3	20	30	24	13	11	5	4	2	2	31,5	32,8
4	LHS	OL	24°27.743'	72°46.112'	25/02/2018	10:13:22	644,500	3	20	30	16	12	8	4	3	2	1	29,0	29,7
4	LHS	OL	24°27.830'	72°46.226'	25/02/2018	10:14:12	644,750	3	20	30	16	12	8	4	3	2	1	29,0	29,7
4	LHS	IL	24°27.894'	72°46.348'	25/02/2018	16:22:25	645,000	3	18	26	21	14	10	5	3	2	2	31,5	32,8
4	LHS	OL	24°27.894'	72°46.348'	25/02/2018	10:15:44	645,000	3	18	26	16	12	8	4	3	2	1	29,0	29,7
4	LHS	OL	24°27.920'	72°46.497'	25/02/2018	10:16:22	645,250	3	18	26	16	12	8	4	3	2	1	29,0	29,7
4	LHS	IL	24°27.944'	72°46.640'	25/02/2018	16:25:25	645,500	3	18	26	11	9	6	4	3	2	1	31,4	32,7
4	LHS	OL	24°27.944'	72°46.640'	25/02/2018	10:19:03	645,500	3	18	26	18	13	9	5	4	3	2	29,0	29,7
4	LHS	OL	24°27.936'	72°46.784'	25/02/2018	10:20:37	645,750	3	18	26	22	18	9	6	2	1	0	29,0	29,9
4	LHS	IL	24°27.992'	72°46.931'	25/02/2018	16:27:34	646,000	3	18	26	21	14	9	5	3	2	2	31,4	32,4
4	LHS	OL	24°27.992'	72°46.931'	25/02/2018	10:23:12	646,000	3	18	26	23	16	9	5	4	2	2	29,3	30,0



Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	OL	24°27.959'	72°46.770'	23/02/2018	11:27:15AM	645,750	3	# REF!	# REF!	19	13	8	5	3	2	1	30,2	31,2
4	RHS	IL	24°27.934'	72°46.626'	25/02/2018	10:40:10AM	645,500	3	# REF!	# REF!	17	13	7	4	3	2	2	29,2	30,0
4	RHS	OL	24°27.934'	72°46.626'	23/02/2018	11:28:48AM	645,500	3	# REF!	# REF!	24	14	7	6	3	3	3	30,2	31,2
4	RHS	IL	24°27.881'	72°46.337'	25/02/2018	10:43:37AM	645,000	3	# REF!	# REF!	11	9	6	3	3	2	2	30,8	31,4
4	RHS	OL	24°27.881'	72°46.337'	23/02/2018	11:30:27AM	645,000	3	# REF!	# REF!	22	15	8	5	4	3	2	30,2	31,0
4	RHS	OL	24°27.802'	72°46.207'	23/02/2018	11:32:21AM	644,750	3	# REF!	# REF!	20	13	8	5	3	2	1	30,2	31,2
4	RHS	IL	24°27.718'	72°46.090'	25/02/2018	10:46:43AM	644,500	3	# REF!	# REF!	10	9	6	3	3	3	2	30,6	30,6
4	RHS	OL	24°27.718'	72°46.090'	23/02/2018	11:33:30AM	644,500	3	# REF!	# REF!	20	13	8	5	3	2	2	30,3	31,2
4	RHS	OL	24°27.630'	72°45.932'	23/02/2018	11:35:03AM	644,250	3	# REF!	# REF!	26	18	11	7	4	4	2	30,3	31,3
4	RHS	IL	24°27.857'	72°45.876'	25/02/2018	11:00:38AM	644,000	3	# REF!	# REF!	20	14	9	6	4	3	2	30,2	30,3
4	RHS	OL	24°27.857'	72°45.876'	23/02/2018	11:37:23AM	644,000	3	# REF!	# REF!	22	15	9	5	3	3	3	30,3	31,3
4	RHS	OL	24°27.412'	72°45.761'	23/02/2018	11:39:02AM	643,750	3	# REF!	# REF!	21	14	9	5	3	3	2	30,5	31,4
4	RHS	IL	24°27.308'	72°45.649'	25/02/2018	11:02:47AM	643,500	3	# REF!	# REF!	18	12	8	5	4	3	2	30,3	30,7
4	RHS	OL	24°27.308'	72°45.649'	23/02/2018	11:40:37AM	643,500	3	# REF!	# REF!	16	11	8	5	3	3	2	30,6	31,4
4	RHS	OL	24°27.302'	72°45.535'	23/02/2018	11:42:14AM	643,250	3	# REF!	# REF!	21	18	11	7	4	3	2	30,6	31,4
4	RHS	IL	24°27.218'	72°45.421'	25/02/2018	11:05:13AM	643,000	3	# REF!	# REF!	14	11	7	5	4	3	2	30,4	30,8
4	RHS	OL	24°27.218'	72°45.421'	23/02/2018	11:44:05AM	643,000	3	# REF!	# REF!	22	11	8	5	4	3	3	30,7	31,5
4	RHS	OL	24°27.110'	72°45.274'	23/02/2018	11:45:51AM	642,750	3	# REF!	# REF!	20	15	10	6	4	3	2	30,6	31,4
4	RHS	IL	24°27.043'	72°45.138'	25/02/2018	11:07:29AM	642,500	3	# REF!	# REF!	13	9	7	6	4	4	3	30,5	31,1
4	RHS	OL	24°27.043'	72°45.138'	23/02/2018	11:47:25AM	642,500	3	# REF!	# REF!	18	14	9	6	4	3	2	30,7	31,5
4	RHS	OL	24°26.966'	72°45.080'	23/02/2018	11:48:56AM	642,250	3	# REF!	# REF!	28	20	12	7	4	3	3	30,7	31,6
4	RHS	OL	24°26.966'	72°45.080'	23/02/2018	11:29:41AM	642,250	3	# REF!	# REF!	22	15	8	5	4	3	2	30,2	31,0
4	RHS	IL	24°26.876'	72°44.967'	25/02/2018	11:10:24AM	642,000	3	# REF!	# REF!	25	17	10	6	5	4	3	30,4	30,8
4	RHS	OL	24°26.876'	72°44.967'	23/02/2018	11:50:38AM	642,000	3	# REF!	# REF!	25	17	12	7	5	4	3	30,8	31,6
4	RHS	OL	24°26.784'	72°44.834'	23/02/2018	11:52:24AM	641,750	3	# REF!	# REF!	13	10	7	4	3	2	1	30,8	31,6
4	RHS	IL	24°26.718'	72°44.744'	25/02/2018	11:12:28AM	641,500	3	# REF!	# REF!	29	22	12	7	4	3	2	30,4	30,9
4	RHS	OL	24°26.718'	72°44.744'	23/02/2018	11:54:55AM	641,500	3	# REF!	# REF!	17	14	10	6	4	3	3	30,9	31,6
4	RHS	OL	24°26.625'	72°44.626'	23/02/2018	11:54:42AM	641,250	3	# REF!	# REF!	26	20	11	6	4	3	3	30,9	31,6
4	RHS	IL	24°26.534'	72°44.504'	25/02/2018	11:15:41AM	641,000	3	# REF!	# REF!	20	14	9	6	4	3	2	30,4	30,9
4	RHS	OL	24°26.534'	72°44.504'	23/02/2018	11:55:52AM	641,000	3	# REF!	# REF!	16	14	9	6	3	3	2	30,9	31,9
4	RHS	OL	24°26.445'	72°44.384'	23/02/2018	11:57:38AM	640,750	3	# REF!	# REF!	13	9	6	4	3	2	1	31,1	31,9
4	RHS	IL	24°26.366'	72°44.268'	25/02/2018	11:16:12AM	640,500	3	# REF!	# REF!	22	15	10	6	5	5	4	30,5	30,9
4	RHS	OL	24°26.366'	72°44.268'	23/02/2018	11:59:15AM	640,500	3	# REF!	# REF!	12	10	7	5	3	2	2	30,9	31,9
4	RHS	OL	24°26.200'	72°44.157'	23/02/2018	12:00:46PM	640,250	3	# REF!	# REF!	14	11	7	5	4	2	2	30,8	31,6
4	RHS	IL	24°26.259'	72°44.004'	25/02/2018	11:19:16AM	640,000	3	16	27	22	14	8	4	3	2	2	30,2	30,9
4	RHS	OL	24°26.259'	72°44.004'	23/02/2018	12:02:25PM	640,000	3	16	27	17	12	7	5	3	2	2	30,6	31,5
4	RHS	OL	24°26.289'	72°43.878'	23/02/2018	12:05:44PM	639,750	3	16	27	14	10	7	5	3	2	2	31,0	31,7
4	RHS	IL	24°26.323'	72°43.712'	25/02/2018	11:21:40AM	639,500	3	16	27	24	17	11	6	5	3	3	30,0	30,8
4	RHS	OL	24°26.323'	72°43.712'	23/02/2018	12:06:09PM	639,500	3	16	27	18	13	8	5	3	2	2	30,5	31,5
4	RHS	OL	24°26.260'	72°43.559'	23/02/2018	12:08:03PM	639,250	3	16	27	22	15	8	4	3	2	2	30,7	31,8
4	RHS	IL	24°26.207'	72°43.462'	25/02/2018	11:24:03AM	639,000	3	16	27	26	18	10	4	3	3	2	30,2	31,1
4	RHS	OL	24°26.207'	72°43.462'	23/02/2018	12:09:32PM	639,000	3	16	27	18	14	8	5	3	2	1	30,8	31,9
4	RHS	OL	24°26.110'	72°43.280'	23/02/2018	12:11:29PM	638,750	3	16	27	7	5	4	4	3	3	3	31,1	31,9
4	RHS	IL	24°26.063'	72°43.183'	25/02/2018	11:27:08AM	638,500	3	16	27	19	14	9	5	3	2	2	30,6	31,3
4	RHS	OL	24°26.063'	72°43.183'	23/02/2018	12:12:51PM	638,500	3	16	27	20	16	11	5	3	1	1	31,1	32,0
4	RHS	OL	24°25.995'	72°43.070'	23/02/2018	12:14:23PM	638,250	3	16	27	13	11	7	4	3	2	2	31,2	32,0



PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE
NATIONAL HIGHWAYS ON ROADS UNDER (The National Highways
Infra Trust)

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana
– Abu Road (ANNEXURES)



Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	IL	24°25.927'	72°42.946'	25/02/2018	11:29:30AM	638,000	3	16	27	24	19	11	6	3	2	1	30,7	31,4

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged ection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	OL	24°25.927'	72°42.946'	23/02/2018	12:17:09PM	638,000	3	16	27	12	11	8	5	3	3	2	31,1	32,0
4	RHS	OL	24°25.856'	72°42.775'	23/02/2018	12:19:28PM	637,750	3	16	27	11	9	6	4	3	2	1	31,1	31,9
4	RHS	IL	24°25.844'	72°42.625'	25/02/2018	11:31:40AM	637,500	3	16	27	16	15	8	5	4	3	3	30,8	31,5
4	RHS	OL	24°25.844'	72°42.625'	23/02/2018	12:22:09PM	637,500	3	16	27	10	10	6	4	3	2	2	31,2	32,1
4	RHS	OL	24°25.833'	72°42.582'	23/02/2018	12:26:18PM	637,250	3	16	27	20	12	7	4	3	2	2	31,2	32,0
4	RHS	IL	24°25.818'	72°42.377'	25/02/2018	11:33:51AM	637,000	3	16	27	5	3	2	2	2	1	1	30,9	31,6
4	RHS	OL	24°25.818'	72°42.377'	23/02/2018	12:27:58PM	637,000	3	16	27	6	4	3	2	1	1	1	31,2	32,0
4	RHS	OL	24°25.808'	72°42.225'	23/02/2018	12:30:03PM	636,750	3	16	27	12	10	7	5	3	2	2	31,2	32,1
4	RHS	IL	24°25.792'	72°42.091'	25/02/2018	11:37:24AM	636,500	3	16	27	13	9	6	4	3	2	2	30,8	31,6
4	RHS	OL	24°25.792'	72°42.091'	23/02/2018	02:58:45PM	636,500	3	16	27	17	11	7	4	3	2	2	31,6	32,3
4	RHS	OL	24°25.782'	72°41.946'	23/02/2018	02:59:19PM	636,250	3	16	27	11	9	6	4	2	2	1	31,3	32,2
4	RHS	IL	24°25.767'	72°41.790'	25/02/2018	11:39:13AM	636,000	3	16	27	18	12	11	6	4	3	2	30,7	31,4
4	RHS	OL	24°25.767'	72°41.790'	23/02/2018	03:00:22PM	636,000	3	16	27	6	6	6	3	2	2	1	31,5	32,2
4	RHS	OL	24°25.709'	72°41.647'	23/02/2018	03:01:16PM	635,750	3	16	27	23	15	8	5	3	3	2	31,5	32,6
4	RHS	IL	24°25.625'	72°41.500'	25/02/2018	11:42:00AM	635,500	3	16	27	16	11	8	5	4	3	2	30,7	31,4
4	RHS	OL	24°25.625'	72°41.500'	23/02/2018	03:02:50PM	635,500	3	16	27	18	14	7	4	3	2	2	31,6	32,7
4	RHS	OL	24°25.541'	72°41.461'	23/02/2018	03:04:23PM	635,250	3	16	27	21	14	8	5	3	3	1	31,8	32,8
4	RHS	IL	24°25.438'	72°41.313'	25/02/2018	11:44:27AM	635,000	3	14	23	16	14	11	7	4	3	3	30,9	31,6
4	RHS	OL	24°25.438'	72°41.313'	23/02/2018	03:06:59PM	635,000	3	14	23	23	15	9	5	3	3	2	31,9	32,9
4	RHS	OL	24°24.333'	72°41.243'	23/02/2018	03:09:27PM	634,750	3	14	23	24	16	11	6	4	3	2	31,9	32,9
4	RHS	IL	24°24.250'	72°41.155'	25/02/2018	11:46:48AM	634,500	3	14	23	14	10	7	5	3	2	2	31,1	31,6
4	RHS	OL	24°24.250'	72°41.155'	23/02/2018	03:11:04PM	634,500	3	14	23	17	15	11	7	4	3	3	31,9	32,9
4	RHS	OL	24°24.123'	72°41.021'	23/02/2018	03:14:23PM	634,250	3	14	23	14	11	8	5	3	2	2	31,8	32,9
4	RHS	IL	24°24.051'	72°40.911'	25/02/2018	11:49:34AM	634,000	3	14	23	10	7	5	5	3	2	2	31,3	31,9
4	RHS	OL	24°24.051'	72°40.911'	23/02/2018	03:15:59PM	634,000	3	14	23	17	10	7	5	3	3	3	31,9	32,9
4	RHS	OL	24°24.963'	72°40.772'	23/02/2018	03:17:45PM	633,750	3	14	23	5	4	3	2	2	1	1	31,8	32,8
4	RHS	IL	24°24.893'	72°40.661'	25/02/2018	11:51:47AM	633,500	3	14	23	16	15	10	7	4	3	3	31,3	31,5
4	RHS	OL	24°24.893'	72°40.661'	23/02/2018	03:20:55PM	633,500	3	14	23	14	10	6	4	3	2	2	31,7	32,7
4	RHS	OL	24°24.833'	72°40.567'	23/02/2018	03:22:30PM	633,250	3	14	23	18	12	6	3	2	1	1	31,7	32,8
4	RHS	IL	24°24.784'	72°40.426'	25/02/2018	11:54:56AM	633,000	3	14	23	17	12	8	5	4	3	2	31,4	31,9
4	RHS	OL	24°24.784'	72°40.426'	23/02/2018	03:24:30PM	633,000	3	14	23	8	6	4	4	3	2	2	31,5	32,4
4	RHS	OL	24°24.727'	72°40.258'	23/02/2018	03:29:45PM	632,750	3	14	23	19	13	8	4	3	2	2	31,2	32,1
4	RHS	IL	24°24.696'	72°40.130'	25/02/2018	11:56:48AM	632,500	3	14	23	15	11	8	5	4	3	2	31,4	30,8
4	RHS	OL	24°24.696'	72°40.130'	23/02/2018	03:31:19PM	632,500	3	14	23	13	11	8	5	3	2	2	31,2	32,2
4	RHS	OL	24°24.659'	72°39.985'	23/02/2018	03:33:56PM	632,250	3	14	23	19	13	9	6	4	3	2	31,2	32,2
4	RHS	IL	24°24.638'	72°39.848'	25/02/2018	11:58:51AM	632,000	3	14	23	11	8	7	5	3	2	2	31,3	30,8
4	RHS	OL	24°24.638'	72°39.848'	23/02/2018	03:36:21PM	632,000	3	14	23	20	14	9	5	3	2	1	31,2	32,3
4	RHS	OL	24°24.581'	72°39.717'	23/02/2018	03:37:59PM	631,750	3	14	23	13	9	7	4	3	2	2	31,2	32,2
4	RHS	IL	24°24.578'	72°39.608'	25/02/2018	12:01:00PM	631,500	3	14	23	16	12	9	5	4	3	2	31,1	31,8
4	RHS	OL	24°24.578'	72°39.608'	23/02/2018	03:39:31PM	631,500	3	14	23	10	8	5	3	2	2	1	31,3	32,3
4	RHS	OL	24°24.444'	72°39.487'	23/02/2018	03:41:25PM	631,250	3	14	23	8	6	5	3	2	2	1	31,3	32,4
4	RHS	IL	24°24.355'	72°39.346'	25/02/2018	12:03:15PM	631,000	3	14	23	13	10	8	6	4	3	2	31,1	31,6
4	RHS	OL	24°24.355'	72°39.346'	23/02/2018	03:43:32PM	631,000	3	14	23	10	8	6	5	3	2	2	31,3	32,3
4	RHS	OL	24°24.275'	72°39.202'	23/02/2018	03:45:31PM	630,750	3	14	23	13	9	7	5	3	3	2	31,1	32,1
4	RHS	IL	24°24.221'	72°39.100'	25/02/2018	12:05:33PM	630,500	3	14	23	9	8	5	4	3	2	2	31,2	31,4

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature	
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
4	RHS	OL	24°24.221'	72°39.100'	23/02/2018	03:49:35PM	630,500	3	14	23	10	6	4	3	2	1	1	30,8	31,8
4	RHS	OL	24°24.160'	72°38.977'	23/02/2018	03:51:23PM	630,250	3	14	23	14	10	7	5	4	3	2	30,7	31,9

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	IL	24°24.077'	72°38.885'	25/02/2018	12:08:37PM	630,000	3	15	24	19	14	9	5	4	3	2	31,4	32,0
4	RHS	OL	24°24.077'	72°38.885'	23/02/2018	03:53:06PM	630,000	3	15	24	10	7	5	3	2	2	1	30,7	31,8
4	RHS	OL	24°24.022'	72°38.748'	23/02/2018	03:54:32PM	629,750	3	15	24	19	8	6	5	3	3	2	31,0	32,1
4	RHS	IL	24°23.940'	72°38.607'	25/02/2018	12:10:21PM	629,500	3	15	24	15	12	9	6	4	3	2	31,6	32,2
4	RHS	OL	24°23.940'	72°38.607'	23/02/2018	03:54:58PM	629,500	3	15	24	23	7	6	5	3	2	2	31,0	32,1
4	RHS	OL	24°23.860'	72°38.484'	23/02/2018	03:55:56PM	629,250	3	15	24	28	20	11	7	4	3	3	31,1	32,2
4	RHS	IL	24°23.805'	72°38.288'	25/02/2018	12:12:19PM	629,000	3	15	24	14	12	8	6	4	3	2	31,6	32,3
4	RHS	OL	24°23.805'	72°38.288'	23/02/2018	03:58:36PM	629,000	3	15	24	10	9	7	4	2	1	1	31,2	32,1
4	RHS	OL	24°23.800'	72°38.187'	23/02/2018	04:00:35PM	628,750	3	15	24	16	10	7	4	3	2	2	30,7	31,8
4	RHS	IL	24°23.810'	72°38.006'	25/02/2018	12:14:44PM	628,500	3	15	24	18	12	9	6	4	3	3	31,6	32,2
4	RHS	OL	24°23.810'	72°38.006'	23/02/2018	04:02:13PM	628,500	3	15	24	25	19	12	7	5	4	3	30,6	31,8
4	RHS	OL	24°23.818'	72°37.872'	23/02/2018	04:03:45PM	628,250	3	15	24	15	10	8	5	4	3	3	30,6	32,0
4	RHS	IL	24°23.792'	72°37.735'	25/02/2018	12:16:44PM	628,000	3	15	24	16	11	8	7	5	4	3	31,6	32,3
4	RHS	OL	24°23.792'	72°37.735'	23/02/2018	04:05:16PM	628,000	3	15	24	15	11	8	5	3	2	2	30,6	32,0
4	RHS	OL	24°23.717'	72°37.589'	23/02/2018	04:07:10PM	627,750	3	15	24	17	10	6	4	3	3	2	30,6	31,8
4	RHS	IL	24°23.635'	72°37.435'	25/02/2018	12:19:40PM	627,500	3	15	24	12	9	6	4	2	2	1	31,5	32,1
4	RHS	OL	24°23.635'	72°37.435'	23/02/2018	05:22:11PM	627,500	3	15	24	14	10	7	5	4	3	2	30,4	31,3
4	RHS	OL	24°23.580'	72°37.377'	23/02/2018	05:24:44PM	627,250	3	15	24	10	8	6	4	3	2	2	30,4	31,4
4	RHS	IL	24°23.498'	72°37.249'	26/02/2018	08:17:39AM	627,000	3	15	24	15	11	7	4	3	2	2	25,1	25,9
4	RHS	OL	24°23.498'	72°37.249'	23/02/2018	05:26:24PM	627,000	3	15	24	6	5	4	3	2	2	1	30,4	31,5
4	RHS	OL	24°23.410'	72°37.098'	23/02/2018	05:28:24PM	626,750	3	15	24	10	8	6	4	3	2	2	30,4	31,5
4	RHS	IL	24°23.351'	72°36.997'	26/02/2018	08:20:19AM	626,500	3	15	24	12	9	6	5	4	3	3	25,2	26,1
4	RHS	OL	24°23.351'	72°36.997'	23/02/2018	05:30:07PM	626,500	3	15	24	15	11	9	6	5	4	4	30,5	31,6
4	RHS	OL	24°23.297'	72°36.861'	23/02/2018	05:32:04PM	626,250	3	15	24	13	9	6	4	3	3	2	30,5	31,6
4	RHS	IL	24°23.207'	72°36.744'	26/02/2018	08:23:00AM	626,000	3	15	24	10	8	7	5	4	3	2	25,3	25,8
4	RHS	OL	24°23.207'	72°36.744'	23/02/2018	05:33:39PM	626,000	3	15	24	12	8	7	5	4	3	2	30,5	31,5
4	RHS	OL	24°23.143'	72°36.633'	23/02/2018	05:35:34PM	625,750	3	15	24	18	13	9	5	4	3	2	30,5	31,2
4	RHS	IL	24°23.066'	72°36.491'	26/02/2018	08:25:06AM	625,500	3	15	24	13	9	7	5	4	3	2	25,4	26,2
4	RHS	OL	24°23.066'	72°36.491'	23/02/2018	05:37:06PM	625,500	3	15	24	16	13	10	7	4	3	3	30,4	31,5
4	RHS	OL	24°22.998'	72°36.378'	23/02/2018	05:39:26PM	625,250	3	15	24	10	7	6	4	3	3	2	30,4	31,5
4	RHS	IL	24°22.921'	72°36.243'	26/02/2018	08:27:19AM	625,000	3	18	31	11	10	8	6	4	3	2	25,4	26,4
4	RHS	OL	24°22.921'	72°36.243'	23/02/2018	05:41:06PM	625,000	3	18	31	19	13	9	6	4	3	3	30,4	31,4
4	RHS	OL	24°22.885'	72°36.125'	23/02/2018	05:42:51PM	624,750	3	18	31	26	20	11	7	5	4	3	30,4	31,4
4	RHS	IL	24°22.787'	72°36.006'	26/02/2018	08:29:29AM	624,500	3	18	31	11	9	7	5	4	4	3	25,6	26,5
4	RHS	OL	24°22.787'	72°36.006'	23/02/2018	05:44:31PM	624,500	3	18	31	15	12	8	6	4	3	3	30,4	31,4
4	RHS	OL	24°22.707'	72°35.865'	23/02/2018	05:46:07PM	624,250	3	18	31	12	9	7	5	3	3	2	30,3	31,3
4	RHS	IL	24°22.638'	72°35.741'	26/02/2018	08:31:48AM	624,000	3	18	31	19	13	8	5	4	3	2	25,6	26,5
4	RHS	OL	24°22.638'	72°35.741'	23/02/2018	05:47:53PM	624,000	3	18	31	12	8	6	4	3	2	2	30,4	30,5
4	RHS	OL	24°22.566'	72°35.615'	23/02/2018	05:49:30PM	623,750	3	18	31	17	11	7	5	3	3	2	30,4	31,2
4	RHS	IL	24°22.495'	72°35.491'	26/02/2018	08:33:48AM	623,500	3	18	31	11	9	6	4	3	2	2	25,6	26,6
4	RHS	OL	24°22.495'	72°35.491'	23/02/2018	05:51:01PM	623,500	3	18	31	18	13	9	6	4	3	2	30,4	31,2
4	RHS	OL	24°22.432'	72°35.380'	23/02/2018	05:52:29PM	623,250	3	18	31	16	10	6	4	2	2	2	30,3	31,4
4	RHS	IL	24°22.350'	72°35.232'	26/02/2018	08:36:05AM	623,000	3	18	31	19	15	9	7	5	4	3	25,8	26,7
4	RHS	OL	24°22.350'	72°35.232'	23/02/2018	05:54:03PM	623,000	3	18	31	41	30	17	9	6	4	3	30,4	31,4
4	RHS	OL	24°22.266'	72°35.083'	23/02/2018	05:56:41PM	622,750	3	18	31	26	18	10	6	4	3	3	30,4	31,5
4	RHS	IL	24°22.222'	72°35.007'	26/02/2018	08:38:25AM	622,500	3	18	31	19	14	9	5	4	3	2	25,9	26,8

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	OL	24°22.222'	72°35.007'	23/02/2018	05:57:57PM	622,500	3	18	31	20	15	9	5	3	3	3	30,4	31,4

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	OL	24°22.142'	72°34.869'	23/02/2018	05:59:36PM	622,250	3	18	31	27	19	11	7	4	4	3	30,3	31,2
4	RHS	IL	24°22.058'	72°34.742'	26/02/2018	08:40:27AM	622,000	3	18	31	15	11	6	4	2	2	1	26,0	26,9
4	RHS	OL	24°22.058'	72°34.742'	23/02/2018	06:01:09PM	622,000	3	18	31	20	14	8	5	4	3	3	30,3	31,3
4	RHS	OL	24°21.972'	72°34.652'	23/02/2018	06:04:10PM	621,750	3	18	31	12	9	5	3	1	1	1	30,2	31,3
4	RHS	IL	24°21.859'	72°34.536'	26/02/2018	08:42:41AM	621,500	3	18	31	23	18	11	6	4	3	3	26,1	26,9
4	RHS	OL	24°21.859'	72°34.536'	23/02/2018	06:05:49PM	621,500	3	18	31	18	12	7	4	2	2	2	30,2	31,3
4	RHS	OL	24°21.761'	72°34.434'	23/02/2018	06:07:25PM	621,250	3	18	31	22	16	9	5	3	2	2	30,2	31,2
4	RHS	IL	24°21.675'	72°34.332'	26/02/2018	08:44:43AM	621,000	3	18	31	13	10	7	5	3	2	2	26,4	26,9
4	RHS	OL	24°21.675'	72°34.332'	23/02/2018	06:09:06PM	621,000	3	18	31	13	9	7	4	3	2	2	30,2	31,1
4	RHS	OL	24°21.591'	72°34.206'	23/02/2018	06:10:51PM	620,750	3	18	31	16	11	7	4	2	1	1	30,2	30,8
4	RHS	IL	24°21.516'	72°34.095'	26/02/2018	08:46:49AM	620,500	3	18	31	18	13	7	4	3	2	1	26,4	27,0
4	RHS	OL	24°21.516'	72°34.095'	23/02/2018	06:12:21PM	620,500	3	18	31	23	14	8	4	3	3	3	30,1	31,1
4	RHS	OL	24°21.444'	72°33.989'	23/02/2018	06:15:10PM	620,250	3	18	31	18	12	7	4	3	3	2	29,9	31,1
4	RHS	IL	24°21.972'	72°33.882'	26/02/2018	08:48:52AM	620,000	3	14	23	8	6	5	3	2	2	2	26,3	27,0
4	RHS	OL	24°21.972'	72°33.882'	23/02/2018	06:16:42PM	620,000	3	14	23	10	6	4	2	1	1	1	29,9	31,1
4	RHS	OL	24°21.267'	72°33.726'	23/02/2018	06:18:51PM	619,750	3	14	23	26	19	10	5	3	2	2	29,9	31,1
4	RHS	IL	24°21.201'	72°33.627'	26/02/2018	08:50:57AM	619,500	3	14	23	19	14	8	4	3	2	2	26,3	26,9
4	RHS	OL	24°21.201'	72°33.627'	23/02/2018	06:20:19PM	619,500	3	14	23	17	12	8	5	3	2	2	29,9	31,1
4	RHS	OL	24°21.123'	72°33.570'	23/02/2018	06:22:01PM	619,250	3	14	23	21	14	8	4	3	2	2	29,9	30,9
4	RHS	IL	24°21.031'	72°33.375'	26/02/2018	08:53:12AM	619,000	3	14	23	15	13	8	5	3	2	2	26,4	27,3
4	RHS	OL	24°21.031'	72°33.375'	23/02/2018	06:23:41PM	619,000	3	14	23	16	12	7	4	2	1	1	29,9	30,9
4	RHS	OL	24°20.963'	72°33.274'	24/02/2018	08:59:53AM	618,750	3	14	23	24	17	9	5	3	2	2	25,8	26,6
4	RHS	IL	24°20.891'	72°33.169'	26/02/2018	08:55:57AM	618,500	3	14	23	17	13	8	5	3	3	2	26,5	27,0
4	RHS	OL	24°20.891'	72°33.169'	24/02/2018	09:01:24AM	618,500	3	14	23	13	9	5	4	3	2	1	25,9	26,6
4	RHS	OL	24°20.791'	72°33.021'	24/02/2018	09:03:09AM	618,250	3	14	23	12	8	5	4	2	2	2	26,0	26,7
4	RHS	IL	24°20.711'	72°32.902'	26/02/2018	08:57:48AM	618,000	3	14	23	10	7	5	4	2	2	1	26,6	27,5
4	RHS	OL	24°20.711'	72°32.902'	24/02/2018	09:04:46AM	618,000	3	14	23	10	8	6	4	3	2	2	26,3	26,9
4	RHS	OL	24°20.629'	72°32.775'	24/02/2018	09:05:14AM	617,750	3	14	23	21	12	7	4	3	2	2	26,1	26,7
4	RHS	IL	24°20.555'	72°32.670'	26/02/2018	08:59:42AM	617,500	3	14	23	16	14	7	4	3	2	2	26,9	27,8
4	RHS	OL	24°20.555'	72°32.670'	24/02/2018	09:06:02AM	617,500	3	14	23	13	9	5	4	3	2	2	26,4	26,8
4	RHS	OL	24°20.479'	72°32.559'	24/02/2018	09:08:47AM	617,250	3	14	23	12	8	5	3	3	2	2	26,6	27,4
4	RHS	IL	24°20.394'	72°32.431'	26/02/2018	09:02:21AM	617,000	3	14	23	10	8	5	3	2	2	1	26,9	27,8
4	RHS	OL	24°20.394'	72°32.431'	24/02/2018	09:10:33AM	617,000	3	14	23	8	7	5	4	2	2	1	26,6	27,4
4	RHS	OL	24°20.303'	72°32.295'	24/02/2018	09:12:14AM	616,750	3	14	23	10	8	6	4	3	2	2	26,8	27,6
4	RHS	IL	24°20.216'	72°32.167'	26/02/2018	09:04:29AM	616,500	3	14	23	13	9	7	5	3	2	2	26,9	27,7
4	RHS	OL	24°20.216'	72°32.167'	24/02/2018	09:13:52AM	616,500	3	14	23	9	7	6	4	4	3	3	26,8	27,5
4	RHS	OL	24°20.159'	72°32.082'	24/02/2018	09:15:20AM	616,250	3	14	23	10	7	6	4	3	2	2	26,8	27,5
4	RHS	IL	24°20.070'	72°31.948'	26/02/2018	09:06:40AM	616,000	3	14	23	12	8	5	4	3	2	1	26,9	27,7
4	RHS	OL	24°20.070'	72°31.948'	24/02/2018	09:17:02AM	616,000	3	14	23	9	8	5	4	2	2	1	26,9	27,5
4	RHS	OL	24°19.986'	72°31.824'	24/02/2018	09:20:33AM	615,750	3	14	23	14	9	6	3	2	2	1	27,0	27,7
4	RHS	IL	24°19.894'	72°31.704'	26/02/2018	09:08:40AM	615,500	3	14	23	17	12	8	5	4	3	3	27,0	27,7
4	RHS	OL	24°19.894'	72°31.704'	24/02/2018	09:22:13AM	615,500	3	14	23	11	8	5	4	2	2	1	27,1	27,6
4	RHS	OL	24°19.784'	72°31.629'	24/02/2018	09:23:47AM	615,250	3	14	23	9	8	5	3	3	2	1	27,1	27,6
4	RHS	IL	24°19.674'	72°31.564'	26/02/2018	09:10:44AM	615,000	3	14	24	15	12	8	5	3	3	2	27,1	28,0
4	RHS	OL	24°19.674'	72°31.564'	24/02/2018	09:25:30AM	615,000	3	14	24	25	21	12	7	6	4	3	27,2	28,1
4	RHS	OL	24°19.538'	72°31.484'	24/02/2018	09:26:41AM	614,750	3	14	24	12	9	6	3	2	2	1	27,3	28,1



PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE
NATIONAL HIGHWAYS ON ROADS UNDER (The National Highways
Infra Trust)

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana
– Abu Road (ANNEXURES)



Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	IL	24°19.431'	72°31.421'	26/02/2018	09:13:02AM	614,500	3	14	24	11	8	5	3	2	2	2	27,5	28,2

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	OL	24°19.431'	72°31.421'	24/02/2018	09:28:26AM	614,500	3	14	24	12	9	6	4	2	2	1	27,7	28,3
4	RHS	OL	24°19.316'	72°31.353'	24/02/2018	09:29:58AM	614,250	3	14	24	7	6	4	3	2	2	1	27,7	28,1
4	RHS	IL	24°19.197'	72°31.282'	26/02/2018	09:15:01AM	614,000	3	14	24	10	8	6	4	2	1	1	27,6	27,5
4	RHS	OL	24°19.197'	72°31.282'	24/02/2018	09:31:49AM	614,000	3	14	24	11	8	6	4	3	3	2	27,6	27,8
4	RHS	OL	24°19.070'	72°31.206'	24/02/2018	09:36:16AM	613,750	3	14	24	15	10	6	4	3	2	2	27,9	28,3
4	RHS	IL	24°18.960'	72°31.141'	26/02/2018	09:17:16AM	613,500	3	14	24	13	10	7	4	3	2	2	27,6	28,2
4	RHS	OL	24°18.960'	72°31.141'	24/02/2018	09:38:00AM	613,500	3	14	24	12	9	7	5	3	2	2	28,0	28,3
4	RHS	OL	24°18.846'	72°31.049'	24/02/2018	09:59:59AM	613,250	3	14	24	20	16	10	5	3	2	2	28,9	28,8
4	RHS	IL	24°18.750'	72°30.959'	26/02/2018	09:19:14AM	613,000	3	14	24	22	15	8	4	3	2	2	27,7	28,3
4	RHS	OL	24°18.750'	72°30.959'	24/02/2018	10:01:50AM	613,000	3	14	24	18	12	7	5	3	2	2	28,9	28,9
4	RHS	OL	24°18.688'	72°30.870'	24/02/2018	10:03:51AM	612,750	3	14	24	19	14	8	4	3	2	2	29,0	29,0
4	RHS	IL	24°18.538'	72°30.847'	26/02/2018	09:21:31AM	612,500	3	14	24	16	15	8	4	3	2	2	27,8	28,4
4	RHS	OL	24°18.538'	72°30.847'	24/02/2018	10:05:29AM	612,500	3	14	24	28	20	10	4	3	3	2	28,9	29,2
4	RHS	OL	24°18.401'	72°30.832'	24/02/2018	10:08:08AM	612,250	3	14	24	12	9	6	4	3	2	2	29,1	29,3
4	RHS	IL	24°18.241'	72°30.804'	26/02/2018	09:23:34AM	612,000	3	14	24	8	7	5	4	2	2	1	27,9	28,5
4	RHS	OL	24°18.241'	72°30.804'	24/02/2018	10:09:52AM	612,000	3	14	24	7	5	4	3	2	1	1	29,1	29,6
4	RHS	OL	24°18.110'	72°30.781'	24/02/2018	10:11:48AM	611,750	3	14	24	12	8	5	3	2	2	1	29,2	29,6
4	RHS	IL	24°17.999'	72°30.762''	26/02/2018	09:25:55AM	611,500	3	14	24	10	7	6	4	2	2	1	28,0	28,4
4	RHS	OL	24°17.999'	72°30.762''	24/02/2018	10:13:20AM	611,500	3	14	24	11	8	6	4	3	2	2	29,3	29,6
4	RHS	OL	24°17.847'	72°30.728'	24/02/2018	10:14:55AM	611,250	3	14	24	13	10	6	3	2	2	2	29,4	29,8
4	RHS	IL	24°17.686'	72°30.679'	26/02/2018	09:28:07AM	611,000	3	14	24	17	14	8	6	3	3	2	28,2	28,9
4	RHS	OL	24°17.686'	72°30.679'	24/02/2018	10:16:40AM	611,000	3	14	24	17	13	7	4	3	2	1	29,6	29,9
4	RHS	OL	24°17.624'	72°30.613'	24/02/2018	10:17:52AM	610,750	3	14	24	12	9	5	4	2	2	1	29,2	29,6
4	RHS	IL	24°17.516'	72°30.450'	26/02/2018	09:30:26AM	610,500	3	14	24	14	13	7	4	2	2	2	28,0	28,5
4	RHS	OL	24°17.516'	72°30.450'	24/02/2018	10:18:32AM	610,500	3	14	24	11	9	6	4	2	2	1	29,3	29,8
4	RHS	OL	24°17.525'	72°30.327'	24/02/2018	10:19:53AM	610,250	3	14	24	11	10	6	3	2	2	1	29,5	29,8
4	RHS	IL	24°17.439'	72°30.180'	26/02/2018	09:31:33AM	610,000	3	10	16	11	9	6	4	2	2	1	28,1	28,6
4	RHS	OL	24°17.439'	72°30.180'	24/02/2018	10:21:07AM	610,000	3	10	16	11	8	6	2	2	2	1	29,6	29,9
4	RHS	OL	24°17.354'	72°30.049'	24/02/2018	10:22:52AM	609,750	3	10	16	5	3	3	2	2	1	1	29,6	30,1
4	RHS	IL	24°17.281'	72°29.234'	26/02/2018	09:33:28AM	609,500	3	10	16	13	9	7	4	2	2	1	28,2	28,7
4	RHS	OL	24°17.281'	72°29.234'	24/02/2018	10:23:54AM	609,500	3	10	16	10	7	6	4	2	2	1	29,6	29,8
4	RHS	OL	24°17.240'	72°29.843'	24/02/2018	10:25:16AM	609,250	3	10	16	9	7	5	4	3	2	2	29,6	29,9
4	RHS	IL	24°17.108'	72°29.731'	26/02/2018	09:34:02AM	609,000	3	10	16	19	14	8	4	3	2	2	28,3	29,0
4	RHS	OL	24°17.108'	72°29.731'	24/02/2018	10:26:56AM	609,000	3	10	16	11	6	6	4	3	2	2	29,4	29,9
4	RHS	OL	24°16.980'	72°29.688'	24/02/2018	10:29:42AM	608,750	3	10	16	13	9	6	4	3	2	2	29,7	30,1
4	RHS	IL	24°16.795'	72°29.600'	26/02/2018	09:36:18AM	608,500	3	10	16	16	12	7	4	2	2	1	28,5	29,2
4	RHS	OL	24°16.795'	72°29.600'	24/02/2018	10:31:35AM	608,500	3	10	16	10	8	6	4	3	2	2	30,0	30,4
4	RHS	OL	24°16.695'	72°29.641'	24/02/2018	10:33:00AM	608,250	3	10	16	12	9	6	4	2	2	1	30,1	30,3
4	RHS	IL	24°16.586'	72°29.604'	26/02/2018	09:38:10AM	608,000	3	10	16	5	4	3	2	1	1	1	28,7	28,7
4	RHS	OL	24°16.586'	72°29.604'	24/02/2018	10:34:27AM	608,000	3	10	16	8	6	4	3	2	2	1	30,1	30,4
4	RHS	OL	24°16.469'	72°29.494'	24/02/2018	10:36:08AM	607,750	3	10	16	5	5	4	3	2	1	1	30,1	30,4
4	RHS	IL	24°16.501'	72°29.375'	26/02/2018	09:40:47AM	607,500	3	10	16	11	8	5	4	2	2	1	28,8	29,5
4	RHS	OL	24°16.501'	72°29.375'	24/02/2018	10:38:45AM	607,500	3	10	16	8	7	5	3	2	2	1	30,1	30,4
4	RHS	OL	24°16.333'	72°29.256'	24/02/2018	10:40:13AM	607,250	3	10	16	6	5	3	2	1	1	1	30,1	30,4
4	RHS	IL	24°16.254'	72°29.115'	26/02/2018	09:43:04AM	607,000	3	10	16	8	6	4	3	2	1	1	28,9	29,6
4	RHS	OL	24°16.254'	72°29.115'	24/02/2018	10:41:45AM	607,000	3	10	16	9	7	5	3	2	1	1	30,0	30,5



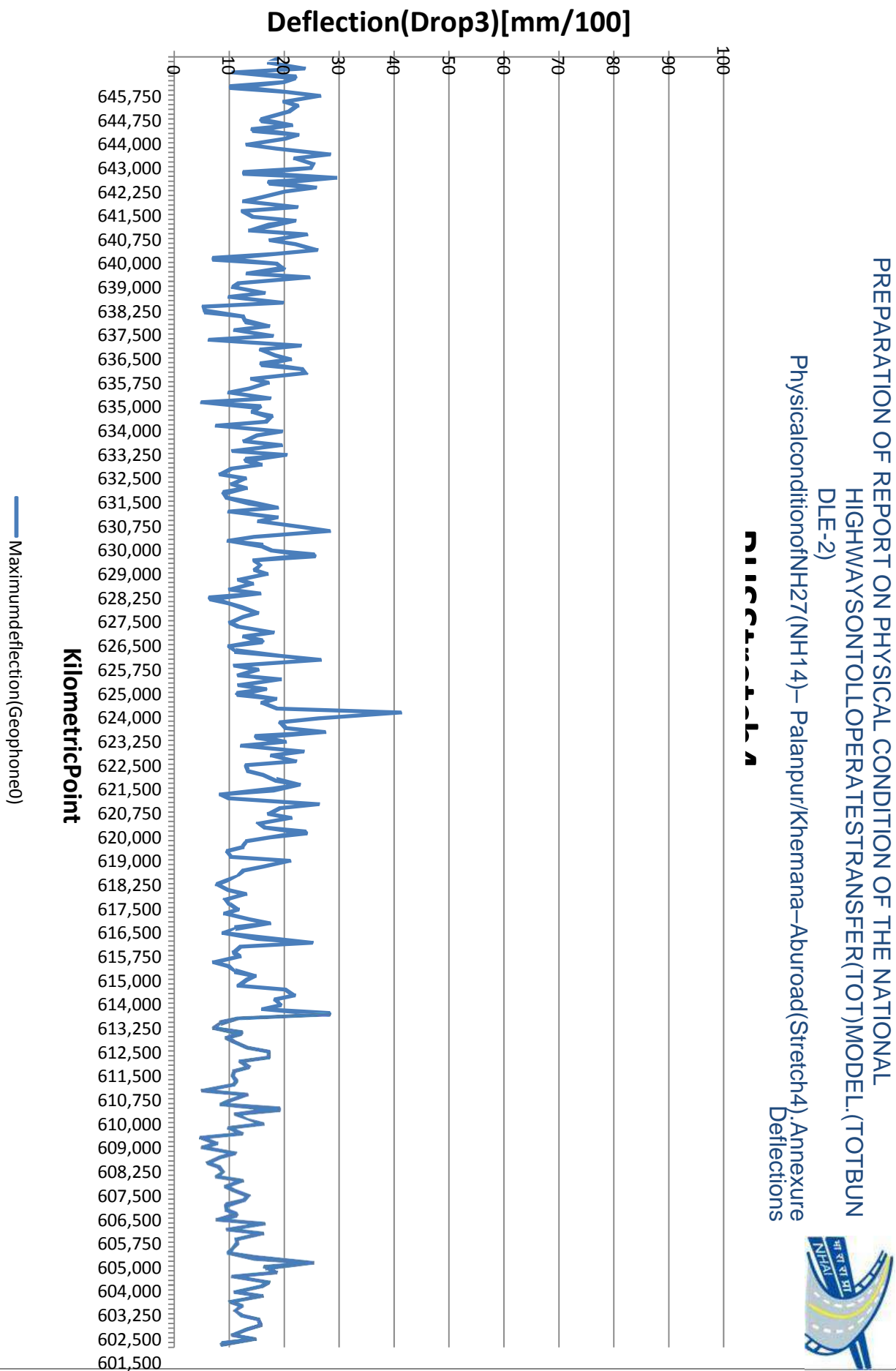
PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE
NATIONAL HIGHWAYS ON ROADS UNDER (The National Highways
Infra Trust)

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana
– Abu Road (ANNEXURES)



Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged eflection	Characteristic deflection	Deflection(mm/100)							Airtemp erature	Pavementt emperature
											Maximumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500	Geophone 1800		
4	RHS	OL	24°16.177'	72°28.933'	24/02/2018	10:43:20AM	606,750	3	10	16	8	5	4	2	2	1	1	30,0	30,5

Road	Segment	Lane	Lat	Long	Date	Time	Kilometric Point(Km)	Drop	Averaged efection	Characteristic deflection	Deflection(mm/100)						Airtemp erature	Pavementt emperature
											Maximiumdefl ection(Geoph one0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500		
4	RHS	IL	24°16.092'	72°28.892'	26/02/2018	09:44:58AM	606,500	3	10	16	12	9	6	3	2	1	28,9	29,5
4	RHS	OL	24°16.092'	72°28.892'	24/02/2018	10:45:09AM	606,500	3	10	16	9	6	4	3	2	2	30,0	30,5
4	RHS	OL	24°15.971'	72°28.838'	24/02/2018	10:46:49AM	606,250	3	10	16	11	8	5	3	2	2	30,0	30,5
4	RHS	IL	24°15.854'	72°28.823'	26/02/2018	09:46:57AM	606,000	3	10	16	14	10	6	4	2	2	29,0	29,7
4	RHS	OL	24°15.854'	72°28.823'	24/02/2018	10:48:21AM	606,000	3	10	16	13	9	6	4	2	1	30,1	30,4
4	RHS	OL	24°15.670'	72°28.800'	24/02/2018	10:50:07AM	605,750	3	10	16	9	7	5	3	2	1	30,2	30,5
4	RHS	IL	24°15.556'	72°28.764'	26/02/2018	09:49:03AM	605,500	3	10	16	10	7	4	3	2	1	29,1	29,8
4	RHS	OL	24°15.556'	72°28.764'	24/02/2018	10:51:38AM	605,500	3	10	16	11	9	5	3	2	1	30,1	30,4
4	RHS	OL	24°15.400'	72°28.678'	24/02/2018	11:14:16AM	605,250	3	10	16	8	5	4	3	2	2	29,3	30,0
4	RHS	IL	24°15.350'	72°28.616'	26/02/2018	09:51:03AM	605,000	3	14	21	16	12	7	4	3	2	29,2	29,7
4	RHS	OL	24°15.350'	72°28.616'	24/02/2018	11:21:05AM	605,000	3	14	21	10	8	6	4	2	2	30,0	30,4
4	RHS	OL	24°15.271'	72°28.481'	24/02/2018	11:22:44AM	604,750	3	14	21	16	15	9	5	3	2	30,1	30,6
4	RHS	IL	24°15.232'	72°28.379'	26/02/2018	09:53:16AM	604,500	3	14	21	11	8	5	3	2	1	29,2	29,8
4	RHS	OL	24°15.232'	72°28.379'	24/02/2018	11:24:07AM	604,500	3	14	21	12	8	5	3	2	2	30,2	30,6
4	RHS	OL	24°15.136'	72°28.211'	24/02/2018	11:25:45AM	604,250	3	14	21	11	7	5	3	2	2	30,3	30,8
4	RHS	IL	24°15.065'	72°28.128'	26/02/2018	09:55:16AM	604,000	3	14	21	10	8	6	4	2	1	29,3	29,9
4	RHS	OL	24°15.065'	72°28.128'	24/02/2018	11:27:09AM	604,000	3	14	21	15	10	7	5	3	2	30,3	30,9
4	RHS	OL	24°14.929'	72°28.054'	24/02/2018	11:28:45AM	603,750	3	14	21	25	18	11	6	4	3	30,4	31,1
4	RHS	IL	24°14.856'	72°27.994'	26/02/2018	09:58:01AM	603,500	3	14	21	16	13	8	4	2	1	29,4	29,8
4	RHS	OL	24°14.856'	72°27.994'	24/02/2018	11:30:10AM	603,500	3	14	21	18	13	8	4	3	2	30,5	30,9
4	RHS	OL	24°14.642'	72°27.886'	24/02/2018	11:31:51AM	603,250	3	14	21	11	11	6	4	2	1	30,6	30,9
4	RHS	IL	24°14.585'	72°27.845'	26/02/2018	09:59:59AM	603,000	3	14	21	17	12	6	3	2	1	29,5	30,1
4	RHS	OL	24°14.585'	72°27.845'	24/02/2018	11:33:09AM	603,000	3	14	21	16	12	7	3	2	1	30,5	30,9
4	RHS	OL	24°14.471'	72°27.761'	24/02/2018	11:35:17AM	602,750	3	14	21	11	11	5	3	2	1	30,5	31,1
4	RHS	IL	24°14.357'	72°27.682'	26/02/2018	10:03:35AM	602,500	3	14	21	16	12	7	3	2	1	29,6	30,0
4	RHS	OL	24°14.357'	72°27.682'	24/02/2018	11:44:47AM	602,500	3	14	21	10	7	4	3	2	1	30,5	31,1
4	RHS	OL	24°14.234'	72°27.593'	24/02/2018	11:46:20AM	602,250	3	14	21	12	9	6	3	2	1	30,6	30,8
4	RHS	IL	24°14.129'	72°27.518'	26/02/2018	10:05:36AM	602,000	3	14	21	11	8	6	4	2	2	29,7	30,3
4	RHS	OL	24°14.129'	72°27.518'	24/02/2018	11:47:56AM	602,000	3	14	21	12	9	5	3	3	2	30,7	31,2
4	RHS	OL	24°14.032'	72°27.449'	24/02/2018	11:50:20AM	601,750	3	14	21	15	10	6	3	2	1	30,9	31,3
4	RHS	IL	24°13.917'	72°27.370'	26/02/2018	10:07:49AM	601,500	3	14	21	16	11	6	3	2	2	29,7	30,3
4	RHS	OL	24°13.917'	72°27.370'	24/02/2018	11:53:02AM	601,500	3	14	21	13	9	6	3	2	1	30,8	31,2
4	RHS	OL	24°13.806'	72°27.291'	24/02/2018	11:54:30AM	601,250	3	14	21	11	8	6	4	2	2	30,8	31,4
4	RHS	IL	24°13.787'	72°27.277'	26/02/2018	10:09:28AM	601,000	3	14	21	15	10	6	4	3	2	29,7	30,3
4	RHS	OL	24°13.787'	72°27.277'	24/02/2018	11:55:43AM	601,000	3	14	21	9	6	4	3	2	2	30,9	31,4



ANNEXURE 5 IRI AND RUT RESULTS

INTERNATIONAL ROUGHNESS INDEX (IRI)-LHS

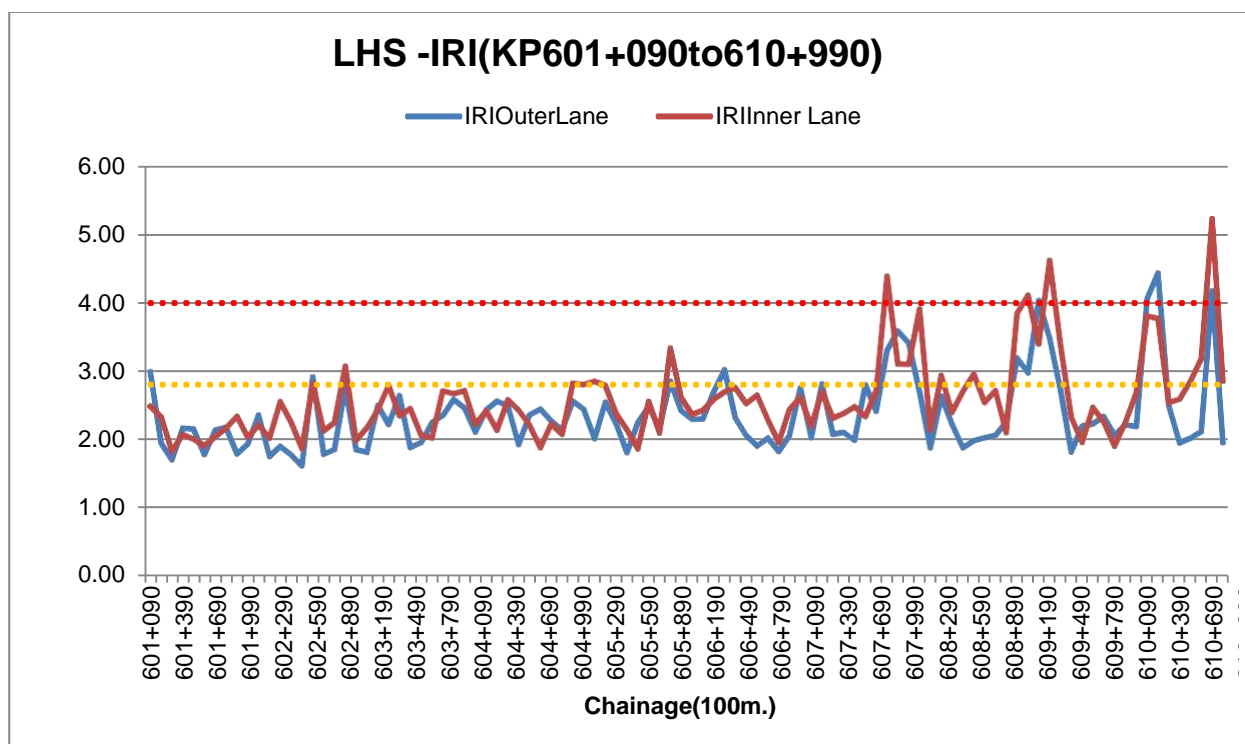


Figure1.LHS-IRI(KP601+090to610+990)

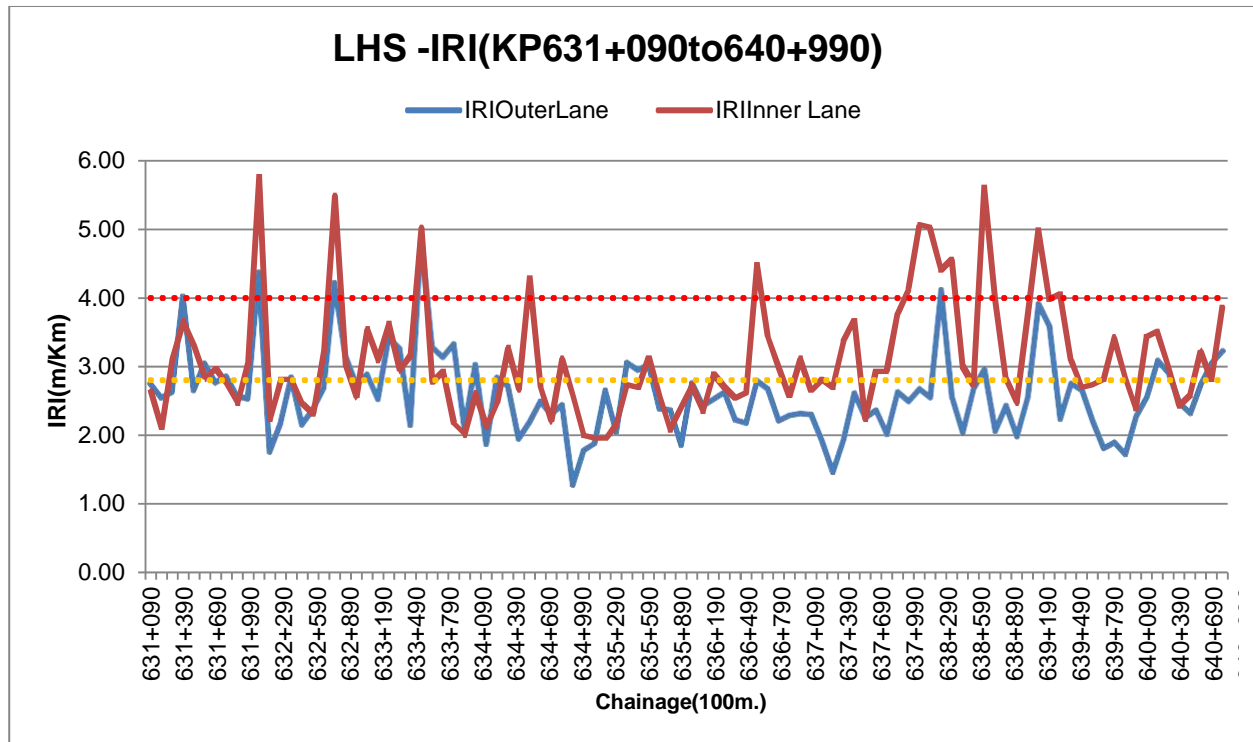


Figure4.LHS-IRI(KP631+090to640+990)

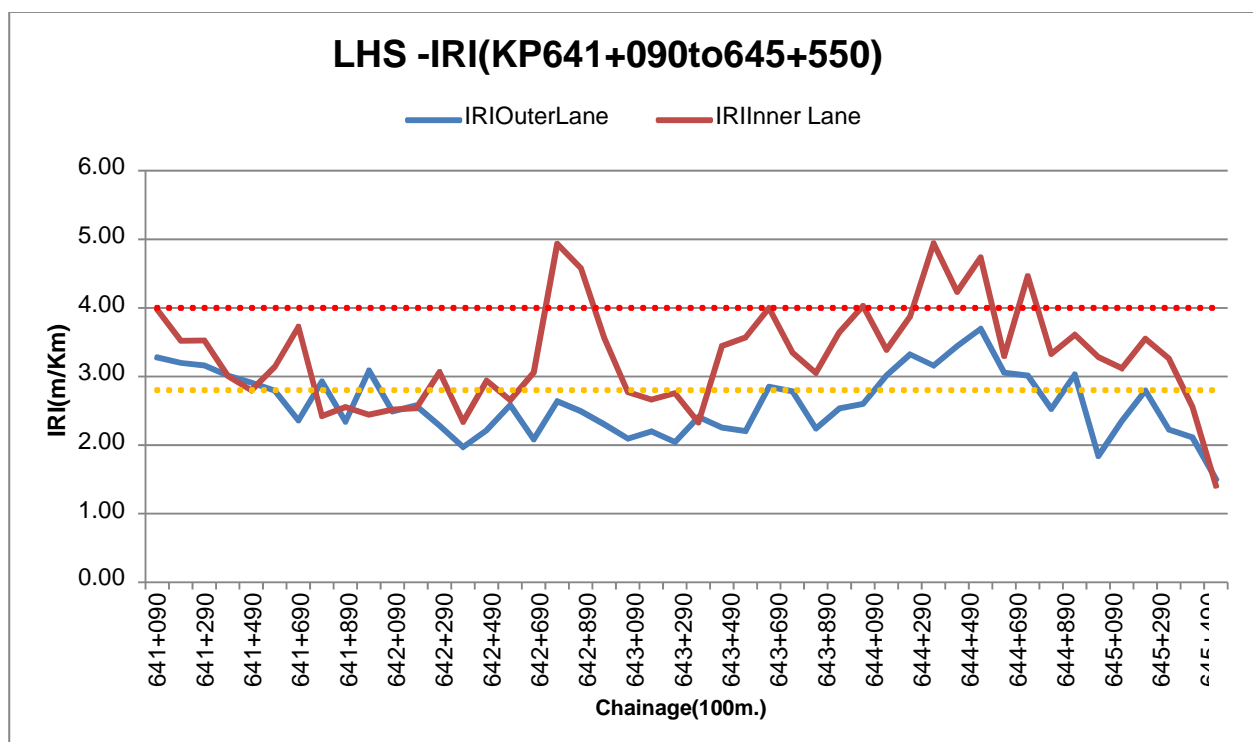


Figure5.LHS-IRI(KP641+090to645+550)

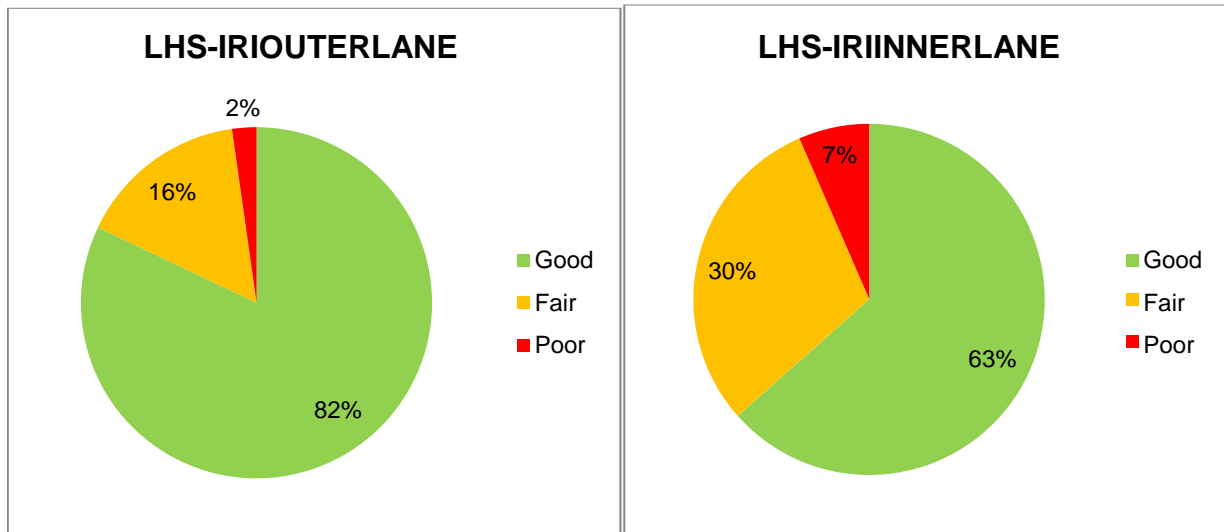


Figure6. IRI LHS Outer and Inner Lanes Results

KP	LHS Outer Lane	LHS Inner Lane
601+090	3.0	2.5
601+190	2.0	2.3
601+290	1.7	1.8
601+390	2.2	2.1
601+490	2.2	2.0
601+590	1.8	1.9
601+690	2.1	2.0
601+790	2.2	2.2
601+890	1.8	2.3
601+990	1.9	2.0
602+090	2.4	2.2
602+190	1.8	2.0
602+290	1.9	2.6
602+390	1.8	2.3
602+490	1.6	1.9
602+590	2.9	2.8
602+690	1.8	2.1
602+790	1.9	2.3
602+890	2.8	3.1
602+990	1.9	2.0
603+090	1.8	2.2
603+190	2.5	2.4

KP	LHS OuterL ane	LHS InnerL ane
603+290	2.2	2.8
603+390	2.6	2.4
603+490	1.9	2.5
603+590	2.0	2.1
603+690	2.3	2.0
603+790	2.4	2.7
603+890	2.6	2.7
603+990	2.5	2.7
604+090	2.1	2.2
604+190	2.4	2.4
604+290	2.6	2.1
604+390	2.5	2.6
604+490	1.9	2.4
604+590	2.4	2.2
604+690	2.5	1.9
604+790	2.3	2.2
604+890	2.1	2.1
604+990	2.6	2.8
605+090	2.4	2.8
605+190	2.0	2.9
605+290	2.6	2.8
605+390	2.2	2.4
605+490	1.8	2.1
605+590	2.3	1.9
605+690	2.5	2.6
605+790	2.2	2.1
605+890	2.9	3.3
605+990	2.4	2.6
606+090	2.3	2.4
606+190	2.3	2.4
606+290	2.7	2.6
606+390	3.0	2.7
606+490	2.3	2.8
606+590	2.1	2.5
606+690	1.9	2.7
606+790	2.0	2.3
606+890	1.8	2.0
606+990	2.1	2.4
607+090	2.8	2.6
607+190	2.0	2.2
607+290	2.8	2.7

KP	LHS Outer Lane	LHS Inner Lane
607+390	2.1	2.3
607+490	2.1	2.4
607+590	2.0	2.5
607+690	2.8	2.3
607+790	2.4	2.7
607+890	3.3	4.4
607+990	3.6	3.1
608+090	3.4	3.1
608+190	2.7	3.9
608+290	1.9	2.2
608+390	2.6	2.9
608+490	2.2	2.4
608+590	1.9	2.7
608+690	2.0	3.0
608+790	2.0	2.5
608+890	2.1	2.7
608+990	2.3	2.1
609+090	3.2	3.8
609+190	3.0	4.1
609+290	4.0	3.4
609+390	3.5	4.6
609+490	2.7	3.4
609+590	1.8	2.3
609+690	2.2	2.0
609+790	2.2	2.5
609+890	2.3	2.3
609+990	2.1	1.9
610+090	2.2	2.3
610+190	2.2	2.7
610+290	4.1	3.8
610+390	4.4	3.8
610+490	2.5	2.5
610+590	2.0	2.6
610+690	2.0	2.9
610+790	2.1	3.2
610+890	4.2	5.2
610+990	2.0	2.9
611+090	2.3	2.7
611+190	2.5	2.5
611+290	2.4	2.8
611+390	2.2	2.8

KP	LHS OuterL ane	LHS InnerL ane
611+490	2.1	2.8
611+590	2.4	2.5
611+690	2.1	2.6
611+790	2.2	2.9
611+890	1.9	2.3
611+990	2.2	2.2
612+090	2.0	2.7
612+190	1.9	2.2
612+290	2.3	3.3
612+390	2.3	2.4
612+490	2.7	2.5
612+590	3.1	3.0
612+690	3.5	3.5
612+790	2.0	2.3
612+890	2.4	2.3
612+990	2.2	2.0
613+090	2.1	2.5
613+190	2.7	2.1
613+290	2.0	2.3
613+390	2.3	2.6
613+490	2.7	3.0
613+590	2.1	2.7
613+690	3.4	3.7
613+790	2.2	2.4
613+890	2.0	2.4
613+990	2.0	2.6
614+090	2.4	2.7
614+190	2.0	2.7
614+290	2.4	2.8
614+390	2.0	2.6
614+490	2.8	2.6
614+590	2.4	3.0
614+690	2.3	2.5
614+790	2.2	2.5
614+890	2.3	2.1
614+990	1.8	2.0
615+090	1.8	2.1
615+190	2.3	3.1
615+290	2.3	2.5
615+390	2.5	2.7
615+490	2.1	2.9

KP	LHS Outer Lane	LHS Inner Lane
615+590	2.3	2.8
615+690	1.8	2.6
615+790	2.1	2.7
615+890	2.0	2.8
615+990	2.0	2.6
616+090	2.2	2.0
616+190	2.1	2.6
616+290	1.8	2.6
616+390	2.2	2.5
616+490	2.0	2.5
616+590	2.0	1.9
616+690	2.0	2.2
616+790	1.9	2.9
616+890	2.3	2.2
616+990	2.3	2.1
617+090	1.8	2.3
617+190	2.1	2.3
617+290	1.9	2.3
617+390	2.3	3.3
617+490	3.0	2.9
617+590	1.8	2.8
617+690	2.1	2.2
617+790	2.2	2.2
617+890	2.0	1.9
617+990	2.7	3.6
618+090	2.6	2.5
618+190	4.5	4.9
618+290	2.3	2.3
618+390	2.1	2.6
618+490	3.1	2.9
618+590	1.6	2.8
618+690	2.7	2.7
618+790	2.0	2.6
618+890	3.2	2.6
618+990	2.9	2.5
619+090	2.5	2.9
619+190	2.3	3.2
619+290	2.9	2.6
619+390	2.3	2.6
619+490	2.5	3.4
619+590	1.8	3.2

KP	LHS OuterL ane	LHS InnerL ane
619+690	3.7	3.2
619+790	2.4	2.4
619+890	2.7	2.6
619+990	1.6	2.4
620+090	1.8	2.1
620+190	2.1	2.9
620+290	2.4	3.1
620+390	2.7	2.9
620+490	2.4	2.8
620+590	3.1	3.3
620+690	2.4	2.5
620+790	2.5	2.3
620+890	2.6	1.7
620+990	1.8	1.4
621+090	2.5	1.6
621+190	2.6	2.5
621+290	2.1	2.1
621+390	1.9	2.4
621+490	3.3	4.2
621+590	2.5	3.5
621+690	1.6	2.0
621+790	2.3	2.5
621+890	2.3	2.0
621+990	2.4	2.4
622+090	2.0	2.7
622+190	2.3	2.4
622+290	2.1	2.8
622+390	2.4	3.1
622+490	2.1	2.6
622+590	2.5	2.4
622+690	2.2	2.7
622+790	2.0	2.5
622+890	2.4	2.3
622+990	2.2	2.5
623+090	1.9	2.3
623+190	2.3	2.9
623+290	1.8	2.5
623+390	1.7	2.7
623+490	2.2	2.3
623+590	2.2	2.7
623+690	2.6	2.9

KP	LHS Outer Lane	LHS Inner Lane
623+790	2.4	2.9
623+890	2.2	2.5
623+990	2.1	2.7
624+090	2.5	2.3
624+190	2.1	1.9
624+290	1.9	1.7
624+390	2.2	2.4
624+490	2.2	2.7
624+590	2.4	2.8
624+690	2.6	3.0
624+790	2.0	2.1
624+890	2.0	2.7
624+990	2.1	2.5
625+090	2.3	2.8
625+190	2.4	2.4
625+290	2.1	2.4
625+390	2.8	2.2
625+490	2.3	2.5
625+590	2.4	2.7
625+690	2.7	2.3
625+790	2.2	3.1
625+890	1.9	2.5
625+990	2.0	2.2
626+090	2.5	2.5
626+190	2.2	2.7
626+290	2.4	2.8
626+390	4.0	4.5
626+490	3.4	5.0
626+590	1.8	2.9
626+690	1.8	2.3
626+790	1.9	2.3
626+890	1.6	2.3
626+990	2.2	2.3
627+090	2.1	2.0
627+190	2.1	2.1
627+290	2.3	2.7
627+390	2.7	2.7
627+490	1.9	2.5
627+590	2.1	2.3
627+690	2.4	2.5
627+790	2.2	2.4

KP	LHS OuterL ane	LHS InnerL ane
627+890	1.6	2.3
627+990	2.4	2.5
628+090	2.4	2.7
628+190	2.8	3.2
628+290	2.4	2.9
628+390	2.5	2.4
628+490	1.9	2.3
628+590	2.1	2.5
628+690	2.5	3.3
628+790	2.2	2.8
628+890	2.0	2.3
628+990	1.8	2.6
629+090	2.7	2.9
629+190	3.0	2.8
629+290	3.0	2.7
629+390	3.3	3.5
629+490	2.8	2.9
629+590	2.8	2.5
629+690	2.8	3.2
629+790	2.8	3.7
629+890	2.4	2.3
629+990	2.5	2.5
630+090	2.7	3.4
630+190	2.7	2.4
630+290	2.4	2.1
630+390	1.7	1.7
630+490	2.2	1.8
630+590	1.4	1.7
630+690	1.9	2.3
630+790	1.6	2.4
630+890	2.2	2.5
630+990	2.5	2.0
631+090	2.8	2.7
631+190	2.6	2.1
631+290	2.6	3.1
631+390	4.0	3.7
631+490	2.7	3.3
631+590	3.1	2.9
631+690	2.8	3.0
631+790	2.9	2.8
631+890	2.6	2.5

KP	LHS Outer Lane	LHS Inner Lane
631+990	2.5	3.1
632+090	4.4	5.8
632+190	1.8	2.2
632+290	2.2	2.8
632+390	2.8	2.8
632+490	2.2	2.5
632+590	2.4	2.3
632+690	2.7	3.3
632+790	4.2	5.5
632+890	3.2	3.0
632+990	2.8	2.6
633+090	2.9	3.6
633+190	2.5	3.1
633+290	3.4	3.6
633+390	3.3	3.0
633+490	2.2	3.2
633+590	4.9	5.0
633+690	3.3	2.8
633+790	3.1	3.0
633+890	3.3	2.2
633+990	2.1	2.0
634+090	3.0	2.6
634+190	1.9	2.1
634+290	2.8	2.5
634+390	2.7	3.3
634+490	2.0	2.7
634+590	2.2	4.3
634+690	2.5	2.7
634+790	2.3	2.2
634+890	2.4	3.1
634+990	1.3	2.6
635+090	1.8	2.0
635+190	1.9	2.0
635+290	2.7	2.0
635+390	2.1	2.2
635+490	3.1	2.8
635+590	3.0	2.7
635+690	3.0	3.2
635+790	2.4	2.6
635+890	2.4	2.1
635+990	1.9	2.4

KP	LHS OuterL ane	LHS InnerL ane
636+090	2.8	2.7
636+190	2.4	2.4
636+290	2.5	2.9
636+390	2.6	2.7
636+490	2.2	2.6
636+590	2.2	2.6
636+690	2.8	4.5
636+790	2.7	3.5
636+890	2.2	3.0
636+990	2.3	2.6
637+090	2.3	3.1
637+190	2.3	2.7
637+290	1.9	2.8
637+390	1.5	2.7
637+490	1.9	3.4
637+590	2.6	3.7
637+690	2.3	2.3
637+790	2.4	3.0
637+890	2.0	3.0
637+990	2.6	3.8
638+090	2.5	4.2
638+190	2.7	5.1
638+290	2.6	5.0
638+390	4.1	4.4
638+490	2.6	4.6
638+590	2.0	3.0
638+690	2.7	2.8
638+790	3.0	5.6
638+890	2.1	4.0
638+990	2.4	2.8
639+090	2.0	2.5
639+190	2.6	3.7
639+290	3.9	5.0
639+390	3.6	4.0
639+490	2.2	4.1
639+590	2.8	3.1
639+690	2.7	2.7
639+790	2.2	2.8
639+890	1.8	2.8
639+990	1.9	3.4
640+090	1.7	2.9

KP	LHS Outer Lane	LHS Inner Lane
640+190	2.3	2.4
640+290	2.6	3.5
640+390	3.1	3.5
640+490	2.9	3.0
640+590	2.5	2.5
640+690	2.3	2.6
640+790	2.8	3.2
640+890	3.1	2.8
640+990	3.2	3.9
641+090	3.3	4.0
641+190	3.2	3.5
641+290	3.2	3.5
641+390	3.0	3.0
641+490	2.9	2.8
641+590	2.8	3.1
641+690	2.4	3.7
641+790	2.9	2.4
641+890	2.3	2.6
641+990	3.1	2.4
642+090	2.5	2.5
642+190	2.6	2.5
642+290	2.3	3.1
642+390	2.0	2.3
642+490	2.2	2.9
642+590	2.6	2.7
642+690	2.1	3.1
642+790	2.6	4.9
642+890	2.5	4.6
642+990	2.3	3.6
643+090	2.1	2.8
643+190	2.2	2.7
643+290	2.0	2.8
643+390	2.4	2.3
643+490	2.3	3.4
643+590	2.2	3.6
643+690	2.9	4.0
643+790	2.8	3.4
643+890	2.2	3.1
643+990	2.5	3.6
644+090	2.6	4.0
644+190	3.0	3.4

KP	LHS OuterL ane	LHS InnerL ane
644+290	3.3	3.9
644+390	3.2	4.9
644+490	3.4	4.2
644+590	3.7	4.7
644+690	3.1	3.3
644+790	3.0	4.5
644+890	2.5	3.3
644+990	3.0	3.6
645+090	1.8	3.3
645+190	2.4	3.1
645+290	2.8	3.6
645+390	2.2	3.3
645+490	2.1	2.6
645+550	1.5	1.4

Table 1.LHSIRIResults

INTERNATIONALROUGHNESSINDEX(IRI)-RHS

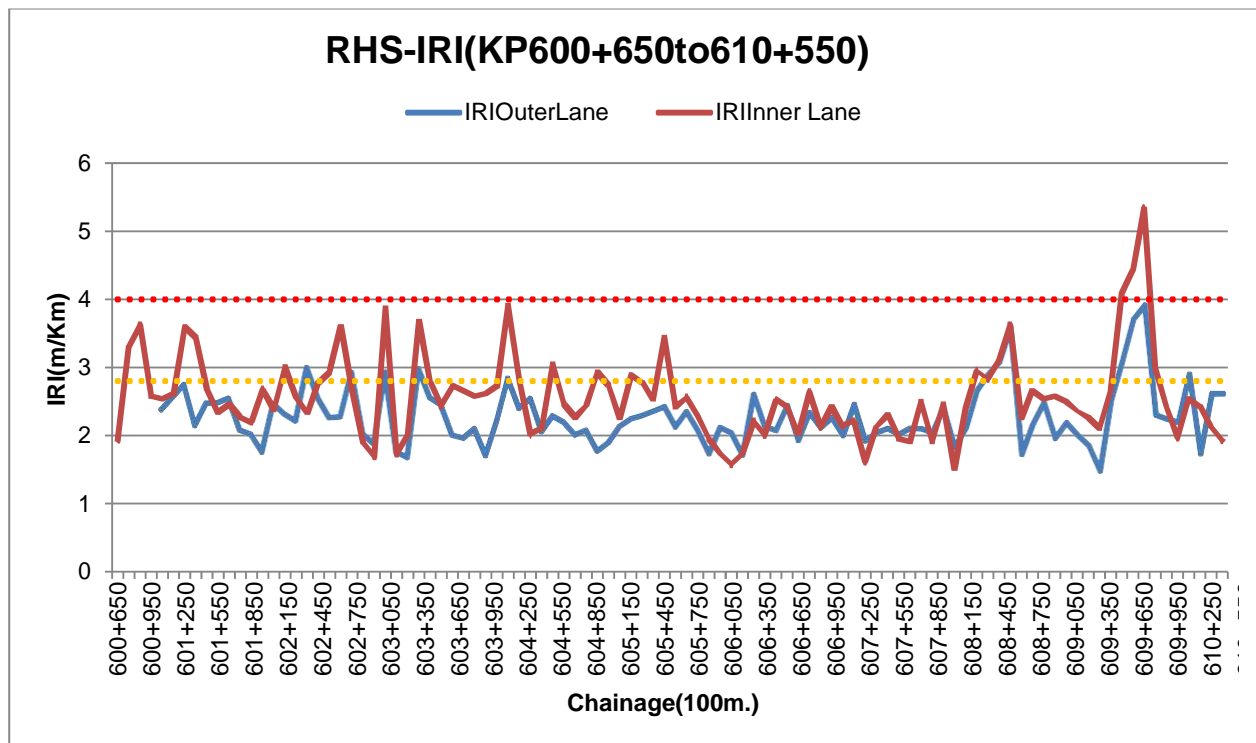


Figure7.RHS-IRI(KP600+650toKP610+550)

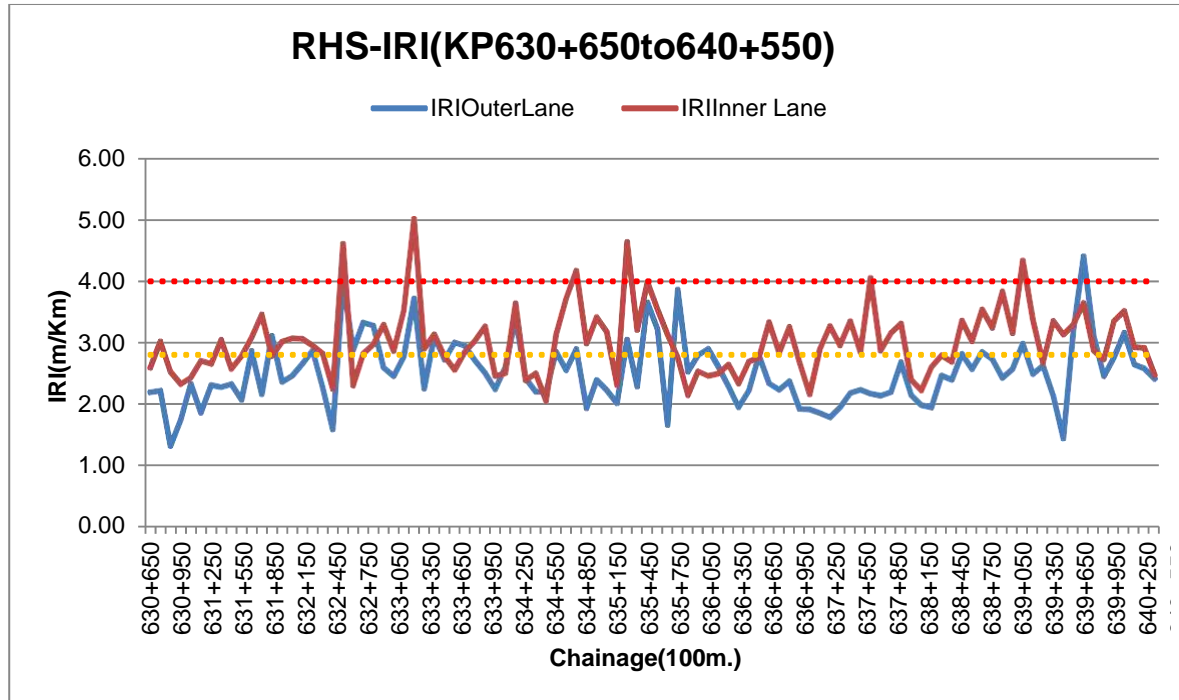


Figure10. RHS-IRI(KP630+650toKP640+550)

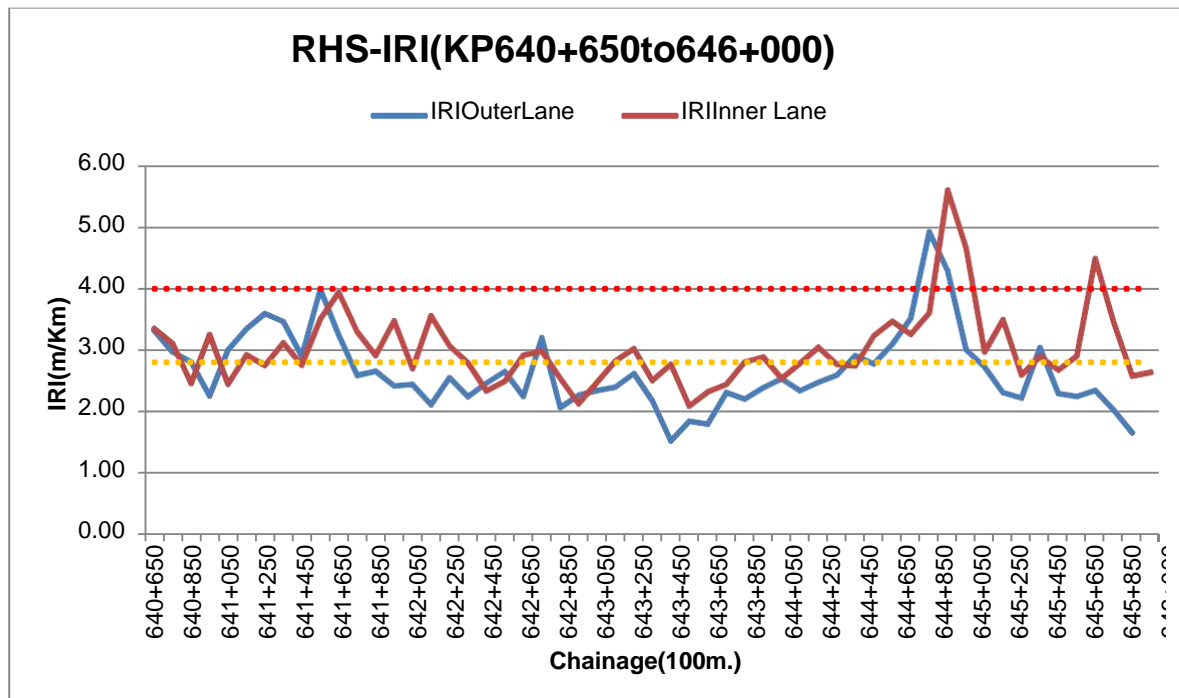


Figure11. RHS-IRI(KP640+650toKP646+000)

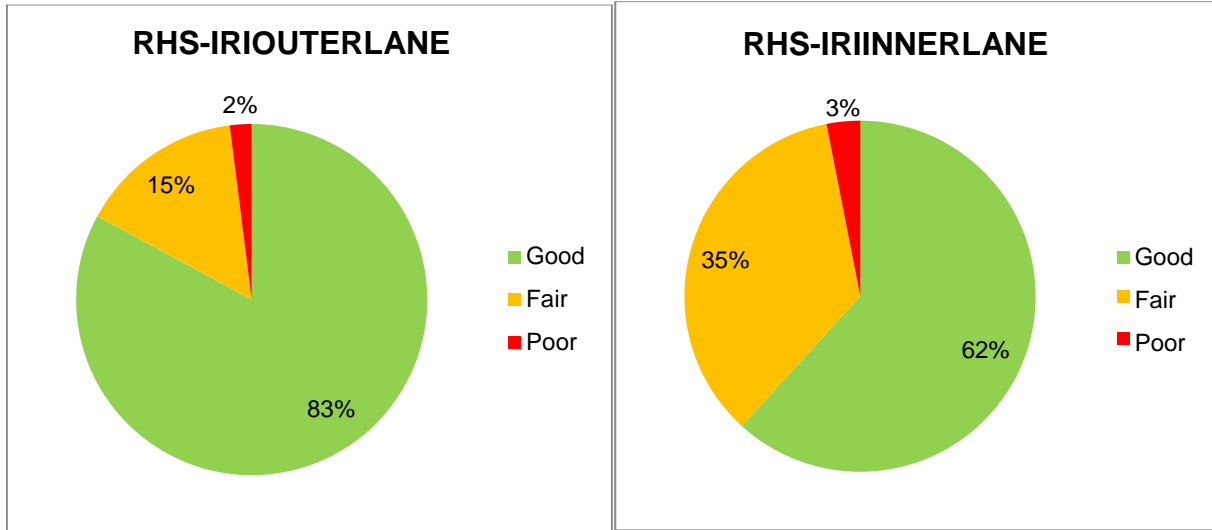


Figure 12. IRIRHS Outer and Inner Lanes Results

KP	RHS Outer Lane	RHS Inner Lane
600+690		2.0
600+790		3.3
600+890		3.6
600+990		2.6
601+090	2.4	2.6
601+190	2.6	2.6
601+290	2.7	3.6
601+390	2.2	3.5
601+490	2.5	2.7
601+590	2.5	2.4
601+690	2.5	2.5
601+790	2.1	2.3
601+890	2.0	2.2
601+990	1.8	2.7
602+090	2.5	2.4
602+190	2.3	3.0
602+290	2.2	2.6
602+390	3.0	2.4
602+490	2.5	2.8
602+590	2.3	3.0
602+690	2.3	3.6
602+790	2.9	2.7
602+890	2.0	1.9

KP	RHS OuterL ane	RHS InnerL ane
602+990	1.9	1.7
603+090	2.9	3.9
603+190	1.8	1.7
603+290	1.7	2.0
603+390	3.0	3.7
603+490	2.6	2.8
603+590	2.5	2.5
603+690	2.0	2.7
603+790	2.0	2.7
603+890	2.1	2.6
603+990	1.7	2.6
604+090	2.2	2.7
604+190	2.8	3.9
604+290	2.4	2.8
604+390	2.5	2.0
604+490	2.1	2.1
604+590	2.3	3.1
604+690	2.2	2.5
604+790	2.0	2.3
604+890	2.1	2.5
604+990	1.8	2.9
605+090	1.9	2.7
605+190	2.1	2.3
605+290	2.2	2.9
605+390	2.3	2.8
605+490	2.4	2.6
605+590	2.4	3.5
605+690	2.1	2.4
605+790	2.4	2.6
605+890	2.1	2.3
605+990	1.7	2.0
606+090	2.1	1.8
606+190	2.0	1.6
606+290	1.7	1.8
606+390	2.6	2.2
606+490	2.1	2.0
606+590	2.1	2.5
606+690	2.4	2.4
606+790	1.9	2.0
606+890	2.3	2.7
606+990	2.1	2.1

KP	RHS OuterL ane	RHS InnerL ane
607+090	2.3	2.4
607+190	2.0	2.2
607+290	2.5	2.2
607+390	1.9	1.6
607+490	2.0	2.1
607+590	2.1	2.3
607+690	2.0	2.0
607+790	2.1	1.9
607+890	2.1	2.5
607+990	2.0	1.9
608+090	2.4	2.5
608+190	1.8	1.5
608+290	2.1	2.4
608+390	2.7	3.0
608+490	2.9	2.8
608+590	3.1	3.1
608+690	3.6	3.6
608+790	1.7	2.3
608+890	2.2	2.7
608+990	2.5	2.6
609+090	2.0	2.6
609+190	2.2	2.5
609+290	2.0	2.4
609+390	1.9	2.3
609+490	1.5	2.1
609+590	2.5	2.7
609+690	3.1	4.1
609+790	3.7	4.4
609+890	3.9	5.4
609+990	2.3	3.0
610+090	2.2	2.4
610+190	2.2	2.0
610+290	2.9	2.6
610+390	1.7	2.5
610+490	2.6	2.1
610+590	2.6	2.0
610+690	2.4	2.4
610+790	4.2	3.5
610+890	3.4	3.1
610+990	2.4	2.9
611+090	2.0	2.9

KP	RHS OuterL ane	RHS InnerL ane
611+190	2.2	2.0
611+290	1.7	2.6
611+390	3.7	3.7
611+490	2.3	1.8
611+590	1.8	2.8
611+690	1.8	2.5
611+790	2.5	3.3
611+890	1.8	2.7
611+990	2.3	2.4
612+090	2.0	2.1
612+190	2.5	2.0
612+290	2.5	2.4
612+390	2.2	2.2
612+490	1.8	1.9
612+590	2.3	1.9
612+690	2.1	2.3
612+790	2.3	2.3
612+890	1.9	2.6
612+990	2.3	2.8
613+090	2.8	3.1
613+190	4.4	5.3
613+290	2.2	2.6
613+390	2.5	3.0
613+490	2.5	3.0
613+590	2.5	2.5
613+690	2.0	2.8
613+790	2.2	2.4
613+890	2.1	2.3
613+990	2.1	3.0
614+090	2.2	2.6
614+190	3.0	2.4
614+290	2.3	2.6
614+390	2.5	2.3
614+490	2.1	2.4
614+590	2.1	2.3
614+690	1.9	2.5
614+790	2.2	2.4
614+890	2.5	2.6
614+990	2.8	2.6
615+090	2.4	3.0
615+190	2.2	2.4

KP	RHS OuterL ane	RHS InnerL ane
615+290	2.1	2.8
615+390	2.6	2.6
615+490	2.7	2.1
615+590	2.1	2.4
615+690	2.5	2.4
615+790	2.2	2.4
615+890	2.2	2.3
615+990	1.9	2.8
616+090	2.2	2.2
616+190	2.1	2.1
616+290	2.1	2.1
616+390	2.4	2.2
616+490	2.3	2.2
616+590	2.1	2.6
616+690	2.2	2.8
616+790	2.4	2.3
616+890	1.8	2.8
616+990	2.6	2.5
617+090	2.3	2.4
617+190	2.4	2.9
617+290	2.1	2.7
617+390	1.5	2.4
617+490	1.8	2.0
617+590	2.0	1.8
617+690	2.0	2.4
617+790	1.9	2.0
617+890	2.4	2.0
617+990	2.6	3.3
618+090	2.5	2.3
618+190	3.0	2.0
618+290	1.6	1.8
618+390	1.8	1.6
618+490	1.8	2.3
618+590	2.0	2.3
618+690	4.2	4.4
618+790	2.3	2.1
618+890	2.5	2.6
618+990	2.7	2.7
619+090	2.5	3.0
619+190	1.9	2.7
619+290	2.0	2.2

KP	RHS OuterL ane	RHS InnerL ane
619+390	2.2	2.8
619+490	1.8	2.4
619+590	1.9	2.5
619+690	2.2	2.3
619+790	2.4	2.5
619+890	1.8	2.6
619+990	1.8	2.4
620+090	1.5	2.1
620+190	4.2	3.4
620+290	1.7	2.8
620+390	1.7	1.8
620+490	2.0	2.3
620+590	1.8	2.0
620+690	1.9	2.3
620+790	2.1	2.0
620+890	2.0	2.6
620+990	1.9	2.8
621+090	1.9	2.4
621+190	1.8	1.9
621+290	2.1	2.3
621+390	2.4	2.6
621+490	2.0	2.4
621+590	2.4	2.3
621+690	2.2	2.4
621+790	1.9	2.2
621+890	2.3	2.1
621+990	2.4	3.7
622+090	2.9	3.2
622+190	2.3	3.1
622+290	3.0	3.3
622+390	2.1	2.8
622+490	2.2	2.9
622+590	2.0	2.6
622+690	1.9	2.9
622+790	2.9	3.0
622+890	3.0	4.0
622+990	2.3	3.0
623+090	2.4	2.8
623+190	2.2	3.4
623+290	2.2	2.3
623+390	2.5	2.8

KP	RHS OuterLane	RHS InnerLane
623+490	2.3	2.4
623+590	2.3	3.0
623+690	2.1	2.8
623+790	2.1	2.4
623+890	2.0	2.3
623+990	1.7	2.5
624+090	1.6	2.4
624+190	1.4	2.2
624+290	2.2	2.2
624+390	2.4	2.1
624+490	2.4	2.5
624+590	2.9	3.1
624+690	2.4	2.5
624+790	2.7	2.6
624+890	2.8	2.3
624+990	2.3	2.8
625+090	2.5	2.7
625+190	4.7	3.2
625+290	2.4	2.5
625+390	2.1	2.4
625+490	2.5	2.2
625+590	2.1	1.9
625+690	2.0	2.3
625+790	2.2	2.6
625+890	2.3	2.2
625+990	2.0	2.4
626+090	2.7	2.0
626+190	2.3	2.9
626+290	1.9	2.1
626+390	2.0	1.9
626+490	2.3	2.6
626+590	2.3	2.3
626+690	2.5	2.7
626+790	2.4	2.6
626+890	2.8	2.9
626+990	3.1	2.8
627+090	2.3	2.6
627+190	2.3	2.5
627+290	2.0	2.8
627+390	2.1	2.6
627+490	2.3	2.7

KP	RHS OuterL ane	RHS InnerL ane
627+590	1.8	2.7
627+690	2.2	2.2
627+790	2.5	2.5
627+890	2.1	2.6
627+990	2.6	2.1
628+090	2.2	2.9
628+190	2.2	2.5
628+290	2.0	2.1
628+390	2.2	2.1
628+490	2.0	2.4
628+590	2.5	3.1
628+690	3.1	3.7
628+790	2.5	2.7
628+890	1.9	3.0
628+990	2.7	2.3
629+090	2.1	3.0
629+190	2.3	2.5
629+290	2.7	2.7
629+390	2.5	2.2
629+490	2.3	2.1
629+590	2.9	3.1
629+690	2.5	2.5
629+790	3.5	2.9
629+890	2.9	3.5
629+990	2.7	2.9
630+090	2.6	3.3
630+190	2.6	2.9
630+290	2.3	3.2
630+390	2.7	3.1
630+490	2.5	3.2
630+590	2.5	2.9
630+690	2.2	2.6
630+790	2.2	3.0
630+890	1.3	2.5
630+990	1.8	2.3
631+090	2.3	2.4
631+190	1.9	2.7
631+290	2.3	2.7
631+390	2.3	3.1
631+490	2.3	2.6
631+590	2.1	2.8

KP	RHS OuterLane	RHS InnerLane
631+690	2.9	3.1
631+790	2.2	3.5
631+890	3.1	2.8
631+990	2.4	3.0
632+090	2.5	3.1
632+190	2.7	3.1
632+290	2.9	3.0
632+390	2.3	2.8
632+490	1.6	2.3
632+590	4.0	4.6
632+690	2.9	2.3
632+790	3.3	2.8
632+890	3.3	3.0
632+990	2.6	3.3
633+090	2.5	2.9
633+190	2.8	3.5
633+290	3.7	5.0
633+390	2.3	2.9
633+490	3.1	3.1
633+590	2.7	2.8
633+690	3.0	2.6
633+790	3.0	2.9
633+890	2.7	3.0
633+990	2.5	3.3
634+090	2.3	2.5
634+190	2.6	2.5
634+290	3.4	3.6
634+390	2.4	2.4
634+490	2.2	2.5
634+590	2.2	2.1
634+690	2.9	3.1
634+790	2.6	3.7
634+890	2.9	4.2
634+990	1.9	3.0
635+090	2.4	3.4
635+190	2.2	3.2
635+290	2.0	2.3
635+390	3.1	4.6
635+490	2.3	3.2
635+590	3.7	4.0
635+690	3.2	3.5

KP	RHS OuterL ane	RHS InnerL ane
635+790	1.7	3.1
635+890	3.9	2.8
635+990	2.5	2.2
636+090	2.8	2.5
636+190	2.9	2.5
636+290	2.6	2.5
636+390	2.3	2.7
636+490	2.0	2.3
636+590	2.2	2.7
636+690	2.8	2.8
636+790	2.3	3.3
636+890	2.2	2.8
636+990	2.4	3.3
637+090	1.9	2.7
637+190	1.9	2.2
637+290	1.9	2.9
637+390	1.8	3.3
637+490	2.0	3.0
637+590	2.2	3.4
637+690	2.2	2.9
637+790	2.2	4.1
637+890	2.1	2.9
637+990	2.2	3.2
638+090	2.7	3.3
638+190	2.2	2.4
638+290	2.0	2.2
638+390	2.0	2.6
638+490	2.5	2.8
638+590	2.4	2.7
638+690	2.8	3.4
638+790	2.6	3.0
638+890	2.9	3.5
638+990	2.7	3.2
639+090	2.4	3.8
639+190	2.6	3.2
639+290	3.0	4.3
639+390	2.5	3.4
639+490	2.6	2.7
639+590	2.1	3.4
639+690	1.5	3.1
639+790	3.2	3.3

KP	RHS OuterL ane	RHS InnerL ane
639+890	4.4	3.6
639+990	3.1	2.9
640+090	2.5	2.7
640+190	2.8	3.4
640+290	3.2	3.5
640+390	2.7	2.9
640+490	2.6	2.9
640+590	2.4	2.5
640+690	3.3	3.4
640+790	3.0	3.1
640+890	2.8	2.5
640+990	2.3	3.3
641+090	3.0	2.5
641+190	3.3	2.9
641+290	3.6	2.8
641+390	3.5	3.1
641+490	2.9	2.8
641+590	4.0	3.5
641+690	3.2	3.9
641+790	2.6	3.3
641+890	2.7	2.9
641+990	2.4	3.5
642+090	2.4	2.7
642+190	2.1	3.6
642+290	2.6	3.1
642+390	2.3	2.8
642+490	2.5	2.3
642+590	2.7	2.5
642+690	2.3	2.9
642+790	3.2	3.0
642+890	2.1	2.5
642+990	2.3	2.1
643+090	2.3	2.5
643+190	2.4	2.8
643+290	2.6	3.0
643+390	2.2	2.5
643+490	1.5	2.8
643+590	1.9	2.1
643+690	1.8	2.3
643+790	2.3	2.4
643+890	2.2	2.8

KP	RHS OuterL ane	RHS InnerL ane
643+990	2.4	2.9
644+090	2.5	2.5
644+190	2.3	2.8
644+290	2.5	3.0
644+390	2.6	2.8
644+490	2.9	2.7
644+590	2.8	3.2
644+690	3.1	3.5
644+790	3.5	3.3
644+890	4.9	3.6
644+990	4.3	5.6
645+090	3.0	4.7
645+190	2.7	3.0
645+290	2.3	3.5
645+390	2.2	2.6
645+490	3.0	2.9
645+590	2.3	2.7
645+690	2.3	2.9
645+790	2.3	4.5
645+890	2.0	3.5
645+980	1.7	2.6
646+000		2.6

Table2.RHSIRIResults

RUTDEPTH-LHS

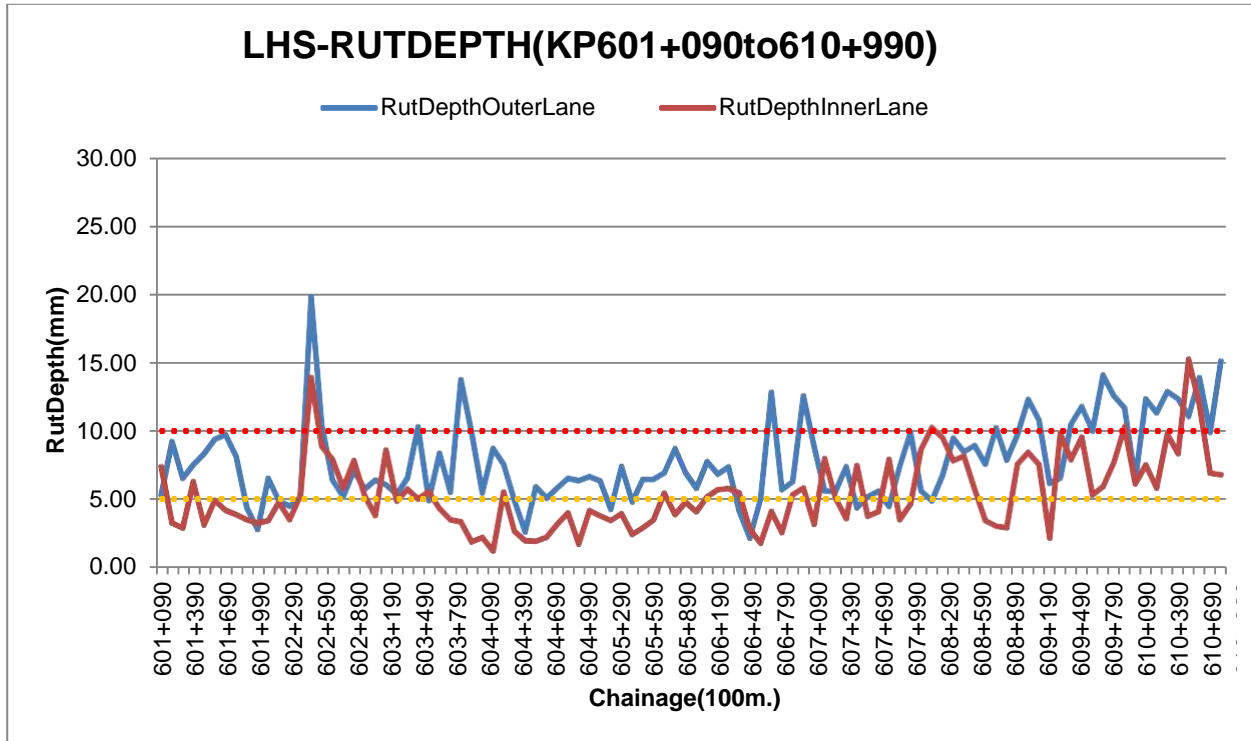


Figure13.LHS-RUTDEPTH(KP601+090to610+990)

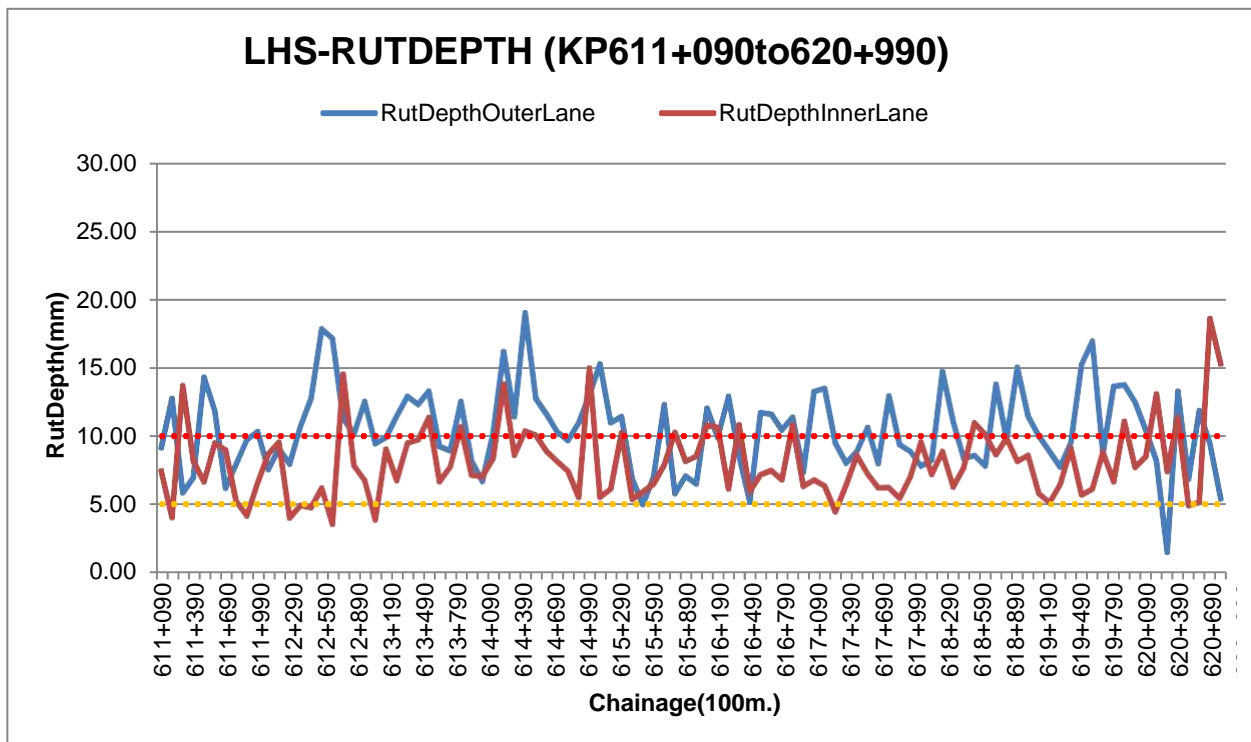


Figure14.LHS-RUTDEPTH(KP611+090to620+990)

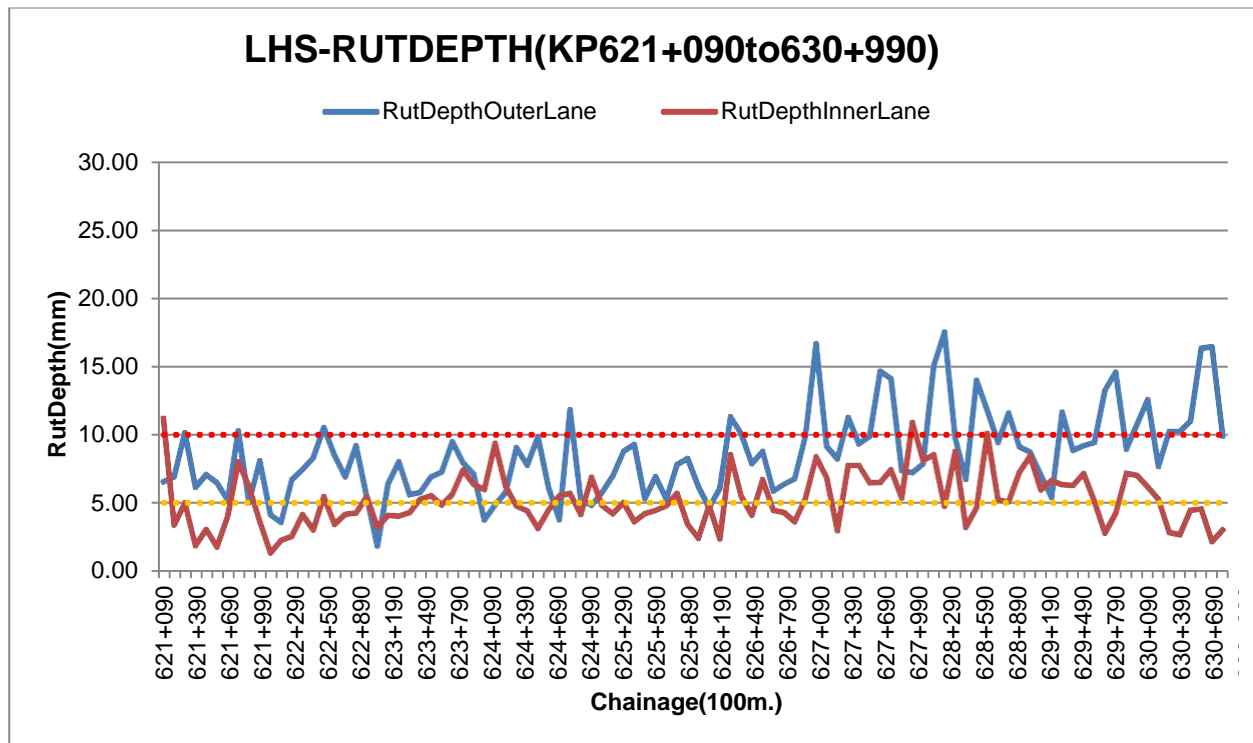


Figure15.LHS-RUTDEPTH(KP621+090to630+990)

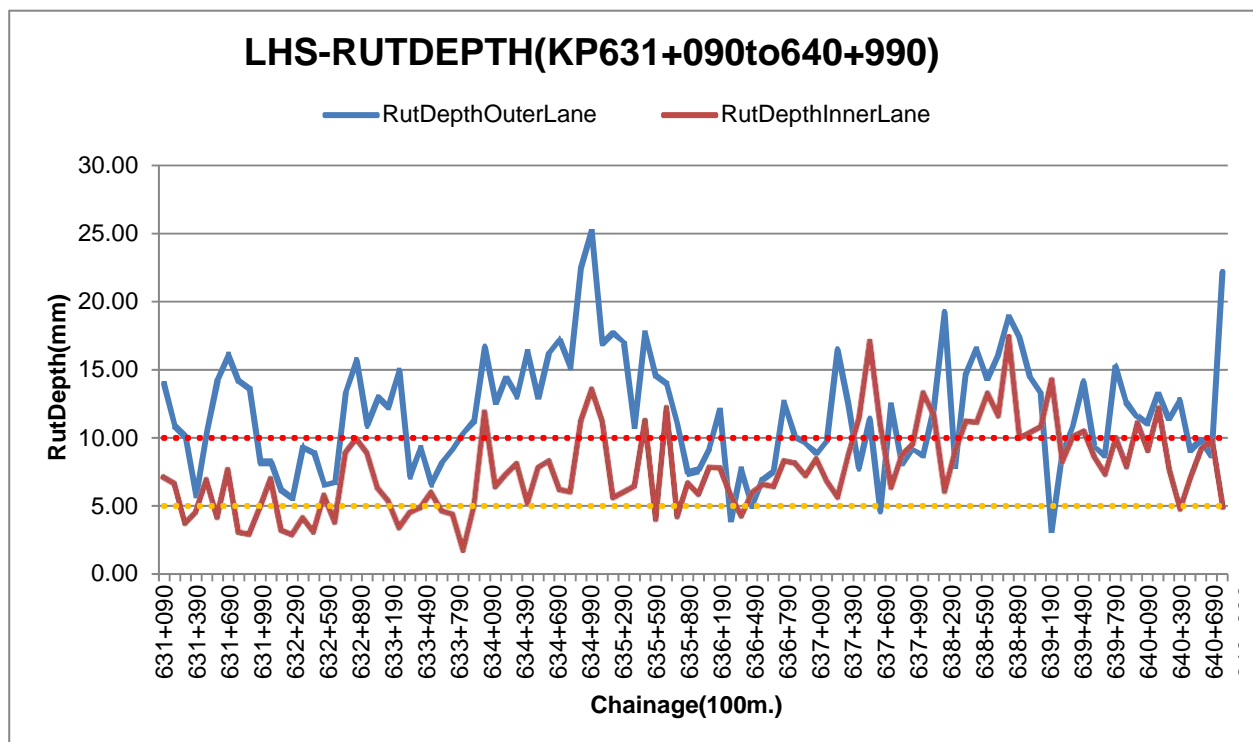


Figure16.LHS-RUTDEPTH(KP631+090to640+990)

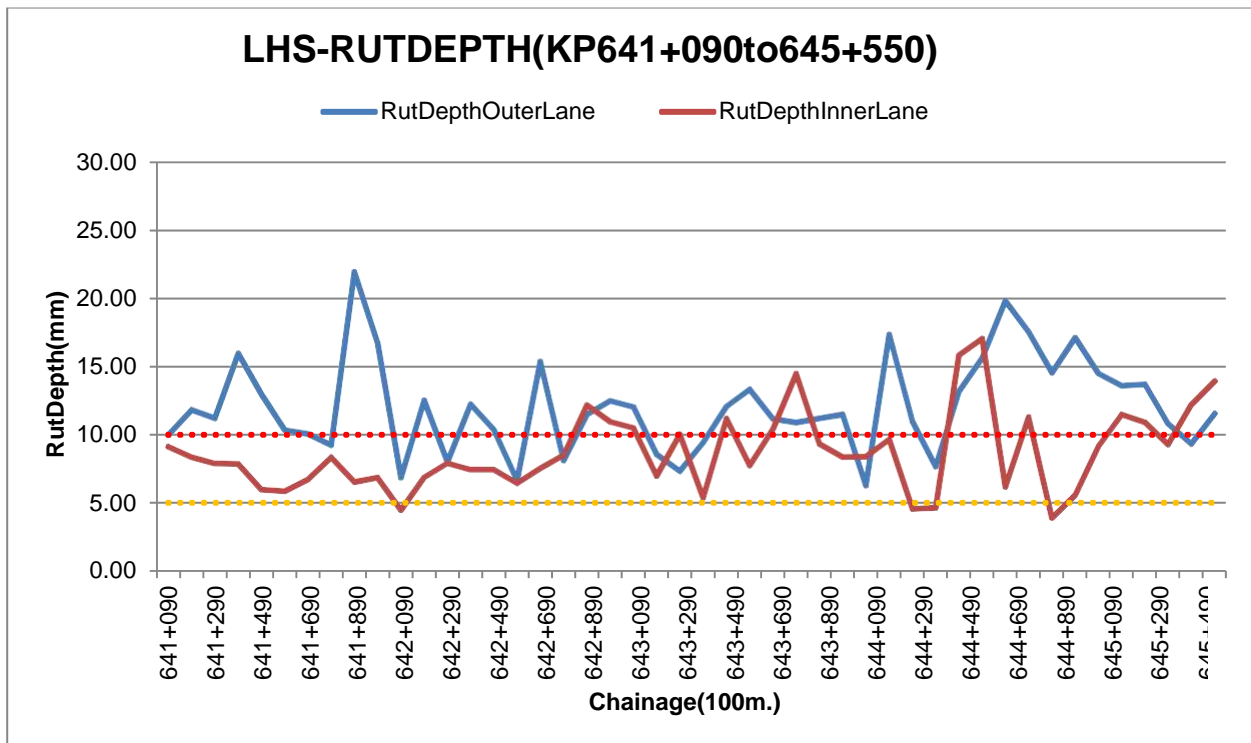


Figure17.LHS-RUTDEPTH(KP641+090to645+550)

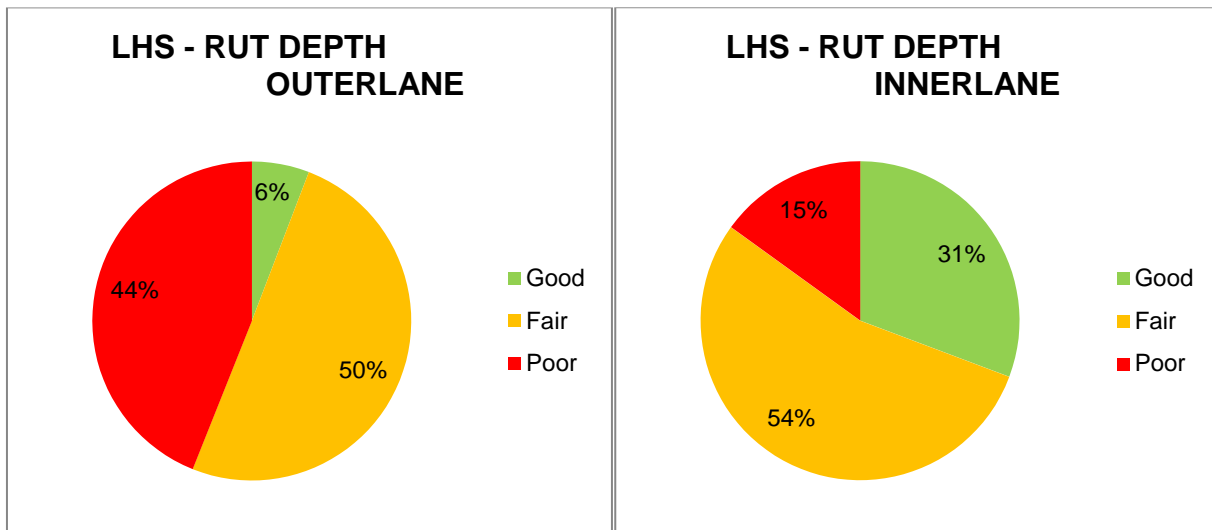


Figure18.RutDepthLHSOuterandInnerLanesResults

KP	LHS OuterL ane	LHS InnerL ane
601+090	5	7
601+190	9	3
601+290	7	3
601+390	8	6
601+490	8	3
601+590	9	5
601+690	10	4
601+790	8	4
601+890	4	3
601+990	3	3
602+090	7	3
602+190	5	5
602+290	4	3
602+390	5	5
602+490	20	14
602+590	10	9
602+690	6	8
602+790	5	6
602+890	7	8
602+990	6	5
603+090	6	4
603+190	6	9
603+290	5	5
603+390	7	6
603+490	10	5
603+590	5	6
603+690	8	4
603+790	6	4
603+890	14	3
603+990	10	2
604+090	5	2
604+190	9	1
604+290	8	6
604+390	5	3
604+490	3	2
604+590	6	2
604+690	5	2
604+790	6	3
604+890	7	4
604+990	6	2
605+090	7	4

KP	LHS Outer Lane	LHS Inner Lane
605+190	6	4
605+290	4	3
605+390	7	4
605+490	5	2
605+590	6	3
605+690	6	3
605+790	7	5
605+890	9	4
605+990	7	5
606+090	6	4
606+190	8	5
606+290	7	6
606+390	7	6
606+490	4	5
606+590	2	3
606+690	5	2
606+790	13	4
606+890	6	3
606+990	6	5
607+090	13	6
607+190	9	3
607+290	6	8
607+390	6	5
607+490	7	4
607+590	4	7
607+690	5	4
607+790	6	4
607+890	4	8
607+990	7	4
608+090	10	5
608+190	6	9
608+290	5	10
608+390	7	9
608+490	9	8
608+590	8	8
608+690	9	6
608+790	8	3
608+890	10	3
608+990	8	3
609+090	10	8
609+190	12	8

KP	LHS OuterL ane	LHS InnerL ane
609+290	11	8
609+390	6	2
609+490	7	10
609+590	10	8
609+690	12	10
609+790	10	5
609+890	14	6
609+990	13	8
610+090	12	10
610+190	6	6
610+290	12	8
610+390	11	6
610+490	13	10
610+590	12	8
610+690	11	15
610+790	14	12
610+890	10	7
610+990	15	7
611+090	9	7
611+190	13	4
611+290	6	14
611+390	7	8
611+490	14	7
611+590	12	9
611+690	6	9
611+790	8	5
611+890	10	4
611+990	10	7
612+090	8	9
612+190	9	10
612+290	8	4
612+390	11	5
612+490	13	5
612+590	18	6
612+690	17	4
612+790	11	15
612+890	10	8
612+990	13	7
613+090	9	4
613+190	10	9
613+290	11	7

KP	LHS OuterL ane	LHS InnerL ane
613+390	13	9
613+490	12	10
613+590	13	11
613+690	9	7
613+790	9	8
613+890	13	11
613+990	8	7
614+090	7	7
614+190	10	8
614+290	16	14
614+390	11	9
614+490	19	10
614+590	13	10
614+690	12	9
614+790	10	8
614+890	10	7
614+990	11	6
615+090	13	15
615+190	15	6
615+290	11	6
615+390	11	10
615+490	7	5
615+590	5	6
615+690	7	7
615+790	12	8
615+890	6	10
615+990	7	8
616+090	7	9
616+190	12	11
616+290	10	11
616+390	13	6
616+490	9	11
616+590	5	6
616+690	12	7
616+790	12	7
616+890	10	7
616+990	11	11
617+090	7	6
617+190	13	7
617+290	13	6
617+390	9	4

KP	LHS OuterL ane	LHS InnerL ane
617+490	8	6
617+590	9	9
617+690	11	7
617+790	8	6
617+890	13	6
617+990	9	5
618+090	9	7
618+190	8	10
618+290	8	7
618+390	15	9
618+490	11	6
618+590	8	8
618+690	9	11
618+790	8	10
618+890	14	9
618+990	10	10
619+090	15	8
619+190	11	9
619+290	10	6
619+390	9	5
619+490	8	6
619+590	10	9
619+690	15	6
619+790	17	6
619+890	9	9
619+990	14	7
620+090	14	11
620+190	12	8
620+290	10	8
620+390	8	13
620+490	2	7
620+590	13	11
620+690	7	5
620+790	12	5
620+890	9	19
620+990	5	15
621+090	7	11
621+190	7	3
621+290	10	5
621+390	6	2
621+490	7	3

KP	LHS Outer Lane	LHS Inner Lane
621+590	6	2
621+690	5	4
621+790	10	8
621+890	5	6
621+990	8	4
622+090	4	1
622+190	4	2
622+290	7	3
622+390	7	4
622+490	8	3
622+590	11	5
622+690	8	3
622+790	7	4
622+890	9	4
622+990	5	5
623+090	2	3
623+190	6	4
623+290	8	4
623+390	6	4
623+490	6	5
623+590	7	6
623+690	7	5
623+790	9	6
623+890	8	7
623+990	7	6
624+090	4	6
624+190	5	9
624+290	6	6
624+390	9	5
624+490	8	4
624+590	10	3
624+690	6	4
624+790	4	6
624+890	12	6
624+990	5	4
625+090	5	7
625+190	6	5
625+290	7	4
625+390	9	5
625+490	9	4
625+590	5	4

KP	LHS OuterL ane	LHS InnerL ane
625+690	7	4
625+790	5	5
625+890	8	6
625+990	8	3
626+090	6	2
626+190	5	5
626+290	6	2
626+390	11	9
626+490	10	6
626+590	8	4
626+690	9	7
626+790	6	4
626+890	6	4
626+990	7	4
627+090	10	5
627+190	17	8
627+290	9	7
627+390	8	3
627+490	11	8
627+590	9	8
627+690	10	6
627+790	15	7
627+890	14	7
627+990	7	5
628+090	7	11
628+190	8	8
628+290	15	9
628+390	18	5
628+490	10	9
628+590	7	3
628+690	14	5
628+790	12	10
628+890	9	5
628+990	12	5
629+090	9	7
629+190	9	8
629+290	7	6
629+390	5	7
629+490	12	6
629+590	9	6
629+690	9	7

KP	LHS Outer Lane	LHS Inner Lane
629+790	9	5
629+890	13	3
629+990	15	4
630+090	9	7
630+190	11	7
630+290	13	6
630+390	8	5
630+490	10	3
630+590	10	3
630+690	11	4
630+790	16	5
630+890	16	2
630+990	10	3
631+090	14	7
631+190	11	7
631+290	10	4
631+390	6	5
631+490	11	7
631+590	14	4
631+690	16	8
631+790	14	3
631+890	14	3
631+990	8	5
632+090	8	7
632+190	6	3
632+290	6	3
632+390	9	4
632+490	9	3
632+590	7	6
632+690	7	4
632+790	14	9
632+890	16	10
632+990	11	9
633+090	13	6
633+190	12	5
633+290	15	3
633+390	7	5
633+490	9	5
633+590	7	6
633+690	8	5
633+790	9	4

KP	LHS OuterL ane	LHS InnerL ane
633+890	10	2
633+990	11	5
634+090	17	12
634+190	13	6
634+290	15	7
634+390	13	8
634+490	16	5
634+590	13	8
634+690	16	8
634+790	17	6
634+890	15	6
634+990	23	11
635+090	25	14
635+190	17	11
635+290	18	6
635+390	17	6
635+490	11	6
635+590	18	11
635+690	15	4
635+790	14	12
635+890	11	4
635+990	8	7
636+090	8	6
636+190	9	8
636+290	12	8
636+390	4	6
636+490	8	4
636+590	5	6
636+690	7	7
636+790	8	6
636+890	13	8
636+990	10	8
637+090	10	7
637+190	9	8
637+290	10	7
637+390	17	6
637+490	13	9
637+590	8	11
637+690	11	17
637+790	5	11
637+890	12	6

KP	LHS Outer Lane	LHS Inner Lane
637+990	8	9
638+090	9	10
638+190	9	13
638+290	12	12
638+390	19	6
638+490	8	9
638+590	15	11
638+690	17	11
638+790	14	13
638+890	16	12
638+990	19	17
639+090	17	10
639+190	15	10
639+290	13	11
639+390	3	14
639+490	9	8
639+590	11	10
639+690	14	11
639+790	9	9
639+890	9	7
639+990	15	10
640+090	13	8
640+190	12	11
640+290	11	9
640+390	13	12
640+490	11	8
640+590	13	5
640+690	9	7
640+790	10	9
640+890	9	10
640+990	22	5
641+090	10	9
641+190	12	8
641+290	11	8
641+390	16	8
641+490	13	6
641+590	10	6
641+690	10	7
641+790	9	8
641+890	22	7
641+990	17	7

KP	LHS OuterL ane	LHS InnerL ane
642+090	7	5
642+190	13	7
642+290	8	8
642+390	12	7
642+490	10	7
642+590	7	6
642+690	15	8
642+790	8	9
642+890	12	12
642+990	13	11
643+090	12	11
643+190	9	7
643+290	7	10
643+390	9	5
643+490	12	11
643+590	13	8
643+690	11	10
643+790	11	14
643+890	11	9
643+990	12	8
644+090	6	8
644+190	17	10
644+290	11	5
644+390	8	5
644+490	13	16
644+590	16	17
644+690	20	6
644+790	18	11
644+890	15	4
644+990	17	6
645+090	15	9
645+190	14	12
645+290	14	11
645+390	11	9
645+490	9	12
645+550	12	14

Table3.LHSRutDepthResults

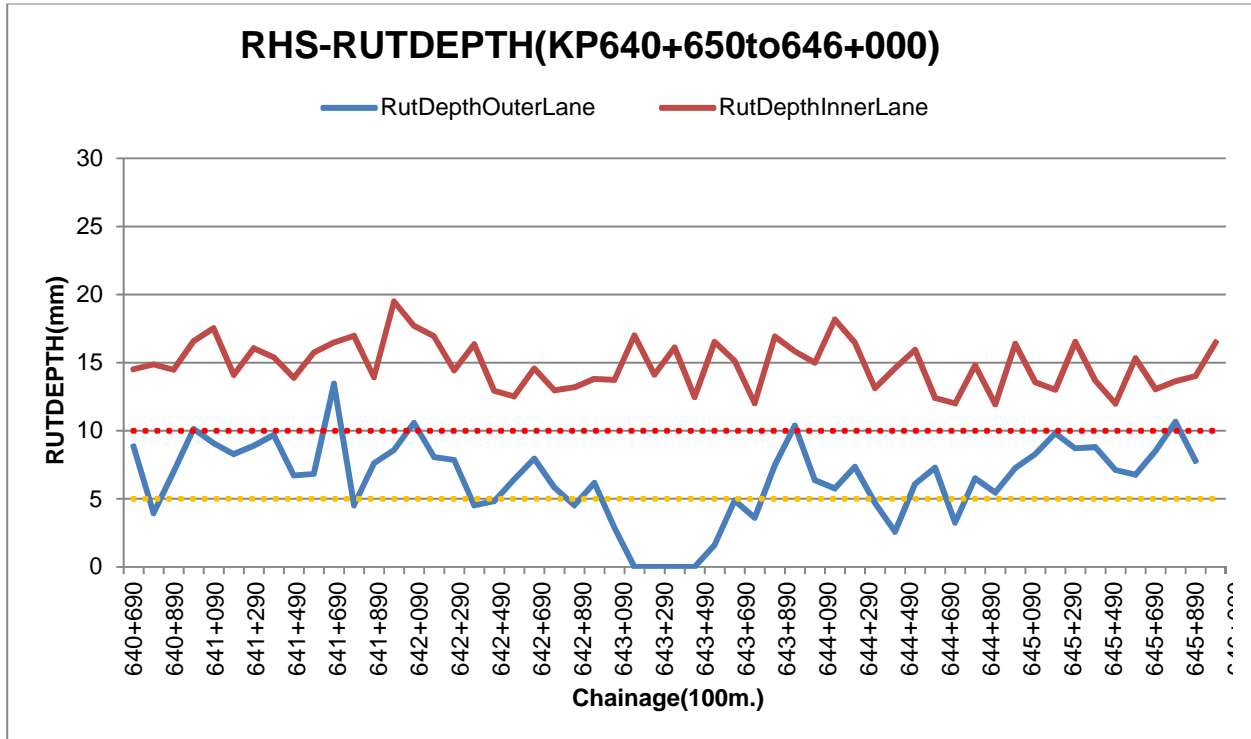


Figure23.RHS-RUTDEPTH(KP640+650to646+000)

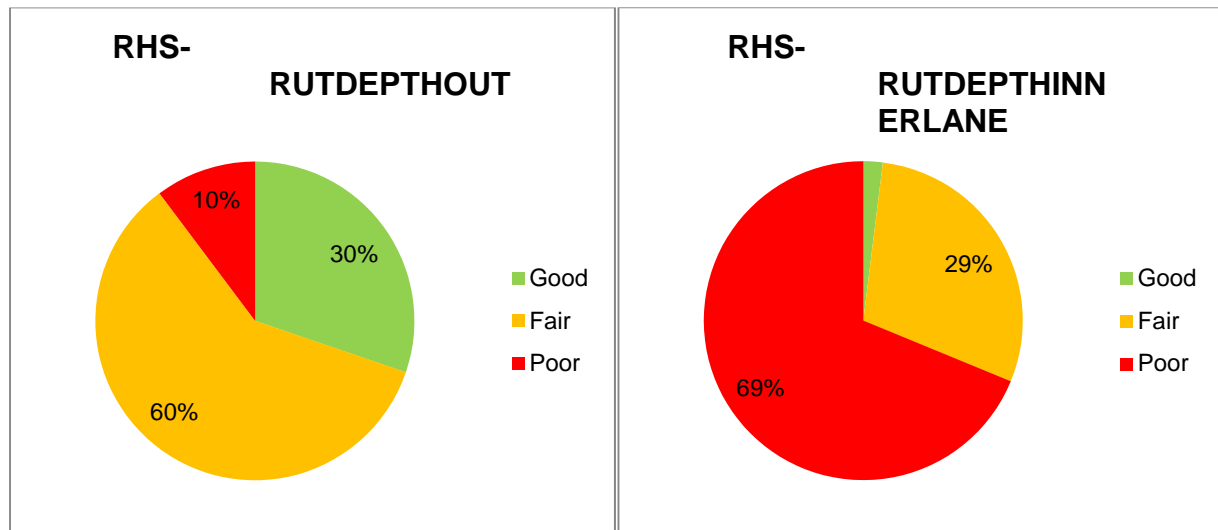


Figure24.RutDepthRHSOuterandInnerLanesResults

KP	RHS OuterL ane	RHS InnerL ane
600+690		22
600+790		29
600+890		30
600+990		28
601+090	9	29
601+190	7	30
601+290	8	28
601+390	6	28
601+490	3	10
601+590	3	7
601+690	4	7
601+790	8	9
601+890	4	7
601+990	3	7
602+090	7	7
602+190	12	6
602+290	5	6
602+390	4	7
602+490	3	7
602+590	8	7
602+690	9	8
602+790	7	7
602+890	6	8
602+990	7	7
603+090	11	7
603+190	14	6
603+290	6	6
603+390	9	7
603+490	7	6
603+590	10	8
603+690	6	6
603+790	8	8
603+890	10	6
603+990	9	7
604+090	7	5
604+190	10	7
604+290	7	6
604+390	5	7
604+490	7	7
604+590	8	7
604+690	8	7

KP	RHS OuterL ane	RHS InnerL ane
604+790	3	8
604+890	9	7
604+990	6	8
605+090	6	6
605+190	7	8
605+290	5	5
605+390	7	6
605+490	8	7
605+590	7	6
605+690	6	6
605+790	5	6
605+890	7	7
605+990	8	8
606+090	10	8
606+190	9	6
606+290	10	5
606+390	12	5
606+490	8	5
606+590	11	8
606+690	7	20
606+790	9	19
606+890	8	15
606+990	9	10
607+090	6	12
607+190	9	10
607+290	16	11
607+390	16	13
607+490	12	13
607+590	12	11
607+690	10	8
607+790	8	7
607+890	12	13
607+990	9	11
608+090	12	10
608+190	7	15
608+290	12	15
608+390	9	16
608+490	7	6
608+590	6	5
608+690	7	5
608+790	7	6

KP	RHS OuterL ane	RHS InnerL ane
608+890	7	6
608+990	6	5
609+090	8	5
609+190	8	9
609+290	7	15
609+390	8	18
609+490	8	13
609+590	9	11
609+690	9	12
609+790	10	13
609+890	9	10
609+990	6	12
610+090	6	11
610+190	7	13
610+290	6	8
610+390	9	11
610+490	6	9
610+590	9	14
610+690	7	13
610+790	13	13
610+890	9	17
610+990	6	16
611+090	9	12
611+190	10	13
611+290	9	17
611+390	12	9
611+490	6	5
611+590	7	5
611+690	7	6
611+790	4	5
611+890	7	6
611+990	8	5
612+090	8	5
612+190	8	5
612+290	4	5
612+390	7	5
612+490	6	5
612+590	8	6
612+690	7	6
612+790	6	5
612+890	8	6

KP	RHS OuterL ane	RHS InnerL ane
612+990	10	13
613+090	7	15
613+190	8	18
613+290	8	14
613+390	10	11
613+490	4	10
613+590	7	13
613+690	12	18
613+790	5	19
613+890	3	20
613+990	8	18
614+090	5	19
614+190	9	19
614+290	8	19
614+390	10	20
614+490	3	20
614+590	14	20
614+690	13	18
614+790	13	18
614+890	9	17
614+990	7	19
615+090	7	15
615+190	6	19
615+290	5	18
615+390	6	17
615+490	5	21
615+590	9	18
615+690	6	16
615+790	4	8
615+890	6	10
615+990	12	9
616+090	7	9
616+190	15	10
616+290	5	9
616+390	7	10
616+490	5	11
616+590	9	13
616+690	9	9
616+790	8	12
616+890	2	9
616+990	4	10

KP	RHS OuterL ane	RHS InnerL ane
617+090	6	12
617+190	3	11
617+290	5	12
617+390	5	8
617+490	6	9
617+590	7	12
617+690	5	10
617+790	5	8
617+890	6	9
617+990	7	10
618+090	8	9
618+190	3	9
618+290	4	10
618+390	3	7
618+490	4	11
618+590	6	7
618+690	8	10
618+790	10	11
618+890	8	9
618+990	6	13
619+090	4	11
619+190	6	12
619+290	9	11
619+390	7	11
619+490	4	12
619+590	9	12
619+690	6	11
619+790	5	9
619+890	6	10
619+990	8	8
620+090	7	10
620+190	3	8
620+290	6	9
620+390	9	9
620+490	4	12
620+590	8	10
620+690	5	10
620+790	3	10
620+890	7	9
620+990	12	9
621+090	8	9

KP	RHS OuterL ane	RHS InnerL ane
621+190	4	11
621+290	4	13
621+390	8	11
621+490	5	9
621+590	9	7
621+690	7	11
621+790	4	8
621+890	5	9
621+990	8	9
622+090	7	9
622+190	7	10
622+290	7	12
622+390	6	12
622+490	6	12
622+590	8	11
622+690	9	10
622+790	12	11
622+890	5	8
622+990	6	8
623+090	10	9
623+190	8	10
623+290	11	9
623+390	4	8
623+490	4	9
623+590	5	8
623+690	3	9
623+790	4	8
623+890	4	9
623+990	6	9
624+090	8	8
624+190	9	11
624+290	1	11
624+390	5	14
624+490	3	10
624+590	4	10
624+690	5	11
624+790	9	11
624+890	7	8
624+990	6	9
625+090	5	8
625+190	4	11

KP	RHS OuterL ane	RHS InnerL ane
625+290	6	7
625+390	6	8
625+490	3	8
625+590	4	10
625+690	6	10
625+790	7	12
625+890	3	9
625+990	4	7
626+090	4	11
626+190	1	11
626+290	8	14
626+390	2	13
626+490	4	12
626+590	4	12
626+690	4	14
626+790	7	14
626+890	2	14
626+990	3	14
627+090	9	14
627+190	9	14
627+290	4	13
627+390	7	14
627+490	3	13
627+590	5	12
627+690	9	14
627+790	4	9
627+890	7	11
627+990	9	10
628+090	5	12
628+190	4	10
628+290	3	13
628+390	3	13
628+490	2	11
628+590	5	11
628+690	3	10
628+790	4	15
628+890	3	11
628+990	5	14
629+090	3	13
629+190	3	15
629+290	10	12

KP	RHS OuterL ane	RHS InnerL ane
629+390	4	13
629+490	3	16
629+590	6	12
629+690	5	13
629+790	4	11
629+890	5	14
629+990	6	14
630+090	7	13
630+190	4	14
630+290	3	12
630+390	5	11
630+490	2	13
630+590	2	12
630+690	5	16
630+790	8	14
630+890	9	19
630+990	3	13
631+090	6	16
631+190	6	13
631+290	3	17
631+390	2	15
631+490	4	14
631+590	4	15
631+690	5	16
631+790	5	15
631+890	6	14
631+990	7	15
632+090	5	14
632+190	4	13
632+290	3	13
632+390	4	16
632+490	5	16
632+590	4	17
632+690	16	17
632+790	6	16
632+890	4	18
632+990	7	14
633+090	7	13
633+190	6	15
633+290	3	17
633+390	8	15

KP	RHS OuterL ane	RHS InnerL ane
633+490	6	17
633+590	4	15
633+690	7	14
633+790	8	15
633+890	10	16
633+990	7	15
634+090	5	13
634+190	2	11
634+290	10	13
634+390	7	14
634+490	7	14
634+590	14	19
634+690	8	18
634+790	8	15
634+890	6	17
634+990	18	18
635+090	7	19
635+190	10	17
635+290	6	16
635+390	10	18
635+490	14	17
635+590	8	18
635+690	6	14
635+790	8	18
635+890	9	15
635+990	10	14
636+090	6	13
636+190	6	16
636+290	9	12
636+390	8	11
636+490	4	14
636+590	5	15
636+690	5	13
636+790	4	12
636+890	3	17
636+990	4	14
637+090	5	15
637+190	4	12
637+290	7	16
637+390	6	13
637+490	3	13

KP	RHS OuterL ane	RHS InnerL ane
637+590	1	15
637+690	1	13
637+790	1	15
637+890	3	15
637+990	5	16
638+090	3	13
638+190	3	17
638+290	2	14
638+390	11	16
638+490	7	12
638+590	9	16
638+690	7	15
638+790	7	13
638+890	11	17
638+990	9	17
639+090	11	15
639+190	7	15
639+290	10	19
639+390	4	17
639+490	11	19
639+590	10	20
639+690	8	14
639+790	14	16
639+890	11	18
639+990	9	19
640+090	6	14
640+190	8	11
640+290	19	17
640+390	8	13
640+490	7	15
640+590	6	14
640+690	9	15
640+790	4	15
640+890	7	14
640+990	10	17
641+090	9	18
641+190	8	14
641+290	9	16
641+390	10	15
641+490	7	14
641+590	7	16

KP	RHS OuterL ane	RHS InnerL ane
641+690	13	16
641+790	5	17
641+890	8	14
641+990	9	20
642+090	11	18
642+190	8	17
642+290	8	14
642+390	5	16
642+490	5	13
642+590	6	13
642+690	8	15
642+790	6	13
642+890	5	13
642+990	6	14
643+090	3	14
643+190	0	17
643+290	0	14
643+390	0	16
643+490	0	12
643+590	2	17
643+690	5	15
643+790	4	12
643+890	7	17
643+990	10	16
644+090	6	15
644+190	6	18
644+290	7	17
644+390	5	13
644+490	3	15
644+590	6	16
644+690	7	12
644+790	3	12
644+890	7	15
644+990	5	12
645+090	7	16
645+190	8	14
645+290	10	13
645+390	9	17
645+490	9	14
645+590	7	12
645+690	7	15

KP	RHS OuterL ane	RHS InnerL ane
645+790	9	13
645+890	11	14
645+980	8	14
646+000		16

Table4.RHSRutDepthResults

ANNEXURE 6 HDM-4 RESULTS

Section: Str4-01-LHS-601000-605000

Alternative: Base Alternative

Sensitivity: No Sensitivity Analysis Conducted

Length: 4,00km

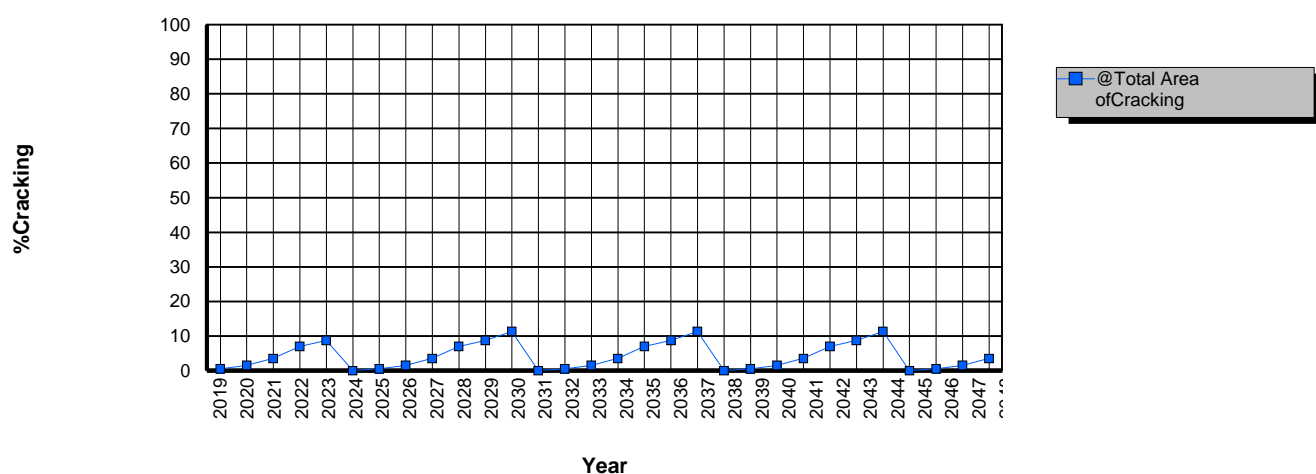
Width: 7,00m

Rise+Fall: 1,00m/km

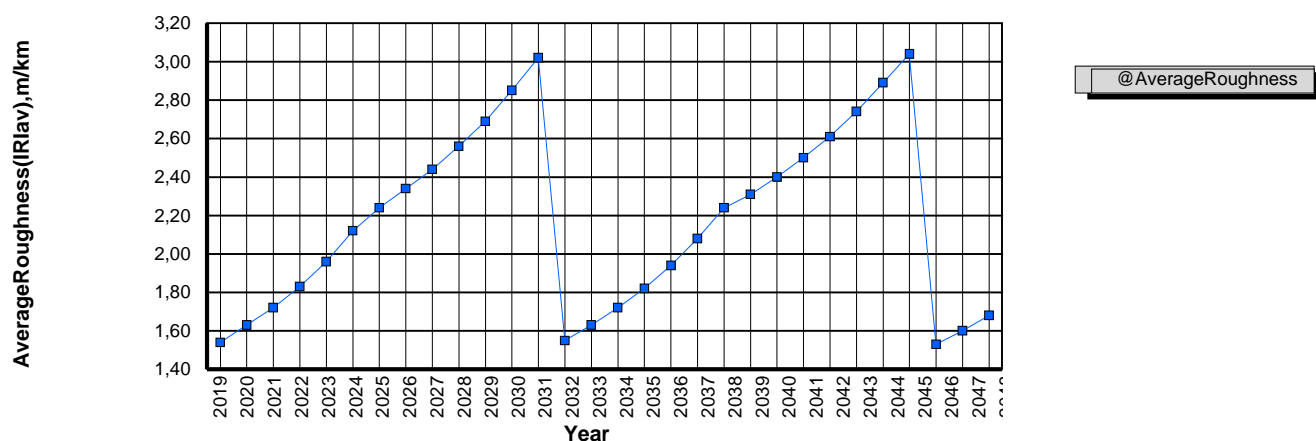
Curvature: 3,00deg/km

oadClass: Primary or Trunk

Progression of Cracking overtime
(after works values)



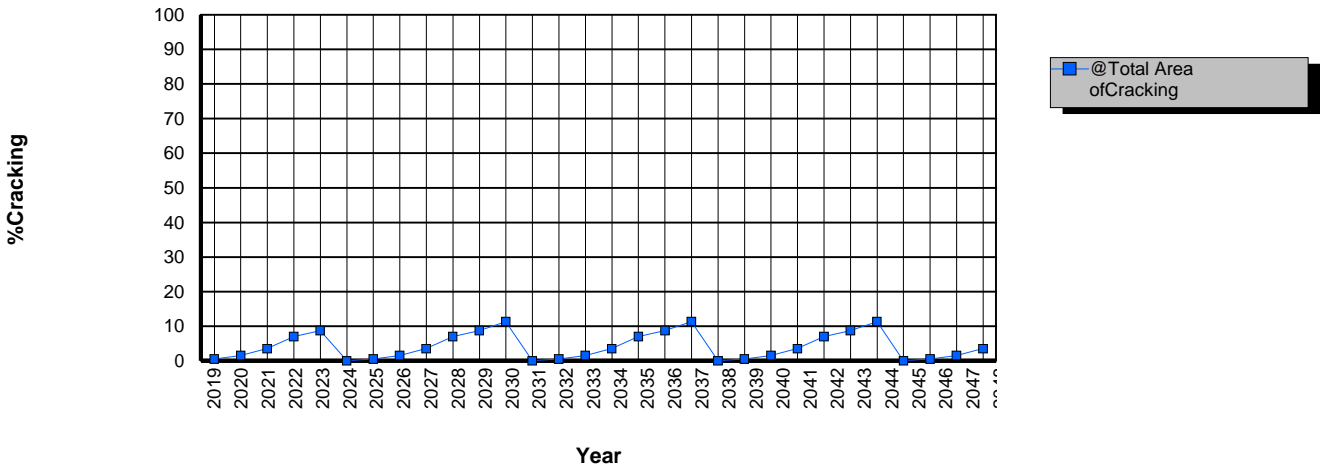
Progression of Average Roughness overtime



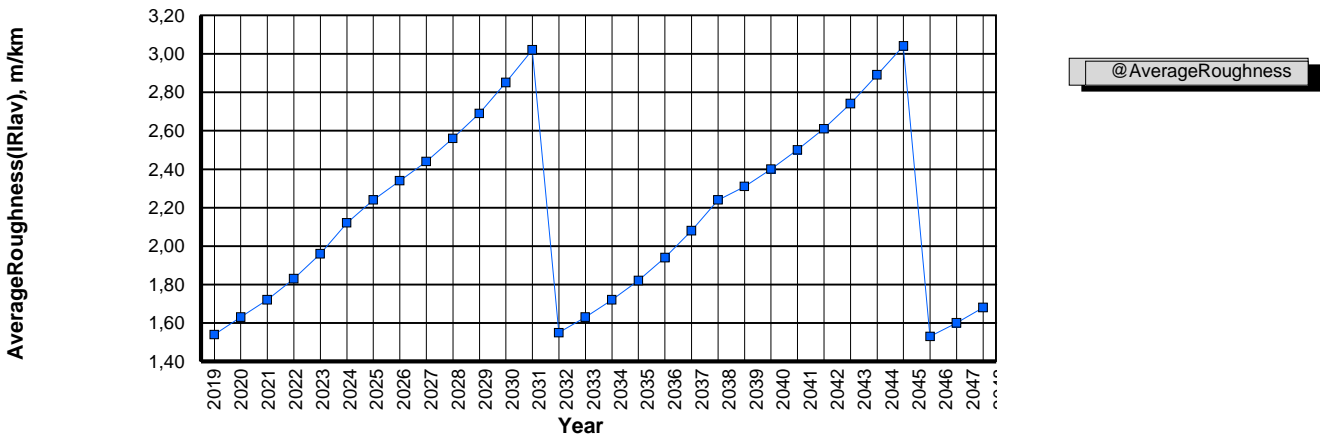
Section: Str4-02-LHS-605000-608000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:3,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

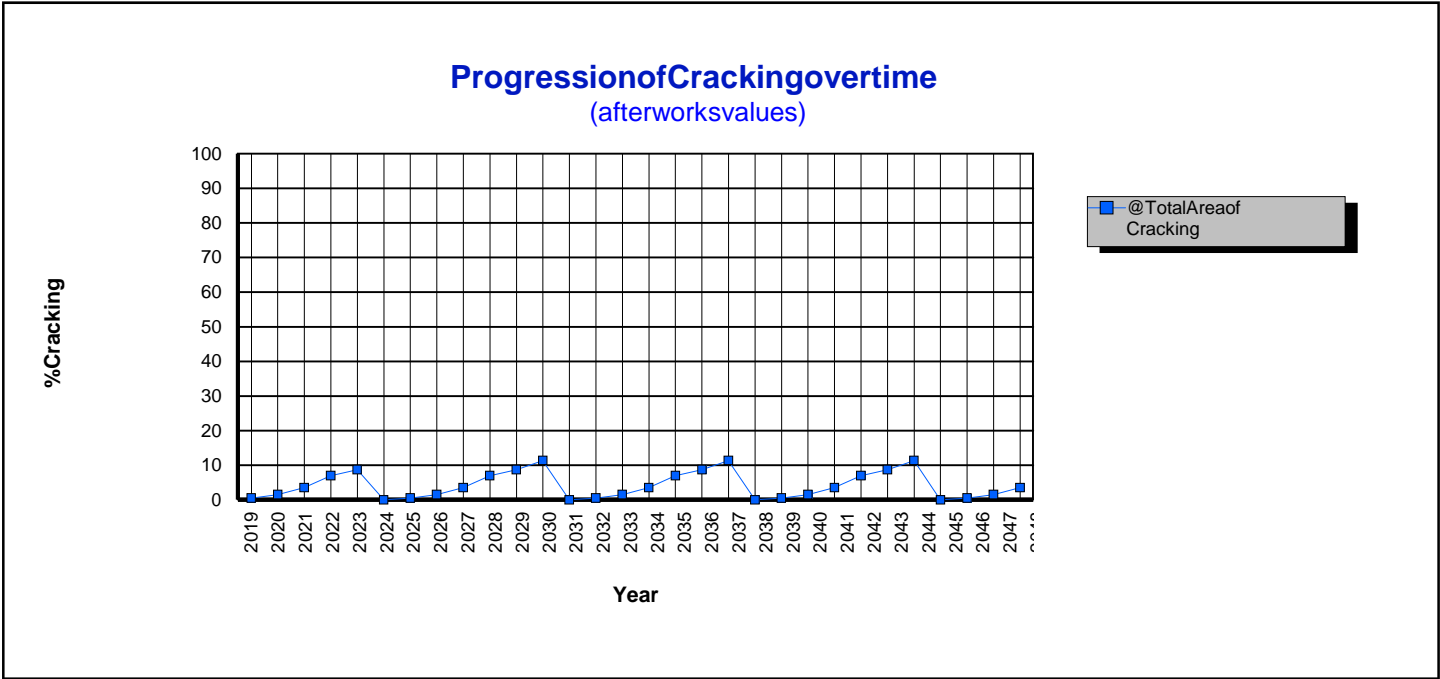


ProgressionofAverageRoughnessovertime

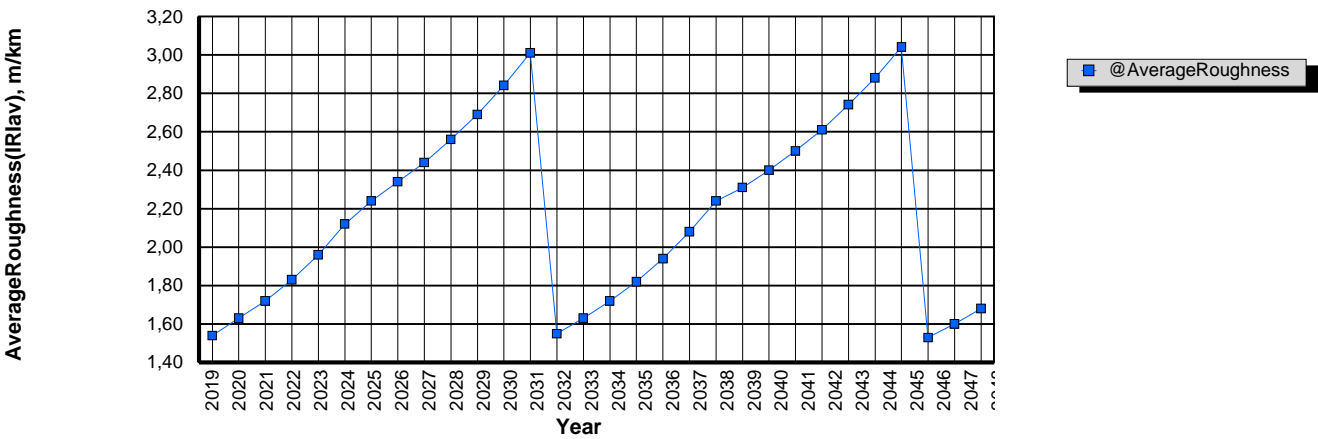


Section: Str4-03-LHS-608000-611000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:3,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



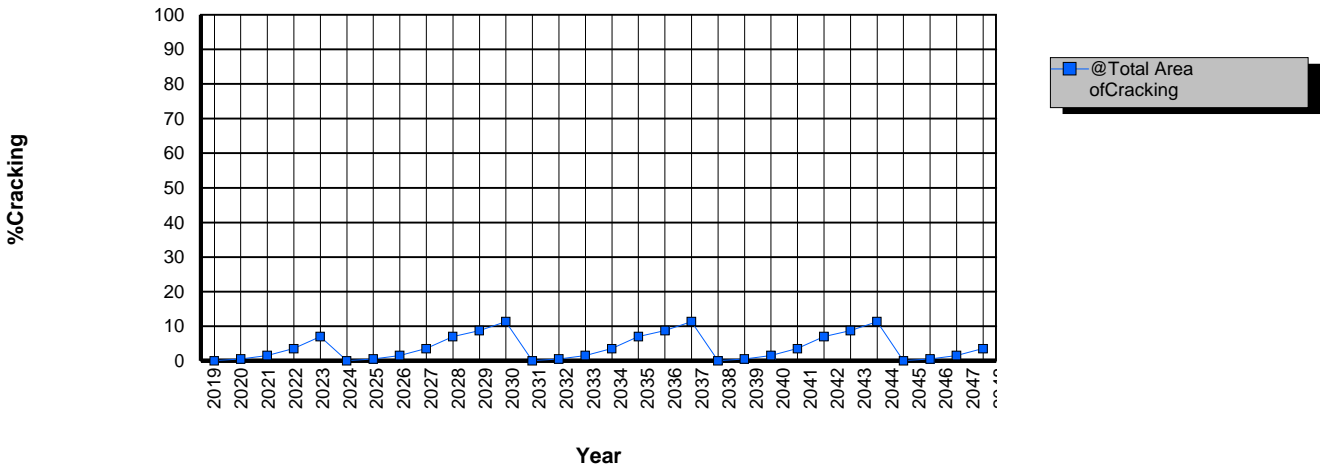
ProgressionofAverageRoughnessovertime



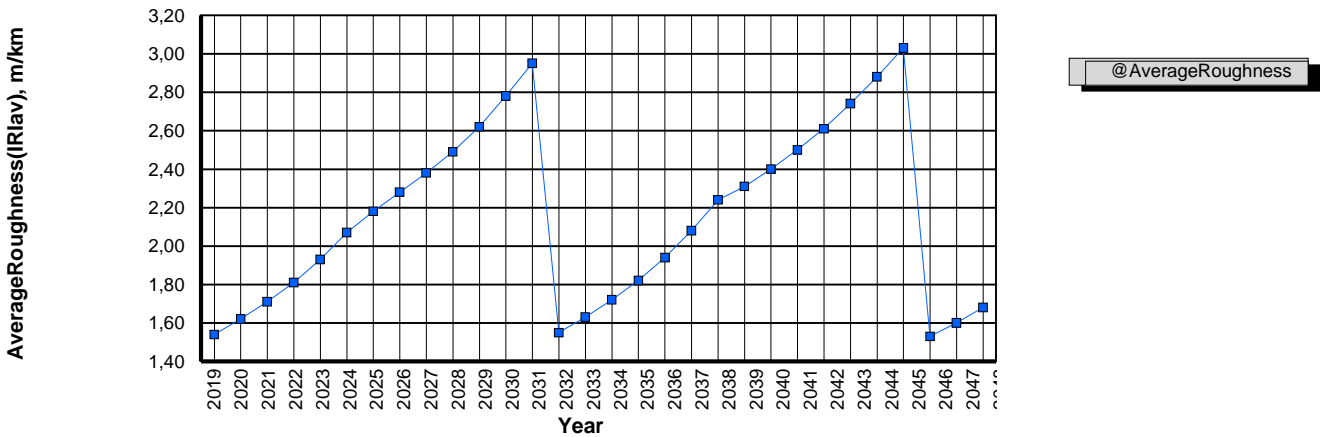
Section: Str4-04-LHS-611000-615000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:4,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

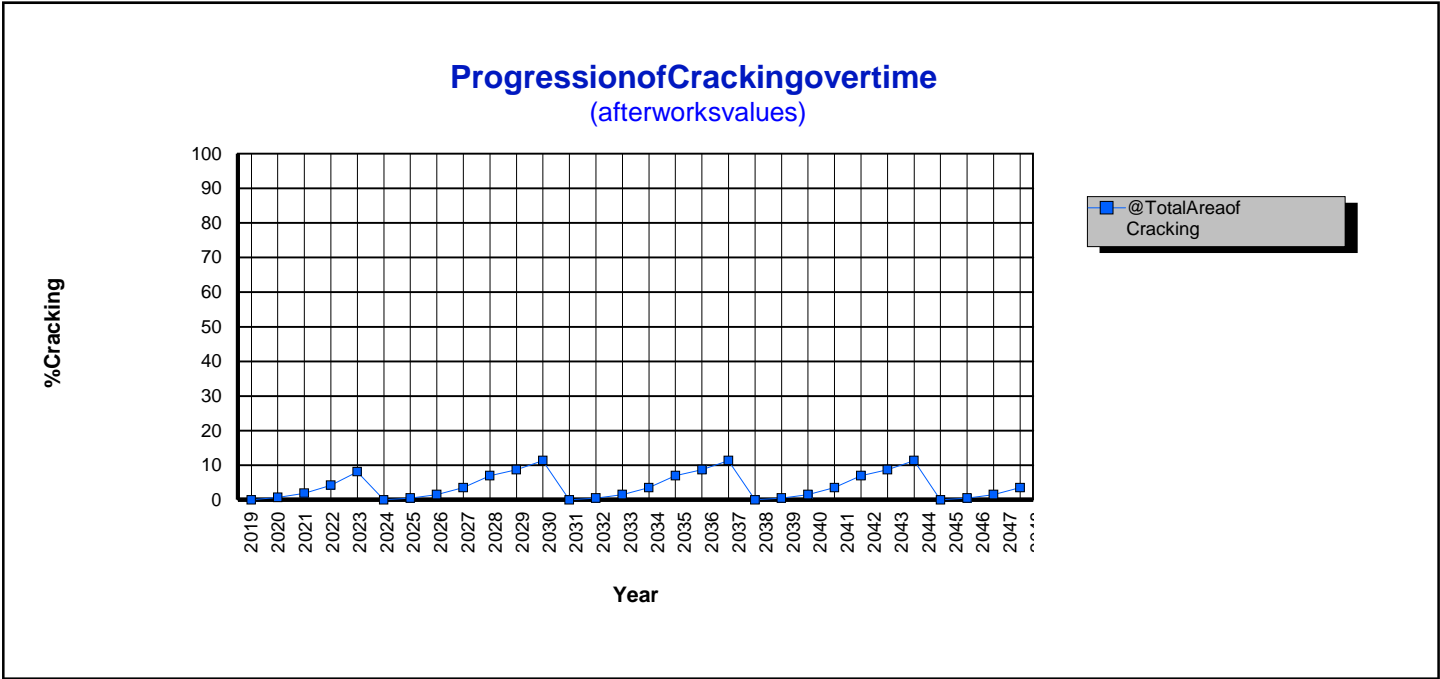


ProgressionofAverageRoughnessovertime

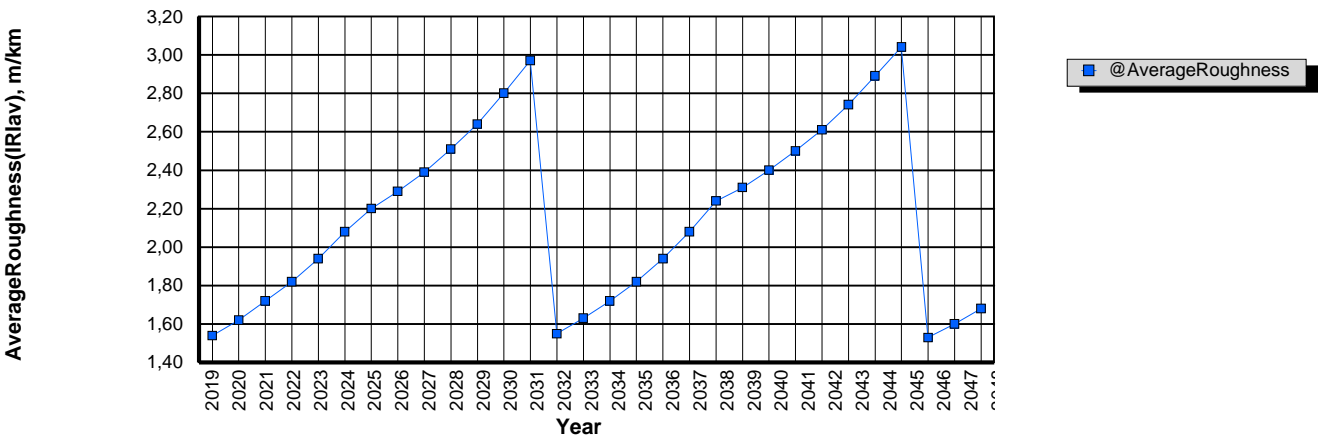


Section: Str4-05-LHS-615000-616500
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:1,50km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

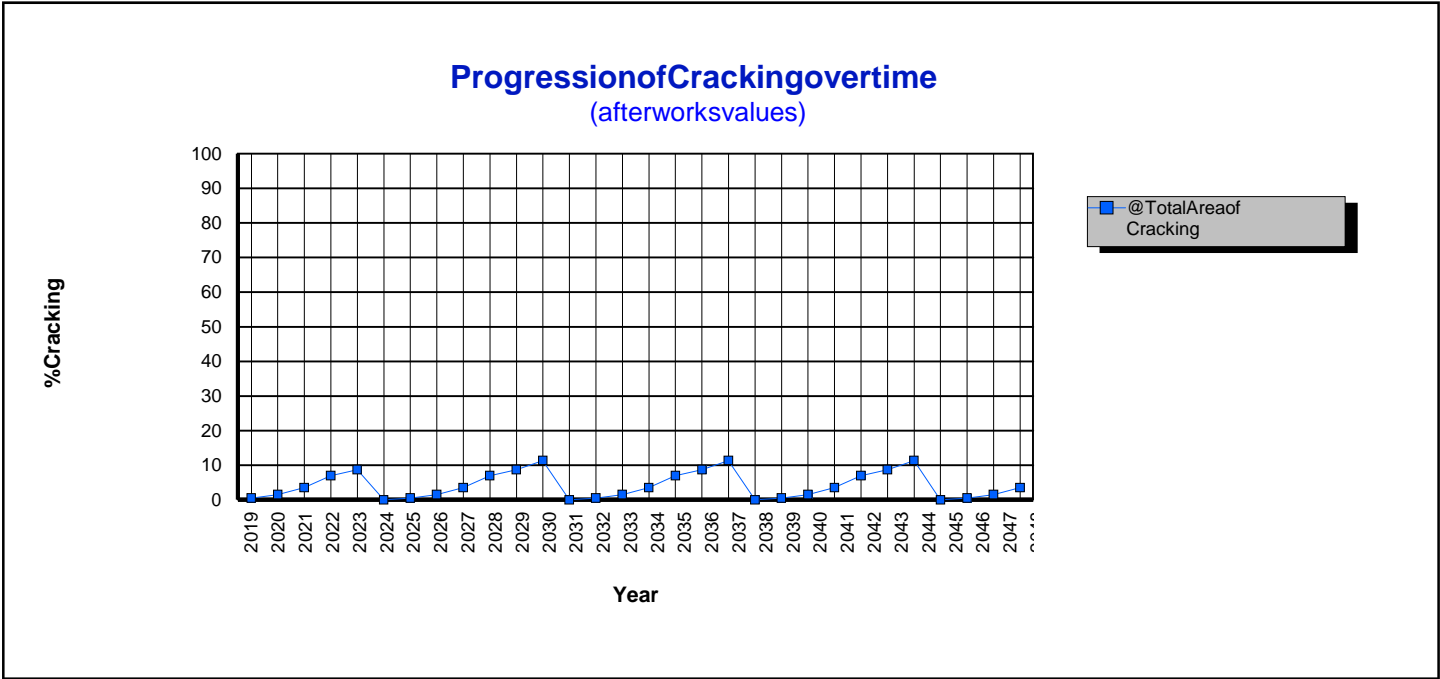


ProgressionofAverageRoughnessovertime

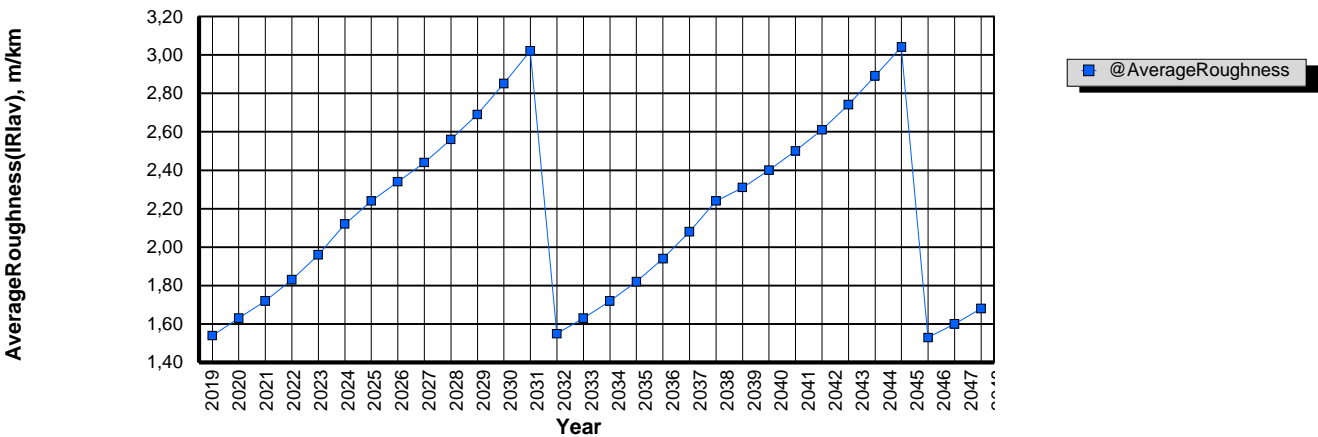


Section: Str4-06-LHS-616500-618250
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:1,75km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

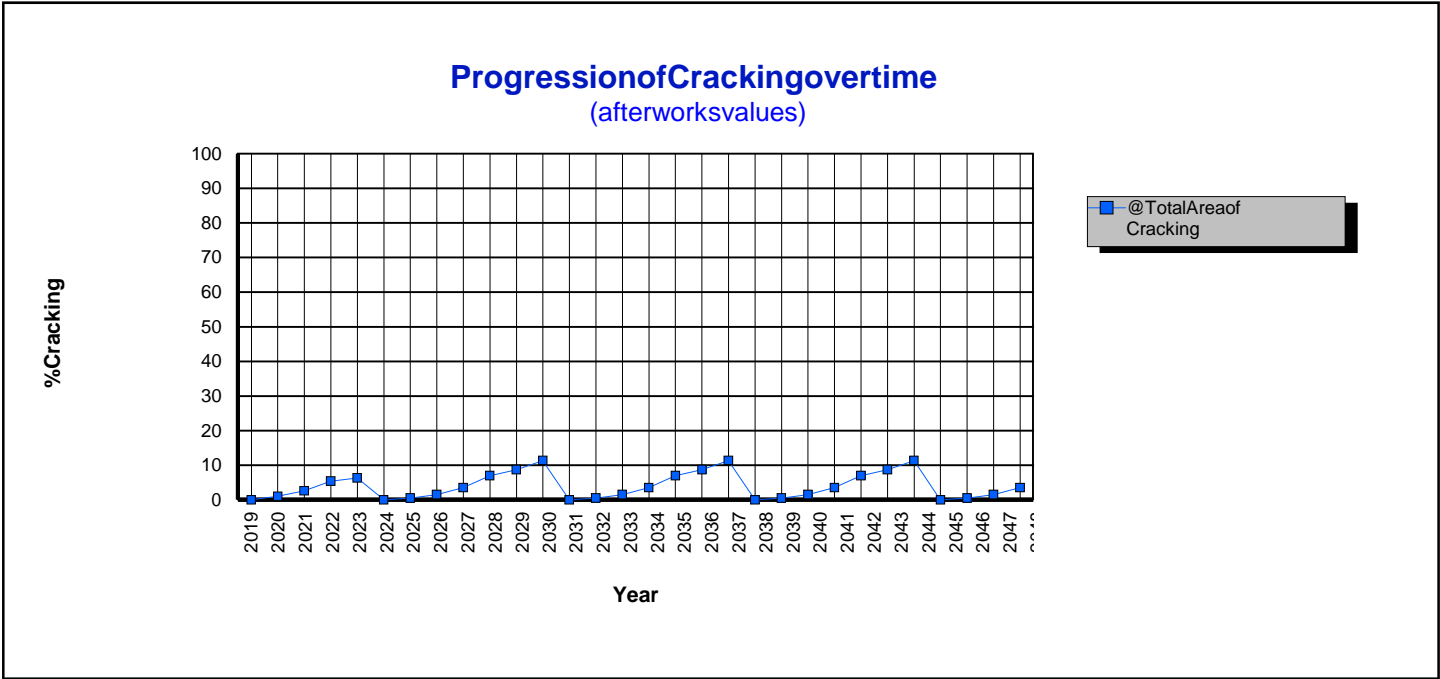


ProgressionofAverageRoughnessovertime

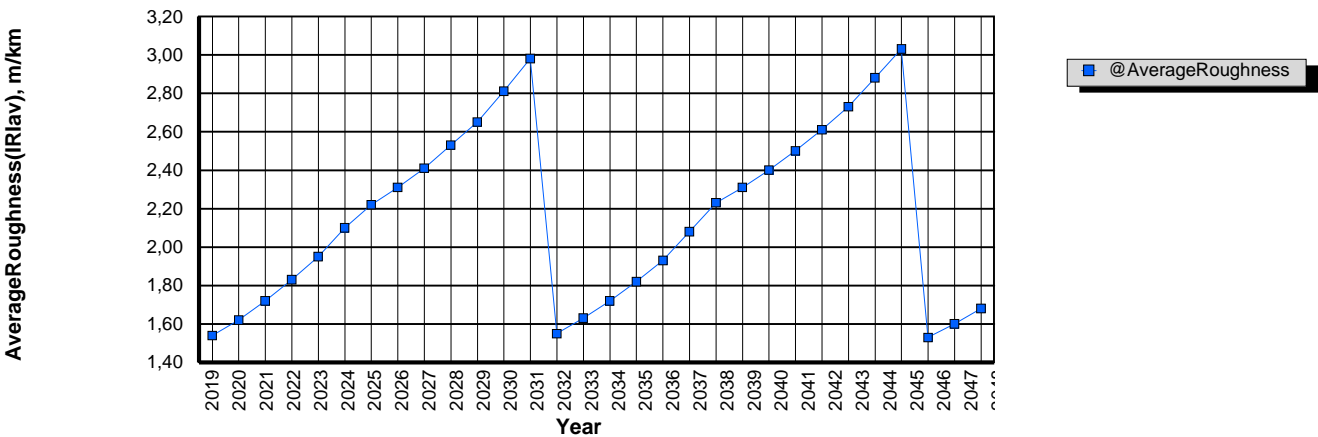


Section: Str4-07-LHS-618250-620250
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:2,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

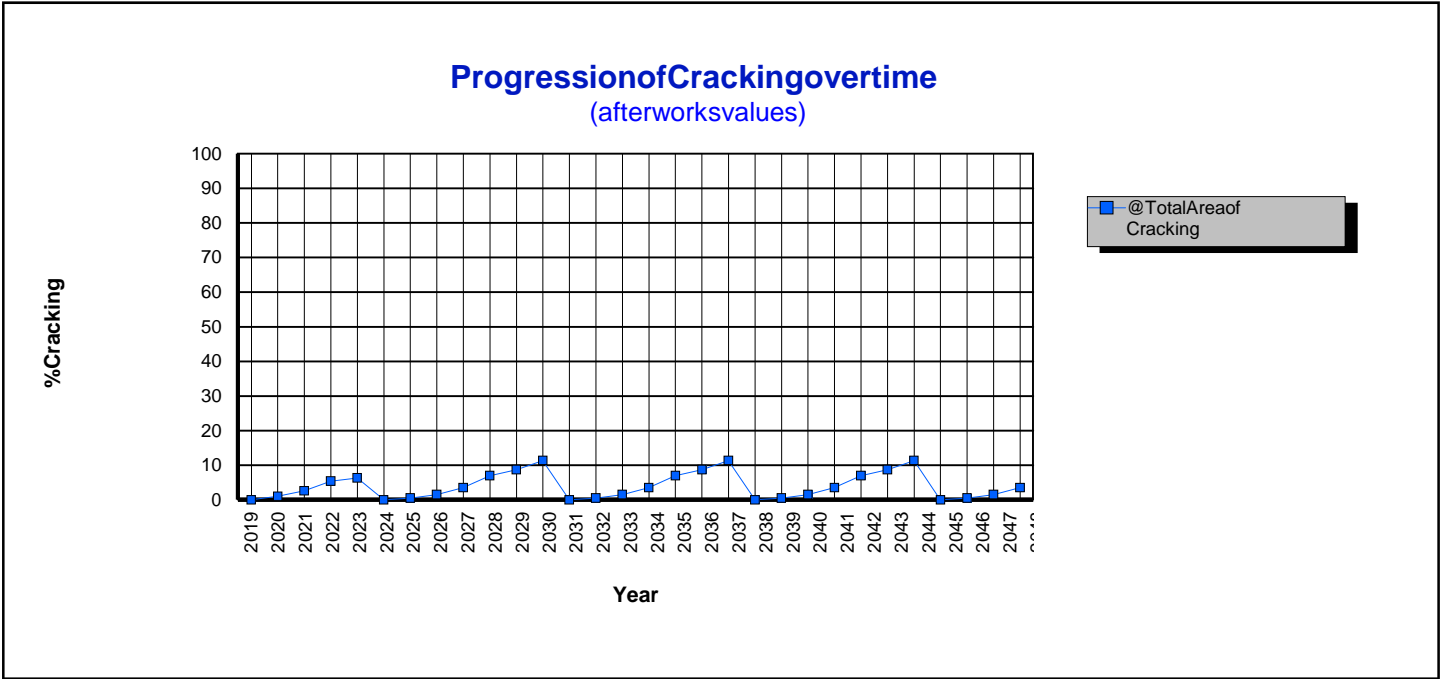


ProgressionofAverageRoughnessovertime

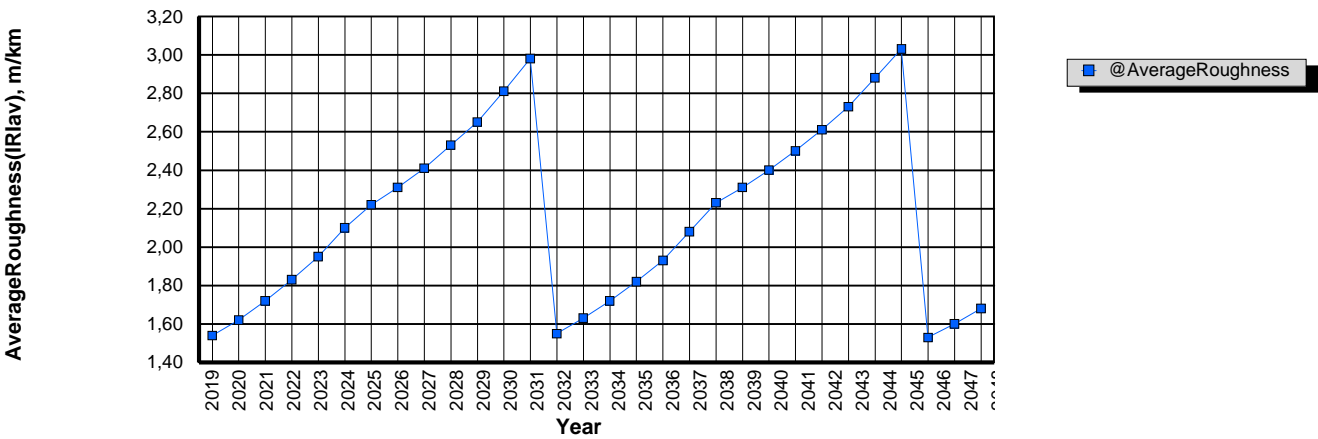


Section: Str4-08-LHS-620250-623000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:2,75km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



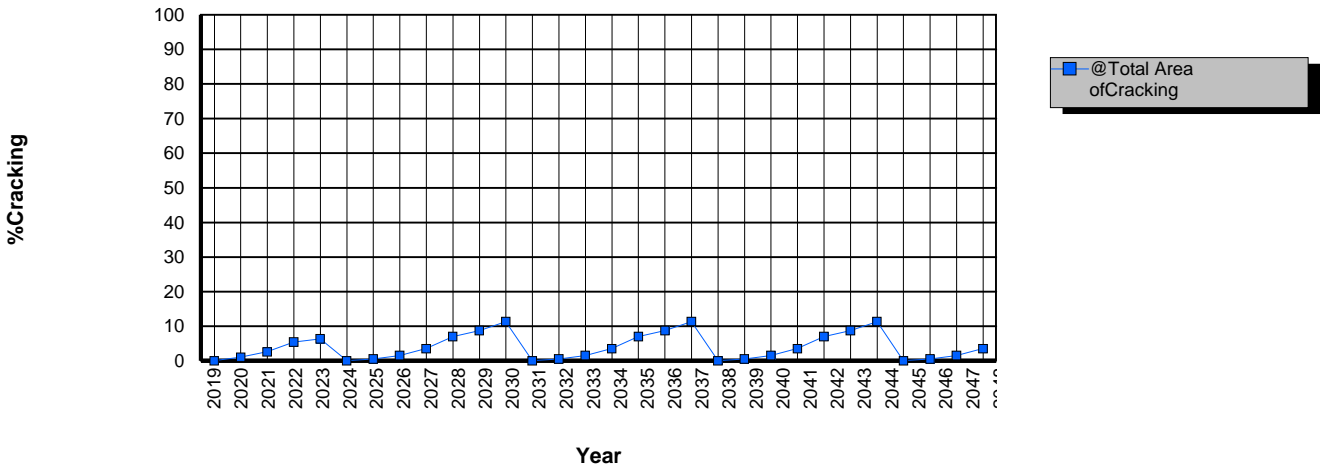
ProgressionofAverageRoughnessovertime



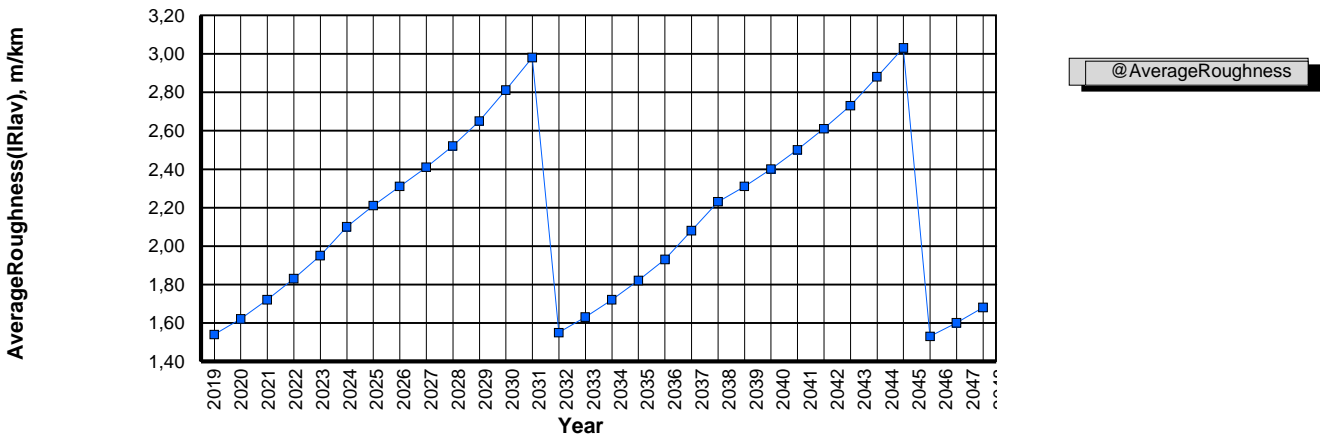
Section: Str4-09-LHS-623000-628000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:5,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

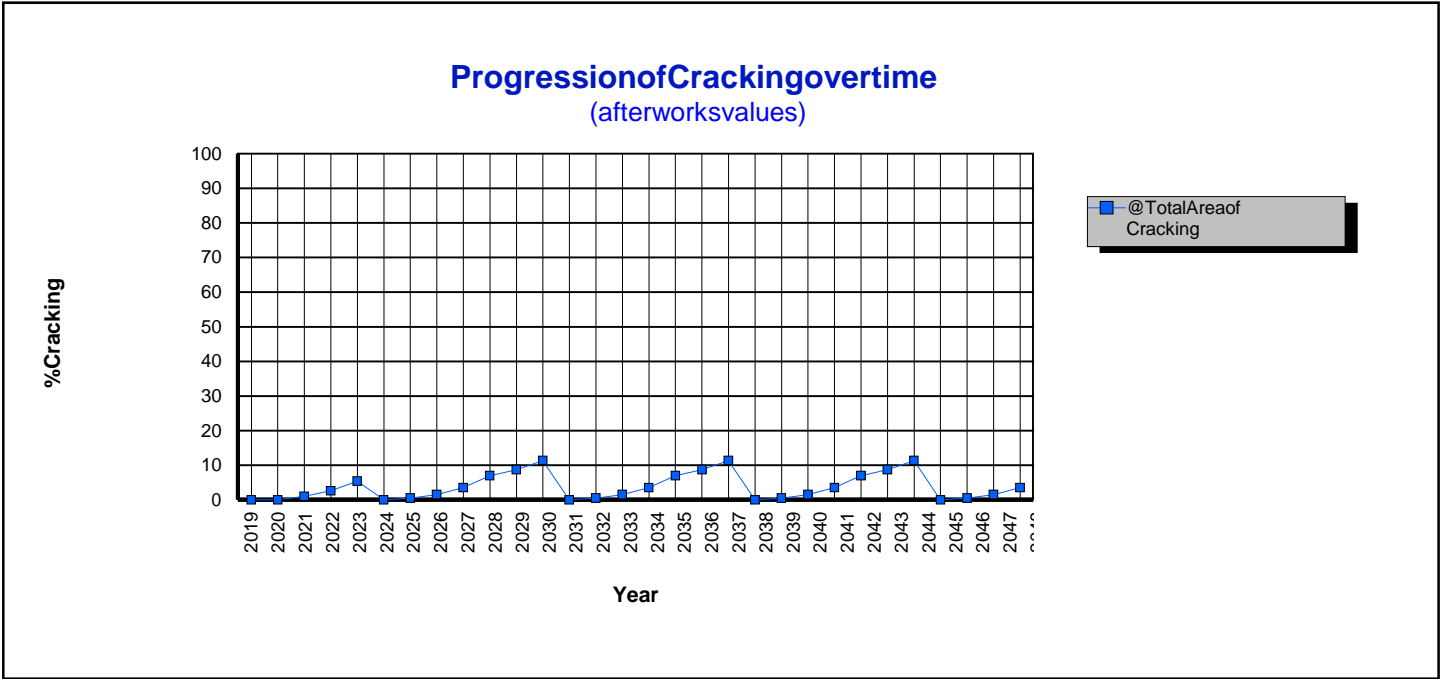


ProgressionofAverageRoughnessovertime

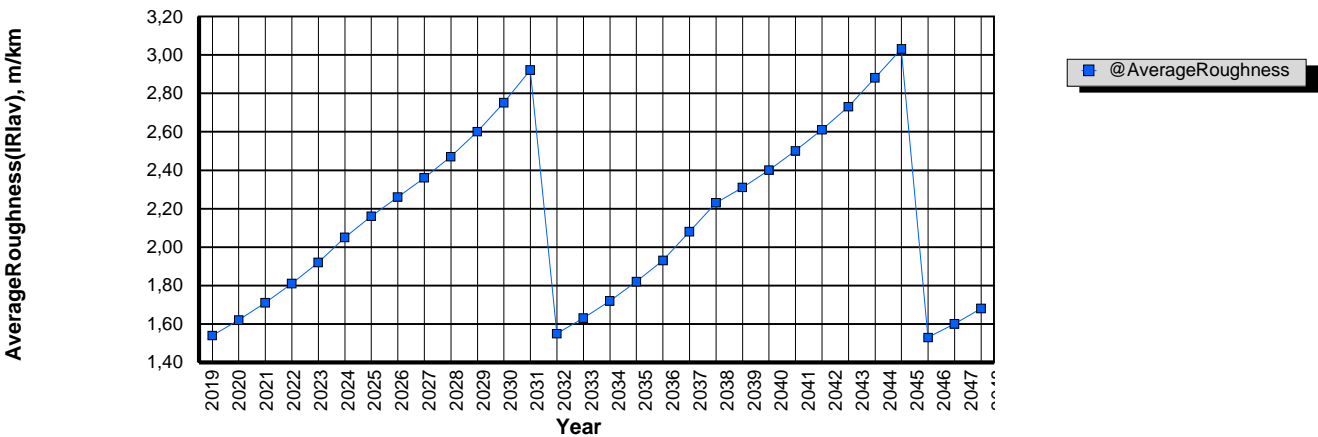


Section: Str4-10-LHS-628000-630250
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:2,25km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

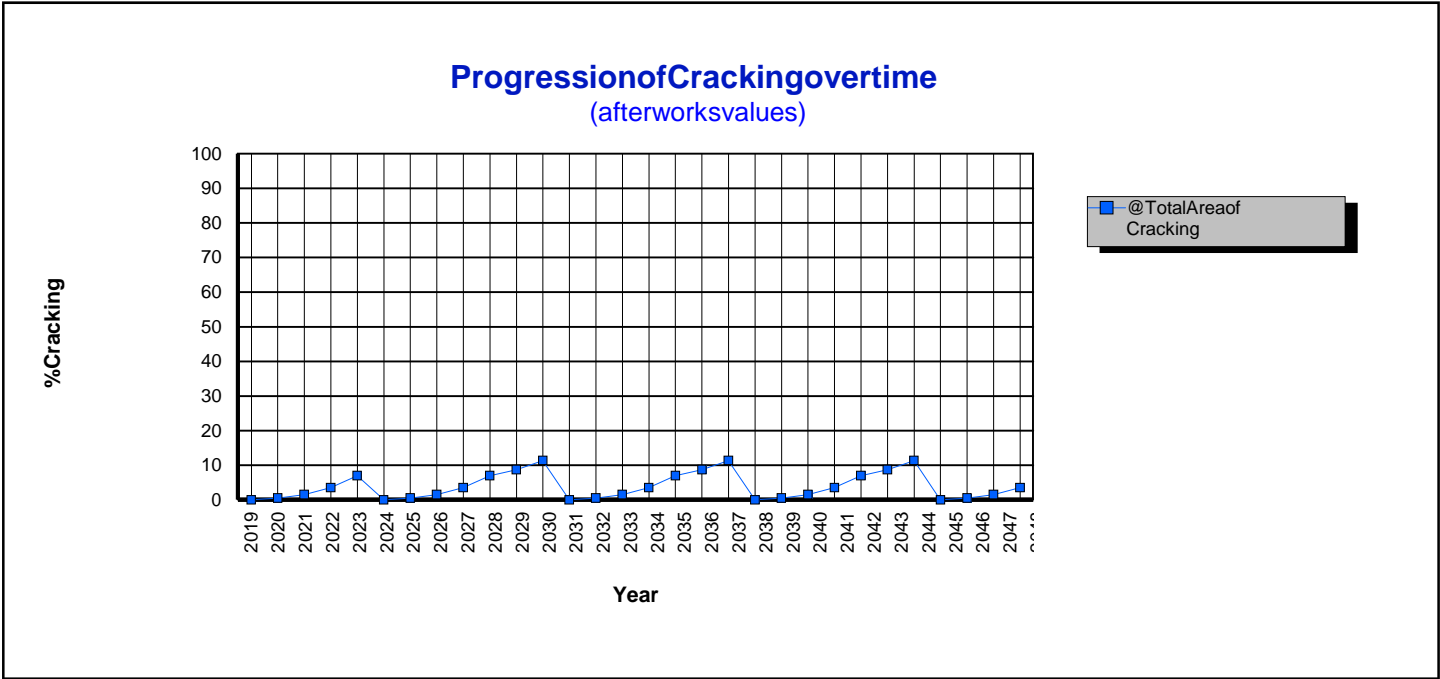


ProgressionofAverageRoughnessovertime

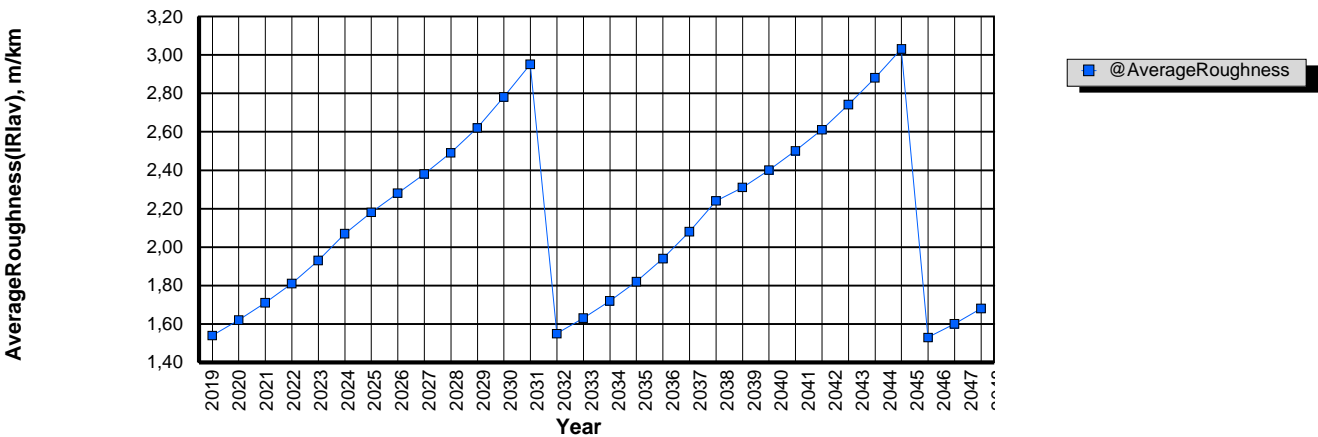


Section: Str4-11-LHS-630250-633500
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:3,25km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



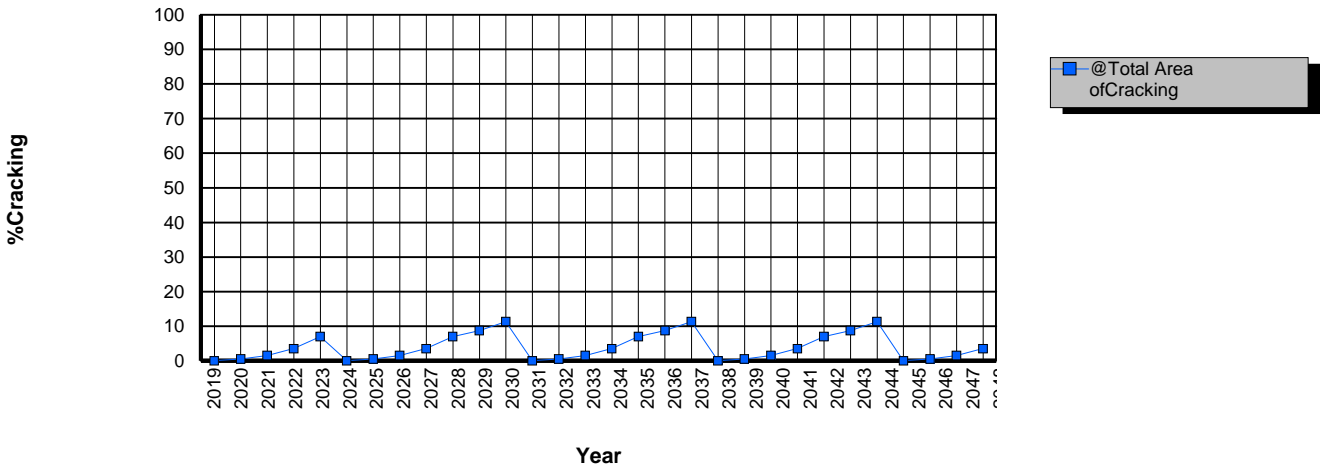
ProgressionofAverageRoughnessovertime



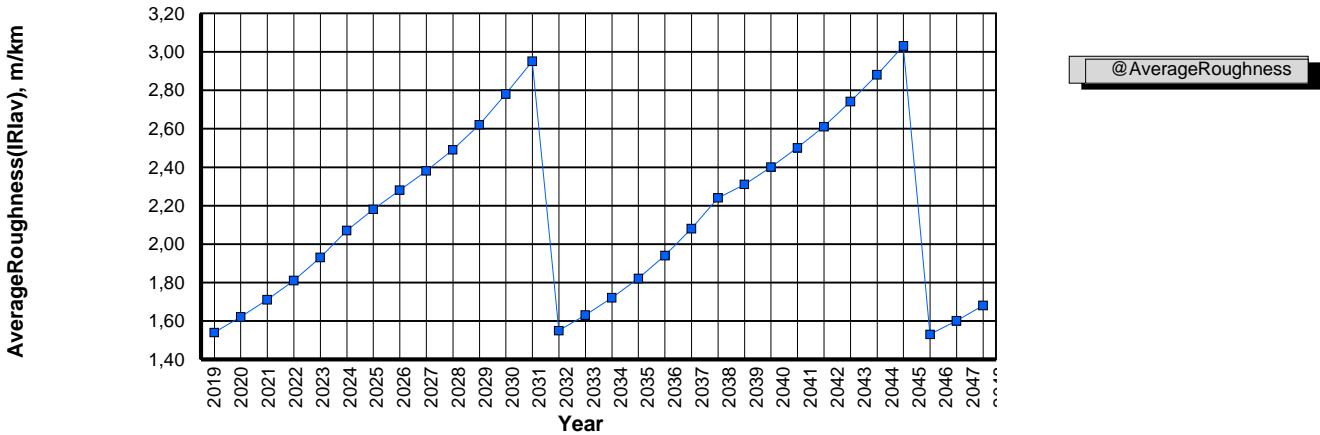
Section: Str4-12-LHS-633500-639000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:5,50km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

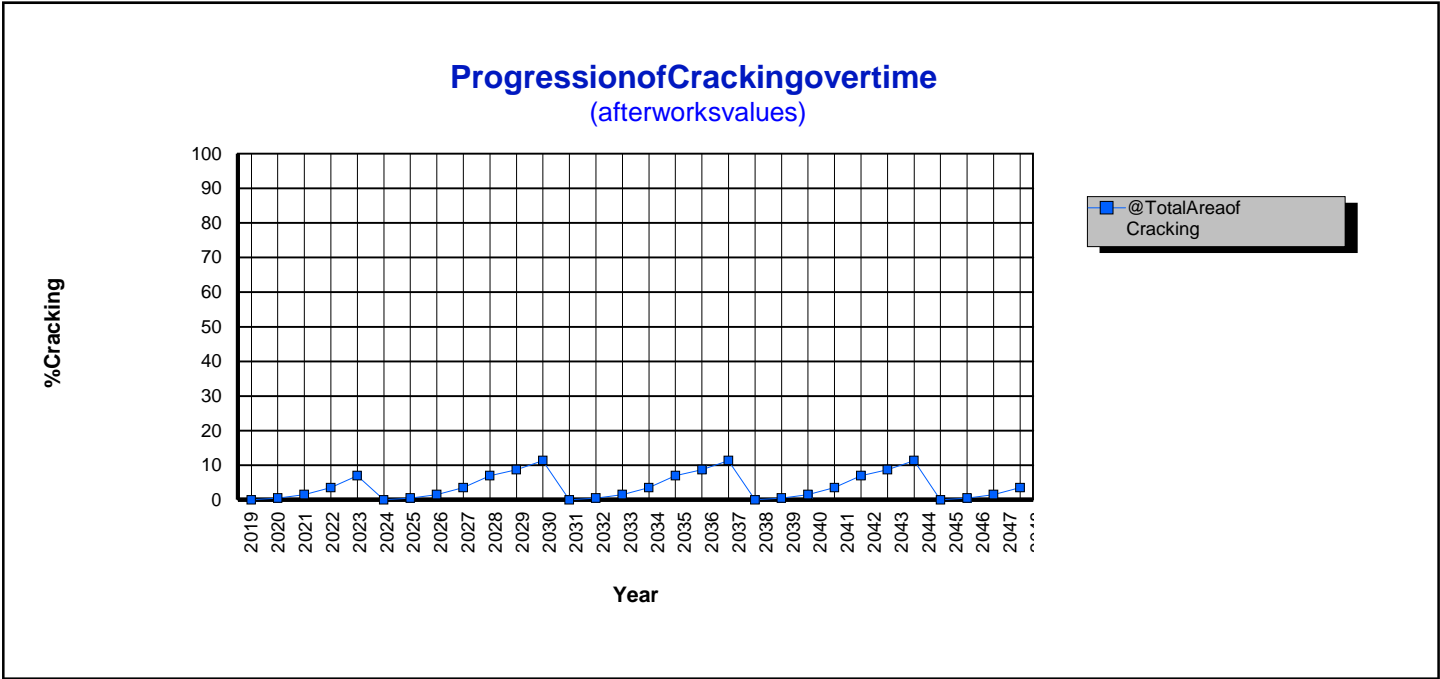


ProgressionofAverageRoughnessovertime

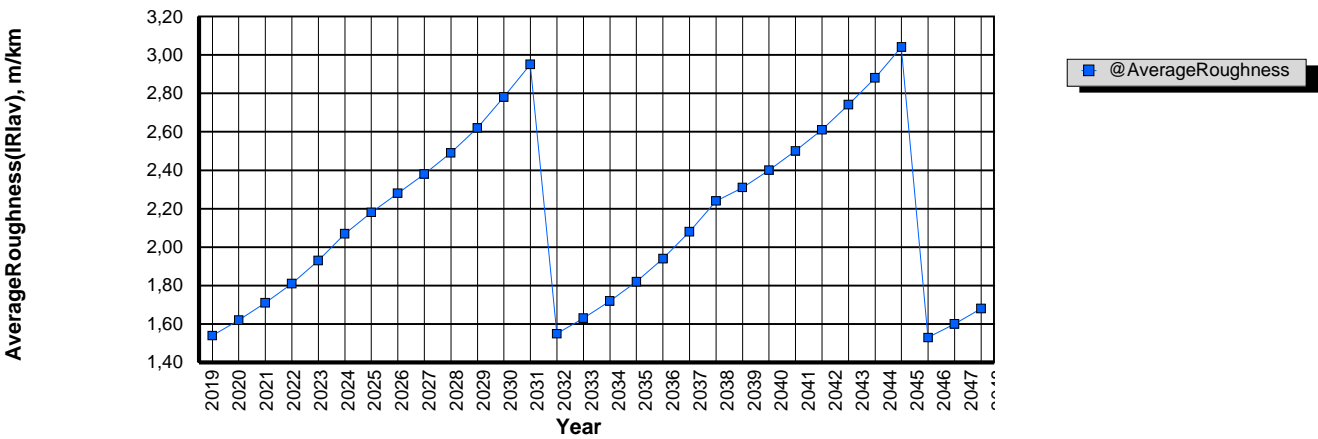


Section: Str4-13-LHS-639000-645000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:6,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



ProgressionofAverageRoughnessovertime



Note:onlysectionsthathaveworkstriggeredaredisplayed.

Section: Str4-01-LHS-601000-605000
Alternative: BaseAlternative
Sensitivity: NoSensitivityAnalysisConducted
SurfaceClass: Bituminous
Length: 4,00km

RoadClass: PrimaryorTrunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	1.016,30sq.m
2024	Overlay2024	O24	0.0	0.0	28.000,00sq.m
2029	Patching	Patch	0.0	0.0	1.016,30sq.m
2030	Patching	Patch	0.0	0.0	1.016,30sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	28.000,00sq.m
2036	Patching	Patch	0.0	0.0	1.016,30sq.m
2037	Patching	Patch	0.0	0.0	1.016,30sq.m
2038	Overlay2038	O38	0.0	0.0	28.000,00sq.m
2043	Patching	Patch	0.0	0.0	1.016,30sq.m
2044	Patching	Patch	0.0	0.0	1.016,30sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	28.000,00sq.m
Totalcostforthissection:			0.0	0.0	

Section: Str4-02-LHS-605000-608000
Alternative: BaseAlternative
Sensitivity: NoSensitivityAnalysisConducted
SurfaceClass: Bituminous
Length: 3,00km

RoadClass: PrimaryorTrunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	762,22sq.m
2024	Overlay2024	O24	0.0	0.0	21.000,00sq.m
2029	Patching	Patch	0.0	0.0	762,22sq.m
2030	Patching	Patch	0.0	0.0	762,22sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	21.000,00sq.m
2036	Patching	Patch	0.0	0.0	762,22sq.m
2037	Patching	Patch	0.0	0.0	762,22sq.m
2038	Overlay2038	O38	0.0	0.0	21.000,00sq.m
2043	Patching	Patch	0.0	0.0	762,22sq.m
2044	Patching	Patch	0.0	0.0	762,22sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	21.000,00sq.m
Totalcostforthissection:			0.0	0.0	

Section:	Str4-03-LHS-608000-611000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	3,00km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	762,22sq.m
2024	Overlay2024	O24	0.0	0.0	21.000,00sq.m
2029	Patching	Patch	0.0	0.0	762,22sq.m
2030	Patching	Patch	0.0	0.0	762,22sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	21.000,00sq.m
2036	Patching	Patch	0.0	0.0	762,22sq.m
2037	Patching	Patch	0.0	0.0	762,22sq.m
2038	Overlay2038	O38	0.0	0.0	21.000,00sq.m
2043	Patching	Patch	0.0	0.0	762,22sq.m
2044	Patching	Patch	0.0	0.0	762,22sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	21.000,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-04-LHS-611000-615000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	4,00km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	28.000,00sq.m
2029	Patching	Patch	0.0	0.0	1.016,30sq.m
2030	Patching	Patch	0.0	0.0	1.016,30sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	28.000,00sq.m
2036	Patching	Patch	0.0	0.0	1.016,30sq.m
2037	Patching	Patch	0.0	0.0	1.016,30sq.m
2038	Overlay2038	O38	0.0	0.0	28.000,00sq.m
2043	Patching	Patch	0.0	0.0	1.016,30sq.m
2044	Patching	Patch	0.0	0.0	1.016,30sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	28.000,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-05-LHS-615000-616500	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	1,50km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	10.500,00sq.m
2029	Patching	Patch	0.0	0.0	381,11sq.m
2030	Patching	Patch	0.0	0.0	381,11sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	10.500,00sq.m
2036	Patching	Patch	0.0	0.0	381,11sq.m
2037	Patching	Patch	0.0	0.0	381,11sq.m
2038	Overlay2038	O38	0.0	0.0	10.500,00sq.m
2043	Patching	Patch	0.0	0.0	381,11sq.m
2044	Patching	Patch	0.0	0.0	381,11sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	10.500,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-06-LHS-616500-618250	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	1,75km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	444,63sq.m
2024	Overlay2024	O24	0.0	0.0	12.250,00sq.m
2029	Patching	Patch	0.0	0.0	444,63sq.m
2030	Patching	Patch	0.0	0.0	444,63sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	12.250,00sq.m
2036	Patching	Patch	0.0	0.0	444,63sq.m
2037	Patching	Patch	0.0	0.0	444,63sq.m
2038	Overlay2038	O38	0.0	0.0	12.250,00sq.m
2043	Patching	Patch	0.0	0.0	444,63sq.m
2044	Patching	Patch	0.0	0.0	444,63sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	12.250,00sq.m
Totalcostforthesection:			0.0	0.0	

Section: Str4-07-LHS-618250-620250
Alternative: BaseAlternative
Sensitivity: NoSensitivityAnalysisConducted
SurfaceClass: Bituminous
Length: 2,00km

RoadClass: PrimaryorTrunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	508,15sq.m
2024	Overlay2024	O24	0.0	0.0	14.000,00sq.m
2029	Patching	Patch	0.0	0.0	508,15sq.m
2030	Patching	Patch	0.0	0.0	508,15sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	14.000,00sq.m
2036	Patching	Patch	0.0	0.0	508,15sq.m
2037	Patching	Patch	0.0	0.0	508,15sq.m
2038	Overlay2038	O38	0.0	0.0	14.000,00sq.m
2043	Patching	Patch	0.0	0.0	508,15sq.m
2044	Patching	Patch	0.0	0.0	508,15sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	14.000,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-08-LHS-620250-623000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	2,75km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	698,71sq.m
2024	Overlay2024	O24	0.0	0.0	19.250,00sq.m
2029	Patching	Patch	0.0	0.0	698,71sq.m
2030	Patching	Patch	0.0	0.0	698,71sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	19.250,00sq.m
2036	Patching	Patch	0.0	0.0	698,71sq.m
2037	Patching	Patch	0.0	0.0	698,71sq.m
2038	Overlay2038	O38	0.0	0.0	19.250,00sq.m
2043	Patching	Patch	0.0	0.0	698,71sq.m
2044	Patching	Patch	0.0	0.0	698,71sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	19.250,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-09-LHS-623000-628000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	5,00km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	1.270,37sq.m
2024	Overlay2024	O24	0.0	0.0	35.000,00sq.m
2029	Patching	Patch	0.0	0.0	1.270,37sq.m
2030	Patching	Patch	0.0	0.0	1.270,37sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	35.000,00sq.m
2036	Patching	Patch	0.0	0.0	1.270,37sq.m
2037	Patching	Patch	0.0	0.0	1.270,37sq.m
2038	Overlay2038	O38	0.0	0.0	35.000,00sq.m
2043	Patching	Patch	0.0	0.0	1.270,37sq.m
2044	Patching	Patch	0.0	0.0	1.270,37sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	35.000,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-10-LHS-628000-630250	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	2,25km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	15.750,00sq.m
2029	Patching	Patch	0.0	0.0	571,67sq.m
2030	Patching	Patch	0.0	0.0	571,67sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	15.750,00sq.m
2036	Patching	Patch	0.0	0.0	571,67sq.m
2037	Patching	Patch	0.0	0.0	571,67sq.m
2038	Overlay2038	O38	0.0	0.0	15.750,00sq.m
2043	Patching	Patch	0.0	0.0	571,67sq.m
2044	Patching	Patch	0.0	0.0	571,67sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	15.750,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-11-LHS-630250-633500	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	3,25km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	22.750,00sq.m
2029	Patching	Patch	0.0	0.0	825,74sq.m
2030	Patching	Patch	0.0	0.0	825,74sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	22.750,00sq.m
2036	Patching	Patch	0.0	0.0	825,74sq.m
2037	Patching	Patch	0.0	0.0	825,74sq.m
2038	Overlay2038	O38	0.0	0.0	22.750,00sq.m
2043	Patching	Patch	0.0	0.0	825,74sq.m
2044	Patching	Patch	0.0	0.0	825,74sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	22.750,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-12-LHS-633500-639000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	5,50km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	38.500,00sq.m
2029	Patching	Patch	0.0	0.0	1.397,41sq.m
2030	Patching	Patch	0.0	0.0	1.397,41sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	38.500,00sq.m
2036	Patching	Patch	0.0	0.0	1.397,41sq.m
2037	Patching	Patch	0.0	0.0	1.397,41sq.m
2038	Overlay2038	O38	0.0	0.0	38.500,00sq.m
2043	Patching	Patch	0.0	0.0	1.397,41sq.m
2044	Patching	Patch	0.0	0.0	1.397,41sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	38.500,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-13-LHS-639000-645000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	6,00km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	42.000,00sq.m
2029	Patching	Patch	0.0	0.0	1.524,45sq.m
2030	Patching	Patch	0.0	0.0	1.524,45sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	42.000,00sq.m
2036	Patching	Patch	0.0	0.0	1.524,45sq.m
2037	Patching	Patch	0.0	0.0	1.524,45sq.m
2038	Overlay2038	O38	0.0	0.0	42.000,00sq.m
2043	Patching	Patch	0.0	0.0	1.524,45sq.m
2044	Patching	Patch	0.0	0.0	1.524,45sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	42.000,00sq.m

Totalcostforthesection:	0.0	0.0
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Summary of Total Annual Economic Costs

:BaseSensitivityScenario

	BaseAlternative
2023	0.00
2024	0.00
2029	0.00
2030	0.00
2031	0.00
2036	0.00
2037	0.00
2038	0.00
2043	0.00
2044	0.00
2045	0.00
Total	0,00

Section: Str4-01-RHS-601000-608250

Alternative: Base Alternative

Sensitivity: No Sensitivity Analysis Conducted

Length: 7,25 km

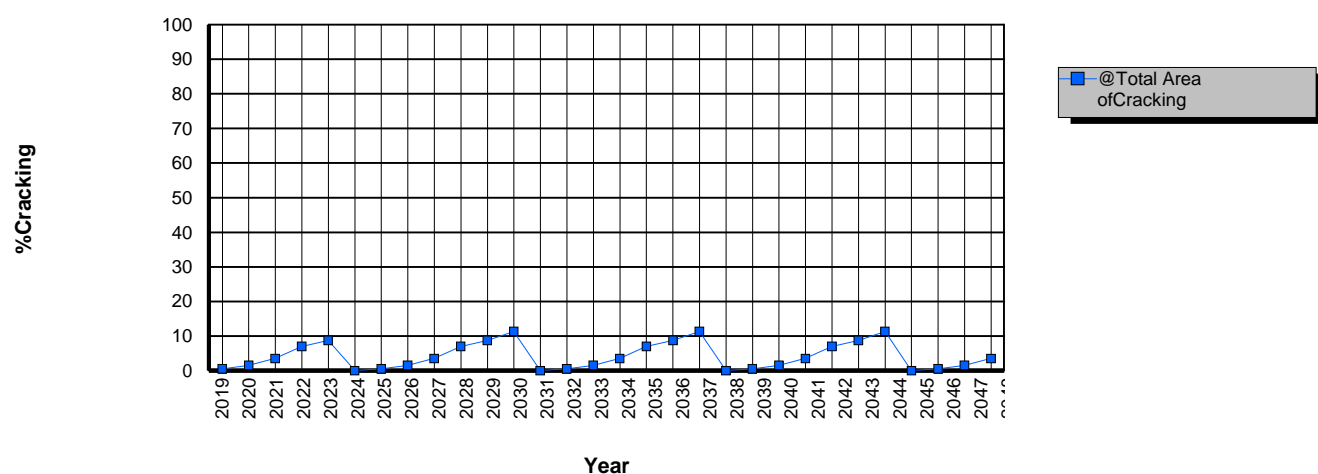
Width: 7,00 m

Rise+Fall: 1,00 m/km

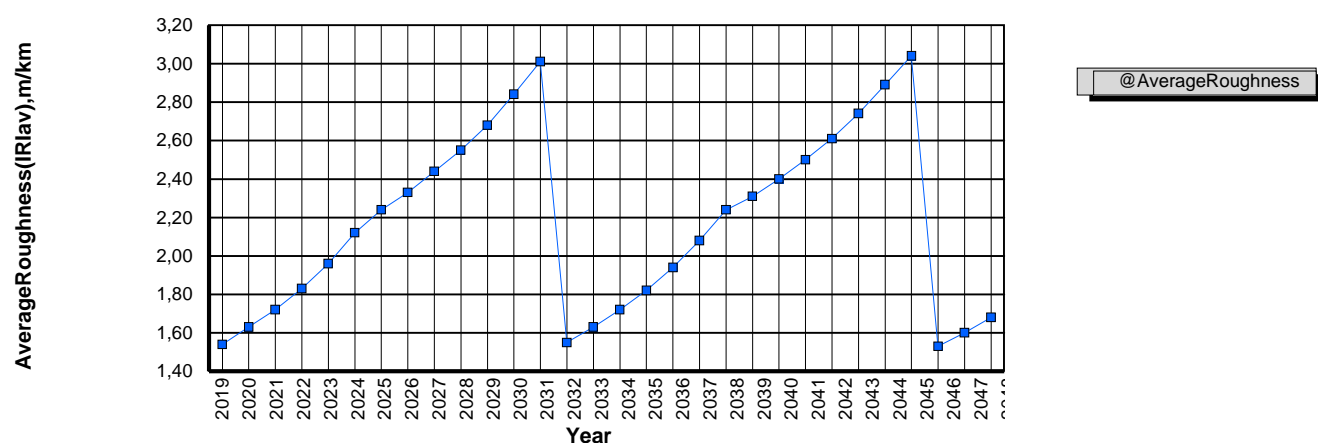
Curvature: 3,00 deg/km

oad Class: Primary or Trunk

Progression of Cracking over time
(after works values)



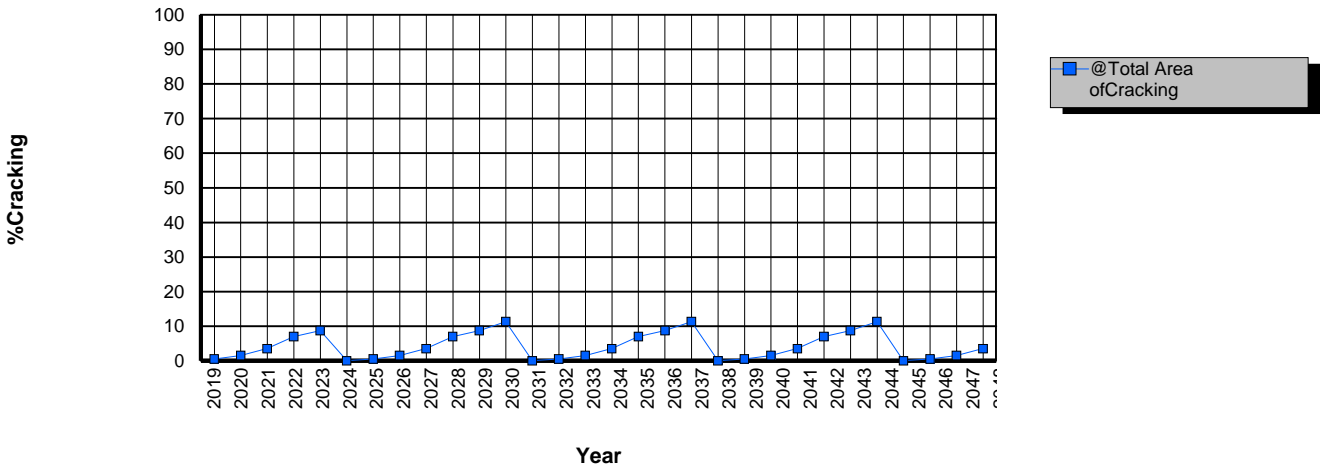
Progression of Average Roughness over time



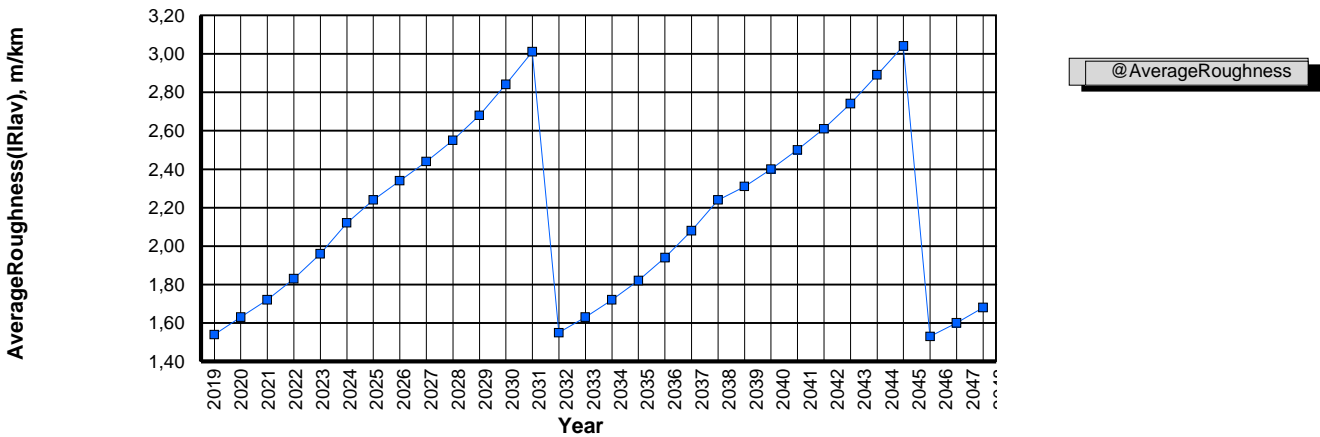
Section: Str4-02-RHS-608250-613000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:4,75km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

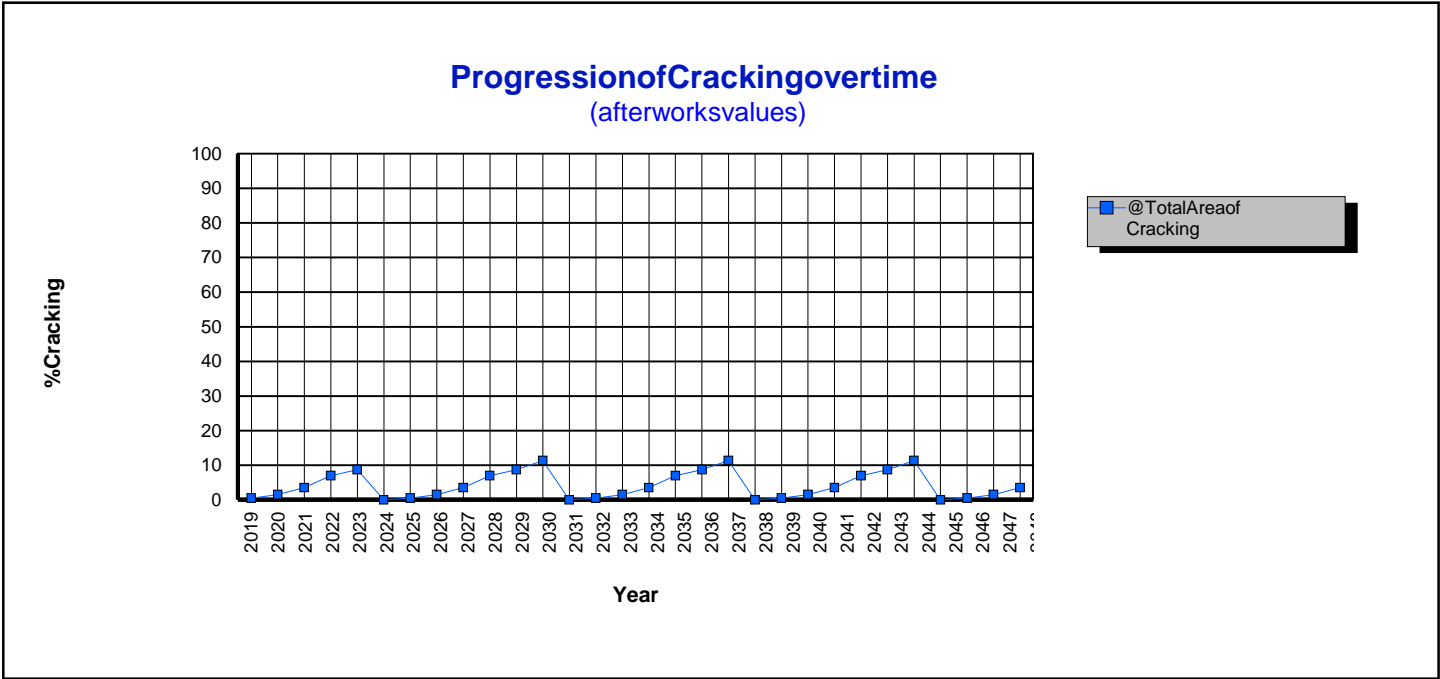


ProgressionofAverageRoughnessovertime

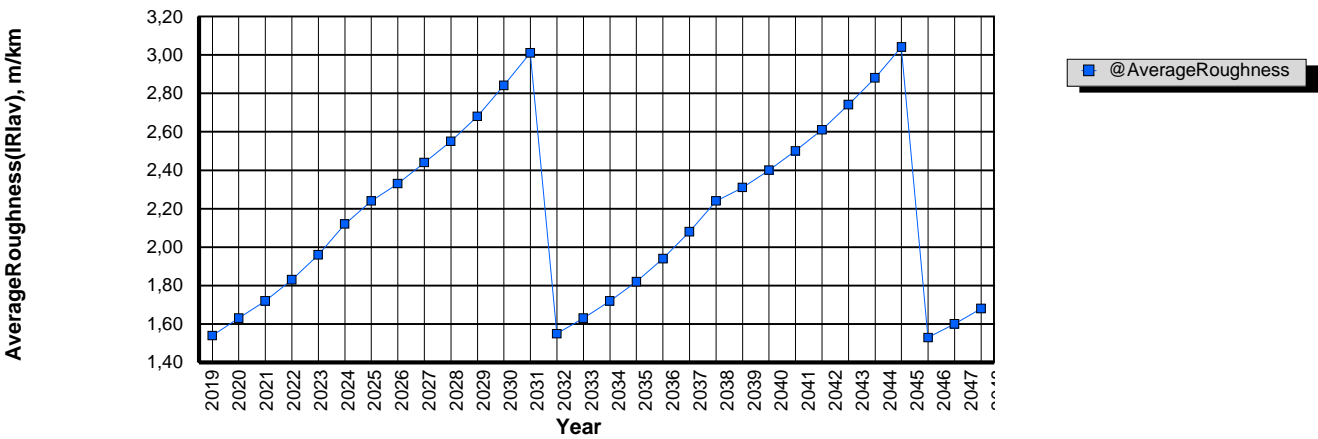


Section: Str4-03-RHS-613000-617500
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:4,50km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

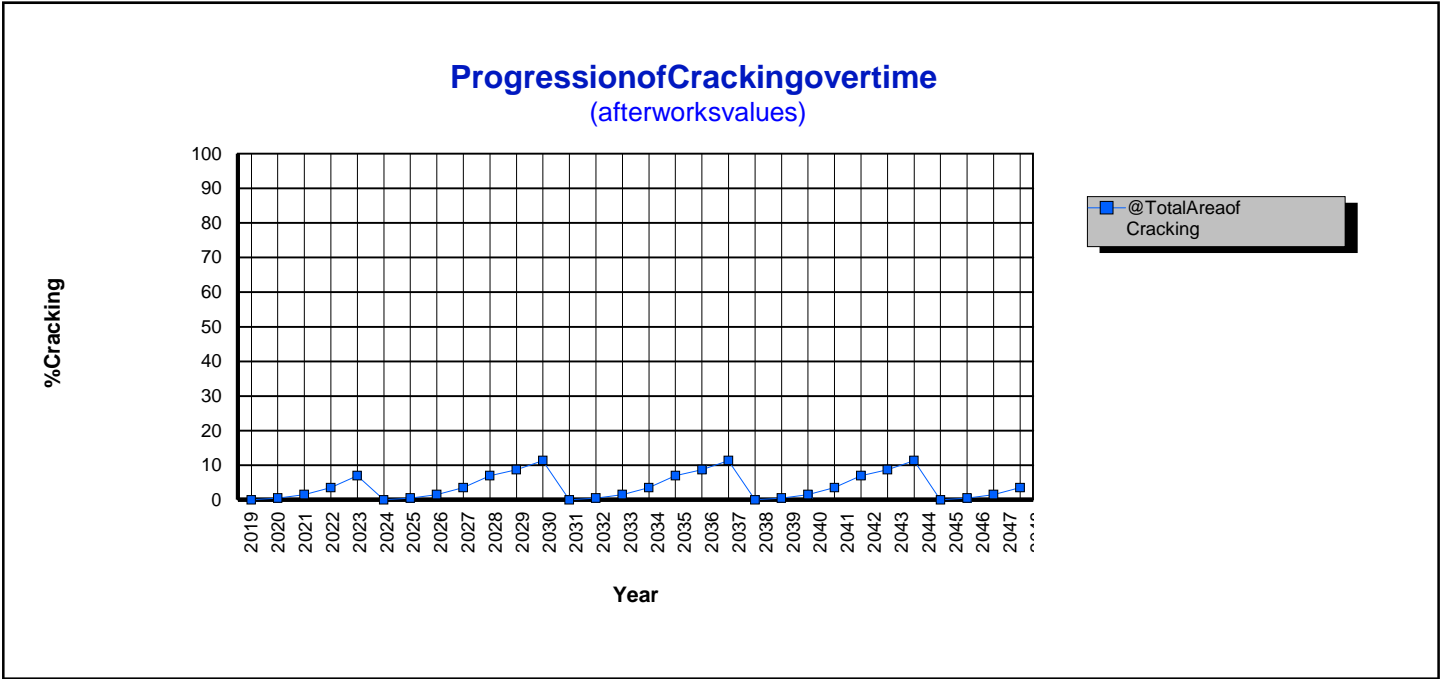


ProgressionofAverageRoughnessovertime

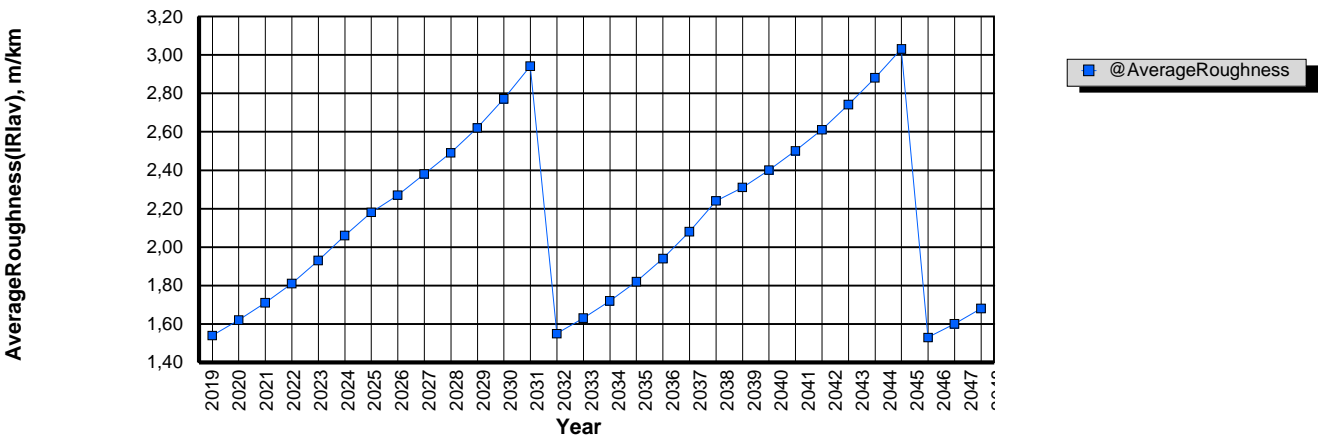


Section: Str4-04-RHS-617500-623000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:5,50km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



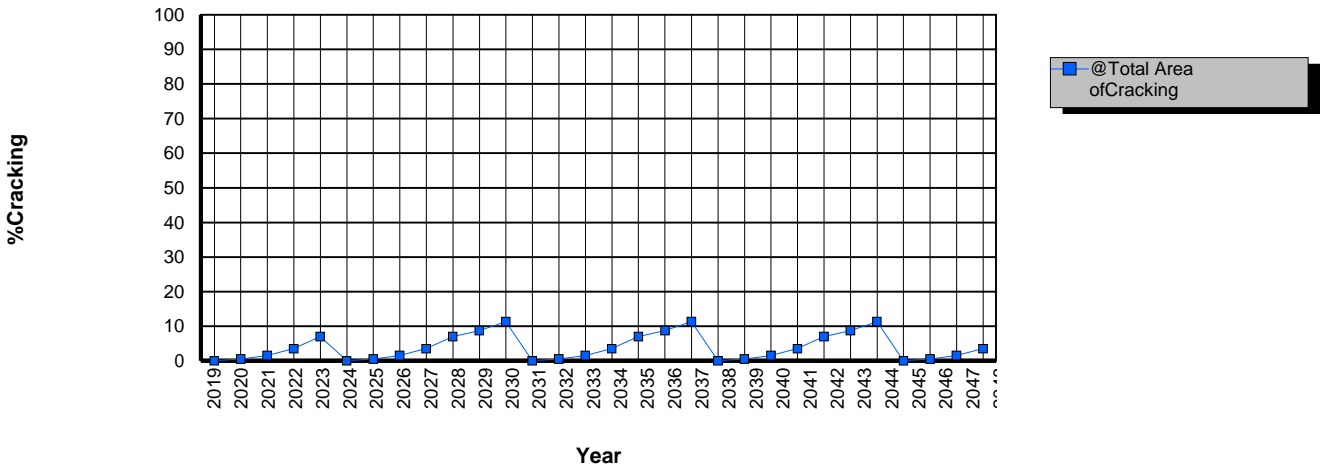
ProgressionofAverageRoughnessovertime



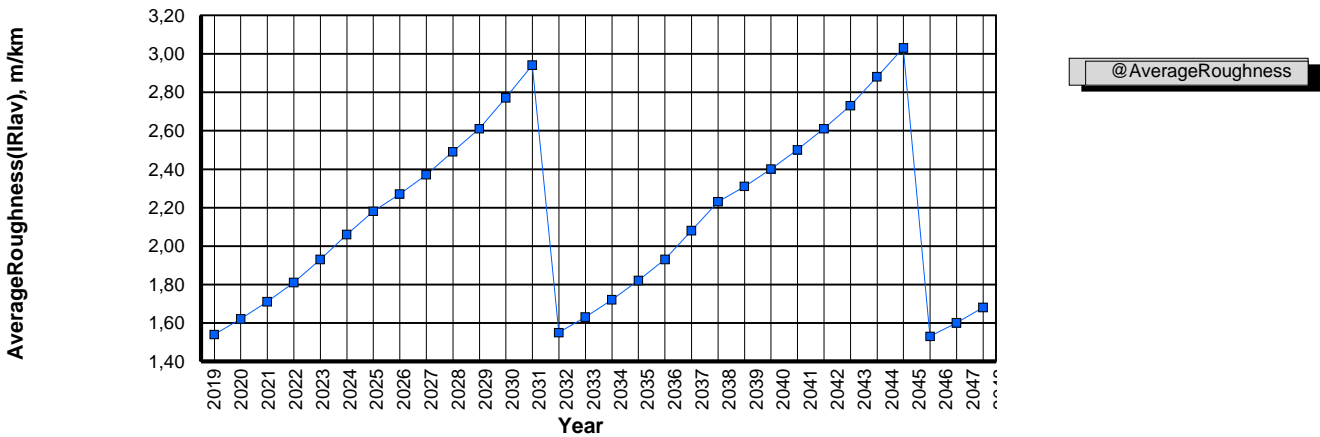
Section: Str4-05-RHS-623000-629000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:6,00km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

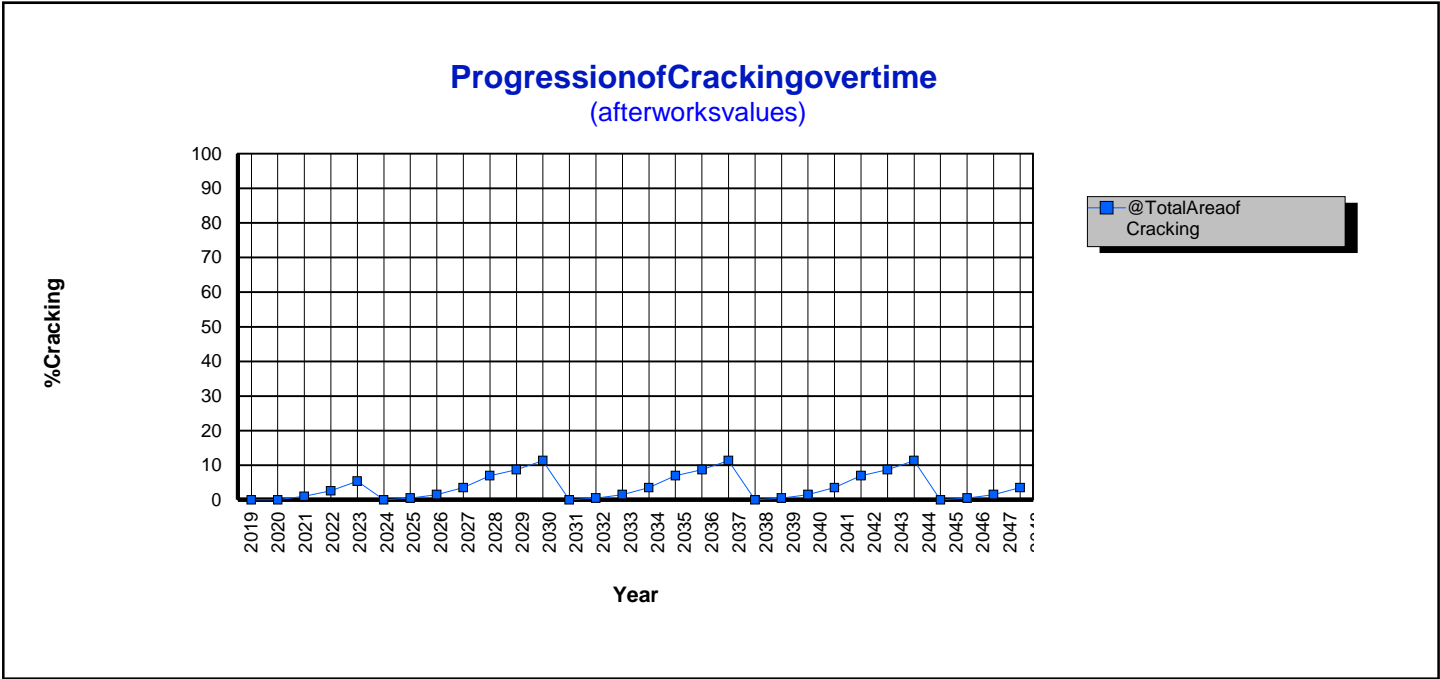


ProgressionofAverageRoughnessovertime

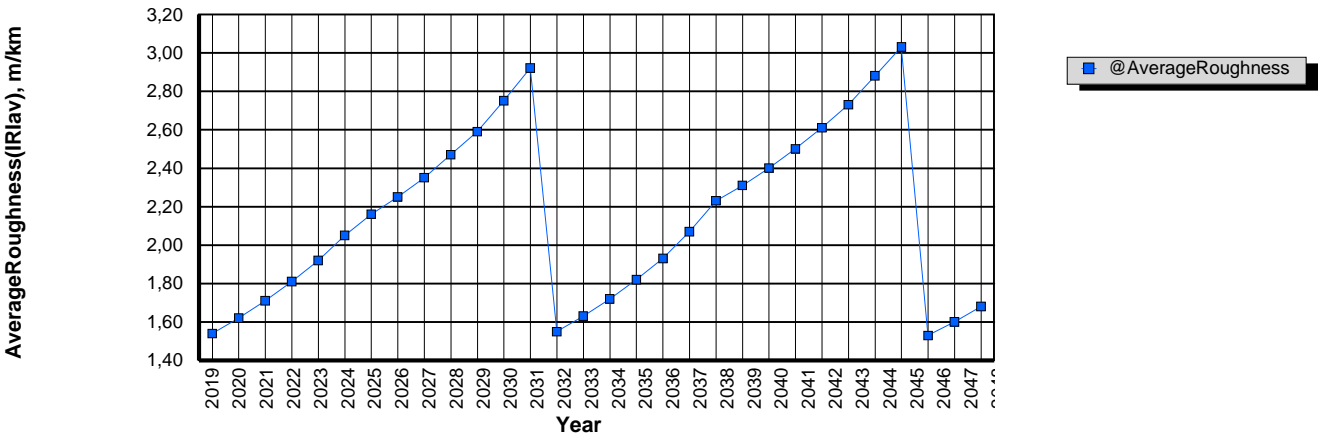


Section: Str4-06-RHS-629000-633500
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:4,50km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



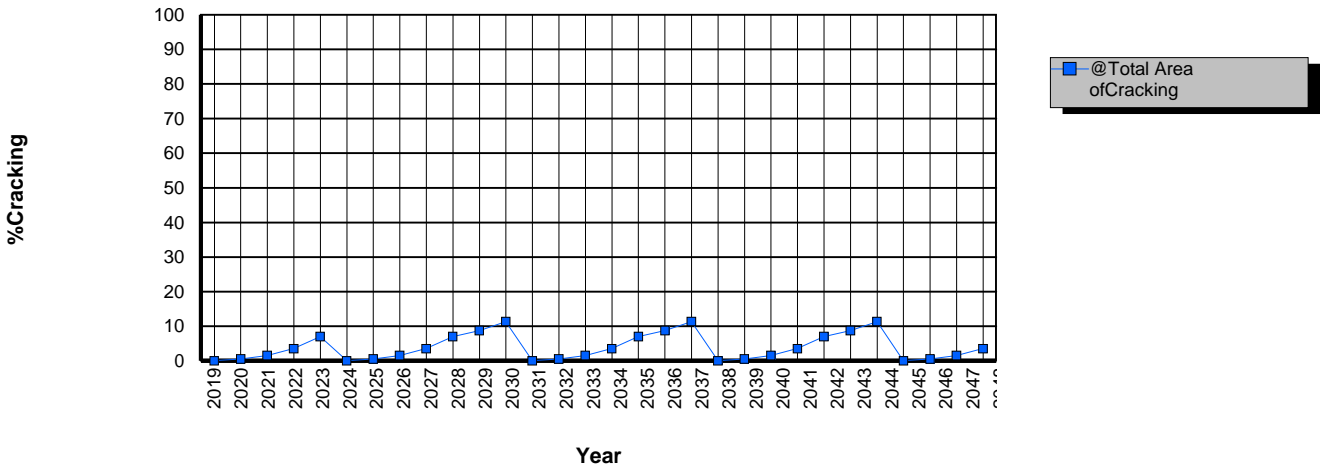
ProgressionofAverageRoughnessovertime



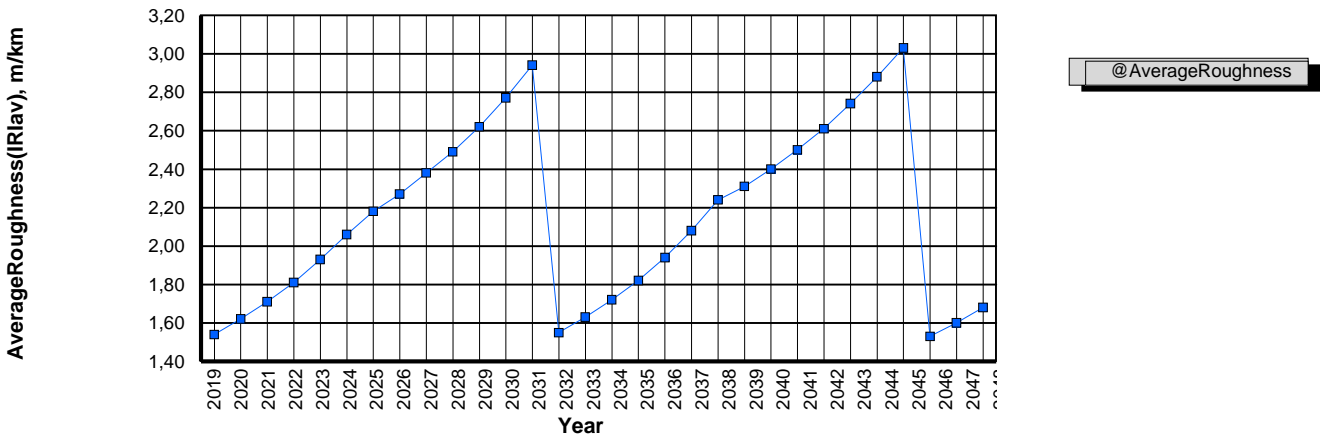
Section: Str4-07-RHS-633500-639000
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:5,50km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)

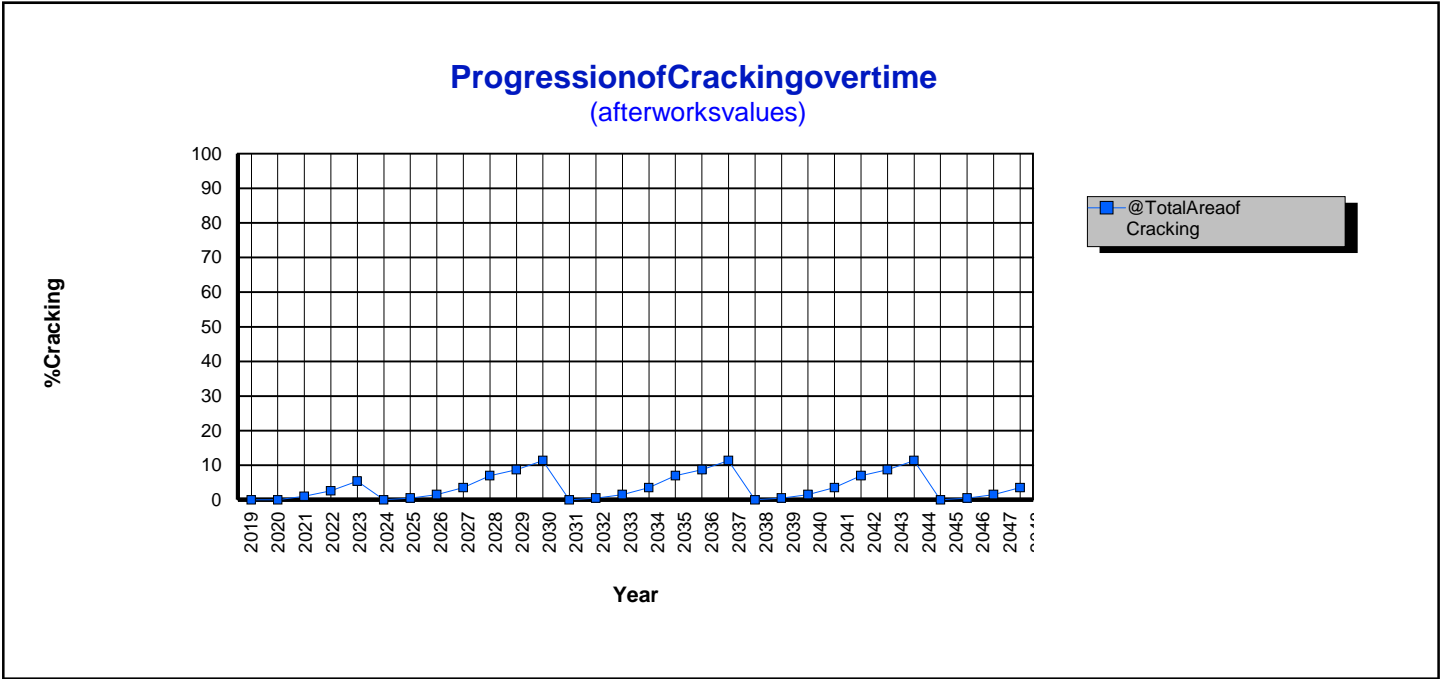


ProgressionofAverageRoughnessovertime

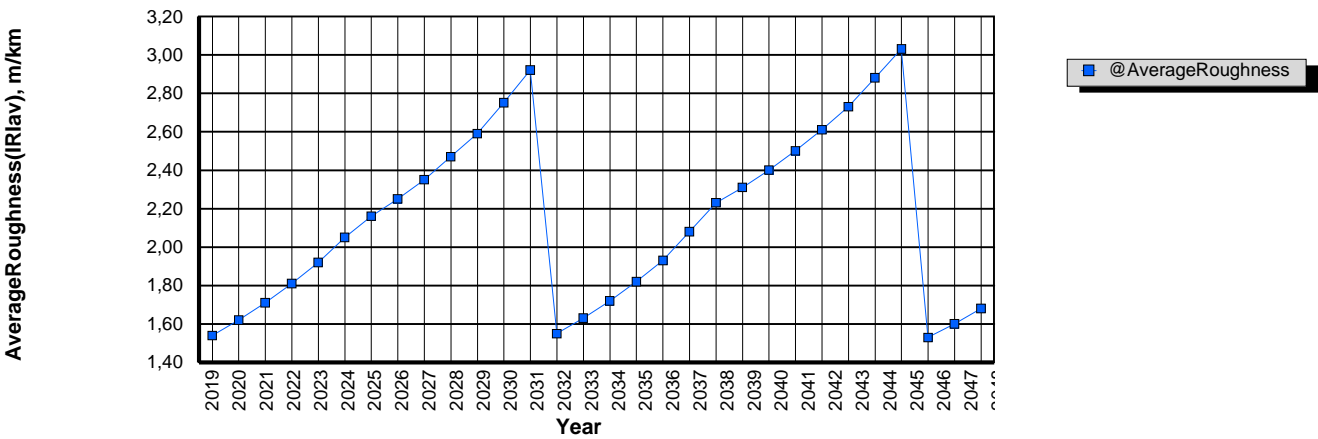


Section: Str4-08-RHS-639000-642250
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:3,25km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk



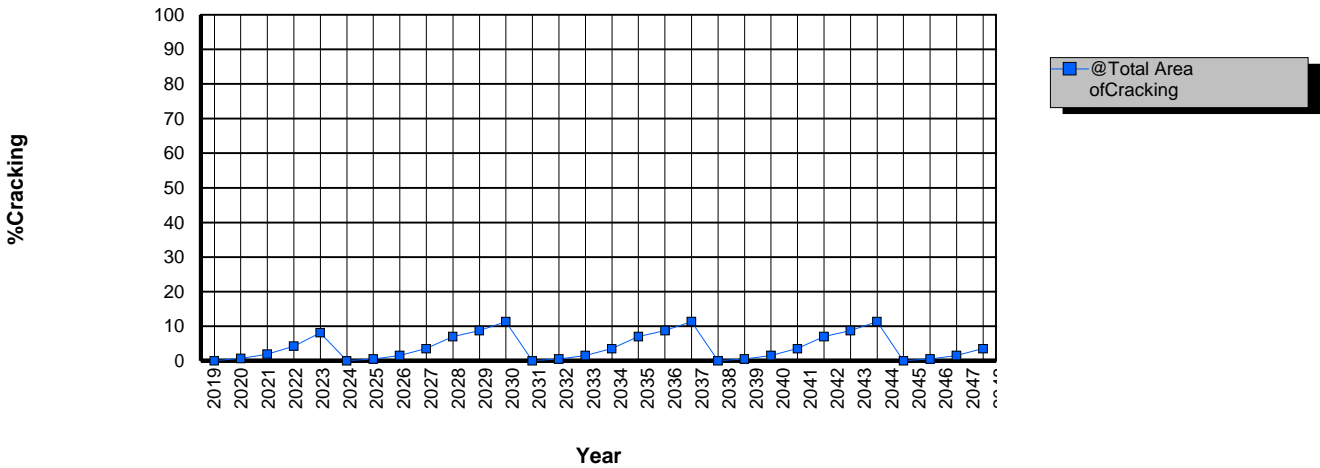
ProgressionofAverageRoughnessovertime



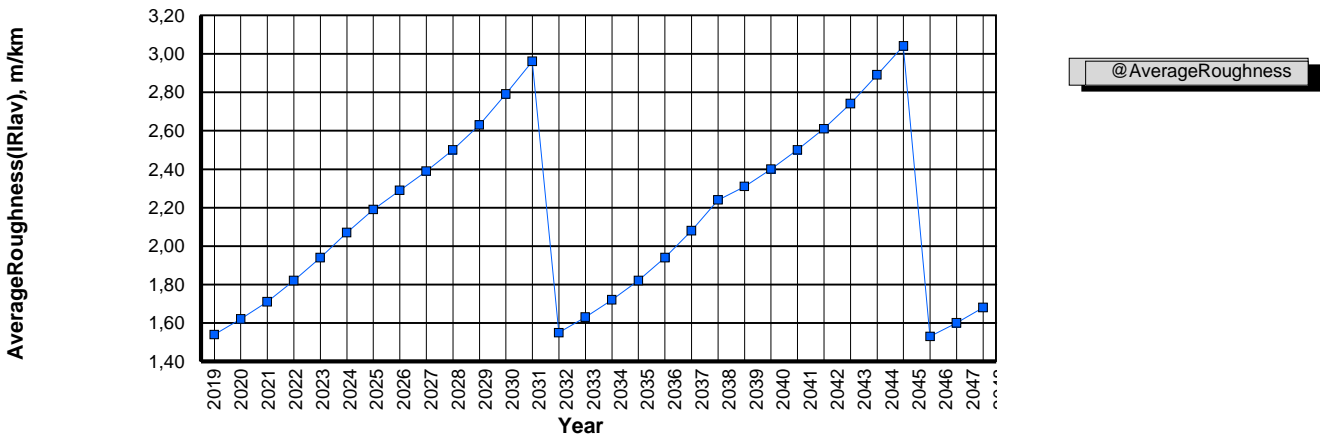
Section: Str4-09-RHS-642250-645500
Alternative:BaseAlternative
Sensitivity:NoSensitivityAnalysisConducted

Length:3,25km Width:7,00m Rise+Fall:1,00m/km Curvature:3,00deg/km oadClass:Primaryor Trunk

ProgressionofCrackingovertime
(afterworksvalues)



ProgressionofAverageRoughnessovertime



Note:onlysectionsthathaveworkstriggeredaredisplayed.

Section: Str4-01-RHS-601000-608250
Alternative: BaseAlternative
Sensitivity: NoSensitivityAnalysisConducted
SurfaceClass: Bituminous
Length: 7,25km

RoadClass: PrimaryorTrunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	1.842,04sq.m
2024	Overlay2024	O24	0.0	0.0	50.750,00sq.m
2029	Patching	Patch	0.0	0.0	1.842,04sq.m
2030	Patching	Patch	0.0	0.0	1.842,04sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	50.750,00sq.m
2036	Patching	Patch	0.0	0.0	1.842,04sq.m
2037	Patching	Patch	0.0	0.0	1.842,04sq.m
2038	Overlay2038	O38	0.0	0.0	50.750,00sq.m
2043	Patching	Patch	0.0	0.0	1.842,04sq.m
2044	Patching	Patch	0.0	0.0	1.842,04sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	50.750,00sq.m
Totalcostforthissection:			0.0	0.0	

Section: Str4-02-RHS-608250-613000
Alternative: BaseAlternative
Sensitivity: NoSensitivityAnalysisConducted
SurfaceClass: Bituminous
Length: 4,75km

RoadClass: PrimaryorTrunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	1.206,85sq.m
2024	Overlay2024	O24	0.0	0.0	33.250,00sq.m
2029	Patching	Patch	0.0	0.0	1.206,85sq.m
2030	Patching	Patch	0.0	0.0	1.206,85sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	33.250,00sq.m
2036	Patching	Patch	0.0	0.0	1.206,85sq.m
2037	Patching	Patch	0.0	0.0	1.206,85sq.m
2038	Overlay2038	O38	0.0	0.0	33.250,00sq.m
2043	Patching	Patch	0.0	0.0	1.206,85sq.m
2044	Patching	Patch	0.0	0.0	1.206,85sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	33.250,00sq.m
Totalcostforthissection:			0.0	0.0	

Section:	Str4-03-RHS-613000-617500	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	4,50km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2023	Patching	Patch	0.0	0.0	1.143,34sq.m
2024	Overlay2024	O24	0.0	0.0	31.500,00sq.m
2029	Patching	Patch	0.0	0.0	1.143,34sq.m
2030	Patching	Patch	0.0	0.0	1.143,34sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	31.500,00sq.m
2036	Patching	Patch	0.0	0.0	1.143,34sq.m
2037	Patching	Patch	0.0	0.0	1.143,34sq.m
2038	Overlay2038	O38	0.0	0.0	31.500,00sq.m
2043	Patching	Patch	0.0	0.0	1.143,34sq.m
2044	Patching	Patch	0.0	0.0	1.143,34sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	31.500,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-04-RHS-617500-623000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	5,50km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	38.500,00sq.m
2029	Patching	Patch	0.0	0.0	1.397,41sq.m
2030	Patching	Patch	0.0	0.0	1.397,41sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	38.500,00sq.m
2036	Patching	Patch	0.0	0.0	1.397,41sq.m
2037	Patching	Patch	0.0	0.0	1.397,41sq.m
2038	Overlay2038	O38	0.0	0.0	38.500,00sq.m
2043	Patching	Patch	0.0	0.0	1.397,41sq.m
2044	Patching	Patch	0.0	0.0	1.397,41sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	38.500,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-05-RHS-623000-629000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	6,00km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	42.000,00sq.m
2029	Patching	Patch	0.0	0.0	1.524,45sq.m
2030	Patching	Patch	0.0	0.0	1.524,45sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	42.000,00sq.m
2036	Patching	Patch	0.0	0.0	1.524,45sq.m
2037	Patching	Patch	0.0	0.0	1.524,45sq.m
2038	Overlay2038	O38	0.0	0.0	42.000,00sq.m
2043	Patching	Patch	0.0	0.0	1.524,45sq.m
2044	Patching	Patch	0.0	0.0	1.524,45sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	42.000,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-06-RHS-629000-633500	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	4,50km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	31.500,00sq.m
2029	Patching	Patch	0.0	0.0	1.143,34sq.m
2030	Patching	Patch	0.0	0.0	1.143,34sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	31.500,00sq.m
2036	Patching	Patch	0.0	0.0	1.143,34sq.m
2037	Patching	Patch	0.0	0.0	1.143,34sq.m
2038	Overlay2038	O38	0.0	0.0	31.500,00sq.m
2043	Patching	Patch	0.0	0.0	1.143,34sq.m
2044	Patching	Patch	0.0	0.0	1.143,34sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	31.500,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-07-RHS-633500-639000	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	5,50km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	38.500,00sq.m
2029	Patching	Patch	0.0	0.0	1.397,41sq.m
2030	Patching	Patch	0.0	0.0	1.397,41sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	38.500,00sq.m
2036	Patching	Patch	0.0	0.0	1.397,41sq.m
2037	Patching	Patch	0.0	0.0	1.397,41sq.m
2038	Overlay2038	O38	0.0	0.0	38.500,00sq.m
2043	Patching	Patch	0.0	0.0	1.397,41sq.m
2044	Patching	Patch	0.0	0.0	1.397,41sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	38.500,00sq.m
Totalcostforthesection:			0.0	0.0	

Section:	Str4-08-RHS-639000-642250	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	3,25km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	22.750,00sq.m
2029	Patching	Patch	0.0	0.0	825,74sq.m
2030	Patching	Patch	0.0	0.0	825,74sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	22.750,00sq.m
2036	Patching	Patch	0.0	0.0	825,74sq.m
2037	Patching	Patch	0.0	0.0	825,74sq.m
2038	Overlay2038	O38	0.0	0.0	22.750,00sq.m
2043	Patching	Patch	0.0	0.0	825,74sq.m
2044	Patching	Patch	0.0	0.0	825,74sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	22.750,00sq.m

Totalcostforthesection:	0.0	0.0
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Section:	Str4-09-RHS-642250-645500	
Alternative:	BaseAlternative	
Sensitivity:	NoSensitivityAnalysisConducted	
SurfaceClass:	Bituminous	RoadClass:PrimaryorTrunk
Length:	3,25km	Width:7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2024	Overlay2024	O24	0.0	0.0	22.750,00sq.m
2029	Patching	Patch	0.0	0.0	825,74sq.m
2030	Patching	Patch	0.0	0.0	825,74sq.m
2031	MillingandOverlay2031	MO31	0.0	0.0	22.750,00sq.m
2036	Patching	Patch	0.0	0.0	825,74sq.m
2037	Patching	Patch	0.0	0.0	825,74sq.m
2038	Overlay2038	O38	0.0	0.0	22.750,00sq.m
2043	Patching	Patch	0.0	0.0	825,74sq.m
2044	Patching	Patch	0.0	0.0	825,74sq.m
2045	MillingandOverlay2045	MO45	0.0	0.0	22.750,00sq.m

Totalcostforthesection:	0.0	0.0
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Summary of Total Annual Economic Costs

:BaseSensitivityScenario

	BaseAlternative
2023	0.00
2024	0.00
2029	0.00
2030	0.00
2031	0.00
2036	0.00
2037	0.00
2038	0.00
2043	0.00
2044	0.00
2045	0.00
Total	0,00

ANNEXURE 7 AAHSTO-HDMCALCULATIONS RESULTS

STRETCH4. LHS #HDM-4ID	Geometry				Current structural condition(2018)			
	Section	From	To	Length (m)	Average D eflection(mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thick ness(m m)
Str4-01-LHS	1	601+000	605+000	4000	16	20	8,93	240
Str4-02-LHS	2	605+000	608+000	3000	17	21	8,06	240
Str4-03-LHS	3	608+000	611+000	3000	18	22	7,68	210
Str4-04-LHS	4	611+000	615+000	4000	25	31	6,96	210
Str4-05-LHS	5	615+000	616+500	1500	24	30	6,85	230
Str4-06-LHS	6	616+500	618+250	1750	19	23	7,12	230
Str4-07-LHS	7	618+250	620+250	2000	20	25	7,07	230
Str4-08-LHS	8	620+250	623+000	2750	22	27	6,80	235
Str4-09-LHS	9	623+000	628+000	5000	20	25	6,85	220
Str4-10-LHS	10	628+000	630+250	2250	25	31	7,12	200
Str4-11-LHS	11	630+250	633+500	3250	21	26	7,07	200
Str4-12-LHS	12	633+500	639+000	5500	21	26	6,80	200
Str4-13-LHS	14	639+000	645+000	6000	22	27	6,85	230

STRETCH4. LHS #HDM-4ID	ProposedOverlay(2019)							MSA/day (2019)
	SN beforew orks	Milling(mm)	BC(a1 =0,42) (mm)	DBM(a 2=0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional	
Str4-01-LHS	8,49	0	30	0	30	8,98	Funcional	28878
Str4-02-LHS	7,65	0	30	0	30	8,15	Structural	28878
Str4-03-LHS	7,30	0	30	0	30	7,80	Structural	28878
Str4-04-LHS	6,62	0	30	40	70	7,74	Structural	28878
Str4-05-LHS	6,50	0	50	0	50	7,33	Structural	28878
Str4-06-LHS	6,76	0	30	0	30	7,26	Structural	28878
Str4-07-LHS	6,72	0	40	0	40	7,38	Structural	28878
Str4-08-LHS	6,46	0	40	0	40	7,12	Structural	28878
Str4-09-LHS	6,50	0	40	0	40	7,17	Structural	28878
Str4-10-LHS	6,76	0	40	40	80	8,06	Structural	28878
Str4-11-LHS	6,72	0	30	40	70	7,84	Structural	28878
Str4-12-LHS	6,46	0	30	40	70	7,59	Structural	28878
Str4-13-LHS	6,50	0	30	40	70	7,63	Structural	28878

STRETCH4. LHS #HDM-4ID	ProposedWork(2024)								
	MSA20 24-2033	SN beforewor ks	Required SN2024- 2033	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-LHS	68,31	6,78	7,10	0	30	0	30	7,29	Structural
Str4-02-LHS	68,31	6,78	7,10	0	30	0	30	7,29	Structural
Str4-03-LHS	68,31	6,79	7,10	0	30	0	30	7,30	Structural
Str4-04-LHS	68,31	6,80	7,10	0	30	0	30	7,31	Structural
Str4-05-LHS	68,31	6,78	7,10	0	30	0	30	7,29	Structural
Str4-06-LHS	68,31	6,78	7,10	0	30	0	30	7,29	Structural
Str4-07-LHS	68,31	6,81	7,10	0	30	0	30	7,32	Structural
Str4-08-LHS	68,31	6,81	7,10	0	30	0	30	7,32	Structural
Str4-09-LHS	68,31	6,82	7,10	0	30	0	30	7,32	Structural
Str4-10-LHS	68,31	6,82	7,10	0	30	0	30	7,33	Structural
Str4-11-LHS	68,31	6,80	7,10	0	30	0	30	7,31	Structural
Str4-12-LHS	68,31	6,80	7,10	0	30	0	30	7,31	Structural
Str4-13-LHS	68,31	6,79	7,10	0	30	0	30	7,30	Structural

STRETCH4. LHS #HDM-4ID	ProposedWork(2031)								
	MSA20 31-2040	SN beforewor ks	Required SN2031- 2040	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-LHS	72,31	7,24	7,15	30	30	0	0	7,37	Functional
Str4-02-LHS	72,31	7,24	7,15	30	30	0	0	7,37	Functional
Str4-03-LHS	72,31	7,26	7,15	30	30	0	0	7,38	Functional
Str4-04-LHS	72,31	7,26	7,15	30	30	0	0	7,39	Functional
Str4-05-LHS	72,31	7,25	7,15	30	30	0	0	7,37	Functional
Str4-06-LHS	72,31	7,25	7,15	30	30	0	0	7,37	Functional
Str4-07-LHS	72,31	7,27	7,15	30	30	0	0	7,40	Functional
Str4-08-LHS	72,31	7,27	7,15	30	30	0	0	7,40	Functional
Str4-09-LHS	72,31	7,28	7,15	30	30	0	0	7,40	Functional
Str4-10-LHS	72,31	7,28	7,15	30	30	0	0	7,41	Functional
Str4-11-LHS	72,31	7,27	7,15	30	30	0	0	7,39	Functional
Str4-12-LHS	72,31	7,27	7,15	30	30	0	0	7,39	Functional
Str4-13-LHS	72,31	7,26	7,15	30	30	0	0	7,38	Functional

STRETCH4. LHS #HDM-4ID	ProposedWork(2038)								
	MSA20 38-2047	SN beforewor ks	Required SN2038- 2047	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-LHS	92,34	7,33	7,38	0	30	0	30	7,84	Structural
Str4-02-LHS	92,34	7,33	7,38	0	30	0	30	7,84	Structural
Str4-03-LHS	92,34	7,34	7,38	0	30	0	30	7,85	Structural
Str4-04-LHS	92,34	7,34	7,38	0	30	0	30	7,86	Structural
Str4-05-LHS	92,34	7,33	7,38	0	30	0	30	7,85	Structural
Str4-06-LHS	92,34	7,33	7,38	0	30	0	30	7,85	Structural
Str4-07-LHS	92,34	7,36	7,38	0	30	0	30	7,87	Structural
Str4-08-LHS	92,34	7,35	7,38	0	30	0	30	7,87	Structural
Str4-09-LHS	92,34	7,36	7,38	0	30	0	30	7,88	Structural
Str4-10-LHS	92,34	7,37	7,38	0	30	0	30	7,88	Structural
Str4-11-LHS	92,34	7,35	7,38	0	30	0	30	7,86	Structural
Str4-12-LHS	92,34	7,35	7,38	0	30	0	30	7,86	Structural
Str4-13-LHS	92,34	7,34	7,38	0	30	0	30	7,85	Structural

STRETCH4. LHS #HDM-4ID	ProposedWork(2045)								
	MSA20 45-2054	SN beforewor ks	Required SN2045- 2054	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-LHS	100,72	7,80	7,46	30	30	0	0	7,92	Functional
Str4-02-LHS	100,72	7,80	7,46	30	30	0	0	7,92	Functional
Str4-03-LHS	100,72	7,81	7,46	30	30	0	0	7,94	Functional
Str4-04-LHS	100,72	7,82	7,46	30	30	0	0	7,94	Functional
Str4-05-LHS	100,72	7,80	7,46	30	30	0	0	7,93	Functional
Str4-06-LHS	100,72	7,80	7,46	30	30	0	0	7,93	Functional
Str4-07-LHS	100,72	7,83	7,46	30	30	0	0	7,95	Functional
Str4-08-LHS	100,72	7,83	7,46	30	30	0	0	7,95	Functional
Str4-09-LHS	100,72	7,83	7,46	30	30	0	0	7,96	Functional
Str4-10-LHS	100,72	7,84	7,46	30	30	0	0	7,96	Functional
Str4-11-LHS	100,72	7,82	7,46	30	30	0	0	7,95	Functional
Str4-12-LHS	100,72	7,82	7,46	30	30	0	0	7,95	Functional
Str4-13-LHS	100,72	7,81	7,46	30	30	0	0	7,94	Functional

STRETCH4. RHS #HDM-4ID	Geometry				Current structural condition(2018)			
	Section	From	To	Length (m)	Average Deflection(mm^{-2})	Normalized Deflection to HDM (mm^{-2})	SN before works	Old BT thickness(mm)
Str4-01-RHS	1	601+000	608+250	7250	15	18	9,30	225
Str4-02-RHS	2	608+250	613+000	4750	15	18	9,30	245
Str4-03-RHS	3	613+000	617+500	4500	15	18	9,30	210
Str4-04-RHS	4	617+500	623+000	5500	21	26	7,53	210
Str4-05-RHS	5	623+000	629+000	6000	18	22	8,29	180
Str4-06-RHS	6	629+000	633+500	4500	17	21	8,60	180
Str4-07-RHS	7	633+500	639+000	5500	18	22	8,29	210
Str4-08-RHS	8	639+000	642+250	3250	23	28	7,11	210
Str4-09-RHS	9	642+250	645+500	3250	22	27	7,31	250

STRETCH4. RHS #HDM-4ID	ProposedOverlay(2019)							MSA/day (2019)
	SN beforew orks	Milling(mm)	BC(a1 =0,42) (mm)	DBM(a 2=0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional	
Str4-01-RHS	8,84	0	30	0	30	9,34	Functional	28610
Str4-02-RHS	8,84	0	30	0	30	9,34	Structural	28610
Str4-03-RHS	8,84	0	30	0	30	9,34	Structural	28610
Str4-04-RHS	7,15	0	30	40	70	8,28	Structural	28610
Str4-05-RHS	7,88	0	30	40	70	9,01	Structural	28610
Str4-06-RHS	8,17	0	40	40	80	9,46	Structural	28610
Str4-07-RHS	7,88	0	30	40	70	9,01	Structural	28610
Str4-08-RHS	6,75	0	40	40	80	8,04	Structural	28610
Str4-09-RHS	6,94	0	50	0	50	7,77	Structural	28610

STRETCH4. RHS #HDM-4ID	ProposedWork(2024)								
	MSA20 24-2033	SN beforewor ks	Required SN2024- 2033	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-RHS	67,86	6,78	7,09	0	30	0	30	7,29	Structural
Str4-02-RHS	67,86	6,77	7,09	0	30	0	30	7,29	Structural
Str4-03-RHS	67,86	6,79	7,09	0	30	0	30	7,30	Structural
Str4-04-RHS	67,86	6,80	7,09	0	30	0	30	7,31	Structural
Str4-05-RHS	67,86	6,81	7,09	0	30	0	30	7,32	Structural
Str4-06-RHS	67,86	6,83	7,09	0	30	0	30	7,33	Structural
Str4-07-RHS	67,86	6,80	7,09	0	30	0	30	7,31	Structural
Str4-08-RHS	67,86	6,82	7,09	0	30	0	30	7,32	Structural
Str4-09-RHS	67,86	6,77	7,09	0	30	0	30	7,28	Structural

STRETCH4. RHS #HDM-4ID	ProposedWork(2031)								
	MSA20 31-2040	SN beforewor ks	Required SN2031- 2040	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-RHS	71,99	7,25	7,14	30	30	0	0	7,37	Functional
Str4-02-RHS	71,99	7,24	7,14	30	30	0	0	7,37	Functional
Str4-03-RHS	71,99	7,26	7,14	30	30	0	0	7,38	Functional
Str4-04-RHS	71,99	7,26	7,14	30	30	0	0	7,39	Functional
Str4-05-RHS	71,99	7,27	7,14	30	30	0	0	7,40	Functional
Str4-06-RHS	71,99	7,29	7,14	30	30	0	0	7,41	Functional
Str4-07-RHS	71,99	7,26	7,14	30	30	0	0	7,39	Functional
Str4-08-RHS	71,99	7,28	7,14	30	30	0	0	7,41	Functional
Str4-09-RHS	71,99	7,24	7,14	30	30	0	0	7,37	Functional

STRETCH4. RHS #HDM-4ID	ProposedWork(2038)								
	MSA20 38-2047	SN beforewor ks	Required SN2038- 2047	Milling (mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-RHS	92,14	7,33	7,37	0	30	0	30	7,85	Structural
Str4-02-RHS	92,14	7,32	7,37	0	30	0	30	7,84	Structural
Str4-03-RHS	92,14	7,34	7,37	0	30	0	30	7,85	Structural
Str4-04-RHS	92,14	7,34	7,37	0	30	0	30	7,86	Structural
Str4-05-RHS	92,14	7,35	7,37	0	30	0	30	7,87	Structural
Str4-06-RHS	92,14	7,36	7,37	0	30	0	30	7,89	Structural
Str4-07-RHS	92,14	7,34	7,37	0	30	0	30	7,86	Structural
Str4-08-RHS	92,14	7,36	7,37	0	30	0	30	7,88	Structural
Str4-09-RHS	92,14	7,32	7,37	0	30	0	30	7,84	Structural

STRETCH4. RHS #HDM-4ID	ProposedWork(2045)								
	MSA20 45-2054	SN before works	Required SN2045- 2054	Milling(mm)	BC(a1 =0,42) (mm)	DBM(a2 =0,40) (mm)	Totalover laythickn ess(mm)	SN afterw orks	Structural/ Functional
Str4-01-RHS	100,73	7,80	7,46	30	30	0	0	7,93	Functional
Str4-02-RHS	100,73	7,80	7,46	30	30	0	0	7,92	Functional
Str4-03-RHS	100,73	7,81	7,46	30	30	0	0	7,94	Functional
Str4-04-RHS	100,73	7,82	7,46	30	30	0	0	7,94	Functional
Str4-05-RHS	100,73	7,83	7,46	30	30	0	0	7,95	Functional
Str4-06-RHS	100,73	7,84	7,46	30	30	0	0	7,97	Functional
Str4-07-RHS	100,73	7,82	7,46	30	30	0	0	7,94	Functional
Str4-08-RHS	100,73	7,83	7,46	30	30	0	0	7,96	Functional
Str4-09-RHS	100,73	7,79	7,46	30	30	0	0	7,92	Functional



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ANNEXURE 8 STRUCTURES

Box Culvert

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. work	Condition of Structure	Remark
1	609/1	608+070	1 x 3.00	Good	Good	Cleaning of vegetation
2	609/2	608+120	1 x 3.00	Good	Good	Cleaning of vegetation
3	609/3	608+145	1 x 3.00	Good	Good	Cleaning of vegetation
4	609/5	608+200	1 x 4.00	Fair	Good	Stone pitching required And cleaning of vegetation
5	609/6	608+250	1 x 3.00	Good	Good	Cleaning of vegetation
6	609/7	608+300	1 x 3.00	Good	Good	Cleaning of water way & vegetation
7	609/8	608+350	1 x 3.00	Good	Good	Improvement of stone pitching and cleaning of vegetation
8	610/2	609+620	1 x 3.00	Good	Good	Cleaning of vegetation
9	610/3	609+670	1 x 3.00	Fair	Good	Stone pitching required And cleaning of vegetation
10	610/4	609+700	1 x 3.00	Fair	Good	Cleaning of water way ,vegetation and improvement of stone pitch
11	610/5	610+000	1 x 3.00	Fair	Fair	Stone pitching required And cleaning of vegetation
12	611/1	610+060	1 x 2.00	Fair	Fair	Improvement of stone pitching and cleaning of vegetation
13	614/3	613+910	1 x 4.00	Good	Good	Cleaning of vegetation
14	615/3	614+660	1 x 4.50	Good	Good	Cleaning of water way & vegetation
15	616/2	615+430	1 x 2.00	Good	Good	Cleaning of water way & vegetation
16	621/1	620+880	1 x 2.00	Good	Good	Cleaning of water way & vegetation
17	623/1	622+650	1 x 2.00	Good	Good	Cleaning of water way & vegetation
18	624/1	623+520	1 x 2.50	Good	Good	Cleaning of vegetation
19	625/1	624+390	1 x 3.40	Good	Good	Cleaning of water way & vegetation

20	628/1	627+700	1 x 2.00	Good	Good	Stone pitching required And cleaning of vegetation
21	629/2	628+550	1 x 4.80	Good	Good	Cleaning of water way & vegetation
22	630/1	629+300	1 x 2.00	Good	Good	Cleaning of vegetation
23	631/1	630+090	1 x 2.00	Good	Fair	Cleaning of water way & vegetation
24	633/3	632+740	1 x 2.00	Good	Fair	Stone pitching required And cleaning of vegetation
25	638/1	637+700	1 x 2.00	Good	Good	Stone pitching required And cleaning of vegetation
26	640/1	639+205	1 x 2.00	Good	Good	Cleaning of water way & vegetation
27	641/1	640+810	1 x 1.00	Good	Good	Stone pitching required And cleaning of vegetation
28	642/1	641+150	2 x 1.20 1 x 3.70	Good	Good	Cleaning of water way & vegetation
29	645/2	644+900	1 x 4.30	Good	Good	Stone pitching required And cleaning of vegetation
30	645/3	644+990	1 x 4.00	Fair	Fair	Improvement of stone pitching and cleaning of vegetation

Pipe Culvert

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
1	602/1	601+600	2 x 1.00	Poor	Fair	Improvement of stone pitching, cleaning of water way
2	602/2	601+850	2 x 1.00	Fair	Fair	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
3	603/1	602+650	2 x 1.00	Fair	Fair	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
4	603/2	602+900	1 x 1.00	Poor	Poor	Pipe fully choked by silt, need cleaning and also provide stone pitching
5	604/1	603+780	1 x 1.00	Fair	Good	Improvement of stone pitching
6	604/2	603+950	1 x 0.90	Poor	Good	Cleaning of water way, improvement of stone pitching
7	605/1	604+250	1 x 0.60 LHS	Fair	Good	Improvement of stone pitching and silt observed inside pipe need cleaning
			1 x 1.00 RHS	Good		Cleaning of water way & vegetation
8	605/2	604+670	1 x 1.00	Fair	Good	Cleaning of vegetation
9	606/1	605+500	1 x 1.00	Fair	Good	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
10	606/2	605+900	1 x 1.00	Fair	Fair	Cleaning of water way & vegetation
11	608/1	607+450	1 x 1.00	Fair	Fair	Improvement of stone pitching
12	612/2	611+795	1 x 1.00	Fair	Fair	Improvement of stone pitching, cleaning of water way
13	612/3	611+900	1 x 1.00	Good	Good	Improvement of stone pitching
14	612/4	611+990	1 x 1.00	Fair	Fair	Improvement of stone pitching
15	613/1	612+100	1 x 1.00	Fair	Good	Improvement of stone pitching, Cleaning of vegetation
16	613/2	612+160	1 x 1.00	Fair	Good	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
17	614/1	613+405	1 x 1.00	Poor	Fair	Cleaning of vegetation
18	614/2	613+620	1 x 1.00	Poor	Poor	Cleaning of vegetation
19	614/4	613+950	2 x 1.00	Poor	Poor	Cleaning of vegetation
20	615/1	614+300	1 x 1.00	Good	Fair	Cleaning of vegetation
21	615/2	614+500	2 x 1.00	Good	Fair	Improvement of stone pitching, cleaning of water way

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
22	616/1	615+080	1 x 1.00	Good	Good	Cleaning of water way, improvement of stone pitching
23	616/3	615+950	1 x 1.00	Fair	Good	Improvement of stone pitch, pipe is half choked by silt so cleaning of water way
24	617/1	616+220	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
25	617/2	616+730	1 x 1.00	Fair	Good	Cleaning of vegetation
26	618/1	617+000	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
27	620/1	619+150	2 x 1.00	Fair	Fair	Cleaning of water way, improvement of stone pitching
28	620/2	619+210	1 x 1.00	Fair	Fair	Cleaning of vegetation
29	620/3	619+400	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
30	625/2	624+590	2 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
31	627/1	626+240	1 x 1.00	Fair	Good	Cleaning of vegetation
32	629/1	628+470	1 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
33	630/2	629+460	1 x 1.00	Good	Good	Cleaning of vegetation
34	630/4	629+750	2 x 1.00	Good	Good	Cleaning of water way, improvement of stone pitching
35	630/5	630+000	2 x 1.00	Fair	Good	Cleaning of vegetation
36	633/1	632+770	3 x 1.20	Good	Good	Cleaning of water way, improvement of stone pitching
37	633/4	632+920	1 x 1.00	Good	Good	Cleaning of vegetation
38	635/1	632+170	2 x 1.00	Fair	Good	Cleaning of water way, improvement of stone pitching
39	635/2	634+410	2 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way
40	636/1	635+130	1 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way
41	636/3	635+570	4 x 1.20	Good	Good	Cleaning of vegetation

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protect. Work	Condition of Structure	Remark
42	639/1	638+200	1 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way
43	642/4	641+610	2 x 1.00	Good	Good	Improvement of stone pitching, cleaning of water way



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ROB

No	Location	Type of	Span	Length of	Carriageway	Width of	Protection		Pier foundation		Abutment		Present condition					Condition of various features			Presence of scour	Adequacy of waterway	Remarks
							Type	Condition	Type	Material	Type	Material	Abutments	Piers	Slab	Bearings	Parapet	Slab/Pipe/Box/Arch	Return wall	Parapet/handrill			
1	611/2	Deck Slab	1X22.100 1X29.250 1X28.500	81	2x7.0	23.5	Crash Barrier	Good	-	RCC	-	RCC	Good	Good	Good	Good	Good	Good	Good	Good	No	Yes	Skew

UNDER PASSES

Sl.No	Location (km)	Type of structure	Span arrangement and Total ventway (No. x Length) (m)	Clear height (m)	Horizontal clearance (m)	Carriageway width (m)	Width of structure (m)	Protection		Abutment foundation material	Present condition of bridge					Condition of various features of bridge			Presence of scour	Adequacy of waterway	Remarks
								Type	Condition		Abutments	Piers	Slab	Bearings	Parapet	Slab/ Pipe/ Box/ Arch	Return wall	Parapet/ handrail			
1	606+100	Box VUP	1X10.90	5.5	10.9	2x8.5	24.5	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	Skew
2	606+557	Box LVUP	1X5.00	3	5	2x8.5	24.5	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	
3	610+648	Box VUP	1X11.00	5.5	11	2x8.5	24.5	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	
4	617+710	Box VUP	1X11.00	5.5	11	2x8.5	24.5	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	
5	629+700	Box VUP	1X11.00	5.5	11	2x8.5	24.5	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	
6	635+036	Box VUP	1X11.00	5.5	11	2x8.5	24.5	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	
7	641+200	Box VUP	1X11.00	5.5	9.2	2x8.5	27	Crash Barrier	Good	RCC	Good	Good	N/A	Good	Good	Good	Good	Good	No	Yes	Skew (1X9.200)

No	Location	Type of	Span Both side	Length of	Carriageway	Width of	Protection		Pier foundation		Abutment		Present condition					Condition of various features			Presence of scour	Adequacy of waterway	Remarks
							Type	Condition	Type	Material	Type	Material	Abutments	Piers	Slab	Bearings	Parapet	Slab/Pipe /Box/Arc h	Return wall	Parapet/ handrail			
1	645/1	Deck Slab	1 x 42.650 + 1 x 42.550 + 1 x 42.500 + 1 x 42.800	170.5	2 X 8.05	8.45	Crash Barrier	Good	-	RCC	-	RCC	Good	Good	Good	Good	Good	Good	Good	Good	No	Yes	Skew

INVENTORY

1. Bridge		
1	StateCode	RJ
2	Highway	NH
3	Chainage	27
4	BridgeNumber	610/1
5	BridgeID	610-1
6	NameofRiver/NHNo/orCrossingFeature	
7	Dateofinspection	2/21/2018

2. BridgeClassification		
1	StructuralForm	Slab
2	MaterialofConstruction	Concrete
3	TypeofBridge	MajorBridge
4	LoadingasperIRC	70R
5	YearofConstruction	-
6	TrafficLaneonBridge	2LaneCarriageway
7	BridgeStructureCrossingFeatures	River
8	LengthofBridge	LHS-158.650m RHS-179.300m
9	WidthofCarriageway	8.5m(BothCarriageway)

3. BridgeStructuralRatingNumber		
1	RatingforIntegralandNon-integralDeck	:9
2	RatingforSuperstructure	:8
3	RatingforSubstructure	:8
4	RatingforBankandChannel	:8
5	RatingforStructuralEvaluation	:8
6	RatingforDeckGeometry	:7
7	RatingforVertical&HorizontalClearance	:3
8	RatingforWaterwayAdequacy	:7
9	RatingforScourefficiency	:8

1.1	RoadWidth(m)	2x7.0
1.2	OverallDeckWidth(m)	2x10.5m
1.3	ApproachRoadwayWidthIncludingShoulder(m)	2x8.5m
1.4	HeightofApproachEmbankment	NA
1.5	AverageSkew	NO
1.6	WhetherNavigable	NO
1.7	HorizontalClearance	NA
1.8	VerticalClearance	NA

2.1	CorrosionProtectionMeasures	No CorrosionProtectio n Measures
2.2	BankProtection&Type	StonePitching
2.3	FloorProtection&Type	NA
2.4	IstheBridgeLocatedinbackwater(Marine)or	Nobackwater

3.1	TypeofApproach	Embankment
3.2	MaterialofApproach	Soil
3.3	ApproachGeometrics(Straight/Curvilinearetc.)	Straight
3.4	IfApproacheshavinganySpanthenprovideSpan	Nospansinapproaches
3.5	Pavementsurface(Checkunevennesssettlement, cracking, potholesetc.)	Crackingisobserved
3.6	Sideslopes(Checkpitchedorun-pitched,condition ofpitching/turfing, anysignsofslopefailureetc.)	Un-pitchedandnoslopefailure
3.7	ErosionofEmbankmentbyraincutsoranyother damagetoEmbankment.	Noerosionofembankmentbyraincuts.
3.8	Approachslab(Check, settlement, cracks,	Nosettlement, cracks, movements
3.9	RetainingwallsType	NA
3.10	Retainingwallcondition(Checksubsidence, tilting, conditionofweep-holes, guard-stoneandrailing	NA
3.11	SiltandDebris(CheckAccumulationofsiltand debris on submersible approaches in cutting and	Accumulationofsilt, debris&vegetationobserved

4.1	Type(Mentionwhetherguide-bundorprotection aroundabutmentsorspurs.)	StonePitching
4.2	Layout, crossection profile(Checkdamagetothe layoutandthegeneralcrossectionareinorder.)	Nodamagetothe layout
4.3	Slopepitching, apron, andtoewalls(Checkfor properslope, thicknessofpitchingintheslope,	NA

4.4	Floor Protection works (Condition if impervious floor, flexible apron, curtain walls and indicate)	No floor protection
4.5	Scour (Check any abnormal scour noticed.)	NO
4.6	Reserve store material	NO

5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc.	Vegetation growth is observed
5.2	Flow pattern (Check any abnormal change in meandering in flow and erosion of banks)	No change in meandering in flow
5.3	Maximum Flood Level observed during the year and mark the same on the pier/abutment both on the	NA
5.4	Afflux from U/s and D/s (Check signs of abnormal Afflux from U/s and D/s water mark on piers if any)	NA
5.5	Check for erosion of bank	NA

6.1	Type (Main bridge and approach spans if any)	Not visible
6.2	Material	Not visible
6.3	Condition of Foundation (Check Settlement,	Not visible
6.4	Floating bodies, boulders etc (Check damage due to)	Not visible
6.5	Seepage, vehicle impact etc (For sub-ways report seepage, vehicle impact, if any damage to the)	Not visible
6.6	Check cracking, disintegration, decay, erosion,	Not visible

7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	LHS-Stone-RHS-RCC	LHS-Stone-RHS-RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting)	NA	NA
7.1.4	Efficiency of drainage of the backfill behind abutment	Weep holes present	Weep holes present
7.1.5	Maximum Depth of Abutment Foundation	NA	NA
7.1.6	Abutment Width	NA	NA
7.1.7	Abutment Thickness	NA	NA
7.2	Pier	Pier-1	Pier-2
7.2.1	Type	Wall Type	NA
7.2.2	Material	RCC	NA
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting)	NA	NA
7.2.4	Maximum Depth of Pier Foundation	Not Visible	Not Visible

7.2.5	PierWidth	NA	NA
7.2.6	PierThickness	1.1m	1.1m

8.1	Checkconditionofsideretainingwalllikecracking,	Notapplicable
8.2	Checklargeexcavationsdoneintheroadbelowinthevicinityofflyoverorroadoverbridgeofviaduct	Notapplicable
8.3	Checkdamageto protective measurestopierandabutments(Forviaducts,FlyoverandR.O.Bs.	Notapplicable
8.4	Checkdamageto protective coatingorpaint.	Notapplicable

S.No.	Particulars	Bearing	Pedestal
9.1	No.perAbutment	RHS-3LHS-3	RHS-3LHS-3
9.2	No.perPier	RHS-10LHS-6	RHS-10LHS-6
9.3	Type	NA	NA
9.4	Material	NA	NA
9.5	Generalcondition(Checkrusting, cleanliness, seizing of platesilting, accumulation of dirt in case of	NA	NA
9.6	Functioning(Checkexcessivemovement, tilting,	NA	NA
9.7	CheckConditionof Pads(oxidation, creep, Flattening, Bulging, splitting&displacementany	NA	NA
9.8	Checkforgeneralcleanness	NA	NA
9.9	Checkany signs of distress cracking, spalling, disintegration&any excessiveshifting	NA	NA
9.10	Checkloss of shape	NA	NA
9.11	Checkcracksif any supporting members such as piercap, abutment, Pedestal etc.,	NA	NA
9.12	Condition of D/s stoppers (For submergible Bridges	NA	NA

10.1	Total Number of Spans & Arrangement	RHS-(1x10.45+8x19.80+1x10.45) LHS-(8x19.80)
10.2	Type of Span (T-beam, slab/box-girder etc.)	RHS-Gider LHS-T-Beam
10.3	Structural System (Simply supported/continuous/Continuous	Continuous
10.4	Type of Material (RCC/PSC/Steel/Timber/Masonry	RCC/PSC
10.5	Check spalling disintegration or honeycombing, (special attention: to be given at points of bearings)	No spalling disintegration or honeycombing
10.6	Check cracks (Pattern, location, explains preferably by photograph and plotting on sketch. A map of crackings should be produced. The size and distribution of cracks and their penetrations should	No cracks observed

10.7	Check exposed reinforcement, if any	No reinforcement exposed
10.8	Check wear of deck surface	Wear of deck surface is in Fair condition
10.9	Check scaling (This is gradual and continuous loss of surface mortar and aggregate over irregular areas.)	No scaling observed
10.10	Check surface stains and rust stains along with the	No surface stains and rust stains
10.11	Check leaching (Effects are most usually evident on the soffit of decks)	-
10.12	Check corrosion of reinforcements, sheathing and	-
10.13	Check leakage (Leakage of water cannot take place through concrete decks, construction joints or thin component section of the deck viz., kerbs, etc.)	NA
10.14	Check damages if any due to moving vehicle	NA
10.15	Check condition of articulation (Cracks, exposed reinforcement if any)	No articulation
10.16	Check excessive vibrations, if any	No vibrations on bridge observed
10.17	Check excessive deflections (sag) or loss of camber if any at same point each time	NA
10.18	Check cracks, if any, around anchorage zone for prestressed concrete members	Not applicable
10.19	Check excessive deflection (sag) at central hinge, tip, of cantilever for cantilever bridge	Not applicable
10.20	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of water or debris. Interior diaphragms will also require examination,	-
10.21	Check accumulation of slit and debris on surface of deck (for submersible bridges)	Not applicable
10.22	Check peeling off of protective coat or paint	No paint
10.23	Check steel members	-
10.24	Check condition of protective system	Good
10.25	Check corrosion, if any	-
10.26	Check excessive vibrations, if any	Not applicable
10.27	Check alignment of members	Good
10.28	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringer to cross girders, cross girder to main girders, gusset or	Not applicable
10.29	Check excessive loss of camber and excessive deflections and deformations, if any	No Change in camber observed
10.3	Check buckling, kinking, warping and waviness	Not applicable
10.31	Check apparent fracture if any	Not applicable

10.32	Check excessive wear (such as in pins in joints of truss) and their locations requiring close monitoring	Not applicable
10.33	Check conditions inside the closed members	Not applicable
10.34	Check masonry arches	Not applicable
10.35	Check condition of joints mortar, pointing, masonry,	Not applicable
10.36	Check profile, report flattening by observing rise of the arch at centre and quarter points	Not applicable
10.37	Check cracks (indicate location, pattern, extent, depth; explain by sketches)	Not applicable
10.38	Check drainage of spandrel fillings (check bulging of spandrel walls, if any)	Not applicable
10.39	Check growth of vegetation	Growth of vegetation observed
10.4	Check all cast iron/wrought iron components	Not applicable
10.41	In case of steel bridges (Corrosion/painting/loose	Not applicable
10.42	In case of masonry bridges (Pointing/joints mortar and bulging of spandrel)	Not applicable
10.43	Vegetation (Yes/No)	Yes

11.1	Type	Strip seal
11.2	Condition i.e. Misalignment of joints, Debris,	Good
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, excessive noise, etc.	Cracks on wearing course observed
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check	NA
11.5	Check secureness of the joints	Not visible
11.6	Top sliding plate i.e. check corrosion, damage to	Not applicable
11.7	Locking of joints i.e. Check locking of joints especially for finger type expansion joints.	NA
11.8	Check for debris in joints	Debris observed in joints
11.9	Report rattling, if any	No rattling
11.10	Check drainage from expansion joint	No drainage from expansion joint
11.11	Check alignment and clearance	Proper alignment and clearance

12.1	Material	Bituminous
12.2	Surface Condition i.e. Cracks/potholes/Bulges, spalling, disintegration, etc.	Cracks observed in wearing course
12.3	Check Evidence of wear (Tell tale rings check for thickness against actual thickness, check data of	NA
12.4	Compare additional thickness with design thickness with reference to kerb height	NA

13.1	Check clogging, deterioration and damage, if any	NA
13.2	Check the projection of the spout on the underside (see whether structural members are being	Not affected
13.3	Check adequacy thereof	Sufficient
13.4	For subways report about adequacy of drainage and pumping arrangements etc.	Not applicable
13.5	For submersible bridges, report on functioning	Not applicable
13.6	Report absence of Drainage Spouts	No drainage spouts absence
13.7	Check choking of drainage holes provided in the	NA

14.1	Check General Condition (Check expansion Gaps and Missing parts if)	No expansion gaps observed
14.2	Check Damaged due to collision	No damaged due to collision
14.3	Check alignment (Report any abruptness in profile)	Good

15.1	Check general condition (Damaged due to mounting of vehicles)	NA
15.2	Check missing footpath slabs	NA
15.3	Cleanliness of ducts along footpaths	NA

16.1	Check leakage of water and sewage pipes	NA
16.2	Check any damage by telephone and electric cables.	NA
16.3	Check condition of lighting facilities	No lighting facilities
16.4	Check damages due to any other utilities	No damaged due to utilities

17.1	Check condition of painting	Fair Condition
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18.1	Check for signs of aggressiveness	NA
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19.1	Check any visual intrusion, hoardings, vegetation on	NA
19.2	Check Whether all actions for maintenance and	NA

20.1	Recommendation for testing YES or NO	Yes – Bridge requires some localized repairs (Such as lightning facilities, Removal of vegetation & bank Protection.)
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INVENTORY



INVENTORY

1. Bridge	
1 StateCode	RJ
2 Highway	NH27
3 Chainage	627/2km
4 BridgeNumber	627-2
5 BridgeID	NA
6 NameofRiver/NHNo/orCrossingFeature	NH-27/Chittorgarh
7 Dateofinspection	2/21/2018
2. Bridge Classification	
1 StructuralForm	DecksLab
2 MaterialofConstruction	Concrete
3 TypeofBridge	MajorBridge
4 LoadingasperIRC	70R
5 YearofConstruction	NA
6 TrafficLaneonBridge	2LaneCarriageway
7 BridgeStructureCrossingFeatures	River
8 LengthofBridge	67.5m
9 WidthofCarriageway	7m(BothCarriageway)
3. Bridge Structural Rating Number	
1 RatingforIntegralandNon-integralDeck	:9
2 RatingforSuperstructure	:8
3 RatingforSubstructure	:8
4 RatingforBankandChannel	:8
5 RatingforStructuralEvaluation	:8
6 RatingforDeckGeometry	:7
7 RatingforVertical&HorizontalClearance	:3
8 RatingforWaterwayAdequacy	:7
9 RatingforScourefficiency	:8

INSPECTION		
1. STRUCTURE DATA		
1.1	RoadWidth(m)	2x7m
1.2	OverallDeckWidth(m)	2x10.50m
1.3	ApproachRoadwayWidthIncludingShoulder(m)	2x8.5m
1.4	HeightofApproachEmbankment	5.5m
1.5	AverageSkew	NO
1.6	WhetherNavigable	NO
1.7	HorizontalClearance	NA
1.8	VerticalClearance	NA
2. GENERAL		
2.1	CorrosionProtectionMeasures	No Corrosion Protection Measures
2.2	BankProtection&Type	StonePitching
2.3	FloorProtection&Type	NA
2.4	Is the Bridge Located in backwater (Marine) or chemical affected water body	No backwater
3. APPROACHES		
3.1	Type of Approach	Embankment
3.2	Material of Approach	Soil
3.3	Approach Geometrics (Straight/Curvilinear etc.)	Straight
3.4	If Approaches having any Span then provide Span details	No spans in approaches
3.5	Pavement surface (Check unevenness, settlement, cracking, potholes etc.)	Cracking is observed
3.6	Sideslopes (Check pitched or run-pitched, condition of pitching/turfing, any signs of slope failure etc.)	Un-pitched and no slope failure
3.7	Erosion of Embankment by rain cuts or any other damage to Embankment.	No erosion of embankment by rain cuts.
3.8	Approach slab (Check, settlement, cracks, movement etc.)	No settlement, cracks, movements
3.9	Retaining walls Type	NA
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc.)	NA
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment.)	Accumulation of silt, debris & vegetation observed
4. PROTECTION WORKS		
4.1	Type (Mention whether guide-bund or protection around abutments or spurs.)	Stone Pitching
4.2	Layout, cross section profile (Check damage to the layout and the general cross section are in order.)	No damage to the layout
4.3	Slope pitching, apron, and toe walls (Check for proper slope, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc.)	NA
4.4	Floor Protection works (Condition if impervious floor, flexible apron, curtain walls and indicate nature of damage if any etc.)	No floor protection
4.5	Scour (Check any abnormal scour noticed.)	No
4.6	Reserve store material	No

5. WATERWAY		
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc.	NA
5.2	Flow pattern (Check any abnormal change in Meandering in flow and erosion of banks)	No change in meandering in flow
5.3	Maximum Flood Level observed during the year and mark the same on the pier/abutment both on the U/s and D/s (Local enquiry if necessary)	NA
5.4	Afflux from U/s and D/s (Check signs of abnormal Afflux from U/s and D/s water mark on piers if any)	NA
5.5	Check for erosion of bank	NA
6. FOUNDATION		
6.1	Type (Main bridge and approach spans if any)	Not visible
6.2	Material	Not visible
6.3	Condition of Foundation (Check Settlement, abnormal Scour, Tilting, if any etc)	Not visible
6.4	Floating bodies, boulders etc (Check damaged due to impact of floating bodies, boulders etc)	Not visible
6.5	Seepage, vehicle impact etc (For sub-ways report seepage, vehicle impact, if any damage to the foundation etc.)	Not visible
6.6	Check cracking, disintegration, decay, erosion, Cavitation etc.,	Not visible
7. SUBSTRUCTURE		
7.1	Abutment (A1 & A2)	
7.1.1	Type	Wall type
7.1.2	Material	LHS-Stone RHS-RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed St	NA
7.1.4	Efficiency of drainage of the backfill behind abutments (Check fur	Weep holes present
7.1.5	Maximum Depth of Abutment Foundation	NA
7.1.6	Abutment Width	NA
7.1.7	Abutment Thickness	NA
7.2	Pier	
7.2.1	Type	Wall Type
7.2.2	Material	RCC
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed St	NA
7.2.4	Maximum Depth of Pier Foundation	NA
7.2.5	Pier Width	NA
7.2.6	Pier Thickness	1.1m
8. FOR SUBWAYS		
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable
8.2	Check large excavations done in the road below in the vicinity of flyover or road over bridge or viaduct	Not applicable
8.3	Check damage to protective measures to pier and abutments (For viaducts, Flyover and R.O.Bs.	Not applicable
8.4	Check damage to protective coating or paint.	Not applicable

9. BEARING & PEDESTAL			
S.No.	Particulars	Bearing	Pedestal
9.1	No. per Abutment	RHS-3LHS-3	RHS-3LHS-3
9.2	No. per Pier	RHS-10LHS-6	RHS-10LHS-6
9.3	Type	NA	NA
9.4	Material	NA	NA
9.5	General condition (Check rusting, cleanliness, seizing of plates, silt ing, accumulation of dirt in case of submersible bridges)	NA	NA
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	NA	NA
9.7	Check Condition of Pads (oxidation, creep, Flattening, Bulging, splitting & displacement)	NA	NA
9.8	Check for general cleanness	NA	NA
9.9	Check any signs of distress cracking, spalling, disintegration & any excessive shifting	NA	NA
9.10	Check loss of shape	NA	NA
9.11	Check cracks if any supporting members such as pier cap, abutment, Pedestal etc.,	NA	NA
9.12	Condition of D/S stoppers (For submersible Bridges)	NA	NA
10. SUPERSTRUCTURE			
10.1	Total Number of Spans & Arrangement	RHS (1x10.45+8x19.80+1x10.45) LHS (8x19.80)	
10.2	Type of Span (T-beam, slab/box-girder etc.)	RHS: Girder LHS: T-Beam	
10.3	Structural System (Simply supported/continuous/Continuous overhang/balanced cantilever etc.)	Continuous	
10.4	Type of Material (RCC/PSC/Steel/Timber/Masonry etc.)	RCC/PSC	
10.5	Check spalling, disintegration or honeycombing, (special attention to be given at points of bearings)	No spalling, disintegration or honeycombing	
10.6	Check cracks (Pattern, location, explain preferably by photograph and plotting on sketch. A map of crackings should be produced. The size and distribution of cracks and their penetrations should be noted)	No cracks observed	
10.7	Check exposed reinforcement, if any	No reinforcement exposed	
10.8	Check wear of deck surface	Wear of deck surface is in Fair condition	
10.9	Check scaling (This is gradual and continuous loss of surface mortar and aggregate over irregular areas.)	No scaling observed	
10.10	Check surface stains and rust stains along with the locations	No surface stains and rust stains	
10.11	Check leaching (Effects are most usually evident on the soffit of decks)	NA	
10.12	Check corrosion of reinforcements, sheathing and tendon if visible	NA	
10.13	Check leakage (Leakage of water cannot take place through concrete decks, construction joints or thin component sections of the deck viz., kerbs, etc.)	NA	
10.14	Check damages if any due to moving vehicle	NA	
10.15	Check condition of articulation (Cracks, exposed reinforcement if any)	No articulation	
10.16	Check excessive vibrations, if any	No vibrations on bridge observed	
10.17	Check excessive deflections (sag) or loss of camber if any at same point at time	No Change in Camber observed	

10. SUPERSTRUCTURE		
10.18	Check cracks, if any, around anchorage zone for prestressed concrete members	NA
10.19	Check excessive deflection (sag) at central hinge, tip, of cantilever for cantilever bridge	NA
10.20	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of water or debris. Interior diaphragms will also require examination, particularly for any signs of cracking at their junction into the webs	NA
10.21	Check accumulation of slit and debris on surface of deck (for submersible bridges)	NA
10.22	Check peeling off of protective coat or paint	No paint
10.23	Check steel members	-
10.24	Check condition of protective system	Good
10.25	Check corrosion, if any	-
10.26	Check excessive vibrations, if any	Not applicable
10.27	Check alignment of members	-
10.28	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringer to cross girders, cross girder to main girders, gusset or splices, condition of hinges, splices, etc.)	Not applicable
10.29	Check excessive loss of camber and excessive deflections and deformations, if any	Not applicable
10.3	Check buckling, kinking, warping and waviness	Not applicable
10.31	Check apparent fracture, if any	Not applicable
10.32	Check excessive wear (such as in pins in joints of truss) and their locations requiring close monitoring	Not applicable
10.33	Check conditions inside the closed members	Not applicable
10.34	Check masonry arches	Not applicable
10.35	Check condition of joints mortar, pointing, masonry, etc.	Not applicable
10.36	Check profile, report flattening by observing rise of the arch at center and quarter points	Not applicable
10.37	Check cracks (indicate location, pattern, extent, depth; explain by sketches)	Not applicable
10.38	Check drainage of spandrel fillings (check bulging of spandrel walls, if any)	Not applicable
10.39	Check growth of vegetation	Growth of vegetation observed
10.4	Check all cast iron/wrought iron components	Not applicable
10.41	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable
10.42	In case of masonry bridges (Pointing/joints mortar and bulging of spandrel)	Not applicable
10.43	Vegetation (Yes/No)	Yes
11. EXPANSION JOINT		
11.1	Type	Strip seal
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc.	Good
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, excessive noise, etc.	Cracks on wearing course observed

11.4	Sealingmaterial.i.e.Forneoprenesealingmaterial,checkforsplitting,oxidation, creep, flattening, bulging and for bitumenfiller.,checkhardening,cracking,etc.	NA
11.5	Checksecurenessofthejoints	Notvisible
11.6	Topslidingplatei.e.checkcorrosion,damagetowelds,etc.	Notapplicable
11.7	Lockingofjointsi.e.Checklockingofjointsespeciallyforfingertype expansionjoints.	NA
11.8	Checkfordebrisinjoints	Debrisobservedinjoints
11.9	Report rattling, if any	Norattling
11.10	Check drainage from expansion joint	Nodrainagefromexpansionjoint
11.11	Check alignment and clearance	Proper alignment and clearance
12. WEARING COAT		
12.1	Material	Bituminous
12.2	Surface Condition i.e. Cracks/potholes/Bulges, spalling, disintegration, etc.	Cracks observed in wearing course
12.3	Check Evidence of wear (Tell talerings check for thickness as against actual thickness, check data of last inspection)	NA
12.4	Compare additional thickness with design thickness with reference to kerb Height	NA
13. DRAINAGE SPOUTS AND VEST HOLES		
13.1	Check clogging, deterioration and damage, if any	NA
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not affected
13.3	Check adequacy thereof	Sufficient
13.4	For subways report about adequacy of drainage and pumping arrangements etc.	Not applicable
13.5	For submersible bridges, report on functioning	Not applicable
13.6	Report absence of Drainage Spouts	Nodrainagespoutsabsence
13.7	Check choking of drainage holes provided in the bottom booms	NA
14. HAND RAILS & PARAPET WALLS		
14.1	Check General Condition (Check expansion Gaps and Missing parts if)	No expansion gaps observed
14.2	Check Damaged due to collision	Nodamageduetocollision
14.3	Check alignment (Report any abruptness in profile)	Good
15. FOOTPATHS		
15.1	Check general condition (Damaged due to mounting of vehicles)	NA
15.2	Check missing footpath slabs	NA
15.3	Cleanliness of ducts along footpaths	NA
16. UTILITIES		
16.1	Check leakage of water and sewage pipes	NA

16.2	Checkanydamagebytelephoneandelectriccables.	NA
16.3	Checkconditionoflightingfacilities	NA
16.4	Checkdamagesduetoanyotherutilities	NA
17.BRIDGENUMBER		
17.1	Checkconditionofpainting	FairCondition
18.ENVIRONMENT		
18.1	Checkforsignsofaggressiveness	NA
19.AESTHETICS		
19.1	Checkanyvisualintrusion,hoardings,vegetationonstructural	NA
19.2	CheckWhetherallactionsformaintenanceandrecommended	NA
20.RECOMMENDATION		
20.1	RecommendationfortestingYESorNO	Yes– Bridgerequiressomelocalizedrepairs(Suchaslight ningfacilities,otherutilities,Removalof vegetationsfromstructure&bankProtection.)

PHOTOGRAPHS



INVENTORY

1. Bridge		
1	StateCode	RJ
2	Highway	NH27
3	Chainage	638.755 km
4	BridgeNumber	639-2
5	BridgeID	NA
6	NameofRiver/NHNo/orCrossingFeature	NH-27/AbuRoad
7	Dateofinspection	2/22/2018

2. Bridge Classification		
1	StructuralForm	LHS:SlabRHS:T-Beam
2	MaterialofConstruction	RCC
3	TypeofBridge	MajorBridge
4	LoadingasperIRC	70R
5	YearofConstruction	NA
6	TrafficLaneonBridge	2LaneCarriageway
7	BridgeStructureCrossingFeatures	River
8	LengthofBridge	67.5m
9	WidthofCarriageway	7m(BothCarriageway)

3. Bridge Structural Rating Number		
1	RatingforIntegralandNon-integralDeck	:9
2	RatingforSuperstructure	:8
3	RatingforSubstructure	:8
4	RatingforBankandChannel	:8
5	RatingforStructuralEvaluation	:8
6	RatingforDeckGeometry	:7
7	RatingforVertical&HorizontalClearance	:3
8	RatingforWaterwayAdequacy	:7
9	RatingforScourefficiency	:8

INSPECTION

1. STRUCTURE DATA		
1.1	RoadWidth(m)	2x8.5m
1.2	OverallDeckWidth(m)	2x10.5m
1.3	ApproachRoadwayWidthIncludingShoulder(m)	2x10.5m
1.4	HeightofApproachEmbankment	NA
1.5	AverageSkew	NO
1.6	WhetherNavigable	NO
1.7	HorizontalClearance	5x13.5m
1.8	VerticalClearance	5.5m
2. GENERAL		
2.1	CorrosionProtectionMeasures	NoCorrosion Protection Measures
2.2	BankProtection&Type	No
2.3	FloorProtection&Type	NA
2.4	IstheBridgeLocatedinbackwater(Marine)orchemicalaffectedwaterbody	Nobackwater
3. APPROACHES		
3.1	TypeofApproach	Embankment
3.2	MaterialofApproach	Soil
3.3	ApproachGeometrics(Straight/Curvilinearetc.)	Straight
3.4	IfApproacheshavinganySpanthenprovideSpandetails	Nospansinapproaches
3.5	Pavementsurface(Checkunevennesssettlement,cracking, potholesetc.)	Crackingisobserved
3.6	Sideslopes(Checkpitchedorun-pitched,conditionofpitching/ turfing,anysignsofslopefailureetc.)	Un-pitchedandnoslopefailure
3.7	ErosionofEmbankmentbyraincutsoranyotherdamageto Embankment.	Noerosionofembankmentbyraincuts.
3.8	Approachslab(Check,settlement,cracks,movementetc.)	Nosettlement,cracks,movements
3.9	RetainingwallsType	NA
3.10	Retainingwallcondition(Checksubsidence,tilting,conditionof weep-holes,guard-stoneandrailingetc.)	NA
3.11	SiltandDebris(CheckAccumulationofsiltanddebrison submersibleapproachesincuttingandembankment.)	Accumulationofsilt,debris&vegetation observed
4. PROTECTIONWORKS		
4.1	Type(Mentionwhetherguide-bundorprotectionaroundabutmentsorspurs.)	Notpresent
4.2	Layout,crosssectionprofile(Checkdamagetothe layoutandthegeneralcrosssectionare inorder.)	Nodamagetothe layout
4.3	Slopepitching,apron,andtoewalls(Checkforproverslope,thicknessofpitchinginthe slope,erosionoftoewallandindicatingthenatureofdamageifanyetc.)	No
4.4	FloorProtectionworks(Conditionifimperviousfloor,flexibleapron,curtainwallsand indicate nature of damage if any etc.)	Nofloor protection
4.5	Scour(Checkanyabnormalscournoticed.)	Scouring observed
4.6	Reservestorematerial	No
5. WATERWAY		
5.1	Checkpresenceofobstructioninflowanditsimpactonflow,islandformation,Vegetationgrowth etc.	Vegetationgro wththis observed

5.2	Flow pattern (Check any abnormal change in Meandering in flow and erosion of banks)	No change in meandering in flow
5.3	Maximum Flood Level observed during the year and mark the same on the pier/abutment both on the U/s and D/s (Local enquiry if necessary)	NA
5.4	Afflux from U/s and D/s (Check signs of abnormal Afflux from U/s and D/s water mark on piers if any)	NA
5.5	Check for erosion of bank	Yes
6. FOUNDATION		
6.1	Type (Main bridge and approach spans if any)	Not visible
6.2	Material	Not visible
6.3	Condition of Foundation (Check Settlement, abnormal Scour, Tilting, if any etc)	Not visible
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	Not visible
6.5	Seepage, vehicle impact etc (For sub-ways report seepage, vehicle impact, if any damage to the foundation etc.)	Not visible
6.6	Check cracking, disintegration, decay, erosion, Cavitation etc.,	Not visible
7. SUBSTRUCTURE		
7.1	Abutment (A1 & A2)	A1 A2
7.1.1	Type	Circular type Circular type
7.1.2	Material	RCC Stone
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed)	NA NA
7.1.4	Efficiency of drainage of the backfill behind abutments (Check)	Wheepholes present Wheepholes present
7.1.5	Maximum Depth of Abutment Foundation	NA NA
7.1.6	Abutment Width	NA NA
7.1.7	Abutment Thickness	NA NA
7.2	Pier	Piers
7.2.1	Type	Circular Wall
7.2.2	Material	RCC
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed)	NA
7.2.4	Maximum Depth of Pier Foundation	NA
7.2.5	Pier Width	NA
7.2.6	Pier Thickness	NA
8. FOR SUBWAYS		
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable
8.2	Check large excavations done in the road below in the vicinity of flyover or road over bridge of viaduct	Not applicable
8.3	Check damage to protective measures to pier and abutments (For viaducts, Flyover and R.O.Bs.)	Not applicable
8.4	Check damage to protective coating or paint.	Not applicable

9. BEARING & PEDESTAL			
S.No.	Particulars	Bearing	Pedestal
9.1	No. per Abutment	LHS-0 RHS-3	LHS-4 RHS-3
9.2	No. per Pier	LHS-6	LHS-6
9.3	Type	NA	NA
9.4	Material	Not visible	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plate silt ing, accumulation of dirt in case of submersible bridges)	NA	NA
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	NA	NA
9.7	Check Condition of Pads (oxidation, creep, Flattening, Bulging, splitting & displacement any)	NA	NA
9.8	Check for general cleanness	NA	NA
9.9	Check any signs of distress cracking, spalling, disintegration & any excessive shifting	NA	NA
9.10	Check loss of shape	NA	NA
9.11	Check cracks if any supporting members such as pier cap, abutment, Pedestal etc.,	NA	NA
9.12	Condition of D/S stoppers (For submersible Bridges)	NA	NA
10. SUPERSTRUCTURE			
10.1	Total Number of Spans & Arrangement	5x13.5m	
10.2	Type of Span (T-beam, slab/box-girder etc.)	PSC Girder & T Beam	
10.3	Structural System (Simply supported/continuous/Continuous overhang/balanced cantilever etc.)	Continuous	
10.4	Type of Material (RCC/PSC/Steel/Timber/Masonry etc.)	RCC/PSC	
10.5	Check spalling disintegration or honeycombing, (special attention: to be given at points of bearings)	No spalling disintegration or honeycombing	
10.6	Check cracks (Pattern, location, explains preferably by photograph and plotting on sketch. A map of crackings should be reproduced. The size and distribution of cracks and their penetrations should be noted)	No cracks observed	
10.7	Check exposed reinforcement, if any	No reinforcement exposed	
10.8	Check wear of deck surface	Wear of deck surface is in Fair condition	
10.9	Check scaling (This is gradual and continuous loss of surface mortar and aggregate over irregular areas.)	No scaling observed	
10.10	Check surface stains and rust stains along with the locations	No surface stains and rust stains	
10.11	Check leaching (Effects are most usually evident on the surface of decks)	-	
10.12	Check corrosion of reinforcements, sheathing and tendon if visible	-	
10.13	Check leakage (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck viz., kerbs, etc.)	NA	
10.14	Check damages if any due to moving vehicle	NA	

10.SUPERSTRUCTURE		
10.15	Check condition of articulation (Cracks, exposed reinforcement if any)	No articulation
10.16	Check excessive vibrations, if any	No vibrations on bridge observed
10.17	Check excessive deflections (sag) or loss of camber if any at same point each time	Not applicable
10.18	Check cracks, if any, around anchorage zone for prestressed concrete members	Not applicable
10.19	Check excessive deflection (sag) at central hinge, tip, of cantilever for cantilever bridge	Not applicable
10.20	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of water or debris. Interior diaphragms will also require examination, particularly for any signs of cracking at their junction to the webs	NA
10.21	Check accumulation of slit and debris on surface of deck (for submersible bridges)	Not applicable
10.22	Check peeling off of protective coat or paint	No paint
10.23	Check steel members	NA
10.24	Check condition of protective system	NA
10.25	Check corrosion, if any	NA
10.26	Check excessive vibrations, if any	Not applicable
10.27	Check alignment of members	Good
10.28	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringer to cross girders, cross girder to main girders, gussets or splices, condition of hinges, splices, etc.)	Not applicable
10.29	Check excessive loss of camber and excessive deflections and deformations, if any	No change in camber observed
10.3	Check buckling, kinking, warping and waviness	Not applicable
10.31	Check apparent fracture, if any	Not applicable
10.32	Check excessive wear (such as in pins in joints of truss) and their locations requiring close monitoring	Not applicable
10.33	Check conditions inside the closed members	Not applicable
10.34	Check masonry arches	Not applicable
10.35	Check condition of joints mortar, pointing, masonry, etc.	Not applicable
10.36	Check profile, report flattening by observing rise of the arch at center and quarter points	Not applicable
10.37	Check cracks (indicate location, pattern, extent, depth; explain by sketches)	Not applicable
10.38	Check drainage of spandrel fillings (check bulging of spandrel walls, if any)	Not applicable
10.39	Check growth of vegetation	Growth of vegetation observed
10.4	Check all cast iron/wrought iron components	Not applicable
10.41	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable
10.42	In case of masonry bridges (Pointing/joints mortar and bulging of spandrel)	Not applicable
10.43	Vegetation (Yes/No)	Yes

11. EXPANSIONJOINT		
11.1	Type	Stripseal
11.2	Conditioni.e.MisalignmentofJoints,Debris,Accumulationetc.	Debrisinjoint
11.3	Functioningi.e.Cracksinwearingcourse,existenceofnormalgap,excessivenoise,etc.	Cracksonwearingcourseobserved
11.4	Sealingmateriali.e.Forneoprenesealingmaterial,checkforsplitting,oxidation, creep, flattening, bulging and for bitumenfiller.,checkhardening,cracking,etc.	NA
11.5	Checksecurenessofthejoints	Notvisible
11.6	Topslidingplatei.e.checkcorrosion,damagetowelds,etc.	Notapplicable
11.7	Lockingofjointsi.e.Checklockingofjointsespeciallyforfingertypeexpansionjoints.	NA
11.8	Checkfordebrisinjoints	Debrisobservedinjoints
11.9	Report rattling, if any	Norattling
11.10	Checkdrainagefromexpansionjoint	Nodrainagefromexpansionjoint
11.11	Checkalignmentandclearance	Properalignmentandclearance
12. WEARINGCOAT		
12.1	Material	Bituminous
12.2	SurfaceConditioni.e.Cracks/potholes/Bulges,spalling,disintegration,etc.	Cracksandphotolesobserved
12.3	CheckEvidenceofwear(Telltaleringscheckforthicknessasgainstactualthickness,checkdataofflastinspection)	NA
12.4	Compareadditionalthicknesswithdesignthicknesswithreference to kerb Height	NA
13. DRAINAGESPOUTS AND VEST HOLES		
13.1	Checkclogging,deteriorationanddamage,ifany	NA
13.2	Checktheprojectionofthespoutontheunderside(seewhetherstructuralmembersarebeingaffected)	Notaffected
13.3	Checkadequaciethereof	Sufficient
13.4	Forsubwaysreportaboutadequacyofdrainageandpumpingarrangements etc.	Notapplicable
13.5	Forsubmersiblebridges,reportonfunctioning	Notapplicable
13.6	ReportabsenceofDrainageSpouts	Nodrainagespoutsabsence
13.7	Checkchokingofdrainageholesprovidedinthebottombooms	NA
14. HAND RAILS&PARAPETSWALLS		
14.1	CheckGeneralCondition(CheckexpansionGapsandMissingparts if)	Good
14.2	CheckDamageduetocollision	No
14.3	Checkalignment(Reportanyabruptnessinprofile)	NA
15. FOOTPATHS		
15.1	Checkgeneralcondition(Damageduetomountingofvehicles)	NA
15.2	Checkmissingfootpathslabs	NA
15.3	Cleanlinessofductsalongfootpaths	NA

16. UTILITIES		
16.1	Checkleakageofwaterandsewagepipes	NA
16.2	Checkanydamagebytelephoneandelectriccables.	NA
16.3	Checkconditionoflightingfacilities	Nolightingfacilities
16.4	Checkdamagesduetoanyotherutilities	Nodamageduetoutilities
17. BRIDGE NUMBER		
17.1	Checkconditionofpainting	FairCondition
18. ENVIRONMENT		
18.1	Checkforsignsofaggressiveness	NA
19. AESTHETICS		
19.1	Checkanyvisualintrusion,hoardings,vegetationonstructural	NA
19.2	CheckWhetherallactionsformaintenanceandrecommended	NA
20. RECOMMENDATION		
20.1	RecommendationfortestingYESorNO	Yes– Bridgerequiresomelocalizedrepairs(Suchas Removalofvegetations&bank Protection,HandrailMaintenance)

PHOTOGRAPHS



Picture-1: Expansion joint



Picture-2: Weep holes present



Picture-3: Side Protection Work



Picture-4: Vegetation observed



Picture-5: Observed Flood Level on Pier



Picture-6: Ultrasonic Velocity Test

INVENTORY						
		1. Bridge				
		1 StateCode	RJ			
		2 Highway	NH27			
		3 Chainage	639.725Km			
		4 BridgeNumber	640-2			
		5 BridgeID	NA			
		6 NameofRiver/NHNo/orCrossingFeature	NH-27/Chittorgarh			
		7 Dateofinspection	2/22/2018			
		2. BridgeClassification				
		1 StructuralForm	T-Beam			
		2 MaterialofConstruction	RCC			
		3 TypeofBridge	MajorBridge			
		4 LoadingasperIRC	70R			
		5 YearofConstruction	NA			
		6 TrafficLaneonBridge	2LaneCarriageway			
		7 BridgeStructureCrossingFeatures	River			
		8 LengthofBridge	99.6m			
		9 WidthofCarriageway	7m(BothCarriageway)			
		3. BridgeStructuralRatingNumber				
		1 RatingforIntegralandNon-integralDeck	:9			
		2 RatingforSuperstructure	:8			
		3 RatingforSubstructure	:8			
		4 RatingforBankandChannel	:8			
		5 RatingforStructuralEvaluation	:8			
		6 RatingforDeckGeometry	:7			
		7 RatingforVertical&HorizontalClearance	:3			
		8 RatingforWaterwayAdequacy	:7			
		9 RatingforScourefficiency	:8			

INSPECTION				
1.STRUCTURED DATA				
1.1	RoadWidth(m)			2x 8.5 m
1.2	OverallDeckWidth(m)			2x 10.5 m
1.3	ApproachRoadwayWidthIncludingShoulder(m)			2x 8.5 m
1.4	HeightofApproachEmbankment			NA
1.5	AverageSkew			NO
1.6	WhetherNavigable			NO
1.7	HorizontalClearance			3x 33 m
1.8	VerticalClearance			5.5m
2.GENERAL				
2.1	CorrosionProtectionMeasures			No CorrosionProtecti on Measures
2.2	BankProtection&Type			No
2.3	FloorProtection&Type			NA
2.4	Is the Bridge Located in backwater (Marine) or chemical affected water body			No backwater
3.APPROACHES				
3.1	Type of Approach			Embankment
3.2	Material of Approach			Soil
3.3	Approach Geometrics (Straight/Curvilinear etc.)			Straight
3.4	If Approaches having any Span then provide Span details			No spans in approaches
3.5	Pavement surface (Check unevenness, settlement, cracking, potholes etc.)			Cracking is observed
3.6	Sideslopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc.)			Un-pitched and no slope failure
3.7	Erosion of Embankment by rain cuts or any other damage to Embankment.			No erosion of embankment by rain cuts.
3.8	Approach slab (Check, settlement, cracks, movement etc.)			No settlement, cracks, movements
3.9	Retaining walls Type			NA
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc.)			NA
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment.)			Accumulation of silt, debris & vegetation observed
4.PROTECTION WORKS				
4.1	Type (Mention whether guide-bund or protection around abutments or spurs.)			NA
4.2	Layout, cross section profile (Check damage to the layout and the general cross section are in order.)			No damage to the layout
4.3	Slope pitching, apron, and toe walls (Check for proper slope, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc.)			No
4.4	Floor Protection works (Condition if impervious floor, flexible apron, curtain walls and indicate nature of damage if any etc.)			No floor protection
4.5	Scour (Check any abnormal scour noticed.)			scouring is noticed

4.6	Reservestorematerial		No
5.WATERWAY			
5.1	Checkpresenceofobstructioninflowanditsimpactonflow,islandformation,Vegetationgrowthetc.		Vegetation growth is observed
5.2	Flowpattern(CheckanyabnormalchangeinMeanderinginflowanderosionofbanks)		No change in meandering in flow
5.3	MaximumFloodLevelobservedduringtheyearandmarkthesameonthepier/abutmentbothon theU/sandD/s(Localenquiryifnecessary)		NA
5.4	AffluxfromU/sandD/s(ChecksignsofabnormalAffluxfromU/sandD/swatermarkonpiersif any)		NA
5.5	Checkoferosionofbank		Yes
6.FOUNDATION			
6.1	Type(Mainbridgeandapproachspansifany)		Notvisible
6.2	Material		Notvisible
6.3	ConditionofFoundation(CheckSettlement,abnormalScour,Tilting,ifanyetc)		Notvisible
6.4	Floatingbodies,bouldersetc(Checkdamageduettoimpactoffloatingbodies,bouldersetc)		Notvisible
6.5	Seepage,vehicleimpactetc(Forsub-waysreportseepage,vehicleimpact,ifanydamagetothe foundationsetc.)		Notvisible
6.6	Checkcracking,disintegration,decay,erosion,Cavitationetc.,		Notvisible
7.SUBSTRUCTURE			
7.1	Abutment(A1&A2)	A1	A2
7.1.1	Type	Circular type	Circular type
7.1.2	Material	RCC	RCC
7.1.3	Condition(Crack,Settlement,Scour,Tilting,Rustinginexposed Steel,Strainsandotherdamagesetc)	NA	NA
7.1.4	Efficiencyofdrainageofthebackfillbehindabutments(Check functioningofweepholes,evidenceofmoistureonabutmentfaces,etc.)	Weepholes present	Weep holes present
7.1.5	MaximumDepthofAbutmentFoundation	NA	NA
7.1.6	AbutmentWidth	NA	NA
7.1.7	AbutmentThickness	NA	NA
7.2	Pier	Pier-1	Pier-2
7.2.1	Type	Circular	Circular
7.2.2	Material	RCC	RCC
7.2.3	Condition(Crack,Settlement,Scour,Tilting,Rustinginexposed Steel	NA	NA
7.2.4	MaximumDepthofPierFoundation	NA	NA
7.2.5	PierWidth	NA	NA
7.2.6	PierThickness	NA	NA
8.FORSUBWAYS			
8.1	Checkconditionofsideretainingwalllikecracking,disintegrationandseepage,ifany		Notapplicable
8.2	Checklargeexcavationsdoneintheroadbelowinthevicinityofflyoverorroadoverbridgeofviaduct		Notapplicable
8.3	Checkdamagestoprotectivemeasurestopierandabutments(Forviaducts,FlyoverandR.O.Bs.		Notapplicable

8.4	Check damage to protective coating or paint.		Not applicable
9. BEARING & PEDESTAL			
S.No.	Particulars	Bearing	Pedestal
9.1	No. per Abutment	4	4
9.2	No. per Pier	2	2
9.3	Type	NA	NA
9.4	Material	Not visible	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates, silting, accumulation of dirt in case of submersible bridges)	NA	NA
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	NA	NA
9.7	Check Condition of Pads (oxidation, creep, Flattening, Bulging, splitting & displacement any)	NA	NA
9.8	Check for general cleanliness	NA	NA
9.9	Check any signs of distress cracking, spalling, disintegration & any excessive shifting	NA	NA
9.10	Check loss of shape	NA	NA
9.11	Check cracks if any supporting members such as pier cap, abutment, Pedestal etc.,	NA	NA
9.12	Condition of D/S stoppers (For submersible Bridges)	NA	NA
10. SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3x 33 m	
10.2	Type of Span (T-beam, slab/box-girder etc.)	PSC Girder	
10.3	Structural System (Simply supported/continuous/Continuous overhang/balance cantilever etc.)	Continuous	
10.4	Type of Material (RCC/PSC/Steel/Timber/Masonry etc.)	RCC/PSC	
10.5	Check spalling, disintegration or honeycombing, (special attention to be given at points of bearings)	No spalling, disintegration or honeycombing	
10.6	Check cracks (Pattern, location, explain preferably by photograph and plotting on sketch. A map of crackings should be produced. The size and distribution of cracks and their penetrations should be noted)	No cracks observed	
10.7	Check exposed reinforcement, if any	No reinforcement exposed	
10.8	Check wear of deck surface	Wear of deck surface is in Fair condition	
10.9	Check scaling (This is gradual and continuous loss of surface mortar and aggregate over irregular areas.)	No scaling observed	
10.10	Check surface stains and rust stains along with the locations	No surface stains and rust stains	
10.11	Check leaching (Effects are most usually evident on the soffits of decks)	NA	
10.12	Check corrosion of reinforcements, sheathing and tendon if visible	NA	
10.13	Check leakage (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck viz., kerbs, etc.)	NA	
10.14	Check damages if any due to moving vehicle	NA	

10.15	Check condition of articulation (Cracks, exposed reinforcement if any)	No articulation
10.16	Check excessive vibrations, if any	No vibrations on bridge observed
10.17	Check excessive deflections (sag) or loss of camber if any at same point each time	No change in camber observed
10. SUPERSTRUCTURE		
10.18	Check cracks, if any, around anchorage zone for prestressed concrete members	Not applicable
10.19	Check excessive deflection (sag) at central hinge, tip, of cantilever for cantilever bridge	Not applicable
10.20	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of water or debris. Interior diaphragms will also require examination, particularly for any signs of cracking at their junction to the webs	NA
10.21	Check accumulation of slit and debris on surface of deck (for submersible bridges)	Not applicable
10.22	Check peeling off of protective coat or paint	No paint
10.23	Check steel members	NA
10.24	Check condition of protective system	NA
10.25	Check corrosion, if any	NA
10.26	Check excessive vibrations, if any	Not applicable
10.27	Check alignment of members	Good
10.28	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringer to cross girders, cross girder to main girders, gusset or splices, condition of hinges, splices, etc.)	Not applicable
10.29	Check excessive loss of camber and excessive deflections and deformations, if any	No change in camber observed
10.3	Check buckling, kinking, warping and waviness	Not applicable
10.31	Check apparent fracture if any	Not applicable
10.32	Check excessive wear (such as in pins in joints of truss) and their locations requiring close monitoring	Not applicable
10.33	Check conditions inside the closed members	Not applicable
10.34	Check masonry arches	Not applicable
10.35	Check condition of joints mortar, pointing, masonry, etc.	Not applicable
10.36	Check profile, report flattening by observing rise of the arch at centre and quarter points	Not applicable
10.37	Check cracks (indicate location, pattern, extent, depth; explain by sketches)	Not applicable
10.38	Check drainage of spandrel fillings (check bulging of spandrel walls, if any)	Not applicable
10.39	Check growth of vegetation	Growth of vegetation observed
10.4	Check all cast iron/wrought iron components	Not applicable
10.41	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable
10.42	In case of masonry bridges (Pointing/joints mortar and bulging of spandrel)	Not applicable
10.43	Vegetation (Yes/No)	Yes

11.EXPANSIONJOINT					
11.1	Type	Stripseal			
11.2	Conditioni.e.MisalignmentofJoints,Debris,Accumulationetc.	Debrisinjoint			
11.3	Functioningi.e.Cracksinwearingcourse,existenceofnormalgap,excessive noise,etc.	Cracksonwearingcourseobserved			
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc.	NA			
11.5	Check secureness of the joints	Not visible			
11.6	Top sliding plate i.e. check corrosion, damage to welds, etc.	Not applicable			
11.7	Locking of joints i.e. Check locking of joints especially for finger type expansion joints.	NA			
11.8	Check for debris in joints	Debris observed in joints			
11.9	Report rattling, if any	No rattling			
11.10	Check drainage from expansion joint	No drainage from expansion joint			
11.11	Check alignment and clearance	Proper alignment and clearance			
12.WEARINGCOAT					
12.1	Material	Bituminous			
12.2	Surface Condition i.e. Cracks/potholes/Bulges, spalling, disintegration, etc.	Cracks & potholes are observed			
12.3	Check Evidence of wear (Tell tale rings check for thickness as against actual thickness, check data of last inspection)	NA			
12.4	Compare additional thickness with design thickness with reference to kerb Height	NA			
13.DRAINAGESPOUTSANDVESTHOLES					
13.1	Check clogging, deterioration and damage, if any	NA			
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not affected			
13.3	Check adequacy thereof	Sufficient			
13.4	For subways report about adequacy of drainage and pumping arrangements etc.	Not applicable			
13.5	For submersible bridges, report on functioning	Not applicable			
13.6	Report absence of Drainage Spouts	No drainage spouts absence			
13.7	Check choking of drainage holes provided in the bottom booms	NA			
14.HANDRAILS&PARAPETSWALLS					
14.1	Check General Condition (Check expansion Gaps and Missing parts if)	Good			
14.2	Check Damaged due to collision	NA			
14.3	Check alignment (Report any abruptness in profile)	NA			
15.FOOTPATHS					
15.1	Check general condition (Damaged due to mounting of vehicles)	NA			

15.2	Checkmissingfootpathslabs	NA
15.3	Cleanlinessofductsalongfootpaths	NA
16.UTILITIES		
16.1	Checkleakageofwaterandsewagepipes	NA
16.2	Checkanydamagebytelephoneandelectriccables.	NA
16.3	Checkconditionoflightingfacilities	Nolightingfacilitiesobserved
16.4	Checkdamagesduetoanyotherutilities	Nodamageduetoutilities
17.BRIDGENUMBER		
17.1	Checkconditionofpainting	-
18.ENVIRONMENT		
18.1	Checkforsignsofaggressiveness	NA
19.AESTHETICS		
19.1	Checkanyvisualintrusion,hoardings,vegetationonstructural	NA
19.2	CheckWhetherallactionsformaintenanceandrecommended	NA
20.RECOMMENDATION		
20.1	RecommendationfortestingYESorNO	Yes – Bridge requires some localized repairs(Such as Removal of vegetations, bankProtection, provide Hand Rails, EmbankmentRepair both side ,Need to improvement in Bedflooring&CleaningofChockeddrainageholes .)

PHOTOGRAPHS





ANNEXURE9NDTRESULTS

Sr.No.	Structure No.	Chainage	Type of Structure	Side	Span No./Pier	No. of Samples on			Remarks
						UPV	RHT	Carbonation	
1	610/1	609+220	Major Bridge	LHS	II	4	3	1	Overalls structure is in good condition
					V	4	3	2	Overalls structure is in good condition
				RHS	III	4	3	3	Overalls structure is in good condition
2	627/2	626+550	Major Bridge	LHS	I	4	3	1	Overalls structure is in good condition
					III	4	3	2	Overalls structure is in good condition
				RHS	II	4	4	3	Overalls structure is in good condition

3	639/2	638+540	Major Bridge	RHS	III	1	1	-	Overalls structure is in good condition
4	640/2	639+500	Major Bridge	RHS	II	1	1	-	Overalls structure is in good condition

ANNEXURE10TRAFFICPROJECTIONS

	ESTIMATED TRAFFIC FOR 2018/19 (Vehicle Type) Khemana																			
	2 wheel	3 wheel	Car/Jeep	MiniLCV	Minibus	Bus	LCV-4tyre	LCV-6tyre	2axleTruck	3axleTruck	MAV	OS7+ axle	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	AnimalDrw.	Exempted	Total
ADT	3,369	657	5,980	465	28	258	121	536	569	1,455	3,418	0	7	86	16	5	0	2	12	16,984
SFCs	0.99	0.99	1.04	1.03	1.04	1.04	1.03	1.03	0.98	0.92	1.03	1.03	1.03	1.00	1.00	1.00	1.00	1.00	1.00	
AADT	3,335	650	6,219	479	29	268	125	552	558	1,339	3,521	0	7	86	16	5	0	2	12	17,203
PCUfactor	0.50	1.00	1.00	1.50	1.50	3.00	1.50	1.50	3.00	3.00	4.50	4.50	4.50	4.50	1.50	0.50	2.00	4.00	1.00	
AADTPCUs	1,668	650	6,219	718	44	805	187	828	1,673	4,016	15,842	2	32	387	24	3	0	8	12	33,118

Tollable	
ADT	12,837
SeasonalFactors	
AADT(Vehicles)	13,097
PCUFactors	
AADT(PCUs)	30,367

TRAFFIC GROWTH RATES KHEEMANA																			
Year	2-wheel	3-wheel	Car/Jeep	MiniLCV	Minibus	Bus	LCV-4tyre	LCV-6tyre	2axleTruck	3axleTruck	MAV	OS7+axle	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	AnimalDrw.	Exempted
2019	9.0%	2.0%	5.5%	5.3%	3.3%	3.3%	5.3%	5.3%	-1.2%	-2.0%	7.3%	7.3%	7.3%	3.0%	3.0%	2.0%	1.0%	1.0%	5.0%
2020	9.0%	2.0%	5.9%	5.6%	3.5%	3.5%	5.6%	5.6%	-1.3%	-2.1%	7.7%	7.7%	7.7%	3.0%	3.0%	2.0%	1.0%	1.0%	5.0%
2021	9.0%	2.0%	6.0%	5.7%	3.6%	3.6%	5.7%	5.7%	-1.3%	-2.2%	7.9%	7.9%	7.9%	3.0%	3.0%	2.0%	1.0%	1.0%	5.0%
2022	9.0%	2.0%	6.1%	5.9%	3.6%	3.6%	5.9%	5.9%	-1.3%	-2.2%	8.0%	8.0%	8.0%	3.0%	3.0%	2.0%	1.0%	1.0%	5.0%
2023	9.0%	2.0%	6.0%	5.7%	3.6%	3.6%	5.7%	5.7%	-2.0%	-2.9%	7.9%	7.9%	7.9%	3.0%	3.0%	2.0%	1.0%	1.0%	5.0%
2024	8.0%	1.8%	6.0%	5.8%	3.6%	3.6%	5.8%	5.8%	-2.0%	-2.9%	7.9%	7.9%	7.9%	2.8%	2.8%	1.0%	0.0%	0.5%	4.5%
2025	8.0%	1.8%	5.9%	5.7%	3.5%	3.5%	5.7%	5.7%	-12.0%	-12.9%	-2.2%	-2.2%	-2.2%	2.8%	2.8%	1.0%	0.0%	0.5%	4.5%
2026	8.0%	1.8%	5.9%	5.6%	3.5%	3.5%	5.6%	5.6%	-22.0%	-22.8%	-12.3%	-12.3%	-12.3%	2.8%	2.8%	1.0%	0.0%	0.5%	4.5%
2027	8.0%	1.8%	5.8%	5.5%	3.4%	3.4%	5.5%	5.5%	-2.0%	-2.8%	7.6%	7.6%	7.6%	2.8%	2.8%	1.0%	0.0%	0.5%	4.5%
2028	8.0%	1.8%	5.5%	5.3%	3.3%	3.3%	5.3%	5.3%	-2.6%	-3.4%	7.3%	7.3%	7.3%	2.8%	2.8%	1.0%	0.0%	0.5%	4.5%
2029	7.0%	1.6%	5.5%	5.2%	3.2%	3.2%	5.2%	5.2%	-2.5%	-3.3%	7.2%	7.2%	7.2%	2.6%	2.6%	0.5%	0.0%	0.0%	4.0%
2030	7.0%	1.6%	5.4%	5.1%	3.2%	3.2%	5.1%	5.1%	-2.5%	-3.3%	7.1%	7.1%	7.1%	2.6%	2.6%	0.5%	0.0%	0.0%	4.0%
2031	7.0%	1.6%	5.3%	5.1%	3.2%	3.2%	5.1%	5.1%	-2.5%	-3.3%	7.0%	7.0%	7.0%	2.6%	2.6%	0.5%	0.0%	0.0%	4.0%
2032	7.0%	1.6%	5.2%	5.0%	3.1%	3.1%	5.0%	5.0%	-2.4%	-3.2%	6.9%	6.9%	6.9%	2.6%	2.6%	0.5%	0.0%	0.0%	4.0%
2033	7.0%	1.6%	5.0%	4.8%	3.0%	3.0%	4.8%	4.8%	-3.0%	-3.7%	6.6%	6.6%	6.6%	2.6%	2.6%	0.5%	0.0%	0.0%	4.0%
2034	6.0%	1.4%	4.9%	4.7%	2.9%	2.9%	4.7%	4.7%	-2.9%	-3.7%	6.5%	6.5%	6.5%	2.4%	2.4%	0.0%	0.0%	0.0%	3.5%
2035	6.0%	1.4%	4.9%	4.6%	2.9%	2.9%	4.6%	4.6%	-2.9%	-3.6%	6.4%	6.4%	6.4%	2.4%	2.4%	0.0%	0.0%	0.0%	3.5%
2036	6.0%	1.4%	4.8%	4.6%	2.8%	2.8%	4.6%	4.6%	-2.9%	-3.6%	6.3%	6.3%	6.3%	2.4%	2.4%	0.0%	0.0%	0.0%	3.5%
2037	6.0%	1.4%	4.7%	4.5%	2.8%	2.8%	4.5%	4.5%	-2.8%	-3.5%	6.2%	6.2%	6.2%	2.4%	2.4%	0.0%	0.0%	0.0%	3.5%
2038	6.0%	1.4%	4.6%	4.4%	2.8%	2.8%	4.4%	4.4%	-2.8%	-3.4%	6.1%	6.1%	6.1%	2.4%	2.4%	0.0%	0.0%	0.0%	3.5%
2039	5.0%	1.2%	4.4%	4.2%	2.6%	2.6%	4.2%	4.2%	-3.2%	-3.9%	5.8%	5.8%	5.8%	2.2%	2.2%	0.0%	0.0%	0.0%	3.0%
2040	5.0%	1.2%	4.4%	4.2%	2.6%	2.6%	4.2%	4.2%	-3.2%	-3.8%	5.7%	5.7%	5.7%	2.2%	2.2%	0.0%	0.0%	0.0%	3.0%
2041	5.0%	1.2%	4.3%	4.1%	2.5%	2.5%	4.1%	4.1%	-3.1%	-3.8%	5.6%	5.6%	5.6%	2.2%	2.2%	0.0%	0.0%	0.0%	3.0%
2042	5.0%	1.2%	4.2%	4.0%	2.5%	2.5%	4.0%	4.0%	-3.1%	-3.7%	5.5%	5.5%	5.5%	2.2%	2.2%	0.0%	0.0%	0.0%	3.0%
2043	5.0%	1.2%	4.1%	4.0%	2.5%	2.5%	4.0%	4.0%	-3.0%	-3.6%	5.4%	5.4%	5.4%	2.2%	2.2%	0.0%	0.0%	0.0%	3.0%
2044	4.0%	1.0%	4.1%	3.9%	2.4%	2.4%	3.9%	3.9%	-3.0%	-3.6%	5.3%	5.3%	5.3%	2.0%	2.0%	0.0%	0.0%	0.0%	2.5%
2045	4.0%	1.0%	3.9%	3.7%	2.3%	2.3%	3.7%	3.7%	-3.4%	-3.9%	5.1%	5.1%	5.1%	2.0%	2.0%	0.0%	0.0%	0.0%	2.5%
2046	4.0%	1.0%	3.8%	3.6%	2.3%	2.3%	3.6%	3.6%	-3.3%	-3.9%	5.0%	5.0%	5.0%	2.0%	2.0%	0.0%	0.0%	0.0%	2.5%
2047	4.0%	1.0%	3.7%	3.6%	2.2%	2.2%	3.6%	3.6%	-3.3%	-3.8%	4.9%	4.9%	4.9%	2.0%	2.0%	0.0%	0.0%	0.0%	2.5%
2048	4.0%	1.0%	3.7%	3.5%	2.2%	2.2%	3.5%	3.5%	-3.2%	-3.7%	4.8%	4.8%	4.8%	2.0%	2.0%	0.0%	0.0%	0.0%	2.5%

PROJECTEDAADT(Vehicles)Khemana																				
Year	2-wheel	3-wheel	Car/jeep	MiniLCV	Minibus	Bus	LCV-4tyre	LCV-6tyre	2axleTruck	3axleTruck	MAV	OS7+axle	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	AnimalDrw.	Exempted	Total
2019	3,635	663	6,563	504	30	277	131	581	551	1,312	3,776	0	8	89	16	5	0	2	13	18,159
2020	3,963	677	6,949	533	31	287	139	614	544	1,284	4,068	0	8	91	17	5	0	2	13	19,226
2021	4,319	690	7,365	563	32	297	147	649	537	1,256	4,388	1	9	94	17	5	0	2	14	20,387
2022	4,708	704	7,816	596	33	308	155	687	530	1,228	4,741	1	10	97	18	5	0	2	15	21,655
2023	5,132	718	8,285	630	35	319	164	726	519	1,193	5,115	1	10	100	19	6	0	2	15	22,987
2024	5,542	731	8,784	667	36	330	173	768	509	1,158	5,520	1	11	102	19	6	0	2	16	24,375
2025	5,986	744	9,307	704	37	342	183	812	447	1,009	5,399	1	11	105	20	6	0	2	17	25,131
2026	6,465	758	9,853	744	38	354	194	858	349	778	4,735	1	10	108	20	6	0	2	17	25,289
2027	6,982	771	10,423	785	40	366	204	905	342	756	5,096	1	10	111	21	6	0	2	18	26,840
2028	7,540	785	11,001	827	41	378	215	953	333	731	5,467	1	11	114	21	6	0	2	19	28,445
2029	8,068	798	11,602	870	42	390	226	1,003	325	706	5,859	1	12	117	22	6	0	2	20	30,069
2030	8,633	810	12,227	915	44	403	238	1,054	317	683	6,274	1	13	120	22	6	0	2	21	31,782
2031	9,237	823	12,876	961	45	416	250	1,108	309	661	6,711	1	14	124	23	6	0	2	21	33,588
2032	9,884	837	13,550	1,009	47	429	263	1,163	301	640	7,173	1	15	127	24	6	0	2	22	35,491
2033	10,576	850	14,228	1,057	48	441	275	1,219	292	616	7,645	1	16	130	24	6	0	2	23	37,449
2034	11,210	862	14,930	1,107	49	454	288	1,276	284	593	8,140	1	17	133	25	6	0	2	24	39,401
2035	11,883	874	15,655	1,159	51	467	301	1,336	275	572	8,659	1	18	136	25	6	0	2	25	41,445
2036	12,596	886	16,403	1,212	52	481	315	1,397	268	551	9,203	1	19	140	26	6	0	2	26	43,583
2037	13,351	899	17,175	1,266	54	494	329	1,459	260	532	9,772	1	20	143	27	6	0	2	27	45,818
2038	14,153	911	17,971	1,322	55	508	344	1,524	253	514	10,367	1	21	147	27	6	0	2	28	48,154
2039	14,860	922	18,766	1,378	57	521	359	1,588	245	494	10,969	1	22	150	28	6	0	2	28	50,397
2040	15,603	933	19,583	1,435	58	535	374	1,655	237	475	11,596	1	24	153	28	6	0	2	29	52,727
2041	16,383	944	20,421	1,494	59	548	389	1,722	229	457	12,248	1	25	156	29	6	0	2	30	55,146
2042	17,203	956	21,280	1,554	61	562	404	1,791	222	440	12,925	2	26	160	30	6	0	2	31	57,656
2043	18,063	967	22,160	1,616	62	576	420	1,862	216	424	13,628	2	28	163	30	6	0	2	32	60,257
2044	18,785	977	23,061	1,678	64	590	437	1,935	209	409	14,356	2	29	167	31	6	0	2	33	62,769
2045	19,537	987	23,953	1,740	65	603	453	2,006	202	393	15,086	2	31	170	32	6	0	2	34	65,302
2046	20,318	996	24,864	1,804	67	617	469	2,079	195	378	15,839	2	32	173	32	6	0	2	34	67,910
2047	21,131	1,006	25,792	1,868	68	631	486	2,153	189	363	16,616	2	34	177	33	6	0	2	35	70,594
2048	21,976	1,017	26,737	1,934	70	644	503	2,229	183	350	17,416	2	36	180	34	6	0	2	36	73,354

ProjectedAADTTollableKhemana											
Year	Car/jeep	MiniLCV	Minibus	Bus	LCV-4tyre	LCV-6tyre	2axleTruck	3axleTruck	MAV	OS7+axle	TotalToll
2019	6,563	504	30	277	131	581	551	1,312	3,776	0	13,735
2020	6,949	533	31	287	139	614	544	1,284	4,068	0	14,458
2021	7,365	563	32	297	147	649	537	1,256	4,388	1	15,244
2022	7,816	596	33	308	155	687	530	1,228	4,741	1	16,106
2023	8,285	630	35	319	164	726	519	1,193	5,115	1	16,996
2024	8,784	667	36	330	173	768	509	1,158	5,520	1	17,956
2025	9,307	704	37	342	183	812	447	1,009	5,399	1	18,252
2026	9,853	744	38	354	194	858	349	778	4,735	1	17,913
2027	10,423	785	40	366	204	905	342	756	5,096	1	18,929
2028	11,001	827	41	378	215	953	333	731	5,467	1	19,957
2029	11,602	870	42	390	226	1,003	325	706	5,859	1	21,036
2030	12,227	915	44	403	238	1,054	317	683	6,274	1	22,167
2031	12,876	961	45	416	250	1,108	309	661	6,711	1	23,351
2032	13,550	1,009	47	429	263	1,163	301	640	7,173	1	24,590
2033	14,228	1,057	48	441	275	1,219	292	616	7,645	1	25,838
2034	14,930	1,107	49	454	288	1,276	284	593	8,140	1	27,139
2035	15,655	1,159	51	467	301	1,336	275	572	8,659	1	28,493
2036	16,403	1,212	52	481	315	1,397	268	551	9,203	1	29,901
2037	17,175	1,266	54	494	329	1,459	260	532	9,772	1	31,364
2038	17,971	1,322	55	508	344	1,524	253	514	10,367	1	32,881
2039	18,766	1,378	57	521	359	1,588	245	494	10,969	1	34,401
2040	19,583	1,435	58	535	374	1,655	237	475	11,596	1	35,972
2041	20,421	1,494	59	548	389	1,722	229	457	12,248	1	37,595
2042	21,280	1,554	61	562	404	1,791	222	440	12,925	2	39,269
2043	22,160	1,616	62	576	420	1,862	216	424	13,628	2	40,994
2044	23,061	1,678	64	590	437	1,935	209	409	14,356	2	42,769
2045	23,953	1,740	65	603	453	2,006	202	393	15,086	2	44,535

2046	24,864	1,804	67	617	469	2,079	195	378	15,839	2	32	46,347
2047	25,792	1,868	68	631	486	2,153	189	363	16,616	2	34	48,204
2048	26,737	1,934	70	644	503	2,229	183	350	17,416	2	36	50,103



ProjectedAADT(PCUs)Kheemana																				
Year	2-wheel	3-wheel	Car/jeep	MiniLCV	Minibus	Bus	LCV-4tyre	LCV-6tyre	2axleTruck	3axleTruck	MAV	OS7+axle	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	AnimalDraw.	Exempted	Total
2019	1,818	663	6,949	756	45	831	197	872	1,653	3,935	16,994	2	35	399	25	3	0	8	13	34,812
2020	1,981	677	6,949	799	47	861	208	921	1,632	3,852	18,307	2	37	411	25	3	0	8	13	36,733
2021	2,160	690	7,365	845	48	891	220	974	1,611	3,768	19,747	2	40	423	26	3	0	8	14	38,836
2022	2,354	704	7,816	894	50	924	233	1,031	1,590	3,685	21,336	2	44	436	27	3	0	8	15	41,151
2023	2,566	718	8,285	945	52	957	246	1,090	1,557	3,578	23,015	3	47	449	28	3	0	8	15	43,562
2024	2,771	731	8,784	1,000	54	991	260	1,152	1,526	3,473	24,838	3	51	461	29	3	0	8	16	46,151
2025	2,993	744	9,307	1,057	56	1,026	275	1,218	1,342	3,026	24,295	3	50	474	29	3	0	8	17	45,922
2026	3,232	758	9,853	1,116	58	1,062	290	1,286	1,047	2,335	21,310	2	44	487	30	3	0	9	17	42,938
2027	3,491	771	10,423	1,178	60	1,098	306	1,357	1,027	2,269	22,931	3	47	501	31	3	0	9	18	45,522
2028	3,770	785	11,001	1,240	62	1,134	323	1,429	1,000	2,192	24,600	3	50	515	32	3	0	9	19	48,166
2029	4,034	798	11,602	1,305	64	1,171	340	1,504	975	2,119	26,365	3	54	528	33	3	0	9	20	50,925
2030	4,316	810	12,227	1,372	66	1,209	357	1,581	950	2,049	28,231	3	58	542	34	3	0	9	21	53,838
2031	4,619	823	12,876	1,442	68	1,247	375	1,662	927	1,982	30,201	4	62	556	34	3	0	9	21	56,911
2032	4,942	837	13,550	1,514	70	1,286	394	1,745	904	1,919	32,279	4	66	571	35	3	0	9	22	60,148
2033	5,288	850	14,228	1,586	72	1,324	413	1,828	877	1,847	34,401	4	70	586	36	3	0	9	23	63,445
2034	5,605	862	14,930	1,661	74	1,363	432	1,914	851	1,780	36,628	4	75	600	37	3	0	9	24	66,852
2035	5,941	874	15,655	1,738	76	1,402	452	2,003	826	1,715	38,965	5	80	614	38	3	0	9	25	70,421
2036	6,298	886	16,403	1,817	78	1,442	473	2,095	803	1,654	41,413	5	85	629	39	3	0	9	26	74,157
2037	6,676	899	17,175	1,899	80	1,482	494	2,189	780	1,596	43,975	5	90	644	40	3	0	9	27	78,063
2038	7,076	911	17,971	1,983	83	1,523	516	2,286	759	1,541	46,652	5	96	659	41	3	0	9	28	82,143
2039	7,430	922	18,766	2,067	85	1,563	538	2,383	734	1,482	49,362	6	101	674	42	3	0	9	28	86,195
2040	7,802	933	19,583	2,153	87	1,604	560	2,482	711	1,425	52,184	6	107	689	43	3	0	9	29	90,408
2041	8,192	944	20,421	2,241	89	1,645	583	2,583	688	1,371	55,118	6	113	704	44	3	0	9	30	94,784
2042	8,601	956	21,280	2,331	91	1,686	607	2,687	667	1,321	58,165	7	119	719	45	3	0	9	31	99,324
2043	9,031	967	22,160	2,423	94	1,727	631	2,793	647	1,273	61,325	7	126	735	46	3	0	9	32	104,029
2044	9,393	977	23,061	2,518	96	1,769	655	2,902	628	1,227	64,600	8	132	750	47	3	0	9	33	108,805
2045	9,768	987	23,953	2,611	98	1,810	679	3,009	606	1,179	67,886	8	139	765	47	3	0	9	34	113,591
2046	10,159	996	24,864	2,706	100	1,851	704	3,119	586	1,133	71,277	8	146	780	48	3	0	9	34	118,525
2047	10,565	1,006	25,792	2,802	103	1,892	729	3,230	567	1,090	74,773	9	153	796	49	3	0	9	35	123,604
2048	10,988	1,017	26,737	2,900	105	1,933	755	3,343	549	1,049	78,372	9	161	812	50	3	0	9	36	128,827

ProjectedAADTTollable(PCUs)/Kheemana												
Year	Car/jeep	MiniLCV	Minibus	Bus	LCV-4tyre	LCV-6tyre	2axleTruck	3axleTruck	MAV	OS7+axle	HCM/EME	TotalToll
2019	6,563	756	45	831	197	872	1,653	3,935	16,994	2	35	31,884
2020	6,949	799	47	861	208	921	1,632	3,852	18,307	2	37	33,615
2021	7,365	845	48	891	220	974	1,611	3,768	19,747	2	40	35,513
2022	7,816	894	50	924	233	1,031	1,590	3,685	21,336	2	44	37,605
2023	8,285	945	52	957	246	1,090	1,557	3,578	23,015	3	47	39,775
2024	8,784	1,000	54	991	260	1,152	1,526	3,473	24,833	3	51	42,132
2025	9,307	1,057	56	1,026	275	1,218	1,342	3,026	24,295	3	50	41,654
2026	9,853	1,116	58	1,062	290	1,286	1,047	2,335	21,310	2	44	38,402
2027	10,423	1,178	60	1,098	306	1,357	1,027	2,269	22,931	3	47	40,699
2028	11,001	1,240	62	1,134	323	1,429	1,000	2,192	24,600	3	50	43,034
2029	11,602	1,305	64	1,171	340	1,504	975	2,119	26,365	3	54	45,500
2030	12,227	1,372	66	1,209	357	1,581	950	2,049	28,231	3	58	48,103
2031	12,876	1,442	68	1,247	375	1,662	927	1,982	30,201	4	62	50,845
2032	13,550	1,514	70	1,286	394	1,745	904	1,919	32,279	4	66	53,730
2033	14,228	1,586	72	1,324	413	1,828	877	1,847	34,401	4	70	56,650
2034	14,930	1,661	74	1,363	432	1,914	851	1,780	36,628	4	75	59,712
2035	15,655	1,738	76	1,402	452	2,003	826	1,715	38,965	5	80	62,917
2036	16,403	1,817	78	1,442	473	2,095	803	1,654	41,413	5	85	66,268
2037	17,175	1,899	80	1,482	494	2,189	780	1,596	43,975	5	90	69,767
2038	17,971	1,983	83	1,523	516	2,286	759	1,541	46,652	5	96	73,416
2039	18,766	2,067	85	1,563	538	2,383	734	1,482	49,362	6	101	77,087
2040	19,583	2,153	87	1,604	560	2,482	711	1,425	52,184	6	107	80,901
2041	20,421	2,241	89	1,645	583	2,583	688	1,371	55,118	6	113	84,859
2042	21,280	2,331	91	1,686	607	2,687	667	1,321	58,165	7	119	88,960
2043	22,160	2,423	94	1,727	631	2,793	647	1,273	61,325	7	126	93,206
2044	23,061	2,518	96	1,769	655	2,902	628	1,227	64,600	8	132	97,595
2045	23,953	2,611	98	1,810	679	3,009	606	1,179	67,886	8	139	101,979

2046	24,864	2,706	100	1,851	704	3,119	586	1,133	71,277	8	146	106,495
2047	25,792	2,802	103	1,892	729	3,230	567	1,090	74,773	9	153	111,140
2048	26,737	2,900	105	1,933	755	3,343	549	1,049	78,372	9	161	115,913

ANNEXURE11MAJOR AND MINOR JUNCTIONS

MAJOR JUNCTION

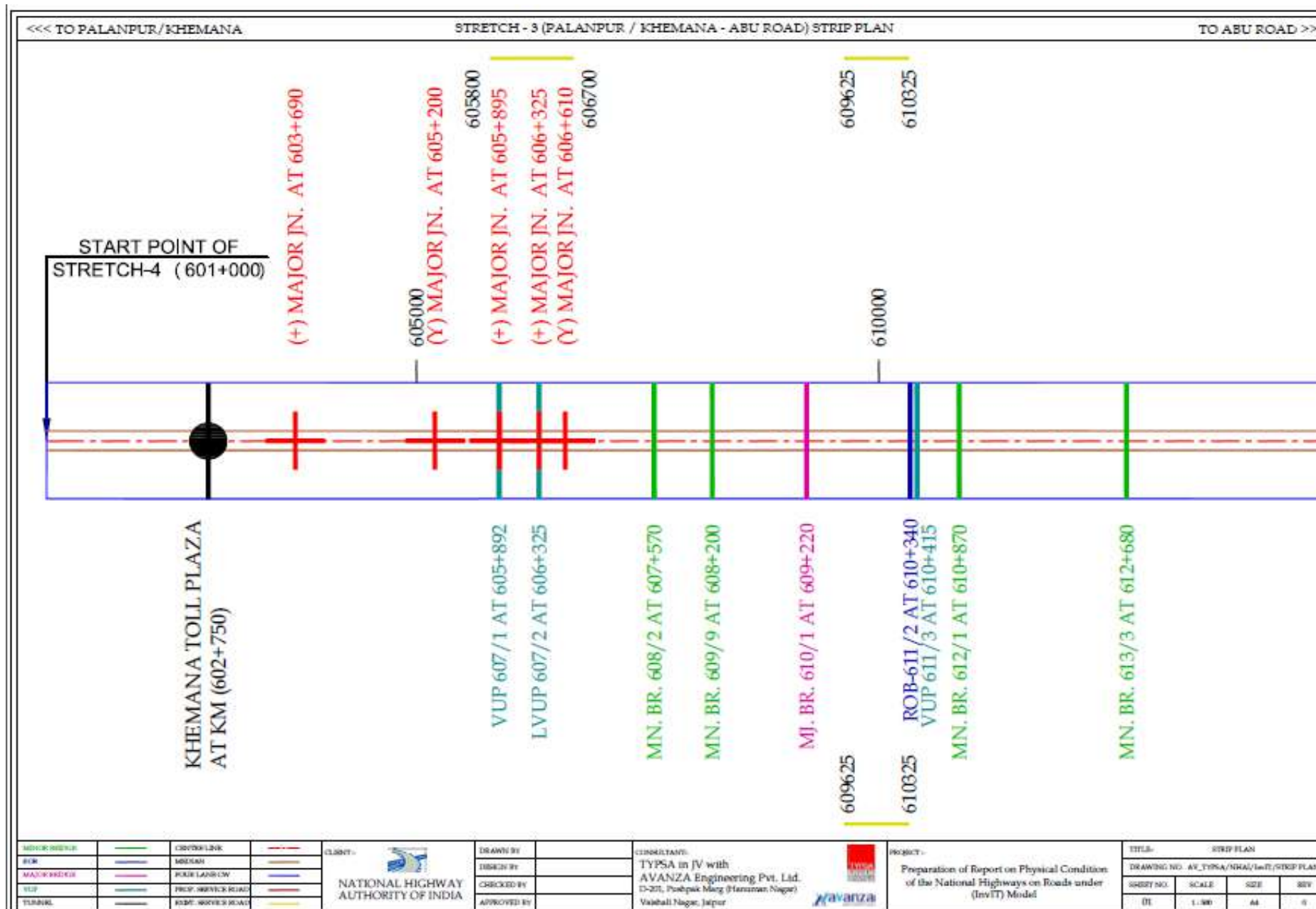
S.No.	Existing Chainage	Type of Junction	Direction		Type of Crossroad	Remarks	
			Left	Right			
1	603+690	+	Hebatpur	Karjoda	BT	Grade Separator	
2	605+200	Y	-	Chitrasni	BT	Grade Separator	
3	605+895	+	Hebatpur	Chitrasni	BT	VUP	SH-54
4	606+325	+	Bhavri	Kotda	BT	VUP Grade Separator	
5	606+610	Y	-	Chitrasni	BT	VR	Grade Separator
6	644+700	+	Mount Abu	Ambaji	BT	Flyover	SH-11

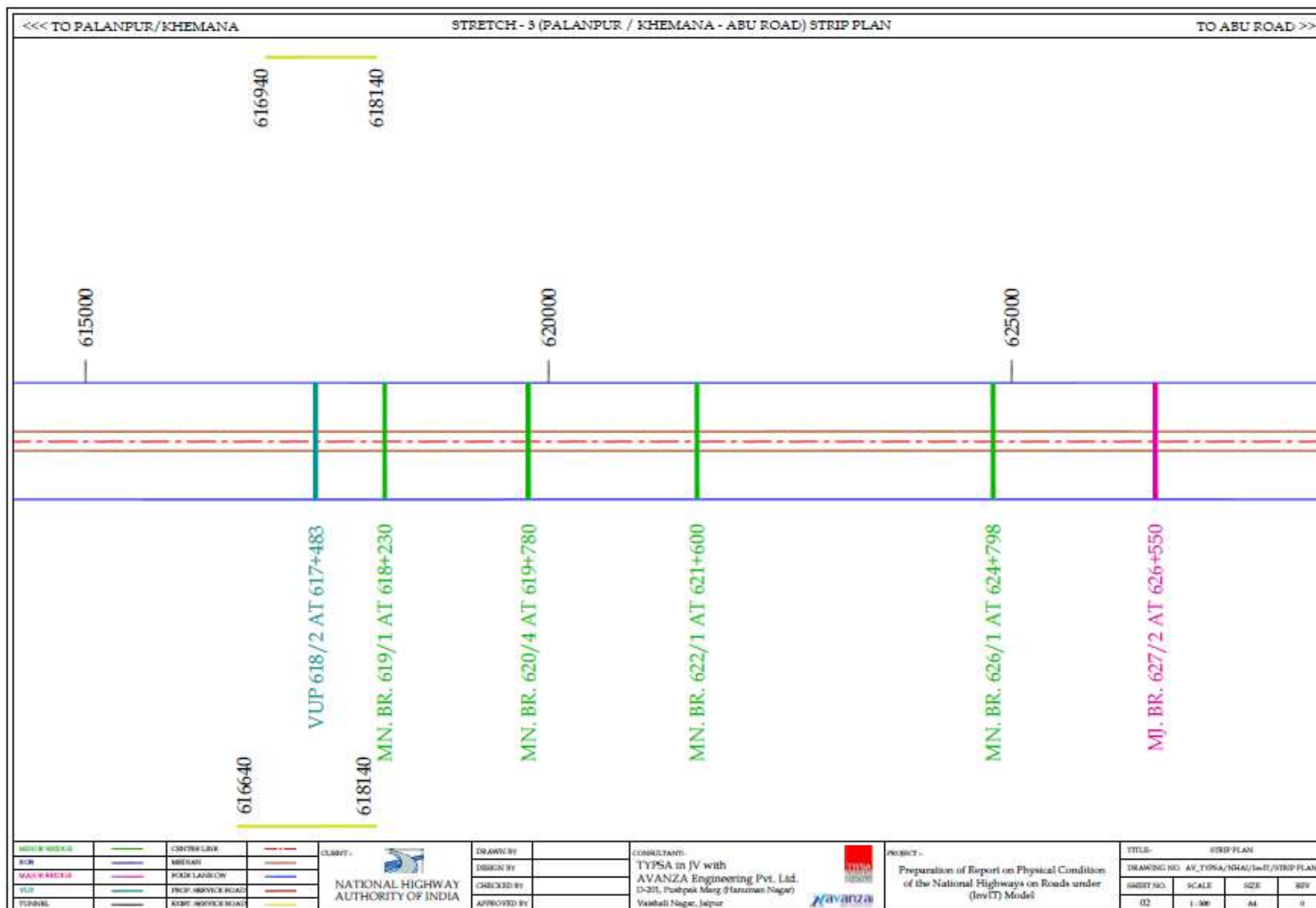
MINOR JUNCTIONS

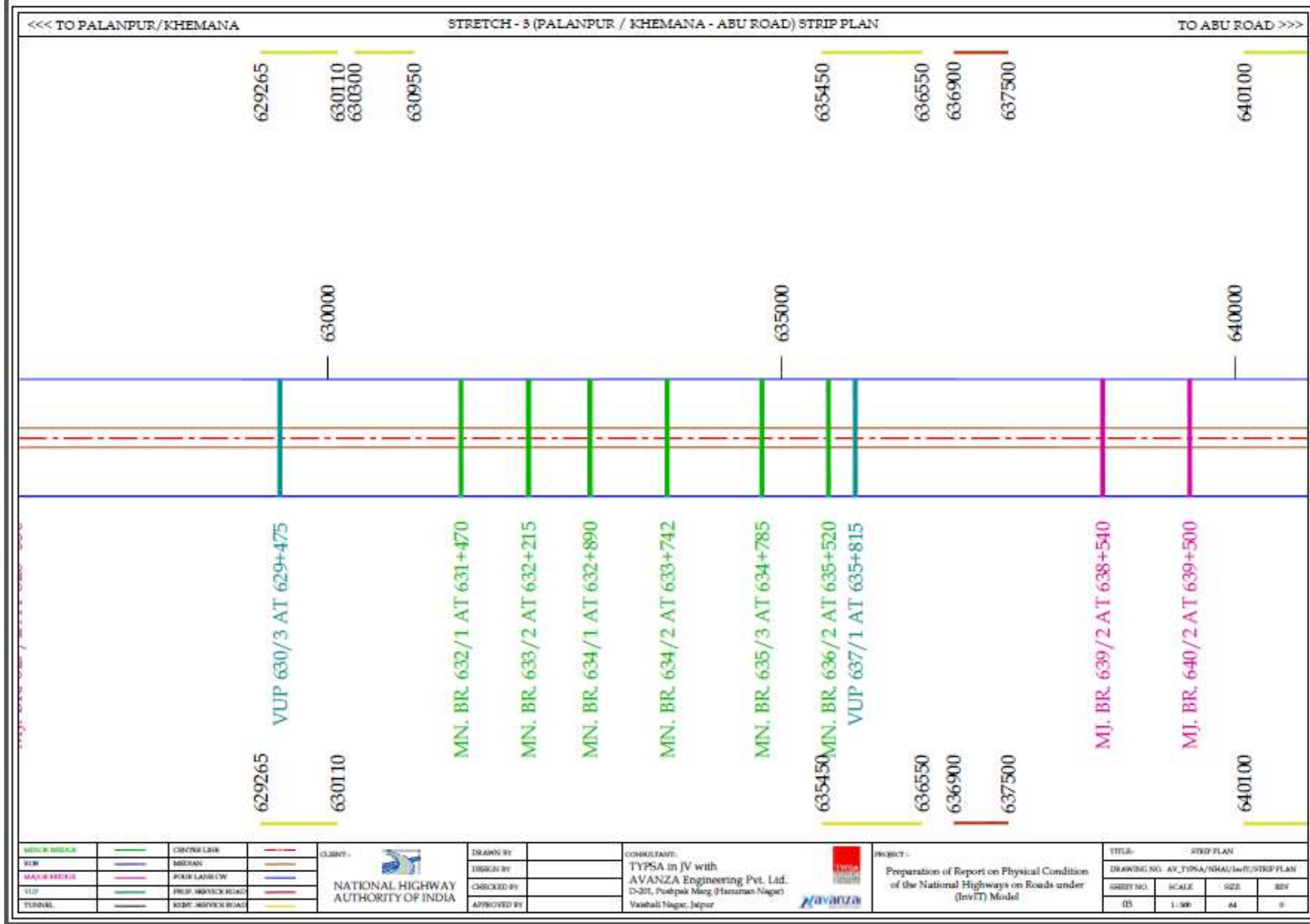
S.No	Chainage	Side	Type
1	603+600	LHS	Y
2	605+200	RHS	Y
3	606+600	RHS	Y
4	613+230	RHS	T
5	617+725	BHS	+
6	620+800	LHS	T
7	621+200	LHS	T
8	622+300	LHS	Y
9	623+650	LHS	T
10	625+880	BHS	+
11	629+200	RHS	T
12	632+200	RHS	Y
13	633+600	BHS	+
14	634+900	RHS	T
15	635+120	RHS	T
16	637+030	RHS	T
17	637+480	RHS	+
18	638+100	LHS	T

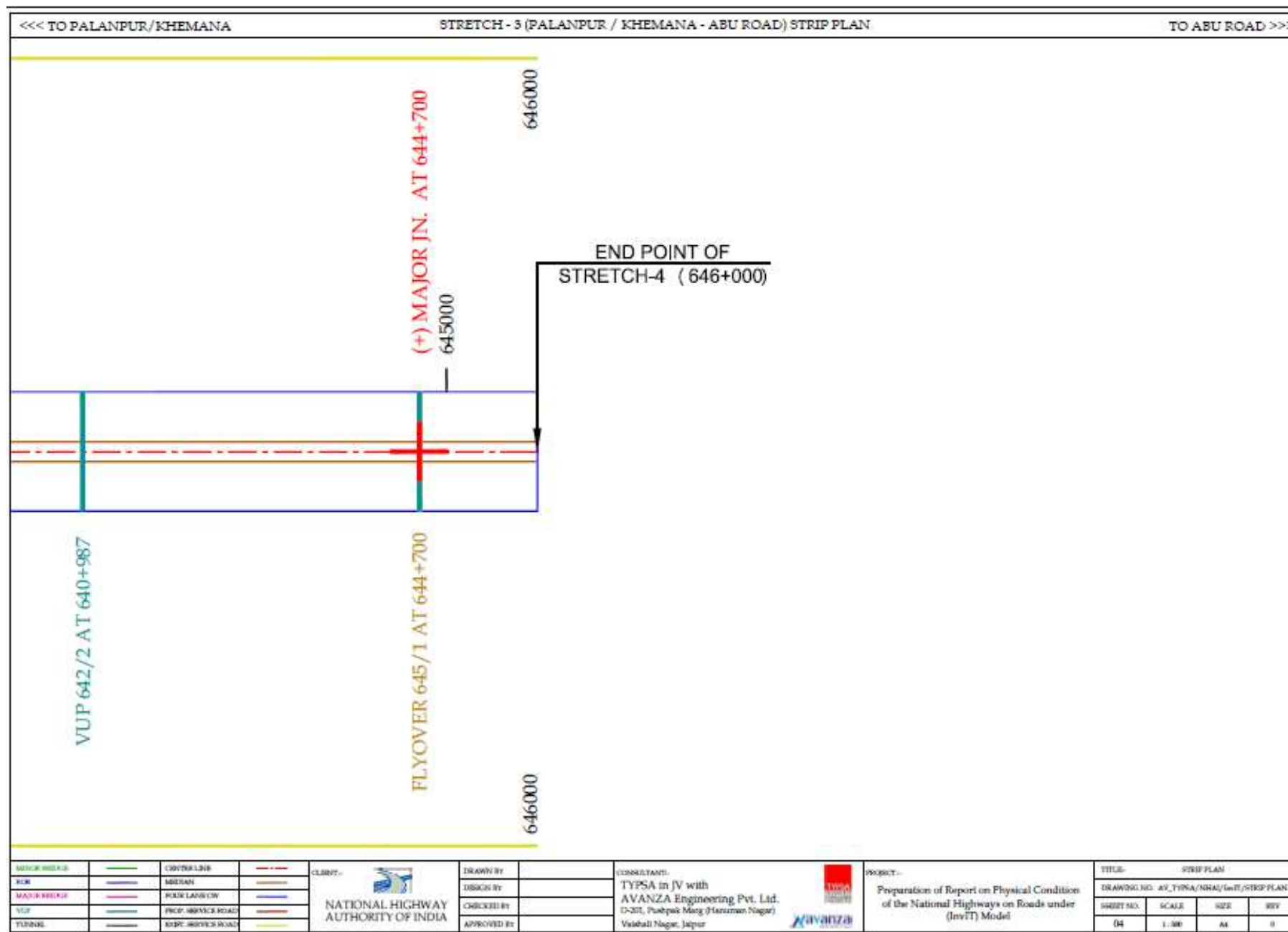
ANNEXURE12

STRIP PLAN & KILOMETRIC REFERENCE









KilometricReference			
NH27Palanpur/Khemana-AbuRoad			
SR.NO.	EXISTINGKMSTONE	PROJECT(NSV)KM CHAINAGE(*)	DESIGN(LiDAR)KM CHAINAGE
1	601+000	601+000	601+000
2	602+000	601+750	601+750
3	603+000	602+760	602+765
4	604+000	603+750	603+770
5	605+000	604+740	604+760
6	606+000	605+750	605+780
7	607+000	606+710	606+735
8	608+000	607+740	607+770
9	609+000	608+730	608+770
10	610+000	609+710	609+750
11	611+000	610+680	610+730
12	612+000	611+710	611+770
13	613+000	612+710	612+775
14	614+000	613+700	613+770
15	615+000	614+700	614+770
16	616+000	615+700	615+770
17	617+000	616+700	616+780
18	618+000	617+690	617+775
19	619+000	618+680	618+775
20	620+000	619+740	619+830
21	621+000	620+660	620+775
22	622+000	621+660	621+775
23	623+000	622+650	622+765
24	624+000	623+650	623+775
25	625+000	624+640	624+775
26	626+000	625+640	625+775
27	627+000	626+640	626+780
28	628+000	627+620	627+765
29	629+000	628+630	628+775
30	630+000	629+620	629+775
31	631+000	-	630+785
32	632+000	631+610	631+780
33	633+000	632+610	632+780
34	634+000	633+600	633+780
35	635+000	634+620	634+810
36	636+000	635+590	635+780
37	637+000	636+590	636+785
38	638+000	637+580	637+780
39	639+000	638+580	638+790
40	640+000	639+570	639+790
41	641+000	640+570	640+790
42	642+000	641+570	641+790
43	643+000	642+570	642+795
44	644+000	643+560	643+790
45	645+000	644+550	644+790
46	646+000	645+550	645+790

(*) KilometricchainagereferstoLHSOuterlane

NATIONAL HIGHWAYS AUTHORITY OF INDIA



Operation and Maintenance period for Palanpur to Swaroopganj Km.340.000 (New Km.601.000) to Km.264.000 (New Km.677.000) of NH-14 (New NH-27) constructed on BOT (Annuity) mode under NHDP Phase-III in the State of Gujarat & Rajasthan

STRUCTURES INVENTORY AND CONDITION SURVEY

Independent Engineer



Mobile Bridge Inspection Unit (MBIU) Survey Report (4th Cycle)

Mobile Bridge Inspection Unit (MBIU)

Instrument Details

Make : Pal finger
Model : PK1901

Specification

The Mobile Bridge Inspection Unit (referred as (MBIU) is an Electro-mechanically driven Articulated Structure mounted on a vehicle (a truck) as an aid towards proper inspection of bridges or similar infrastructures by enabling an inspection team of 2-3 persons carrying instruments access to the underside of bridge decks over flowing rivers or gorges. The present version is the truck mounted system.

Working Principle

The work of condition survey requires use of Mobile Bridge Inspection Unit at the various bridge sites on the National Highways to overcome the accessibility problems. MBIU increases the accessibility for inspection of underside of high level bridge decks and helps in continuous inspection of throughout the span of bridge. It has five folded arms. All of them are electro-mechanically operated.

Once the platform is erected by certified person, Inspection and maintenance experts can inspect underside of bridge, note observations as per IRC SP-35& IRC SP-52 and take photographs for reference.

Advantages

- A large operating range
- A high level of working comfort
- Maximum operational safety
- The shortest possible setting up and dismantling times
- Full mobility in inspection operation without stabilizer supports
- An optimum weight/performance ratio

Applications

Visual Inspection for condition assessment of Bridges, NDT and during repair / and repairing of bridges.

User Instructions

- Operation of MBIU is not allowed for a wind speed exceeding 12.5 m/sec (i.e. 45 km/hr.)
- Transportation speed of MBIU to be restricted to 40-50 Km/hr.

Supporting Equipment Used

- Laser Densitometer
- 30 m Tape
- Torch
- Ladder
- Camera
- 05 m Tape
- Hammer
- Cracks measurement card

Site Photographs



(A)



(B)



(C)



(D)

Structures Inventory & Condition **Survey**

Box Culverts

INVENTORY AND CONDITION SURVEY OF BOX CULVERTS																						
ROAD NAME: NH-27															DIRECTION: PALANPUR - SWAROOPGANJ							
S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
1	Box	609/1	608+080	1	3.00	0.70	0.30	2 x 9.00	22.50	RCC	2.50	0.30	3.60	RCC	2.00	0.30	5.50	Not visible	Not provided	R to L	Poor	1. Silt and debris are accumulated. 2. Vent way is blocked and filled with soil.
2	Box	609/2	608+130	1	3.00	2.50	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.60	RCC	2.00	0.30	4.00	Not visible	Not provided	R to L	Fair	1. Silt and debris are accumulated. .
3	Box	609/3	608+180	1	3.00	2.50	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.60	RCC	1.20	0.30	4.00	Not visible	Not provided	R to L	Fair	1. Silt and debris are accumulated.
4	Box	609/5	608+230	1	3.00	2.50	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.60	RCC	2.00	0.30	4.00	Not visible	Not provided	R to L	Fair	1. Silt and debris are accumulated.
5	Box	609/6	608+280	1	3.00	2.50	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.60	RCC	2.00	0.30	4.00	Not visible	Not provided	R to L	Poor	1. Vegetation is grown on both sides. 2. Vent way is blocked and filled with soil.
6	Box	609/7	608+330	1	3.00	2.50	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.60	RCC	0.60	0.30	4.00	Not visible	Not provided	R to L	Poor	1. Vegetation is grown on both sides. 2. Vent way is blocked and filled with soil.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
7	Box	609/8	608+380	1	3.00	2.50	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.60	RCC	0.60	0.30	4.00	Not visible	Not provided	R to L	Poor	1. Vegetation is grown on both sides. 2. Silt and debris are accumulated.
8	Box	610/2	609+580	1	3.00	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	3.60	RCC	3.10	0.30	4.00	Not visible	Not provided	R to L	Poor	1. Vegetation is grown on both sides. 2. Silt and debris are accumulated.
9	Box	610/3	609+630	1	3.00	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	3.60	RCC	2.50	0.30	4.00	Not visible	Not provided	R to L	Fair	1. Silt and debris are accumulated..
10	Box	610/4	609+680	1	3.00	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	3.60	RCC	2.50	0.30	4.00	Not visible	Not provided	R to L	Poor	1. Vegetation is grown on both sides. 2. Vent way is blocked and filled with soil.
11	Box	610/5	609+980	1	3.00	2.00	0.30	2 x 9.00	38.50	RCC	1.20	0.30	3.60	RCC	2.80	0.30	4.00	Not visible	Not provided	R to L	Fair	1. Vegetation is grown on both sides. 2. Vent way is filled with soil
12	Box	611/1	610+040	1	2.00	1.80	0.30	2 x 9.00	38.50	RCC	1.00	0.30	2.60	RCC	4.00	0.30	4.00	Not visible	Not provided	R to L	Fair	1. Silt and debris are accumulated.
13	Box	614/3	613+915	1	4.00	2.00	0.30	2 x 9.00	22.50	RCC	1.50	0.30	4.60	RCC	4.00	0.30	4.00	Not visible	Stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated.. 2. Vent way is filled with soil.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
14	Box	616/2	615+422	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	3.00	0.30	2.60	RCC	4.00	0.30	4.00	Not visible	Stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated.
15	Box	621/1	620+865	1	2.00	1.80	0.30	2 x 9.00	22.50	RCC	1.00	0.30	2.60	RCC	1.80	0.30	3.00	Not visible	Not provided	R to L	Poor	1. Silt and debris are accumulated. 2. Vent way is blocked and filled with soil and boulders.
16	Box	623/1	622+655	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	1.50	0.30	2.60	RCC	3.00	0.30	3.50	Not visible	Stone pitching is provided	R to L	Poor	1. Vegetation is grown on both sides of side slopes. 2. Vent way is filled with soil. 3. Silt and debris are accumulated..
17	Box	624/1	623+510	1	2.50	1.50	0.30	2 x 9.00	22.50	RCC	2.70	0.30	2.90	RCC	2.10	0.30	3.50	Not visible	Stone pitching is provided	R to L	Poor	1. Vegetation is grown on both sides of side slopes. 2. Vent way is filled with soil. 3. Silt and debris are accumulated..
18	Box	625/1	624+380	1	3.40	1.20	0.20	2 x 9.00	22.50	RCC	1.00	0.30	3.90	RCC	2.40	0.30	2.50	Not visible	Stone pitching is provided	R to L	Poor	1. Vent way is filled with soil. 2. Silt and debris are accumulated..
19	Box	628/1	627+685	1	2.00	2.00	0.20	2 x 9.00	22.50	RCC	1.20	0.30	2.40	RCC	3.00	0.30	3.00	Not visible	Stone pitching is provided	R TO L	Fair	1. Extensive growth of vegetation on side slopes. 2. Silt and debris are accumulated.
20	Box	630/1	629+268	1	2.00	1.30	0.30	2 x 9.00	22.50	RCC	1.50	0.30	1.80	RCC	2.50	0.30	3.50	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation is grown on both sides of side slopes. 2. Stone pitching is partially damaged. 2. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
21	Box	631/1	630+100	1	2.00	1.30	0.30	2 x 9.00	22.50	RCC	1.50	0.30	2.50	RCC	1.80	0.30	2.00	Not visible	Not visible due to growth of vegetation	R to L	Fair	1. Extensive growth of vegetation on side slopes and also in vent way. 2. Silt and debris are accumulated.
22	Box	633/3	632+740	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	4.00	0.30	2.50	RCC	3.50	0.30	7.40	Not visible	Not visible due to growth of vegetation	R to L	Fair	1. Extensive growth of vegetation on side slopes and also in vent way. 2. Silt and debris are accumulated.
23	Box	638/1	637+715	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	1.00	0.30	2.40	RCC	2.40	0.30	2.50	Not visible	Stone pitching is provided	L to R	Poor	1. Vegetation is grown on both sides of side slopes. 2. Stone pitching is partially damaged.
24	Box	640/1	639+211	1	2.00	1.20	0.30	2 x 9.00	22.50	RCC	1.00	0.30	1.80	RCC	1.50	0.30	2.50	Not visible	Stone pitching is provided	R to L	Fair	1. Stone pitching is partially damaged.
25	Box	641/1	640+819	1	2.50	1.00	0.30	2 x 9.00	35.50	RCC	1.00	0.30	3.50	RCC	1.40	0.30	2.80	Not visible	Stone pitching is provided	R to L	Poor	1. Stone pitching is partially damaged. 2. Vegetation is grown on both sides. 3. Water staged in vent way.
26	Box	642/1	641+108	1	3.70	1.10	0.30	2 x 9.00	35.50	RCC	1.00	0.30	4.10	RCC	1.40	0.30	2.50	Not visible	Stone pitching is provided	R to L	Fair	1. Culvert is in fair condition. 2. Silt and debris are accumulated.
27	Box	645/2	644+874	1	4.30	1.40	0.30	2 x 9.00	35.50	RCC	1.30	0.30	4.80	RCC	2.40	0.30	2.80	Not visible	Not provided	L to R	Fair	1. Silt and debris are accumulated. 2. Sewage water is stagnated in vent way.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
28	Box	645/3	644+993	1	4.00	1.00	0.30	2 x 9.00	35.50	RCC	0.90	0.30	4.40	RCC	1.50	0.30	2.50	Not visible	Not provided	R to L	Fair	1. Silt and debris are accumulated. 2. Sewage water is stagnated in vent way.
29	Box	647/1	646+325	1	2.00	1X3.0	0.30	2 x 9.00	35.50	RCC	0.90	0.30	2.40	RCC	1.50	0.30	3.50	Not provided	Stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated. 2. Flow is obstructed by vegetation
31	Box	647/3	646+985	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	2.40	RCC	2.80	0.30	4.50	Not visible	Stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated. 2. Sewage water is stagnated in vent way. 3. Stone pitching is partially damaged.
32	Box	648/1	647+071	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	2.40	RCC	2.80	0.30	4.50	Not visible	Stone pitching is provided	R to L	Fair	1. Flow is obstructed by vegetation 2. Silt and debris are present
33	Box	649/1	648+167	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	1.50	0.30	2.40	RCC	3.20	0.30	3.00	Not visible	Stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated. 2. Sewage water is stagnated in vent way. .
34	Box	649/2	648+884	1	2.40	1.20	0.30	2 x 9.00	22.50	RCC	2.00	0.30	3.60	RCC	2.20	0.30	3.00	Not visible	Stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated. 2. Vegetation are observed on the side slopes
35	Box	650/2	649+684	1	2.40	1.20	0.30	2 x 9.00	22.50	RCC	2.00	0.30	2.80	RCC	3.00	0.30	2.60	Not visible	Stone pitching is provided	L to R	Fair	1. Silt and debris are accumulated. 2. Stone pitching is partially damaged.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
36	Box	650/3	649+790	1	2.50	1.50	0.30	2 x 9.00	22.50	RCC	2.00	0.30	3.00	RCC	3.10	0.30	3.60	Not visible	Stone pitching is provided	L to R	Fair	1. Silt and debris are accumulated. 2. Stone pitching is partially damaged.
37	Box	650/4	650+010	1	5.70	1.50	0.30	2 x 9.00	22.50	RCC	1.20	0.30	6.20	RCC	2.50	0.30	3.00	Not visible	Stone pitching is provided	L to R	Fair	1. Silt and debris are accumulated.
38	Box	652/2	651+690	1	4.00	3.00	0.30	2 x 9.00	22.50	RCC	1.40	0.30	4.60	RCC	4.20	0.30	4.60	Not visible	Stone pitching not visible due to vegetation	R to L	Fair	1. Extensive growth of vegetation on side slopes. 2. Silt and debris are accumulated.
39	Box	652/3	651+800	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	3.00	0.30	2.40	RCC	4.20	0.30	7.60	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation is grown on both side side slopes. 2. Silt and debris are accumulated.
40	Box	654/1	653+125	1	2.00	3.00	0.30	2 x 9.00	22.50	RCC	3.00	0.30	2.40	RCC	5.50	0.30	4.00	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation is grown on LHS. 2. Silt and debris are accumulated.
41	Box	655/1	654+108	1	2.90	1.40	0.30	2 x 9.00	22.50	RCC	1.50	0.30	3.40	RCC	2.50	0.30	3.20	Not visible	Stone pitching is provided	L to R	Fair	1. Vegetation is grown on RHS. 2. Silt and debris are accumulated. 3. water is stagnated in vent way.
42	Box	655/2	654+893	1	2.90	1.40	0.30	2 x 9.00	22.50	RCC	1.20	0.30	3.40	RCC	2.0	0.30	2.50	Not visible	Stone pitching is provided	L to R	Fair	1. Vegetation is growth on side slopes. 2. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
43	Slab/Box	656/1	655+252	1	1.85	1.00	0.30	2 x 9.00	22.50	RCC	1.50	0.30	2.00	STONE	1.50	0.30	3.00	Not visible	Stone pitching is provided	L to R	Poor	2. Silt and debris are accumulated.
44	Slab/Box	656/2	655+688	1	2.50	1.10	0.20	2 x 9.00	22.50	RCC	2.00	0.30	3.00	RCC	2.80	0.30	3.20	Not visible	Stone pitching not visible due to vegetation	L to R	Poor	1. Extensive growth of vegetation on side slopes. 2. Silt and debris are accumulated. 3. Crash barrier is damaged
45	Box	657/1	656+185	1	4.00	1.00	0.30	2 x 9.00	22.50	RCC	1.50	0.30	4.60	RCC	2.00	0.30	2.20	Not visible	Stone pitching is provided	R to L	Poor	1. Vegetation is grown on RHS. 2. Stone pitching is partially damaged.
46	Box	660/1	659+024	1	3.00	3.00	0.30	2 x 9.00	37.50	RCC	1.00	0.30	3.60	RCC	3.60	0.30	4.00	Not visible	Stone pitching is provided	R to L	Poor	1. Silt and debris are accumulated. 2. Stone pitching is partially damaged.
47	Box	660/4	659+708	1	2.90	1.40	0.30	2 x 9.00	37.50	RCC	1.80	0.30	3.50	RCC	3.00	0.30	3.00	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation is grown on side slopes. 2. Stone pitching is partially damaged. 3. Silt and debris are accumulated.
48	Box	661/1	660+463	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	2.00	0.30	2.60	RCC	3.60	0.30	4.50	Not visible	Stone pitching is provided	R to L	Fair	1. Water is stagnated in vent way. 2. Silt and debris are accumulated. 3. Flow is obstructed by boulders
49	Box	661/2	660+963	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	2.70	0.30	2.60	RCC	4.40	0.30	4.50	Not visible	Stone pitching is provided	L to R	Fair	1. Extensive growth of vegetation on side slopes. 2. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
50	Box	662/2	661+489	1	1.50	1.10	0.30	2 x 9.00	22.50	RCC	1.50	0.30	2.00	RCC	2.40	0.30	3.00	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation is grown on both sides. 2. Stone pitching is partially damaged.
51	Box	662/4	661+799	1	1.00	1.40	0.2/0.50	2 x 9.00	22.50	RCC	1.00	0.30	2.00	RCC	0.90	0.30	3.40	Not visible	Stone pitching is provided	R to L	Poor	1. Vegetation is grown on both sides. 2. Water is stagnated in vent way. 3. Silt and debris are accumulated.
52	Box	663/1	662+253	1	2.90	1.40	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.50	RCC	2.00	0.30	2.50	Not visible	Stone pitching not visible due to vegetation	R to L	Poor	1. Extensive growth of vegetation on side slopes. 2. Water is stagnated in vent way.
53	Box	665/1	664+002	1	3.40	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	4.00	RCC	2.00	0.30	2.60	Not visible	Stone pitching not visible due to vegetation	L to R	Poor	1. Extensive growth of vegetation on side slopes and partially damaged 2. Silt and debris are accumulated. 3. Flow is obstructed by vegetation
54	Box	665/2	664+808	1	2.50	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	3.00	RCC	3.00	0.30	3.60	Not visible	Stone pitching is provided	L to R	Fair	1. Extensive growth of vegetation on side slopes and partially damaged 2. Silt and debris are accumulated. 3. Flow is obstructed by vegetation
55	Box	666/1	665+447	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	2.00	0.30	2.50	RCC	3.80	0.30	4.60	Not visible	Stone pitching is provided	L to R	Fair	1. Extensive growth of vegetation on side slopes and partially damaged 2. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
56	Box/Pipe	667/1	666+165	1	2.00/1.00	2.00	0.30/0.10	2 x 9.00	22.50	RCC	1.30	0.30	2.40	RCC	3.00	0.30	3.40	Not visible	Stone pitching is provided	R to L	Fair	1. Stone pitching damaged on LHS. 2. Vegetation is grown on RHS. 3. Silt and debris are accumulated. 3. Silt and debris are accumulated.
57	Box	667/2	666+379	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	1.00	0.30	2.50	RCC	2.80	0.30	3.40	Not visible	Stone pitching is provided	L to R	Fair	1. Vegetation is grown on RHS. 2. Water is stagnated in vent way.
58	Box	668/1	667+033	1	2.30	2.00	0.20	2 x 9.00	22.50	RCC	0.90	0.30	2.00	RCC	2.70	0.30	4.40	Not visible	Stone pitching is provided	R to L	Fair	1. Extensive growth of vegetation on side slopes and partially damaged
59	Box	669/3	668+761	1	4.20	3.10	0.30	2 x 9.00	22.50	RCC	2.40	0.30	4.80	RCC	5.00	0.30	5.50	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation is grown on RHS. 2. Silt and debris are accumulated.
60	Box	671/2	670+899	1	2.20	1.90	0.30	2 x 9.00	29.50	RCC	1.00	0.30	2.60	RCC	2.30	0.30	2.60	Not visible	Stone pitching is not provided	R to L	Fair	1. Vegetation is grown on both sides. 2. Silt and debris are accumulated.
61	Box	672/1	671+193	1	2.00	2.00	0.30	2 x 9.00	22.50	RCC	0.90	0.30	2.70	RCC	2.10	0.30	2.40	Not visible	Stone pitching is not provided	R to L	Poor	1. Silt and debris are accumulated.
62	Box	672/2	671+549	1	2.90	1.00	0.30	2 x 9.00	22.50	RCC	1.00	0.30	3.50	RCC	2.00	0.30	2.50	Not visible	Stone pitching is provided	R to L	Poor	1. Silt is formed in both sides. 2. Vegetation grown on both sides. 3. Water stagnated in vent way.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
63	Box	672/3	671+937	1	2.00	2.00	0.30	2 x 9.00	29.50	RCC	1.20	0.30	2.40	RCC	2.60	0.30	3.60	Not visible	Stone pitching is not visible due to vegetation	R to L	Poor	1. Vegetation is grown on side slopes. 2. Silt and debris are accumulated. 3. Water stagnated in vent way.
64	Box	673/1	672+399	1	3.00	3.00	0.30	2 x 9.00	29.50	RCC	1.20	0.30	3.40	RCC	3.20	0.30	4.00	Not visible	Stone pitching is not visible due to vegetation	L to R	Fair	1. Silt and debris are accumulated
65	Box	673/3	672+812	1	4.10	2.00	0.30	2 x 9.00	22.50	RCC	1.20	0.30	4.50	RCC	2.70	0.30	3.50	Not visible	Stone pitching is not provided	L to R	Fair	1. Vegetation is grown on both sides. 2. Silt and debris are accumulated
66	Box	674/1	673+014	1	2.00	2.00	0.30	2 x 9.00	36.50	RCC	0.90	0.30	2.40	RCC	2.20	0.30	2.80	Not visible	Stone pitching is not provided	L to R	Poor	1. Silt is formed in both sides. 2. Vent way is blocked. 3. Water staged in vents.
67	Box	674/2	673+252	1	2.00	2.00	0.30	2 x 9.00	36.50	RCC	1.20	0.30	6.50	RCC	2.80	0.30	4.20	Not visible	Stone pitching is provided	L to R	Fair	1. Stone pitching is partially damaged. 2. Silt and debris are accumulated.
68	Box	674/4	673+943	1	2.00	2.00	0.30	2 x 9.00	36.50	RCC	1.20	0.30	2.40	RCC	2.70	0.30	3.40	Not visible	Stone pitching is not visible due to vegetation	L to R	Poor	1. Vegetation is grown on side slopes and also vent way. 2. Water staged in vents.
69	Box	675/2	674+151	1	2.00	2.00	0.30	2 x 9.00	36.50	RCC	1.00	0.30	2.40	RCC	2.20	0.20	4.40	Not visible	Stone pitching is not visible due to vegetation	L to R	Poor	1. Silt is formed in both sides. 2. Stone pitching is partially damaged. 3. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
70	Box	675/4	674+518	1	2.00	1.80	0.30	2 x 9.00	36.50	RCC	1.20	0.30	2.60	RCC	2.00	0.30	2.50	Not visible	Stone pitching is not provided	L to R	Fair	1. Parapet wall damaged on LHS. 2. Silt is accumulated in both sides. 3. Vegetation grown on both sides. 4. Water stagnated in vent way.
71	Box	675/5	674+943	1	3.00	2.00	30.00	2 x 9.00	36.50	RCC	1.00	0.30	3.40	RCC	2.40	0.30	3.00	Not visible	Stone pitching is not provided	R to L	Poor	1. Silt is accumulated in both sides. 2. Vegetation grown on both sides. 3. Water stagnated in vent way.
72	Box	676/1	675+299	1	3.00	3.00	0.20	2 x 9.00	36.50	RCC	0.90	0.30	5.00	RCC	3.20	0.30	3.80	Not visible	Stone pitching is not visible due to vegetation	R TO L	Fair	1. Silt is accumulated in both sides. 2. Vegetation grown on both sides.
73	Box/Slab	676/2	675+577	1	4.00	5.00	0.3	2 x 9.01	37.50	RCC	0.90	0.30	5.00	RCC	3.20	0.30	3.80	Not visible	Stone pitching is not provided	R to L	Poor	1. Vegetation grown on both sides. 2. Vent way is blocked with silt and debris.
74	Box	676/3	675+795	1	2.20	1.10	0.30	2 x 9.00	36.50	RCC	0.90	0.30	2.80	RCC	1.30	0.30	1.80	Not visible	Stone pitching is not visible due to vegetation	R to L	Fair	1. Silt and debris are accumulated.
75	Box	677/1	676+018	1	2.40	1.70	0.30	2 x 9.00	34.50	RCC	1.00	0.30	3.00	RCC	2.00	0.30	2.60	Not visible	Stone pitching is not visible due to vegetation	R to L	Poor	1. Vegetation grown on both sides. 2. Vent way is blocked with vegetation.
76	Box	677/3	676+267	1	3.00	1.80	0.20	2 x 9.00	34.50	RCC	1.00	0.30	3.40	RCC	2.10	0.30	2.70	Not visible	Stone pitching is provided	R to L	Poor	1. Vegetation grown on both sides. 2. Stone pitching is partially damaged. 3. Water stagnated in vent way.

S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			
77	Box	677/4	676+664	1X1	2.00	2.00	0.30	2 x 9.00	34.50	RCC	2.50	0.30	2.40	RCC	4.50	0.30	3.50	Not visible	Stone pitching is not provided	L to R	Poor	1. Silt is formed in both sides. 2. Vegetation grown on both sides and vent way is blocked with vegetation. 3. Water stagnated in vent way.

Photographs

CH : KM 608+080



CH : KM 608+300



CH : KM 610+040



S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			

CH : KM 624+388



CH : KM 637+715



CH : KM 644+874



CH : KM 655+252



S.No	Type of Culvert	Structure number	Chainage as per site	Span			Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length(m)				Wing/Return wall (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Width (m)	Depth (m)				Type	Height (m)	Thickness (m)	Length (m)	Type	Height (m)	Thickness (m)	Length (m)	Bed	Slope			

CH : KM 662+253



CH : KM 676+276



Pipe Culverts

INVENTORY AND CONDITION SURVEY OF PIPE CULVERTS

Road Name: NH-27

DIRECTION: PALANPUR-SWAROOPGANJ

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
1	Pipe	602/1	601+598	2	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated
2	Pipe	602/2	601+861	2	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not visible due to vegetation	L to R	Fair	1. Vegetation is grown on both sides. 2. Silt and debris are accumulated
3	Pipe	603/1	602+629	2	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	8.00	Not visible	stone pitching is provided	R to L	Fair	1. Vegetation is grown on RHS. 2. Water stagnated in vents. 3. Silt and debris are accumulated
4	Pipe	603/2	602+908	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Silt and debris are accumulated. 2. Flow is obstructed by vegetation
5	Pipe	604/1	603+788	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Vegetation is grown on RHS. 2. Silt and debris are accumulated.
6	Pipe	604/2	603+964	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Vegetation is grown on RHS. 2. Stone pitching partially damaged. 3. Silt and debris are accumulated.
7	Pipe	605/1	604+262	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Fair	1. Stone pitching partially damaged in LHS. 2. Stone pitching is not visible in RHS due to vegetation growth. 3. Silt and debris are accumulated.
8	Pipe	605/2	604+690	1	1.00	0.10	2 x 9.01	23.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Fair	1. Culvert in fair condition. 2.Silt and debris are accumulated
9	Pipe	606/1	605+479	1	1.00	0.10	2 x 9.02	24.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not provided	L to R	Fair	1. Vegetation is grown on RHS. 2. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
10	Pipe	606/2	605+928	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not provided	R to L	Fair	1. Vegetation is grown on both sides.
11	Pipe	607/1	606+108	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not provided	L to R	Poor	1. Culvert is a approach of VUP. 2. Vent way is blocked with vegetation and soil
12	Pipe	607/3	606+142	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not provided	L to R	Poor	1. Vegetation is grown on both sides.
13	Pipe	608/1	607+462	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated. 2. Flow is obstructed by vegetation
14	Pipe	609/4	608+196	1	1.00	0.10	2 x 9.00	23.50	RCC	0.40	0.40	5.00	-	-	R to L	Poor	1. Vent way is blocked with vegetation and soil
15	Pipe	612/2	611+798	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Silt and debris are accumulated. 2. Flow is obstructed by vegetation
16	Pipe	612/3	611+900	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Culvert is buried in RHS.
17	Pipe	612/4	611+987	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Silt and debris are accumulated.
18	Pipe	613/1	612+112	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not provided	L to R	Poor	1. Culvert is fair condition

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
19	Pipe	613/2	612+259	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not visible	R to L	Poor	1. Culvert is not visible due to vegetation is growth on one sides.
20	Pipe	614/1	613+407	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Fair	1. Silt and debris are accumulated.
21	Pipe	614/2	613+628	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	4.00	Not visible	stone pitching is provided	R to L	Fair	1. Side slopes are partially damaged 2. Silt and debris are accumulated.
22	Pipe	614/4	613+978	2	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	8.00	Not visible	stone pitching is not provided	R to L	Fair	1. Silt and debris are accumulated.
23	Pipe	615/1	614+329	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Fair	1. Side slopes are partially damaged 2. Silt and debris are accumulated.
24	Pipe	615/2	614+565	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Stone pitching is partially damaged in LHS. 2. Strains are observed in vent way.
25	Pipe	616/1	615+079	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Vegetation is grown on RHS. 2. Silt and debris are accumulated. 3. Stone pitching is partially damaged.
26	Pipe	616/3	615+957	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	L to R	Poor	1. Silt and debris is accumulated.
27	Pipe	617/1	616+240	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is not provided	L to R	Poor	1. Silt and debris is accumulated. 2. Stone pitching is partially damaged.
28	Pipe	617/2	616+715	1	1.00	0.10	2 x 9.00	22.50	RCC	0.60	0.40	5.00	Not visible	stone pitching is provided	L to R	Fair	1. Vegetation is grown on both sides. 2. Silt and debris is accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
29	Pipe	618/1	617+015	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	stone pitching is provided	R to L	Poor	1. Vent way is blocked with soil. 2. Silt and debris is accumulated. 3. Stone pitching is partially damaged.
30	Pipe	620/1	619+119	2	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.50	5.00	Not visible	Not visible	R to L		1. Silt and debris is accumulated. 2. Flow is obstructed by vegetation
31	Pipe	620/2	619+216	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.50	4.00	Not visible	Stone pitching is provided	L to R	Fair	1. Fair condition.
32	Pipe	620/3	619+417	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.00	Not visible	Stone pitching is provided	L to R	Fair	1. Culvert in fair condition.
33	Pipe	625/2	624+544	2	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.40	5.50	Not visible	Stone pitching is not visible	L to R	Poor	1. Vegetation is grown on both sides slopes 2. flow is obstructed by vegetation 3. Silt and debris is accumulated. 4. Stone pitching is partially damaged.
34	Pipe	627/1	626+260	1	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.40	5.00	Not visible	Stone pitching is not visible	L to R	Poor	1. Vegetation is grown on both sides.
35	Pipe	629/1	628+435	1	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.40	5.00	Not visible	Stone pitching is not visible	L to R	-	1. Vegetation is grown on both sides. 2. Silt and debris is accumulated.
36	Pipe	630/2	629+458	1	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.40	4.00	Not visible	Stone pitching is not visible	L to R	Poor	1. Vegetation is grown on RHS and also culvert is not visible. 2. Strains are observed in LHS vent way. 3. Silt and debris is accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
37	Pipe	630/4	629+790	2	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.40	6.00	Not visible	Stone pitching is not visible	L to R	Poor	1. Vegetation is grown on both sides. 2. Silt and debris is accumulated.
38	Pipe	630/5	629+925	1	1.00	0.10	2 x 9.00	22.50					-	-	L to R	Poor	1. Vent way blocked with boulders.
39	Pipe	631/2	630+645	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.30	3.50	Not visible	Stone pitching is not visible	L to R	Fair	1. Vegetation is grown on both sides.
40	Pipe	633/1	632+175	3	1.20	0.10	2 x 9.00	22.50	RCC	0.40	0.30	8.50	Not visible	Stone pitching is not visible	L to R	Fair	1. Vegetation is grown on both sides. 2. Silt and debris is accumulated.
41	Pipe	633/4	632+931	1	1.00	0.10	2 x 9.00	22.50	RCC	0.40	0.30	3.00	Not visible	Stone pitching is provided	L to R	Fair	1. Vegetation is grown on both sides. 2.Silt and debris is accumulated.
42	Pipe	635/1	634+159	2	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.30	5.00	Not visible	Stone pitching is not visible	L to R	Fair	1. Vegetation is grown on both sides 2. Silt and debris is accumulated.
43	Pipe	635/2	634+416	2	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.30	5.00	Not visible	Stone pitching is not visible	L to R	Fair	1. Vegetation is grown on both sides. 2. Silt and debris are accumulated.
44	Pipe	636/1	635+139	1	1.00	0.10	2 x 9.00	22.50	RCC	0.50	0.30	5.00	Not visible	Stone pitching is provided	L to R	Fair	1. Flow is obstructed by vegetation. 2. Silt and debris are accumulated.
45	Pipe	636/3	635+572	4	1.2	0.10	2 x 9.01	21.50	RCC	0.30	0.30	4.00	Not visible	Stone pitching is provided	R to L	Fair	1. Flow is obstructed by vegetation. 2. Silt and debris are accumulated.

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
46	Pipe	639/1	638+182	1	1.00	1.00	2 x 9.00	22.50	RCC	0.30	0.30	4.00	Not visible	Stone pitching is provided	R to L	Poor	1. Flow is obstructed by vegetation. 2. Silt and debris are accumulated.
47	Pipe	642/3	641+585	3	1.00	1.00	2 x 9.00	32.50	RCC	0.50	0.40	8.00	Not visible	Stone pitching is not provided	R to L	Poor	1. Flow is obstructed by vegetation. 2. Silt and debris are accumulated.
48	Pipe	642/4	641+611	3	1.00	1.00	2 x 9.00	32.50	RCC	0.40	0.40	8.00	Not visible	Stone pitching is not provided	R to L	Poor	1. Water stagnated in vent ways.
49	Pipe	642/5	641+653	1	1.00	1.00	2 x 9.00	32.50	RCC	0.40	0.40	6.50	Not visible	Stone pitching is not provided	R to L	Poor	1. Water stagnated in vent ways.
50	Pipe	644/1	643+250	1	1.00	1.00	2 x 9.00	32.50	RCC	0.40	0.40	5.00	Not visible		L to R	Fair	1. Vegetation is grown on both sides. 2. Silt and debris is accumulated.
51	Pipe	644/2	643+882	1	1.00	1.00	2 x 9.01	33.50	RCC	0.40	0.40	5.00	Not visible	Stone pitching is not provided	L to R	Fair	1. Vegetation is grown on both sides.
52	Pipe	651/1	650+135	1	1.00	1.00	2 x 9.00	22.50	RCC	1.20	0.40	6.50	Not visible	Stone pitching is not provided	L to R	Fair	1. Vegetation is grown on both sides. 2. Water stagnated in vent ways.
53	Pipe	653/1	652+050	1	1.00	1.00	2 x 9.00	32.50	RCC	0.30	0.40	5.00	Not visible	Stone pitching is not provided	R to L	Poor	1. Water stagnated in vent ways. 2. Vegetation is growth on both sides.
54	Pipe	660/3	659+461	2	1.00	1.00	2 x 9.00	22.50	RCC	0.30	0.40	5.00	Not visible	Stone pitching is provided	L to R	Poor	1. Soil and debris present

S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			
55	Pipe	662/3	661+748	1	1.00	1.00	2 x 9.00	22.50	RCC	0.40	0.50	3.50	Not visible	Stone pitching is provided	R to L	Fair	1. Vegetation grown on RHS&LHS 2. Flow is obstructed by vegetation
56	Pipe	663/2	662+642	1	1.00	1.00	2 x 9.00	22.50	RCC	0.50	0.40	4.00	Not visible	Stone pitching is not visible	L to R	Poor	1. Vegetation is grown on LHS.
57	Pipe	669/1	668+060	3	0.60	1.00	2 x 9.00	22.50					Not visible	Stone pitching is provided	L to R	Fair	1. Vegetation is growth on both sides. 2.Silt and debris are accumulated.
58	Pipe	670/1	669+365	1	1.00	1.00	2 x 9.00	22.50	RCC				Not visible	Stone pitching is provided	L to R	Poor	1. Vegetation is grown on LHS. 2.Silt and debris are accumulated.
59	Pipe	671/1	670+689	1	1.00	1.00	2 x 9.00	32.50	RCC	0.50	0.50	6.50	Not visible	Stone pitching is provided	L to R	Fair	1. Vegetation is growth on both sides. 2. Silt and debris are accumulated.
60	Pipe	675/1	674+025	2	1.20	1.00	2 x 9.00	32.50	RCC	0.30	0.40	2.70	Not visible	Stone pitching is not provided	L to R	Poor	1. Vent way is blocked with soil and sewage water stagnated in vent ways.
61	Pipe	677/1	676+200	1	1.00	1.00	2 x 9.00	32.50	RCC	0.30	0.40	2.50	Not visible	Stone pitching is not provided	L to R	Poor	1. Both side vent ways are blocked with vegetation. 2. Flow is obstructed vegetation

Photographs
CH.No:602+692



S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			

CH.No: 614+329



CH.No: 610+040



CH.No: 626+260



CH.No: 634+413



S.No	Type of Culvert	Structure number	Chainage as per site	Span		Slab/ Pipe thickness (m)	Road Width (m)	Overall Width (m)	Head/Parapet wall Length (m)				Protection works Condition		Flow Direction	Adequacy / Condition	Observations
				No. of Cells	Diameter (m)				Type	Height	Thickness	Length	Bed	Slope			

CH.No: 641+588



CH.No: 652+050



CH.No: 668+060



CH.No: 674+034



Flyovers

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 644+025		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	Fly over/ (645/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	19.00 m	
1.6	Overall Deck width (m)	21.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	4 x 44.00 m	
1.10	Total length of the bridge (m)	176.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	1.50 m	
1.13	Shoulder width (m) and material	1.20 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	10.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-200.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 644+025		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 644+025			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Twin Circular pier abutment	Twin Circular pier abutment
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	03 Nos.	
7.2.1	Type	Twin Circular pier	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Fair condition	Fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 644+025			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	4 Spans & 4 x 44.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	PSC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Inner faces are in fair condition	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 644+025			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	No	
10.21	Check condition of joints mortar , pointing, masonry, etc	No	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are filled with debris	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No cracks in wearing course, functioning properly	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing materilas	
11.5	Check for debris in joints	Joints are filled with debris	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 644+025		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Downtake pipes are provided, they are partially damaged	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking in downtake pipes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 644+025			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 644+025			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: FLY OVER			
STRUCTURE NO: 645/1			
SNO	GENERAL	CONDITION	REMARKS



Major Bridges

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No.of Bridge/Name of River	MJB/ (610/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) H.F.L	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	6.70 m	
1.6	Overall Deck width (m)	7.70 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	8 x 19.80 m	
1.10	Total length of the bridge (m)	158.40 m	
1.11	Vertical Clearance (m)	6.40 m	
1.12	Whether meadian, if yes its width (m)	No	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-165.20 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approches Having any Span then provide Span details	No spans	
3.5	Pavement surface (Check unevenness settlement, cracking,potholes etc.)	Pavement surface is in fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS
3.6	Side slopes (Check pitched or un-pitched, condition of pitchong/turfing, any signs of slope failure etc.)	Stone pitched and Vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment.	No damages	
3.8	Approach slab (Check settlement, cracks,movement etc.)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.1	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc.)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment.)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs.)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc.)	stone pitching is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed.)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc.	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone massonry	Stone massonry
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	07 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts,Flyover and ROB's)	Not applicable	
9. Bearing & Pedestal			
		Bearings	Pedestals
9.1	No. per Abutment	03 Nos.	03 Nos.
9.2	No. per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Abutment -Elastomeric , Pier - Metallic guide bearings	Square
9.4	Material	Abutment -Neoprone, Pier -Steel	RCC
9.5	General condition (Check rusting, cleanliness,seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings on abutment are in fair condition and pier bearings not visible due to covered by steel plates	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	8 Nos. & 8 x 19.80 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc.)	RCC Deck slab + Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantiliver etc.)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc.)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc.), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch. A map of cracking should be produced. The size and distribution of cracks and their penetration should be noted.]	Minor cracks are observed	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	Reinforcement is exposed	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.1	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, ussets or splices, condition of hinges, splices, etc.)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc.	Not applicable	
10.22	Check cracks (indicate loction, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of massonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11. EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc.	Expansion joints are in fair condition, no misalignment, debris is accumulated	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc.)	Fair condition	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler., check hardening, cracking, etc.	Neoprene sealing material isdamaged in all expansion joints	
11.5	Check for debris in joints	Yes	
12. WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc.	Pavement surface is in fair condition	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS
12.3	Details of water proofing system, if any	Data not available	
13. DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are partially clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14. HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc.	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
S.NO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/Noof Bridge/Name of River	MJB/ (610/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	8 x 18.70 + 2 x 10.50 m	
1.10	Total length of the bridge (m)	170.60 m	
1.11	Vertical Clearance (m)	8.50 m	
1.12	Whether meadian, if yes its width (m)	No	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	9.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-178.60 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitchong/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall / toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Yes, Stone pitched	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitching is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5. WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6. FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7. SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Spill through	Spill through
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	09 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8. For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts,Flyover and ROB's)	Not applicable	
9. Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Abutment = Elastomeric & Pier = POT cum PTFE bearings	Square
9.4	Material	Neoprene & Steel	RCC
9.5	General condition (Check rusting, cleanliness,seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestal are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS
10. SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	10 Nos. 8 x 18.70 + 2 x 10.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck slab + Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantiliver etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	Honey combing is observed	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 609+455 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, ussets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate loction, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of massonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11. EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition ie Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning ie Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material ie For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is in fair condition	
11.5	Check for debris in joints	Joints are filled with debris	
12. WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition ie Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS
13. DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are partially clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14. HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 609+455 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 610/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
1. STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (627/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	5 x 13.52 m	
1.10	Total length of the bridge (m)	67.600 m	
1.11	Vertical Clearance (m)	6.00 m	
1.12	Whether median, if yes its width (m)	No	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	5.30 m	
2. GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-73.00 m	
3. APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4. PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5. WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)		
6. FOUNDATION			
61	Type of Foundation (Main bridge and approach spans if any)	Data not available	
62	Material	Data not available	
63	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 626+766 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
64	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7. SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	04 Nos.	
7.2.1	Type	Circular hammer head	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8. For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9. Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Bearings are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 626+766 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
10. SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5 Nos. & 5 x 13.520 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No spalling and honey combing	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11. EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is in fair condition	
11.5	Check for debris in joints	Joints are filled with debris	
12. WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 626+766 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
13. DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14. HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15. FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16. UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 626+766 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)

ROAD NAME: NH-27

DIRECTION: PALANPUR-SWAROOPGANJ

CHAINAGE : KM 626+766 (RHS)

DATE OF INSPECTION: 30-06-2020

TYPE OF STRUCTURE: MAJOR BRIDGE

STRUCTURE NO: 627/2

SNO	GENERAL	CONDITION	REMARKS
1. STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (627/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	6.50 m	
1.6	Overall Deck width (m)	7.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	5 Nos. x 5 x 13.52 m	
1.10	Total length of the bridge (m)	67.60 m	
1.11	Vertical Clearance (m)	4.80 m	
1.12	Whether median, if yes its width (m)	No	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	5.60 m	
2. GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-68.00 m	
3. APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4. PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5. WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6. FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7. SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masnory	Stone masnory
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Leaching is observed on abutment	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	04 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	Stone masnory	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8. For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9. Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 626+766 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
10. SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5 Nos. & 5 x 13.52 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck slab + Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No spalling and honey combing	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	Reinforcement is exposed	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11. EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is partially damaged	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12. WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 626+766 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS
13. DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14. HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Partially damaged	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15. FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16. UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 626+766 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 627/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (639/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.25 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	5 Nos. & 5 x 13.50 m	
1.10	Total length of the bridge (m)	67.50 m	
1.11	Vertical Clearance (m)	4.90 m	
1.12	Whether median, if yes its width (m)	No	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	6.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	No	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-76.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaged	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	04 Nos.	
7.2.1	Type	Circular hammer head type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 638+755 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5Nos. & 5 x 13.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is in fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 638+755 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (639/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.25 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	5Nos. & 5 x 13.50 m	
1.10	Total length of the bridge (m)	67.50 m	
1.11	Vertical Clearance (m)	4.90 m	
1.12	Whether median, if yes its width (m)	No	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	6.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-76.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Stone masonry Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masnory	Stone masnory
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	04 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	Stone masnory	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 638+755 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5 Nos. & 5 x 13.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck slab + Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 638+755 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	No	
10.21	Check condition of joints mortar , pointing, masonry, etc	No	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 638+755 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 638+755 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 639/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (640/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.25 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 33.50 m	
1.10	Total length of the bridge (m)	100.50 m	
1.11	Vertical Clearance (m)	6.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	7.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-106.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitching is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Circular hammer head type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 639+721 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 33.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box Girder	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 639+721 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (640/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.25 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 33.50 m	
1.10	Total length of the bridge (m)	100.50 m	
1.11	Vertical Clearance (m)	6.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	7.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-106.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Circular hammer head type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 639+721 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 33.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box Girder	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	No cracks	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 639+721 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 639+721 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 639+721 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 640/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (653/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.25 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 24. 00 m	
1.10	Total length of the bridge (m)	72.00 m	
1.11	Vertical Clearance (m)	6.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-80.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+738 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 24.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Voided Slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+738 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (653/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.25 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 24.00 m	
1.10	Total length of the bridge (m)	72.00 m	
1.11	Vertical Clearance (m)	6.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-80.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitching and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+738 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+738 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 24.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Void Slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Debris is filled in expansion joints	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No cracks, gaps are filled with debris	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+738 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+738 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 653/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (659/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	18°	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	5Nos. & 5 x 21..00 m	
1.10	Total length of the bridge (m)	105.00 m	
1.11	Vertical Clearance (m)	8.00 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-112.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	stone pitching is partially damaged due to growth of vegetation	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitching is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+465 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	04 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Good condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+465 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5 Nos. & 5 x 21.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Voided Slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+465 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MJB/ (659/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	18°	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	5 x 21.00 m	
1.10	Total length of the bridge (m)	105.00 m	
1.11	Vertical Clearance (m)	8.00 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-116.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	stone pitching is partially damaged due to growth of vegetation	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	stone pitching is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+465 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	04 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Good condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearing	Pedestal
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+465 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5 Nos. & 5 x 21.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Voided Slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+465 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are partially clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+465 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MAJOR BRIDGE			
STRUCTURE NO: 659/3			
SNO	GENERAL	CONDITION	REMARKS



Minor Bridges

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 607+800 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (608/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.50 m	
1.6	Overall Deck width (m)	28.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 4.40 m	
1.10	Total length of the bridge (m)	8.80 m	
1.11	Vertical Clearance (m)	3.30 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	4.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 607+800 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaged	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 607+800 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	1 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 607+800 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 4.40 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No spalling and honey combing	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 607+800 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 607+800 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 607+800 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 608/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 608+430 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (609/9)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.00 m	
1.6	Overall Deck width (m)	28.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 10.00 m	
1.10	Total length of the bridge (m)	10.00 m	
1.11	Vertical Clearance (m)	3.70 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	4.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 608+430 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaged	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 608+430 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No damages	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 608+430 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 10.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No spalling and honey combing	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 608+430 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 608+430 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 608+430 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 609/9			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (612/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.20 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 16.00 m	
1.10	Total length of the bridge (m)	16.00 m	
1.11	Vertical Clearance (m)	4.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	No	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-22.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitching and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 611+110 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 16.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material, not visible as it is filled with soil and debris	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are partially clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 611+110 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (612/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.20 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 16.00 m	
1.10	Total length of the bridge (m)	16.00 m	
1.11	Vertical Clearance (m)	4.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-22.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitching and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow and erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 611+110 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 611+110 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 16.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material, not visible as it is filled with soil and debris	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 611+110 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 611+110 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 612/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (613/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 14.00 + 1 x 13.50 m	
1.10	Total length of the bridge (m)	41.50 m	
1.11	Vertical Clearance (m)	4.20 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-50.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaed	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masnory	Stone masnory
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	Stone masnory	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 612+910 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 2 x 14.00 + 1 x 13.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck slab + Girder	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material, not visible as it is filled with soil and debris	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 612+910 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 612+910 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (613/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 14.00 + 1 x 13.50 m	
1.10	Total length of the bridge (m)	41.50 m	
1.11	Vertical Clearance (m)	5.00 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.00 m & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-50.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Circular hammer head type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 612+910 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 2 x 14.00 + 1 x 13.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 612+910 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material, not visible as it is filled with soil and debris	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 612+910 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 612+910 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 613/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (619/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	20°	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 15.70 m	
1.10	Total length of the bridge (m)	31.40 m	
1.11	Vertical Clearance (m)	10.50 m	
1.12	Whether median, if yes its width (m)	Yes	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	11.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-33.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 618+480 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 15.70 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is partially damaged	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 618+480 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (619/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	20°	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 15.70 m	
1.10	Total length of the bridge (m)	31.40 m	
1.11	Vertical Clearance (m)	10.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	11.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-33.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 618+480 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	02 Nos.	02 Nos.
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 618+480 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 15.70 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply Supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material, not visible as it is filled with soil and debris	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 618+480 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 618+480 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 619/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (620/4)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	9.40 m	
1.6	Overall Deck width (m)	10.40 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	4 x 6.00 m	
1.10	Total length of the bridge (m)	24.00 m	
1.11	Vertical Clearance (m)	3.20 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-27.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masnory	Stone masnory
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	03 Nos.	
7.2.1	Type	Wall type & Circular pier	
7.2.2	Material	Stone masnory & RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	4 Nos. & 4 x 6.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No Expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (620/4)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 12.00 m	
1.10	Total length of the bridge (m)	24.00 m	
1.11	Vertical Clearance (m)	5.00 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.00 m & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-27.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone Pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Circular hammer head type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Pier is in fair condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	03 Nos.
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 12.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material as it is filled with soil and debris	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 619+996 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 619+996 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 620/4			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (622/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	6.50 m	
1.6	Overall Deck width (m)	7.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 12.30 m	
1.10	Total length of the bridge (m)	36.90 m	
1.11	Vertical Clearance (m)	4.80 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-40.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masnory	Stone masnory
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	Stone masnory	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 620+750 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 12.30 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck slab + Girder	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is partially damaged	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 620+750 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (622/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	9.00 m	
1.6	Overall Deck width (m)	10.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 12.30 m	
1.10	Total length of the bridge (m)	36.90 m	
1.11	Vertical Clearance (m)	4.80 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	5.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-40.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Circular hammer head type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	06 Nos.	06 Nos.
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 620+750 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 12.30 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 620+750 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 620+750 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 622/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 625+020 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (626/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.50 m	
1.6	Overall Deck width (m)	24.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 5.40 m	
1.10	Total length of the bridge (m)	10.80 m	
1.11	Vertical Clearance (m)	4.60 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	5.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 625+020 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 625+020 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	Not applicable	Not applicable
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 625+020 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 5.40 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 625+020 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 625+020 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 625+020 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 626/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (632/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 19.00 m	
1.10	Total length of the bridge (m)	19.00 m	
1.11	Vertical Clearance (m)	5.20 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.30 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-23.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 19.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Voided slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (632/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	12.70 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 9.10 m	
1.10	Total length of the bridge (m)	18.20 m	
1.11	Vertical Clearance (m)	5.20 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	5.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-23.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Wing walls	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Wing walls are in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC & stone masonry	RCC & stone masonry
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos	
7.2.1	Type	Wall type	
7.2.2	Material	RCC & Stone masonry	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 9.10 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck Slab + Girder	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 631+692 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 631+692 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 632/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (633/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 12.00 m	
1.10	Total length of the bridge (m)	12.00 m	
1.11	Vertical Clearance (m)	6.00 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.70 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 632+436 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 12.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 632+436 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (633/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 12.00 m	
1.10	Total length of the bridge (m)	12.00 m	
1.11	Vertical Clearance (m)	6.00 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.70 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	No	
2.3	Floor Protection & Type	No	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitching and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 632+436 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 632+436 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 12.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 632+436 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 632+436 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 633/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (634/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 9.00 m	
1.10	Total length of the bridge (m)	9.00 m	
1.11	Vertical Clearance (m)	5.20 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	4.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+110 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 9.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+110 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (634/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 9.00 m	
1.10	Total length of the bridge (m)	9.00 m	
1.11	Vertical Clearance (m)	5.20 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	No	
1.14	Height of Approach Embankment (m)	1.50 m & Bituminous paved shoulder	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitching and vegetation is grown side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching and vegetation is grown side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+110 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	03 Nos.	03 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+110 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 9.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+110 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+110 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+110 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+960 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (634/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	9.00 m	
1.6	Overall Deck width (m)	12.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 9.00 m	
1.10	Total length of the bridge (m)	27.00 m	
1.11	Vertical Clearance (m)	4.00 m	
1.12	Whether median, if yes its width (m)	4..50 m	
1.13	Shoulder width (m) and material	2.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	No	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-33.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitching and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 9.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck viz,	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip Seal Joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+960 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (634/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	9.00 m	
1.6	Overall Deck width (m)	12.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 9.00 m	
1.10	Total length of the bridge (m)	27.00 m	
1.11	Vertical Clearance (m)	4.00 m	
1.12	Whether median, if yes its width (m)	Yes	
1.13	Shoulder width (m) and material	2.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-33.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 633+960 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Stone masonry Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masonry	Stone masonry
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Stone masonry	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 9.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 633+960 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 634/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 634+999 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (635/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.50	
1.6	Overall Deck width (m)	23.70 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 4.15 m	
1.10	Total length of the bridge (m)	8.30 m	
1.11	Vertical Clearance (m)	3.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	5.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 634+999 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 634+999 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 634+999 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 5.14 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 634+999 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 634+999 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 634+999 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 635/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 635+274 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (636/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.50	
1.6	Overall Deck width (m)	28.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 3.80 m	
1.10	Total length of the bridge (m)	11.40 m	
1.11	Vertical Clearance (m)	3.80 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 635+274 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 635+274 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	2 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 635+274 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 3.80 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 635+274 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 635+274 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 635+274 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 636/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 646+968 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (647/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	12.20 + 9.00 + 7.00(Service road) m	
1.6	Overall Deck width (m)	33.70 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 5.00 m	
1.10	Total length of the bridge (m)	10.00 m	
1.11	Vertical Clearance (m)	1.50 m	
1.12	Whether median, if yes its width (m)	Yes, 3.00 m and 1.50 m on RHS service road	
1.13	Shoulder width (m) and material	2.00 m both sides and bitumunous paved shoulder	
1.14	Height of Approach Embankment (m)	1.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	No	
2.3	Floor Protection & Type	No	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 646+968 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	No	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 646+968 (MCW)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	No bearings	No bearings
9.4	Material	No bearings	No bearings
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	No bearings	No bearings
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	No bearings	No bearings

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 646+968 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 5.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 646+968 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 646+968 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	No	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 646+968 (MCW)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 647/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 647+760 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (648/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 16.20 m	
1.10	Total length of the bridge (m)	32.40 m	
1.11	Vertical Clearance (m)	4.60 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	5.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-35.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 647+760 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	02 Nos .	02 Nos .
9.2	No per Pier	04 Nos.	04 Nos.
9.3	Type and allowable movements	Elastomeric bearings	Square
9.4	Material	Neoprene pad	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Bearings are in fair condition	Pedestals are in fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 16.20 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Voided slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 647+760 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joint	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are in fair condition. No misalignment, debris is accumulated.	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material is fair condition	
11.5	Check for debris in joints	Joints are filled with soil and debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 647+760 (LHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (LHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 647+760 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (648/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	8.50 m	
1.6	Overall Deck width (m)	10.30 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	6 x 5.50 m	
1.10	Total length of the bridge (m)	33.00 m	
1.11	Vertical Clearance (m)	2.70 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m & Earthen shoulder	
1.14	Height of Approach Embankment (m)	3.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-40.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 647+760 (RHS)		DATE OF INSPECTION: 30-06-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	Stone masnory	Stone masnory
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	05 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	Stone masnory	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	6 Nos. & 6 x 5.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Solid slab	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, no structural members are affected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking of draiange holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 647+760 (RHS)			DATE OF INSPECTION: 30-06-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 648/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 649+491 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (650/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 10.20 m	
1.6	Overall Deck width (m)	25.90 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 3.740 m	
1.10	Total length of the bridge (m)	7.480 m	
1.11	Vertical Clearance (m)	3.20 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 649+491 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 649+491 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 649+491 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 3.740 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 649+491 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 649+491 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Good condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 649+491 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 650/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 651+320 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (652/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 10.20 m	
1.6	Overall Deck width (m)	25.90 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	4 x 3.40 m	
1.10	Total length of the bridge (m)	13.60 m	
1.11	Vertical Clearance (m)	3.20 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-18.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 651+320 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 651+320 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 651+320 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	4 Nos. & 4 x 3.40 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 651+320 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 651+320 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 651+320 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 652/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 657+103 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (658/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.00 m	
1.6	Overall Deck width (m)	24.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 6.60 m	
1.10	Total length of the bridge (m)	19.80 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.0 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-23.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 657+103 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 657+103 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 657+103 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 6.60 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 657+103 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 657+103 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 657+103 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: (658/1)			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 669+467 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (670/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	Data not available	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.20 m	
1.6	Overall Deck width (m)	28.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	3 x 4.80 m	
1.10	Total length of the bridge (m)	14.40 m	
1.11	Vertical Clearance (m)	3.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.0 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	Crash barrier & Length-19.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 669+467 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	Raft	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 669+467 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	03 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Pier is in fair condition	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 669+467 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 3 x 4.80 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 669+467 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 669+467 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 669+467 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 670/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 673+529 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (674/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 10.20 m	
1.6	Overall Deck width (m)	25.90 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 5.30 m	
1.10	Total length of the bridge (m)	10.60 m	
1.11	Vertical Clearance (m)	3.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	2.0 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-18.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 673+529 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 673+529 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	01 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 673+529 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 5.30 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 673+529 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 673+529 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 673+529 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 674/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 676+935 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	MNB/ (677/5)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Data not available	
	(b) Inadequacy of waterway	No	
	(c) Erosion of Banks as evident	No	
1.5	Clear Carriageway width(m)	2 x 9.0 m	
1.6	Overall Deck width (m)	28.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	2 x 4.40 m	
1.10	Total length of the bridge (m)	8.80 m	
1.11	Vertical Clearance (m)	3.30 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.20 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not visible	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 676+935 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Un-pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	No	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitching is partially damgaed due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	No	
	b) For Piers	No	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	No	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Uniform. No change in flow, erosion of banks	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 676+935 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	1 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
		Bearings	Pedestals
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	No bearings	No bearings
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 676+935 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	2 Nos. & 2 x 4.40 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 676+935 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Not applicable	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 676+935 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 676+935 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: MINOR BRIDGE			
STRUCTURE NO: 677/5			
SNO	GENERAL	CONDITION	REMARKS



Non-Vehicular Underpasses **(NVUP)**

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 614+750 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	NVUP/ (615/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 9.50 m	
1.6	Overall Deck width (m)	26.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 4.50 m	
1.10	Total length of the bridge (m)	4.50 m	
1.11	Vertical Clearance (m)	2.80 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	3.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-5.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 614+750 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	Spalling is observed over top slab
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone Pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 614+750 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 614+750 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 4.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 614+750 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	Not applicable	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 614+750 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 614+750 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 615/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 628+500 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	NVUP/ (629/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	9.50 + 9.50 m	
1.6	Overall Deck width (m)	24.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 4.50 m	
1.10	Total length of the bridge (m)	4.50 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	1.00 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-15.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 628+500 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 628+500 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 628+500 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 4.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 628+500 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 628+500 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	No	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 628+500 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 629/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 661+100 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	NVUP/ (662/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 9.50 m	
1.6	Overall Deck width (m)	24.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 4.50 m	
1.10	Total length of the bridge (m)	4.50 m	
1.11	Vertical Clearance (m)	3.00 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-5.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 661+100 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched is partially damaged	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 661+100 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 661+100 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 4.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 661+100 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	Not applicable	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 661+100 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 661+100 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 662/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 672+400 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	NVUP/ (673/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 9.50 m	
1.6	Overall Deck width (m)	24.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 4.50 m	
1.10	Total length of the bridge (m)	4.50 m	
1.11	Vertical Clearance (m)	3.00 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-5.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 672+400 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 672+400 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 672+400 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 4.50 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 672+400 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	Not applicable	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 672+400 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 672+400 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: NON VEHICULAR UNDERPASS (NVUP)			
STRUCTURE NO: 673/2			
SNO	GENERAL	CONDITION	REMARKS



Pedestrian Underpasses (PUP)

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+590 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	PUP/ (607/4)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 9.50 m	
1.6	Overall Deck width (m)	24.00 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 5.00 m	
1.10	Total length of the bridge (m)	5.00 m	
1.11	Vertical Clearance (m)	4.00 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	2.50 m (Both sides) & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	4.00 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length - 11.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+590 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall + Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall + Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+590 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 5.00 m	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+590 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 606+590 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	Not applicable	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+590 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 606+590 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: PEDESTRIAN UNDERPASS (PUP)			
STRUCTURE NO: 607/4			
SNO	GENERAL	CONDITION	REMARKS



Road Over Bridges (ROB)

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	ROB/ (611/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	7.50 m	
1.6	Overall Deck width (m)	11.80 m	
1.7	Average skew angle	20°	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 22.18 + 2 x 29.440 m	
1.10	Total length of the bridge (m)	81.06 m	
1.11	Vertical Clearance (m)	7.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.20 m & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-90.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	1 Nos. & 1 x 22.180 m	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched is partially damaged due to growth of vegetation	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched is partially damaged due to growth of vegetation	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	04 Nos.	04 Nos.
9.2	No per Pier	08 Nos.	08 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Fair condition	Fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Nos. & 1 x 22.180 + 2 x 29.440 m	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (LHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck slab + I Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC / PSC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	Minor cracks are observed	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+562 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are filled with debris	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No cracks in wearing course, functioning properly	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing materilas	
11.5	Check for debris in joints	Yes	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+562 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are partially clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided, it's partially damaged	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No Choking in drain pipes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	Yes	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+562 (LHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	ROB/ (611/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	7.50 m	
1.6	Overall Deck width (m)	11.80 m	
1.7	Average skew angle	20°	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 22.18 + 2 x 29.440 m	
1.10	Total length of the bridge (m)	81.06 m	
1.11	Vertical Clearance (m)	7.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.20 m & Bituminous Paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-90.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	1 Nos. & 1 x 22.18 m	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	02 Nos.	
7.2.1	Type	Wall type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	04 Nos.	04 Nos.
9.2	No per Pier	08 Nos.	08 Nos.
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Fair condition	Fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 Spans & 1 x 22.180 + 2 x 29.440 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck Slab + I Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC / PSC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+562 (RHS)		DATE OF INSPECTION: 29-06-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are filled with debris	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No cracks in wearing course, functioning properly	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing materilas	
11.5	Check for debris in joints	Joints are filled with debris	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+562 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No choking in drainage holes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	Yes	
15.FOOTPATHS			
15.1	Present (yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+562 (RHS)			DATE OF INSPECTION: 29-06-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 611/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	ROB/ (659/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	7.50 m	
1.6	Overall Deck width (m)	11.80 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 41.00 m	
1.10	Total length of the bridge (m)	41.00 m	
1.11	Vertical Clearance (m)	7.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.20 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-90.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not visible	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	04 Nos.	04 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Fair condition	Fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 41.00 m	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (LHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck Slab + I Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	PSC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+022 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are filled with debris	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No cracks in wearing course, functioning properly	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing materilas	
11.5	Check for debris in joints	Yes	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+022 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No Choking in drain pipes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	Yes	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+022 (LHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	ROB/ (659/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	High Level	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	7.50 m	
1.6	Overall Deck width (m)	11.80 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 41.00 m	
1.10	Total length of the bridge (m)	41.00 m	
1.11	Vertical Clearance (m)	7.50 m	
1.12	Whether median, if yes its width (m)	Yes, 4.50 m	
1.13	Shoulder width (m) and material	1.20 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	8.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-90.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Data not available	
6.2	Material	Data not available	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	04 Nos.	04 Nos.
9.2	No per Pier	No pier	No pier
9.3	Type and allowable movements	POT cum PTFE	Square
9.4	Material	Steel	RCC
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Fair condition	Fair condition
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Proper functioning	Proper functioning

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+022 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 41.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	RCC Deck Slab + I Girders	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Simply supported	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	PSC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+022 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	Strip seal expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Expansion joints are filled with debris	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	No cracks in wearing course, functioning properly	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Neoprene sealing material	
11.5	Check for debris in joints	Yes	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+022 (RHS)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are provided	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	No Choking in drain pipes	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Good condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	Yes	
15.FOOTPATHS			
15.1	Present (Yes/No)	Yes	
15.2	Material	RCC	
15.3	Condition	Fair condition	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+022 (RHS)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: RAILWAY OF BRIDGE (ROB)			
STRUCTURE NO: 659/1			
SNO	GENERAL	CONDITION	REMARKS



Vehicular Underpasses (VUP)

INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+120 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (607/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-18.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+120 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitched and vegetation is grown on RHS side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE Wall + RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE Wall + Retaining wall are in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone Pitching is partially damaged due to growth of vegetation on RHS side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 606+120 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	Not applicable	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 606+120 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 606+120 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	Not applicable	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 606+120 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided, no structural members are effected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 606+120 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 607/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+645 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (611/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-18.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 610+645 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+645 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	Not applicable	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	No	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+645 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+645 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	No	
10.21	Check condition of joints mortar , pointing, masonry, etc	No	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	No	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	Yes	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+645 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 610+645 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 611/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 617+719 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (618/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 617+719 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 617+719 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	Not applicable	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 617+719 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 617+719 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 617+719 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided, no structural members are effected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 617+719 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 618/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 629+700 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (630/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 629+700 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 629+700 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 629+700 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), dormant/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 629+700 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 629+700 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clear	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	No drain pipe is provided	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Bottom booms are not provided	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 629+700 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 630/3			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 636+035 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (637/1)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 636+035 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 636+035 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 636+035 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 636+035 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	Not applicable	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 636+035 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided, no structural members are effected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 636+035 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 637/1			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 641+200 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (642/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 641+200 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 641+200 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 641+200 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	No	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 641+200 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	Not applicable	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 641+200 (MCW)		DATE OF INSPECTION: 05-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided, no structural members are effected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 641+200 (MCW)			DATE OF INSPECTION: 05-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 642/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+330 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (653/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 652+330 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone Pitching is partially damaged due to growth of vegetation on RHS side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE Wall + RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE Wall + Retaining wall are in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone Pitching is partially damaged due to growth of vegetation on RHS side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+330 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	Not applicable	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+330 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	No	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+330 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	No	
10.21	Check condition of joints mortar , pointing, masonry, etc	No	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No	
10.23	Check growth of Vegetation	No	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+330 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 652+330 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 653/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+070 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (659/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	Structure is in approach of ROB	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+070 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Stone pitched and vegetation is grown on side slopes	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RCC Retaining wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	Retaining wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Stone pitched and vegetation is grown on side slopes	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 658+070 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	Not applicable	Not applicable
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	
9.2	No per Pier	Not applicable	
9.3	Type and allowable movements	Not applicable	
9.4	Material	Not applicable	
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+070 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity,extent,pattern,location,depth,crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+070 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	Not applicable	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+070 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 658+070 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 659/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 659+240 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (660/2)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 659+240 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 659+240 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 659+240 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No Cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 659+240 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	Not applicable	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 659+240 (MCW)		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VENT HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are clogged	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Drain pipes are not provided, no structural members are effected	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 659+240 (MCW)			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: VEHICULAR UNDERPASS (VUP)			
STRUCTURE NO: 660/2			
SNO	GENERAL	CONDITION	REMARKS



INSPECTION AND CONDITION SURVEY OF BRIDGES (AS PER IRC SP-35 CODE)			
ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 674+405		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS
1.STRUCTURE DATA			
1.1	Name of Bridge/No of Bridge/Name of River	VUP/ (675/3)	
1.2	Name of Highway/location of Bridge	NH-27	
1.3	Type of Bridge High level/submersible	Not applicable	
1.4	(a) HFL	Not applicable	
	(b) Inadequacy of waterway	Not applicable	
	(c) Erosion of Banks as evident	Not applicable	
1.5	Clear Carriageway width(m)	2 x 10.00 m	
1.6	Overall Deck width (m)	25.50 m	
1.7	Average skew angle	No	
1.8	Whether Navigable	No	
1.9	Span Arrangement (Nos. x Length in m)	1 x 11.00 m	
1.10	Total length of the bridge (m)	11.00 m	
1.11	Vertical Clearance (m)	5.50 m	
1.12	Whether median, if yes its width (m)	4.50 m	
1.13	Shoulder width (m) and material	3.00 m & Bituminous paved shoulder	
1.14	Height of Approach Embankment (m)	6.50 m	
2.GENERAL			
2.1	Corrosion Protection Measures	No	
2.2	Bank Protection & Type	Not applicable	
2.3	Floor Protection & Type	Not applicable	
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	Not applicable	
2.5	Whether guard rail/Crash barrier, if yes their length/details	RCC Crash barrier & Length-12.00 m	
3.APPROACHES			
3.1	Type of Terrain	Plain	
3.2	Type of Approach	Embankment	
3.3	Material of Approach	Soil	
3.4	if Approaches Having any Span then provide Span details	No spans	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 674+405		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc)	Pavement surface is in fair condition	
3.6	Side slopes (Check pitched or un-pitched, condition of pitching/turfing, any signs of slope failure etc)	Not applicable	
3.7	Erosion of Embankment by cuts or any other damage to Embankment	No damages	
3.8	Approach slab (Check settlement, cracks, movement etc)	Not visible	
3.9	Retaining / RE Wall /toe walls type and height (m)	RE wall	
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc)	RE wall is in fair condition	
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment)	No	
4.PROTECTION WORKS			
4.1	Type of protection (Mention whether guide-bund or protection around abutments or spurs)	Not applicable	
4.2	Slope pitching, apron, and toe walls (Check for proper slopes, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc)	Not applicable	
4.3	Scour (Check any abnormal scour noticed)		
	a) For Abutments	Not applicable	
	b) For Piers	Not applicable	
5.WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc	Not applicable	
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)	Not applicable	
6.FOUNDATION			
6.1	Type of Foundation (Main bridge and approach spans if any)	Raft	
6.2	Material	RCC	
6.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Fair condition	

ROAD NAME: NH-27		DIRECTION: PALANPUR-SWAROOPGANJ	
CHAINAGE : KM 674+405		DATE OF INSPECTION: 01-07-2020	
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	
7.SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	No cracks, settlement, sour, exposed steel	No cracks, settlement, sour, exposed steel
7.1.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)	No	No
7.2	Pier	No pier	
7.2.1	Type	Not applicable	
7.2.2	Material	Not applicable	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed Steel, Strains and other damages etc)	Not applicable	
8.For Subways			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any	Not applicable	
8.2	check damages to protective measures to pier and abutments (For Viaducts, Flyover and ROB's)	Not applicable	
9.Bearing & Pedestal			
9.1	No per Abutment	No bearings	No bearings
9.2	No per Pier	Not applicable	Not applicable
9.3	Type and allowable movements	Not applicable	Not applicable
9.4	Material	Not applicable	Not applicable
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	Not applicable	Not applicable
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	Not applicable	Not applicable

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 674+405			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS
10.SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	1 Nos. & 1 x 11.00 m	
10.2	Type of superstructure (RCC slab, T-Beam, slab/box-girder etc)	Box type	
10.3	Structural System (Simply supported / continuous / continuous overhang / balanced cantilever etc)	Continuous	
10.4	Type of Material (RCC / PSC / STEEL / Timber / Masonry etc)	RCC	
10.5	Check spalling disintegration or honey combing, (special attention: to be given at points of bearings)	No	
10.6	Check cracks [Types: (Flexural, shear etc), donate/active, severity, extent, pattern, location, depth, crack width explain preferably by photograph and plotting on sketch A map of cracking should be produced The size and distribution of cracks and their penetration should be noted]	No cracks	
10.7	Check exposed reinforcement and its rusting area/bar diameter reduction, if any	No	
10.8	Check wear of deck surface	Not visible as it is covered with bituminous wearing coat	
10.9	Check corrosion of reinforcements, sheathing and tendon if visible	No	
10.10	check leakages (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck	No leakages	
10.11	Check cracks , if any, around anchorage zone for Prestressed concrete members	Not applicable	
10.12	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of	Not applicable	
10.13	Check accumulation of silt and debris on surface of deck (for submersible bridges)	Not applicable	
10.14	Check steel members	Not applicable	
10.15	Check condition of protective system	Not applicable	
10.16	Check corrosion , if any	Not applicable	
10.17	Check excessive vibrations, if any (steel members/steel structure)	Not applicable	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 674+405			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS
10.18	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringers to cross girders, cross girders to main girders, us sets or splices, condition of hinges, splices, etc)	Not applicable	
10.19	Check conditions inside the closed members	Not applicable	
10.20	Check masonry arches	Not applicable	
10.21	Check condition of joints mortar , pointing, masonry, etc	Not applicable	
10.22	Check cracks (indicate location, pattern, extent, depth, explain by sketches)	No cracks	
10.23	Check growth of Vegetation	Not applicable	
10.24	Check all cast iron / wrought iron components	Not applicable	
10.25	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable	
10.26	In case of masonry bridges (pointing/joints mortar and bulging of spandrel)	Not applicable	
10.27	Vegetation (Yes/No)	No	
11.EXPANSION JOINT			
11.1	Type	No expansion joints	
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc	Not applicable	
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, etc)	Not applicable	
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc	Not applicable	
11.5	Check for debris in joints	Not applicable	
12.WEARING COAT			
12.1	Material	Bituminous	
12.2	Surface condition i.e. Cracks / potholes / Bulges, spalling, disintegration, etc	Pavement surface is in fair condition	
12.3	Details of water proofing system, if any	Data not available	

ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 674+405			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS
13.DRAINAGE SPOUTS AND VEST HOLES			
13.1	Check clogging, deterioration and damage, if any	Drainage spouts are not provided	
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not applicable	
13.3	For submersible bridges, report on functioning	Not applicable	
13.4	Check choking of drainage holes provided in the bottom booms	Not applicable	
14.HANDRAILS, PARAPETS, CRASH BARRIERS			
14.1	Present (Yes/No)	Yes, Crash barriers	
14.2	Material	RCC	
14.3	Condition	Fair condition	
14.5	Expansion joint gap in hand rail / parapets/Crash barriers	Yes	
14.6	Present of additional safety measures	No	
14.7	Inspection Galley / ladder platform etc	No	
15.FOOTPATHS			
15.1	Present (Yes/No)	No	
15.2	Material	Not applicable	
15.3	Condition	Not applicable	
16.UTILITIES			
16.1	Present (Yes/No)	No	
16.2	Type of Utility	Not applicable	
16.3	Report damage due to Utility if any	Not applicable	
16.4	Any type of Encroachment under the bridge	No	



ROAD NAME: NH-27			DIRECTION: PALANPUR-SWAROOPGANJ
CHAINAGE : KM 674+405			DATE OF INSPECTION: 01-07-2020
TYPE OF STRUCTURE: Vehicular Underpass (VUP)			
STRUCTURE NO: 675/3			
SNO	GENERAL	CONDITION	REMARKS



Annexure

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of			General Observations	
								Super Structure	Substructure			Foundation
									Abutment	Pier		
1	606+120	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Quadrant pitching is partially damaged. 2. Vegetation is grown on side slopes of approaches and abutments on RHS.
2	606+590	PUP	MCW	1 x 5.00 m	5.00 m	2 x 9.50 m	24.00 m	RCC Single cell Box			Raft	1. Quadrant pitching is partially damaged. 2. Vegetation is grown on side slopes of approaches and abutments. 3. Drainage spouts are not provided.
3	607+800	Minor bridge	MCW	2 x 4.40 m	8.80 m	2 x 9.50 m	28.50 m	RCC Double cell Box			Raft	1. Quadrant pitching is partially damaged. 2. Drairage spouts are not provided.
4	608+430	Minor bridge	MCW	1 x 10.00 m	10.00 m	18.00 m	28.50 m	RCC Single cell Box			Raft	1. Quadrant pitching is partially damaged. 2. Drairage spouts are not provided.
5	609+450	Major bridge	LHS	8 x 19.80 m	158.40 m	6.70 m	7.70 m	RCC Deck Slab + Girder	Stone masonry Wall	RCC Wall	Not visible	1. Quadrant pitching is partially damaged. 2. Vegetation is grown on side slopes of approaches and abutments. 3. Reinforcement is exposed in superstructure. 4. Drainage spouts are clogged. 5. Neoprene sealing materials is damaged in all expansion joints. 6. Expansion joints are filled with debris and soil.
			RHS	8 x 18.70 + 2 x 10.50 m	170.60 m	8.50 m	10.30 m	RCC Deck Slab + Girder	Spill through	RCC Wall	Not visible	1. Drainage spouts are partially clogged. 2. Vegetation is grown on side slopes of approaches and abutments. 3. Honey combing is observed in superstructure. 4. Expansion joints are filled with debris and soil.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of				General Observations
								Super Structure	Substructure		Foundation	
									Abutment	Pier		
6	610+562	ROB	LHS	1 x 22.18 + 2 x 29.440 m	81.06 m	7.50 m	11.80 m	RCC Deck Slab + I-Girder	RCC Wall	RCC Wall	Not visible	1. Minor cracks are observed in super structure. 2. Quadrant pitching is partially damaged. 3. Vegetation is grown on side slopes of approaches and abutments. 4. Expansion joints are filled with debris and soil. 5. Draine pipes are partially damaged.
			RHS	1 x 22.18 + 2 x 29.440 m	81.06 m	7.50 m	11.80 m	RCC Deck Slab + I-Girder	RCC Wall	RCC Wall	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris and soil.
7	610+645	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Drainage spouts are not provided.
8	611+110	Minor bridge	LHS	1 x 16.00 m	16.00 m	8.50 m	10.20 m	RCC Solid slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris and soil. 3. Drainge spouts are partially clogged.
			RHS	1 x 16.00 m	16.00 m	8.50 m	10.20 m	RCC Solid slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris and soil.
9	612+910	Minor bridge	LHS	2 x 14.00 + 1 x 13.50 m	41.50 m	8.50 m	10.30 m	RCC Solid slab	Stone masonry Wall	Stone masonry Wall	Not visible	1. Expansion joints are filled with debris and soil. 2. Quadrant pitching is partially damaged.
			RHS	2 x 14.00 + 1 x 13.50 m	41.50 m	8.50 m	10.30 m	RCC Solid slab	RCC Wall	RCC Circular hammer head	Data not available	1. Expansion joints are filled with debris and soil.
10	614+750	NVUP	MCW	1 x 4.50 m	4.50 m	2 x 9.50 m	26.50 m	RCC Single cell Box			Raft	1. Spalling is observed over top slab. 2. Drainage spouts are not provided.
11	617+719	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Structure is in fair condition.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of				General Observations
								Super Structure	Substructure		Foundation	
									Abutment	Pier		
12	618+480	Minor bridge	LHS	2 x 15.70 m	31.40 m	8.50 m	10.30 m	RCC Solid slab	RCC Wall	RCC Wall	Not visible	1. Expansion joints are filled with debris and soil. 2. Neoprene sealing material is partially damaged in expansion joint .
			RHS	2 x 15.70 m	31.40 m	8.50 m	10.30 m	RCC Solid slab	RCC Wall	RCC Wall	Not visible	1. Expansion joints are filled with debris and soil.
13	619+996	Minor bridge	LHS	4 x 6.00 m	24.00 m	9.40 m	10.40 m	RCC Solid slab	Stone masonry + RCC Wall	Stone masonry Wall + RCC Circular column	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Drainage spouts are partially clogged.
			RHS	2 x 12.00 m	24.00 m	8.50 m	10.30 m	RCC Solid slab	RCC Wall	RCC Circular hammer head	Not visible	1. Drainage spouts are partially clogged. 2. Expansion joints are filled with debris and soil.
14	620+750	Minor bridge	LHS	3 x 12.30 m	36.90 m	6.50 m	7.50 m	RCC Deck Slab + Girder	Stone masonry Wall	Stone masonry Wall	Not visible	1. Drainge spouts are partially clogged. 2. Expansion joints are filled with debris and soil. 3. Neoprene sealing material is partially damaged in expansion joint .
			RHS	3 x 12.30 m	36.90 m	9.00 m	10.00 m	RCC Solid slab	RCC Wall	RCC Circular hammer head	Not visible	1. Drainge spouts are partially clogged. 2. Expansion joints are filled with debris.
15	625+020	Minor bridge	MCW	2 x 5.40 m	10.80 m	2 x 9.50 m	24.00 m	RCC Double cell Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation on abument side slopes. 2. Drainge spouts are not provided.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of				General Observations
								Super Structure	Substructure		Foundation	
									Abutment	Pier		
16	626+766	Major bridge	LHS	5 x 13.52 m	67.600 m	8.50 m	10.30 m	RCC Solid slab	RCC Wall	RCC Circular hammer head	Data not available	1. Expansion joints are filled with debris.
			RHS	5 x 13.52 m	67.60 m	6.50 m	7.50 m	RCC Deck Slab + T-Girder	Stone masonry Wall	Stone masonry Wall	Data not available	1. Vegetation is grown on side slopes of approaches and abutments. 2. Vegetation is grown on substructure and superstructure. 3. Neoprene sealing material is partially damaged in expansion joint. 4. Expansion joints are filled with debris. 5. RCC Crash barrier are partially damaged. 6. Leaching is observed at abutment A1.
17	628+500	NVUP	MCW	1 x 4.50 m	4.50 m	2 x 9.50 m	24.00 m	RCC Single cell Box			Raft	1.Drainage spouts are not provided. 2. Vegetation is grown on side slopes of approaches and abutments.
18	629+700	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Structure is in fair condition.
19	631+692	Minor bridge	LHS	1 x 19.00 m	19.00 m	8.50 m	10.30 m	RCC Voided slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris. 3. Drainage spouts are clogged.
			RHS	2 x 9.10 m	18.20 m	8.50 m	12.70 m	RCC Deck Slab + Girder	RCC & stone masonry Wall	-	Not visible	1. Drainage spouts are partially clogged.
20	632+436	Minor bridge	LHS	1 x 12.00 m	12.00 m	8.50 m	10.30 m	Solid slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris. 3. Drainage spouts are clogged.
			RHS	1 x 12.00 m	12.00 m	8.50 m	10.30 m	Solid slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris. 3. Drainage spouts are clogged.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of				General Observations
								Super Structure	Substructure		Foundation	
									Abutment	Pier		
21	633+110	Minor bridge	LHS	1 x 9.00 m	9.00 m	8.50 m	10.30 m	RCC slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris.
			RHS	1 x 9.00 m	9.00 m	8.50 m	10.30 m	RCC slab	RCC Wall	-	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris. 3. Drairage spouts are partially clogged.
22	633+960	Minor bridge	LHS	3 x 9.00 m	27.00 m	9.00 m	12.00 m	Solid slab	RCC Wall	RCC Wall	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris. 3. Drairage spouts are partially clogged.
			RHS	3 x 9.00 m	27.00 m	9.00 m	12.00 m	Solid slab	Stone masonry Wall	RCC Stone masonry	Not visible	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Vegetation is grown on side slopes of approaches. 3. Drairage spouts are partially clogged.
23	634+999	Minor bridge	MCW	2 x 4.15 m	8.30 m	2 x 9.50	23.70 m	RCC Double cell Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drairage spouts are partially clogged.
24	635+274	Minor bridge	MCW	3 x 3.80 m	11.40 m	2 x 9.50	28.50 m	RCC Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drairage spouts are partially clogged. 3. Vegetation is grown on side slopes of approaches.
25	636+035	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Drainage spouts are clogged.
26	638+755	Major bridge	LHS	5 x 13.50 m	67.50 m	8.50 m	10.25 m	RCC Solid slab	RCC Wall	RCC Circular hammer head	Not visible	1. Quadrant pitching is partially damaged. 2. Expansion joints are filled with debris.
			RHS	5 x 13.50 m	67.50 m	8.50 m	10.25 m	RCC Deck Slab + Girder	Stone masonry Wall	Stone masonry Wall	Not visible	1. Expansion joints are filled with debris. 2. Drainage spouts are clogged.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

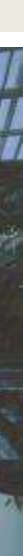
S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of				General Observations
								Super Structure	Substructure		Foundation	
									Abutment	Pier		
27	639+721	Major bridge	LHS	3 x 33.50 m	100.50 m	8.50 m	10.25 m	Box girder	RCC Wall	RCC Circular hammer head	Not visible	1. Quadrant pitching is partially damaged. 2. Expansion joints are filled with debris. 3. Vegetation is grown on side slopes of approaches and abutments.
			RHS	3 x 33.50 m	100.50 m	8.50 m	10.25 m	Box girder	RCC Wall	RCC Circular hammer head	Data not available	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris. 3. Drainage spouts are clogged.
28	641+200	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Drainage spouts are clogged.
29	644+025	Flyover	MCW	4 x 44.00 m	176.00 m	19.00 m	21.50 m	Box girders	Twin Circular pier abutment	Twin Circular pier	Data not available	1. Expansion joints are filled with debris. 2. Down take pipes are partially damaged.
30	646+968	Minor bridge	MCW	2 x 5.00 m	10.00 m	12.20 + 9.00 m (MCW) + 7.00 m (Service road)	33.70 m	RCC Double cell Box			Raft	1. Drainage spouts are not provided.
31	647+760	Minor bridge	LHS	2 x 16.20 m	32.40 m	8.50 m	10.30 m	Voided slab	RCC Wall	RCC Wall	Not visible	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Expansion joints are filled with debris. 3. Drainage spouts are partially clogged.
			RHS	6 x 5.50 m	33.00 m	8.50 m	10.30 m	Solid slab	Stone masonry Wall	Stone masonry Wall	Data not available	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are partially clogged.
32	649+491	Minor bridge	MCW	2 x 3.740 m	7.480 m	2 x 10.20 m	25.90 m	RCC Double cell Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are not provided.
33	651+320	Minor bridge	MCW	4 x 3.40 m	13.60 m	2 x 10.20 m	25.90 m	RCC Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are not provided.
34	652+330	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation onabutment and approaches of side slopes on RHS. 2. Drainage spouts are not provided.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of				General Observations
								Super Structure	Substructure		Foundation	
									Abutment	Pier		
35	652+738	Major bridge	LHS	3 x 24. 00 m	72.00 m	8.50 m	10.25 m	RCC Voided slab	RCC Wall	RCC Wall	Not visible	1. Expansion joints are filled with debris.
			RHS	3 x 24.00 m	72.00 m	8.50 m	10.25 m	RCC Voided slab	RCC Wall	RCC Wall	Not visible	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris.
36	657+103	Minor bridge	MCW	2 x 6.60 m	19.80 m	2 x 9.00 m	24.00 m	RCC Double cell Box			Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are not provided.
37	658+022	ROB	LHS	1 x 41.00 m	41.00 m	7.50 m	11.80 m	RCC Deck Slab + I-Girder	RCC Wall	-	Data not available	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris.
			RHS	1 x 41.00 m	41.00 m	7.50 m	11.80 m	RCC Deck Slab + I-Girder	RCC Wall	-	Data not available	1. Vegetation is grown on side slopes of approaches and abutments. 2. Expansion joints are filled with debris.
38	658+070	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Structure is in approach of ROB. 2. Vegetation is grown on side slopes of approaches and abutments. 3. Drainage spouts are not provided.
39	658+465	Major bridge	LHS	5 x 21..00 m	105.00 m	8.50 m	10.30 m	RCC Voided Slab	RCC Wall	RCC Wall	Not visible	1. Stone pitching is partially damaged due to growth of vegetation on abutment and approach of side slopes. 2. Expansion joints are filled with debris.
			RHS	5 x 21.00 m	105.00 m	8.50 m	10.30 m	RCC Voided Slab	RCC Wall	RCC Wall	Not visible	1. Stone pitching is partially damaged due to growth of vegetation on abutment and approach of side slopes. 2. Expansion joints are filled with debris.
40	659+240	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box			Raft	1. Drainage spouts are clogged.
41	661+100	NVUP	MCW	1 x 4.50 m	4.50 m	2 x 9.50 m	24.00 m	RCC Single cell Box			Raft	1. Quadrant pitching is partially damaged. 2. Vegetation is grown on side slopes of approaches and abutments. 3. Drainage spouts are not provided.

Structures Inventory - Palanpur – Swaroopganj section (Km. 340.000 to 264.000) of NH-14

S.No	Chainage (km)	Type of Structure	LHS/RHS/M CW	Span Arrangement (No.s x Length in m)	Total length (m)	Carriage way Width (m)	Deck Width (m)	Type of			General Observations	
								Super Structure	Substructure			Foundation
									Abutment	Pier		
42	669+467	Minor bridge	MCW	3 x 4.80 m	14.40 m	2 x 9.20 m	28.50 m	RCC Box		Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are not provided.	
43	672+400	NVUP	MCW	1 x 4.50 m	4.50 m	2 x 9.50 m	24.00 m	RCC Single cell Box		Raft	1. Drainage spouts are not provided. 2. Minor cracks are observed in top slab.	
44	673+529	Minor bridge	MCW	2 x 5.30 m	10.60 m	2 x 10.20 m	25.90 m	RCC Double cell Box		Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are not provided.	
45	674+405	VUP	MCW	1 x 11.00 m	11.00 m	2 x 10.00 m	25.50 m	RCC Single cell Box		Raft	1. Structure is in fair condition.	
46	676+935	Minor bridge	MCW	2 x 4.40 m	8.80 m	2 x 9.0 m	28.50 m	RCC Double cell Box		Raft	1. Stone pitching is partially damaged due to growth of vegetation on abutment of side slopes. 2. Drainage spouts are not provided.	



■ QUALITY CONTROL SHEET

DOCUMENT	Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana – Abu Road					
PROJECT	Preparation of report on physical condition of the National Highways on Roads Asset Under (the National Highways Infra Trust)					
CODE	IM4663-FR-STRETCH_3 (Annexure-C)					
AUTHOR	INITIALS					
	DATE	March -2021				
VERIFIED	INITIALS					
	DATE	March -2021				
RECIPIENT	National Highways Authority of India					
NOTES						
TECHNICAL CONSULTANT	Tecnica Y Proyectos, S.A (TYPSA) In JV with AVANZA Engineering Pvt. Ltd. D-75 VASHALI NAGAR JAIPUR (RAJ.), 302021 TEL NO. – 0141 - 4022513					

ANNEXURE-C

- ▣ ANNEXURE 1 TRAFFIC PROJECTIONS
- ▣ ANNEXURE 2 OPERATION AND MAINTENANCE COST
- ▣ ANNEXURE 3 INITIAL IMPROVEMENT COST

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana – Abu Road

ANNEXURE1 TRAFFIC PROJECTIONS

Physical condition of NH14 Abu Road to Jaipur (Stretch 1), Annexure Traffic

TRAFFIC PROJECTIONS AND CAPACITY ANALYSIS

KHEEMAN TOLL

Year	Car/Jeep	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/EME	Total Vehicles	Total PCUS	% ge Growth
2021	7,376	333	36	420	61	776	1,125	4,659	242	0	15,028	36,871	
2022	7,778	350	38	433	64	767	1,103	4,992	259	0	15,785	38,823	5.29%
2023	8,202	369	39	447	68	758	1,081	5,350	278	0	16,591	40,914	5.39%
2024	8,693	390	40	463	72	742	1,050	5,771	300	0	17,521	43,334	5.92%
2025	9,214	412	42	480	76	516	808	4,750	324	0	16,619	38,040	-12.22%
2026	9,766	436	43	497	80	285	540	3,302	349	0	15,297	30,780	-19.08%
2027	10,314	459	45	513	84	278	523	3,546	375	0	16,136	32,550	5.75%
2028	10,892	484	46	530	89	272	507	3,807	402	0	17,028	34,445	5.82%
2029	11,503	510	48	548	94	265	491	4,088	432	0	17,977	36,474	5.89%
2030	12,148	537	49	566	99	259	475	4,389	464	0	18,987	38,646	5.95%
2031	12,830	566	51	585	104	253	460	4,712	498	0	20,059	40,970	6.01%
2032	13,480	593	52	603	109	246	444	5,026	531	0	21,085	43,202	5.45%
2033	14,163	622	54	621	114	239	429	5,361	567	0	22,169	45,577	5.50%
2034	14,881	652	56	640	120	233	414	5,717	604	0	23,316	48,102	5.54%
2035	15,635	684	57	659	125	226	399	6,098	644	0	24,528	50,788	5.58%
2036	16,427	717	59	679	132	220	385	6,504	687	0	25,810	53,644	5.62%
2037	17,179	748	61	697	137	214	371	6,895	729	0	27,032	56,379	5.10%
2038	17,966	781	62	716	143	207	358	7,310	773	0	28,317	59,272	5.13%
2039	18,789	815	64	736	150	201	345	7,750	819	0	29,668	62,330	5.16%

Year	Car/Jeep	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/EME	Total Vehicles	Total PCUs	% ge Growth
2040	19,649	851	66	756	156	195	332	8,216	868	0	31,089	65,563	5.19%
2041	20,549	888	67	777	163	189	320	8,711	921	0	32,584	68,980	5.21%
2042	21,394	923	69	796	169	183	308	9,181	970	0	33,994	72,217	4.69%
2043	22,274	959	71	815	176	178	297	9,677	1,023	0	35,469	75,620	4.71%
2044	23,189	997	72	835	183	172	286	10,200	1,078	0	37,012	79,198	4.73%
2045	24,143	1,036	74	855	190	167	275	10,751	1,136	0	38,628	82,959	4.75%
2046	25,136	1,077	76	876	198	162	265	11,332	1,198	0	40,318	86,912	4.77%
2047	26,057	1,114	78	895	205	156	255	11,877	1,255	0	41,892	90,609	4.25%
2048	27,011	1,154	79	915	212	151	245	12,449	1,316	0	43,532	94,476	4.27%
2049	28,001	1,194	81	935	219	147	236	13,048	1,379	0	45,239	98,518	4.28%
2050	29,027	1,236	83	955	227	142	227	13,676	1,445	0	47,018	102,746	4.29%

TRAFFIC GROWTH RATES AT INTERVAL OF FIVE YEARS

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.77%	2.90%	2.80%	3.89%	3.39%	2.90%	2.48%	2.12%	1.81%
Bus	0.00%	4.42%	4.63%	4.47%	6.20%	5.41%	4.62%	3.95%	3.38%	2.89%
LCV	0.00%	4.24%	4.44%	4.28%	5.94%	5.18%	4.43%	3.79%	3.24%	2.77%
2 AT	0.00%	-1.03%	-1.08%	-1.04%	-1.45%	-1.54%	-1.61%	-1.68%	-1.76%	-1.84%
3 AT	0.00%	-1.15%	-1.20%	-1.16%	-1.61%	-1.71%	-1.79%	-1.87%	-1.95%	-2.04%
MAV	0.00%	5.18%	5.43%	5.24%	7.27%	6.34%	5.42%	4.63%	3.96%	3.39%

TRAFFIC GROWTH RATES

Year	Car/Jeep	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/EME
2021	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2022	2.64%	3.26%	3.22%	3.22%	3.26%	-0.80%	-0.93%	4.28%	4.28%	4.28%
2023	2.68%	3.42%	3.37%	3.37%	3.42%	-0.84%	-0.98%	4.48%	4.48%	4.48%
2024	2.68%	3.30%	3.26%	3.26%	3.30%	-0.81%	-0.94%	4.33%	4.33%	4.33%
2025	3.71%	4.58%	4.52%	4.52%	4.58%	-1.13%	-1.31%	6.01%	6.01%	6.01%
2026	3.24%	4.00%	3.94%	3.94%	4.00%	-1.20%	-1.40%	5.24%	5.24%	5.24%
2027	3.24%	4.00%	3.94%	3.94%	4.00%	-1.20%	-1.40%	5.24%	5.24%	5.24%
2028	3.24%	4.00%	3.94%	3.94%	4.00%	-1.20%	-1.40%	5.24%	5.24%	5.24%
2029	3.24%	4.00%	3.94%	3.94%	4.00%	-1.20%	-1.40%	5.24%	5.24%	5.24%
2030	3.24%	4.00%	3.94%	3.94%	4.00%	-1.20%	-1.40%	5.24%	5.24%	5.24%
2031	2.77%	3.42%	3.37%	3.37%	3.42%	-1.25%	-1.46%	4.48%	4.48%	4.48%
2032	2.77%	3.42%	3.37%	3.37%	3.42%	-1.25%	-1.46%	4.48%	4.48%	4.48%
2033	2.77%	3.42%	3.37%	3.37%	3.42%	-1.25%	-1.46%	4.48%	4.48%	4.48%
2034	2.77%	3.42%	3.37%	3.37%	3.42%	-1.25%	-1.46%	4.48%	4.48%	4.48%
2035	2.77%	3.42%	3.37%	3.37%	3.42%	-1.25%	-1.46%	4.48%	4.48%	4.48%
2036	2.37%	2.92%	2.88%	2.88%	2.92%	-1.31%	-1.53%	3.83%	3.83%	3.83%
2037	2.37%	2.92%	2.88%	2.88%	2.92%	-1.31%	-1.53%	3.83%	3.83%	3.83%
2038	2.37%	2.92%	2.88%	2.88%	2.92%	-1.31%	-1.53%	3.83%	3.83%	3.83%
2039	2.37%	2.92%	2.88%	2.88%	2.92%	-1.31%	-1.53%	3.83%	3.83%	3.83%
2040	2.37%	2.92%	2.88%	2.88%	2.92%	-1.31%	-1.53%	3.83%	3.83%	3.83%
2041	2.03%	2.50%	2.47%	2.47%	2.50%	-1.37%	-1.59%	3.27%	3.27%	3.27%

Year	Car/Jep	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/EME
2042	2.03%	2.50%	2.47%	2.47%	2.50%	-1.37%	-1.59%	3.27%	3.27%	3.27%
2043	2.03%	2.50%	2.47%	2.47%	2.50%	-1.37%	-1.59%	3.27%	3.27%	3.27%
2044	2.03%	2.50%	2.47%	2.47%	2.50%	-1.37%	-1.59%	3.27%	3.27%	3.27%
2045	2.03%	2.50%	2.47%	2.47%	2.50%	-1.37%	-1.59%	3.27%	3.27%	3.27%
2046	1.73%	2.14%	2.11%	2.11%	2.14%	-1.43%	-1.67%	2.80%	2.80%	2.80%
2047	1.73%	2.14%	2.11%	2.11%	2.14%	-1.43%	-1.67%	2.80%	2.80%	2.80%
2048	1.73%	2.14%	2.11%	2.11%	2.14%	-1.43%	-1.67%	2.80%	2.80%	2.80%
2049	1.73%	2.14%	2.11%	2.11%	2.14%	-1.43%	-1.67%	2.80%	2.80%	2.80%
2050	1.73%	2.14%	2.11%	2.11%	2.14%	-1.43%	-1.67%	2.80%	2.80%	2.80%

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana – Abu Road

ANNEXURE 2 OPERATION AND MAINTENANCE

Physical condition of NH-4 Traffic Police Bazar (Stretch

OPERATION AND MAINTENANCE ESTIMATES SUMMARY SHEET

(Rs. Cr.)

	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	FY36
Routine Maintenance	0.0	0.0	0.0	7.4	7.4	7.4	7.4	7.8	5.3	7.4	7.4	7.4	8.7	7.4	5.3
Toll Plaza Operation and Maintenance	4.5	4.5	3.0	3.0	3.0	4.0	3.0	6.3	3.0	3.0	4.0	3.0	3.0	6.3	3.0
Electricity & Patrolling expenses	0.5	0.5	1.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Other office expenses	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Insurance	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
GST @ 12%	1.2	1.2	1.1	2.1	2.1	2.2	2.1	2.5	1.8	2.1	2.2	2.1	2.2	2.5	1.8
Total	11.3	11.3	10.1	19.5	19.5	20.6	19.5	23.6	17.1	19.4	20.6	19.4	20.9	23.1	17.1
Major Maintenance/Periodic Maintenance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.0	0.0	0.0	0.0	0.0	0.0	39.0

	FY37	FY38	Cap Aug		DLP					FY46	FY47	FY48	FY49	FY50	FY51	TOTAL
Routine Maintenance	7.4	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	10.2	10.2	10.2	10.5	10.2	159.8
Toll Plaza Operation and Maintenance	4.0	3.0	3.0	3.0	3.9	3.9	3.9	3.9	3.9	10.7	6.5	5.3	5.3	5.3	5.3	127.1
Electricity & Patrolling expenses	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.4	2.4	2.4	2.4	2.4	2.4	56.2
Other office expenses	4.1	4.1	4.1	4.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	144.6
Insurance	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	35.5
GST @ 12%	2.2	2.1	1.2	1.2	1.6	1.6	1.6	1.6	1.6	3.3	3.2	3.1	3.1	3.1	3.1	62.8
Total	20.6	19.4	11.1	11.1	15.0	15.0	15.0	15.0	15.0	31.3	29.8	28.5	28.5	28.9	28.5	585.9
Major Maintenance/Periodic Maintenance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	0.0	0.0	0.0	0.0	0.0	124.9

OPERATION AND MAINTENANCE COST

	Palanpur/Kheeman-Aburoad Section 45 kms	Under Annuity Period Till March 2024									Periodic Renewal						Periodic Renewal	
	OPEX COST BASED ON YEAR 2020-2021																	
	Maintenance Cost Yearly																	
S.No.	Expenditures Heads	Year1 FY22	Year2 FY23	Year3 FY24	Year4 FY25	Year5 FY26	Year6 FY27	Year7 FY28	Year8 FY29	Year9 FY30	Year10 FY31	Year11 FY32	Year12 FY33	Year13 FY34	Year14 FY35	Year15 FY36		
A	Routine Maintenance																	
1	BT Pavement (31 Kms) at MCW @ 7lacs/km/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 $7 \times 1.05^{10} = 11.40$ lacs/km/year) As per attached circular NHAI/11033/CGM(Fin)/2011 Note:- In periodic maintenance years routine maintenance is considered 70% of above cost	0.00	0.00	0.00	5.13	5.13	5.13	5.13	5.13	3.59	5.13	5.13	5.13	5.13	5.13	3.59		
2	Service and Slip roads (21.560 kms) Junctions Bus bays and Truck lays etc (taken 60% of 7lacs/km/year for 2010-2011, $7 \times 0.6 = 4.2$ lacs/km/year for 2010-2011), (add escalation @5% per year from 2010- 2011 to 2020-2021 $4.2 \times 1.05^{10} = 6.84$ lacs/km/year) As per attached circular NHAI/11033/CGM(Fin)/2011 Note:- In periodic maintenance years routine maintenance is considered 70% of above cost	0.00	0.00	0.00	1.63	1.63	1.63	1.63	1.63	1.14	1.63	1.63	1.63	1.63	1.63	1.14		
3	Equipment Based Survey Works (Annual/Periodic as per Maintenance Schedule)	0.00	0.00	0.00	0.45	0.45	0.45	0.45	0.79	0.45	0.45	0.45	0.45	1.66	0.45	0.45		
4	Contingency @ 3 % of toal cost	0.00	0.00	0.00	0.22	0.22	0.22	0.22	0.23	0.16	0.22	0.22	0.22	0.25	0.22	0.16		
	Total Periodic Maintenance cost =	0.00	0.00	0.00	7.42	7.42	7.42	7.42	7.78	5.33	7.42	7.42	7.42	8.68	7.42	5.33		
B	Toll Plaza Operation and Maintenance																	

Palanpur/Kheeman-Aburoad Section 45 kms		Under Annuity Period Till March 2024								Periodic Renewal	Periodic Renewal					
OPEX COST BASED ON YEAR 2020-2021																
Maintenance Cost Yearly																
S.No.	Expenditures Heads	Year1 FY22	Year2 FY23	Year3 FY24	Year4 FY25	Year5 FY26	Year6 FY27	Year7 FY28	Year8 FY29	Year9 FY30	Year10 FY31	Year11 FY32	Year12 FY33	Year13 FY34	Year14 FY35	Year15 FY36
1	Toll plaza and Operation and maintenance charges @ 0.2 cr /lane (1.6/8=0.2, consider 8 lanes) (0.2*1.05 ^ 10, 5% escalation=0.326) (proposed 12 lane) No of Plaza's=1 As per attached circular NHAI/11033/CGM(Fin)/2011 Note:- After 100% ETC implementation of toll plaza operation and maintenance cost 60% considered from Yr-2024	3.91	3.91	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
2	System Integrator maintenance charges @ 0.048 cr/lane (0.048*1.05, 5% escalation=0.0504) (proposed 12 lane) No of Plaza's=1 As per current market price and audited expenses sheets (Rs 0.38 cr for 8 lanes = 0.048 rs./lane, add escalation @ 5% on 0.048 = 0.0504 rs/lane))	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
3	ATMS	0.00	0.00	0.04	0.04	0.04	0.04	0.04	3.33	0.01	0.01	0.01	0.01	0.01	3.31	0.01
4	TMS	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.99	0.00	0.00	0.00	0.00
	Total Toll Plaza Operation and Maintenance =	4.51	4.51	2.99	2.99	2.99	3.98	2.99	6.28	2.96	2.96	3.95	2.96	2.96	6.26	2.96
C	Electricity & Patrolling expenses @ 1.25 lacs/km/year for 2010-11 (add escalation @5% per year from 2010-2011 to 2020-2021 1.25x1.05 ^ 10 = 2.03 lacs/km/year)	0.00	0.00	0.00	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
1	RPV and Ambulance Services	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
2	Electricity consumption charges for ATMS	0.00	0.00	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
	Total Electricity and Patrolling Charges	0.53	0.53	0.99	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
D	Other office expenses (Rs. 2.5 cr/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 2.5x1.05 ^ 10 = 4.07 cr/year)	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07	4.07
E	Insurance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Yearly O&M Cost (A+B+C+D+E)	10.12	10.12	9.05	17.39	17.39	18.38	17.39	21.04	15.28	17.36	18.36	17.36	18.62	20.66	15.28

	<u>Palanpur/Kheeman-Aburoad Section 45 kms</u>	<i>Under Annuity Period Till March 2024</i>																
	<u>OPEX COST BASED ON YEAR 2020-2021</u>										Periodic Renewal							Periodic Renewal
	Maintenance Cost Yearly																	
S.No.	Expenditures Heads	Year1	Year2	Year3	Year4	Year5	Year6	Year7	Year8	Year9	Year10	Year11	Year12	Year13	Year14	Year15		
		FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33	FY34	FY35	FY36		
F	Add GST @ 12% on total O&M Cost	1.21	1.21	1.09	2.09	2.09	2.21	2.09	2.52	1.83	2.08	2.20	2.08	2.23	2.48	1.83		
	Yearly Total O&M Cost Yearly incl. GST	11.33	11.33	10.14	19.48	19.48	20.59	19.48	23.56	17.11	19.45	20.56	19.45	20.85	23.14	17.11		
	Yealy O&M Cost/Kms	0.25	0.25	0.23	0.43	0.43	0.46	0.43	0.52	0.38	0.43	0.46	0.43	0.46	0.51	0.38		

	Palanpur/Kheeman-Aburoad Section 45 kms			Construction Period for Capacity Augmentation		Defect Laibility Period of 5 Years					Periodic Renewal					
	OPEX COST BASED ON YEAR 2020- 2021															
	Maintenance Cost Yearly															
S.No.	Expenditures Heads	Year16 FY37	Year17 FY38	Year18 FY39	Year19 FY40	Year20 FY41	Year21 FY42	Year22 FY43	Year23 FY44	Year24 FY45	Year25 FY46	Year26 FY47	Year27 FY48	Year28 FY49	Year29 FY50	Year30 FY51
A	Routine Maintenance															
1	BT Pavement (31 Kms) at MCW @ 7lacs/km/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 7x1.05 ^ 10 =11.40 lacs/km/year) As per attached circular NHAI/11033/CGM(Fin)/2011 Note:- In periodic maintenance years routine maintenance is considered 70% of above cost	5.13	5.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.39	7.70	7.70	7.70	7.70	7.70
2	Service and Slip roads (21.560 kms) Junctions Bus bays and Truck lays etc (taken 60% of 7lacs/km/year for 2010-2011, 7*0.6=4.2 lacs/km/year for 2010-2011), (add escalation @5% per year from 2010- 2011 to 2020-2021 4.2x1.05 ^ 10 =6.84 lacs/km/year) As per attached circular NHAI/11033/CGM(Fin)/2011	1.63	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	1.63	1.63	1.63	1.63	1.63

	Palanpur/Kheeman-Aburoad Section 45 kms			Construction Period for Capacity Augmentation		Defect Laibility Period of 5 Years					Periodic Renewal					
	OPEX COST BASED ON YEAR 2020- 2021															
	Maintenance Cost Yearly															
S.No.	Expenditures Heads	Year16 FY37	Year17 FY38	Year18 FY39	Year19 FY40	Year20 FY41	Year21 FY42	Year22 FY43	Year23 FY44	Year24 FY45	Year25 FY46	Year26 FY47	Year27 FY48	Year28 FY49	Year29 FY50	Year30 FY51
	<i>Note:- In periodic maintenance years routine maintenance is considered 70% of above cost</i>															
3	Equipment Based Survey Works (Annual/Periodic as per Maintenance Schedule)	0.45	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.54	0.54	0.54	0.88	0.54
4	Contingency @ 3 % of total cost	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.30	0.30	0.30	0.31	0.30
	Total Periodic Maintenance cost =	7.42	7.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.27	10.16	10.16	10.16	10.51	10.16
B	Toll Plaza Operation and Maintenance															
1	Toll plaza and Operation and maintenance charges @ 0.2 cr /lane (1.6/8=0.2, consider 8 lanes) (0.2*1.05 ^ 10, 5% escalation=0.326) (proposed 12 lane) No of Plaza's=1 As per attached circular NHAI/11033/CGM(Fin)/2011 <i>Note:- After 100% ETC implementation of toll plaza operation and maintenance cost 60% considered from Yr-2024</i>	2.35	2.35	2.35	2.35	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13

Palanpur/Kheeman-Aburoad Section 45 kms				Construction Period for Capacity Augmentation		Defect Liability Period of 5 Years					Periodic Renewal					
OPEX COST BASED ON YEAR 2020- 2021																
Maintenance Cost Yearly																
S.No.	Expenditures Heads	Year16 FY37	Year17 FY38	Year18 FY39	Year19 FY40	Year20 FY41	Year21 FY42	Year22 FY43	Year23 FY44	Year24 FY45	Year25 FY46	Year26 FY47	Year27 FY48	Year28 FY49	Year29 FY50	Year30 FY51
2	System Integrator maintenance charges @ 0.048 cr/lane (0.048*1.05, 5% escalation=0.0504) (proposed 12 lane) No of Plaza's=1 As per current market price and audited expenses sheets (Rs 0.38 cr for 8 lanes = 0.048 rs./lane, add escalation @ 5% on 0.048 = 0.0504 rs/lane))	0.60	0.60	0.60	0.60	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
3	ATMS	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.72	1.36	1.36	1.36	1.36	1.36
4	TMS	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00	0.00
	Total Toll Plaza Operation and Maintenance =	3.95	2.96	2.95	2.95	3.93	3.93	3.93	3.93	3.93	10.66	6.51	5.29	5.29	5.29	5.29
C	Electricity & Patrolling expenses @ 1.25 lacs/km/year for 2010-11 (add escalation @5% per year from 2010-2011 to 2020-2021 $1.25 \times 1.05^10 = 2.03$ lacs/km/year)	0.91	0.91	0.91	0.91	0.89	0.89	0.89	0.89	0.89	1.37	1.37	1.37	1.37	1.37	1.37
1	RPV and Ambulance Services	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
2	Electricity consumption charges for ATMS	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
	Total Electricity and Patrolling Charges	1.91	1.91	1.91	1.91	1.89	1.89	1.89	1.89	1.89	2.36	2.36	2.36	2.36	2.36	2.36
D	Other office expenses (Rs. 2.5 cr/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 $2.5 \times 1.05^10 = 4.07$ cr/year)	4.07	4.07	4.07	4.07	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11
E	Insurance	1.00	1.00	1.00	1.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
	Yealy O&M Cost (A+B+C+D+E)	18.36	17.36	9.93	9.93	13.43	13.43	13.43	13.43	13.43	27.91	26.64	25.42	25.42	25.78	25.42
F	Add GST @ 12% on total O&M Cost	2.20	2.08	1.19	1.19	1.61	1.61	1.61	1.61	1.61	3.35	3.20	3.05	3.05	3.09	3.05
	Yearly Total O&M Cost Yearly incl. GST	20.56	19.45	11.12	11.12	15.04	15.04	15.04	15.04	15.04	31.25	29.83	28.47	28.47	28.87	28.47
	Yealy O&M Cost/Kms	0.46	0.43	0.25	0.25	0.33	0.33	0.33	0.33	0.33	0.69	0.66	0.63	0.63	0.64	0.63

Technical Due Diligence Report of NH27 (NH14) – Palanpur/Khemana – Abu Road

ANNEXURE 3 INITIAL IMPROVEMENT COST

B

(Under the National Highways Infrastructure Investment Trust (InvIT) Palanpur/Khemana to Abu-road Section
(from km 601+000 to km 646+000) of NH-27 in the State of Gujarat, Rajasthan)

ABSTRACT			
Based on BSR 2019-20 Udaipur Circle			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Toll Plaza	49332366.65	4.93
2	Intersections Improvements	26340091.51	2.63
3	Missellaneous Items (Road Marking, Drain, Street Light etc.	105960270.37	10.60
4	Service Roads/Service Lanes	24412372.48	2.44
5	Culverts	1460273.44	0.15
6	Bus Bays	13554723.09	1.36
7 & &A	ATMS & TMS	172993854.41	17.30
	Total	394053951.96	39.41
	Escalation @ 5% per Annum for 1 year	19702697.60	
	Total Amount with Escalation =	413756649.55	41.38
	Contingency Charges @ 5.0 %	20687832.48	2.07
	Total Amount =	434444482.03	43.44

Note - BSR Rates are inclusive all Taxes

BILL OF QUANTITIES						
CODE	Description	Unit	Quantity	Rate (Rs)	Amount (Rs)	BSR Ref.
Bill No. 1 Toll Plaza						
1.00	Subgrade	cum	4,654.45	234.00	1,089,141	R3-3.17
1.01	GSB	cum	1,755.10	676.00	1,186,448	R4-4.2.2
1.02	PQC	cum	2,340.69	6,445.00	15,085,747	R6-6.2
1.03	DLC	cum	1,227.50	2,247.00	2,758,181	R6-6.1
1.04	Toll booths					
a	Single Toll booth	Nr.	4.00	350,000.00	1,400,000	Market Rate
b	Double Toll booth	Nr.	0.00		0	
1.05	Canopy	Sqm	488.75	6,000.00	2,932,500	Market Rate
1.06	Barrier Gate					
a	For 3.2m	Nr.	3.00	251,600.00	754,800	Market Rate
b	For 5.0m	Nr.	1.00	251,600.00	251,600	Market Rate
1.07	Kerb					
	NJB for Toll islands	Rm	200.00	3,293.00	658,600	R8-8.46
1.08	Footpath cum Covered Drain	Rm	762.00	7,459.03	5,683,783	Rate Analysis
1.09	Precast Chequered Tiles					
	Toll Booth Islands	sqm	120.00	534.00	64,080	Market Rate
1.10	Median Fill					
	For Toll islands	cum	78.00	234.00	18,252	R3-3.17
1.11	Clearing and Grubbing	Hec	0.93	30,498.00	28,390	R2-2.3.2.1
1.12	Earthwork in Embankment	cum	2,792.67	243.00	678,619	R3-3.15
1.13	Pavement Marking	Sqm	175.26	618.00	108,311	R8-8.66

1.14	Painting on NJB	Sqm	383.00	85.00	32,555	R-9-69.4.2
1.15	GI Barbed wire fencing	Rm	762.00	291.00	221,742	R8-8.41
1.16	Canopy Lighting 100 Lux	Nos	4.00	10,000.00	40,000	Market Rate
1.17	Granular Shoulder	Cum	857.25	676.00	579,501	R4-4.2.2
1.18	WIM (Weigh in Motion) Extra Wide Lane Slow	Nos.	2.00	700,000.00	1,400,000	Market Rate
1.19	WIM (Weigh in Motion) Medium	Nos.	12.00	975,000.00	11,700,000	Market Rate
1.2	Static Weigh Bridge with Room	Nos.	2.00	1,150,000.00	2,300,000	Market Rate
1.21	Dismelting of Existing					
	Drain	Rmt.	356.00	958.56	341,248	Rate Analysis
	Fencing	Rmt.	356.00	53.00	18,868	R2-2.11
				Total =	49,332,367	
Bill No. 2 Intersections Improvements						
2.00	Subgrade	Cum	13,959.60	234.00	3,266,546	R3-3.17
2.01	GSB Layer	Cum	5,137.44	676.00	3,472,909	R4-4.2.2
2.02	WMM	Cum	4,056.00	1,445.00	5,860,920	R4-4.8
2.03	Prime coat	Sqm	16,236.00	30.00	487,080	R5-5.1
2.04	Tack coat over Granular surface	Sqm	16,236.00	9.00	146,124	R5-5.2
2.05	Tack coat over Bituminous surface	Sqm	15,216.00	9.00	136,944	R5-5.2
2.06	DBM	Cum	1,130.40	6,516.00	7,365,686	R5-5.4.2
2.07	BC	Cum	583.20	7,529.00	4,390,913	R5-5.7.2.1
2.08	Clearing and grubbing	Hec	21.57	30,498.00	657,878	R2-2.3.2.1
2.09	Earthen shoulder	Cum	1,626.00	234.00	380,484	R3-3.17
2.10	Stop Line	sqm	282.53	618.00	174,606	R8-8.66
				Total	26,340,092	
Bill No. 3 Missellaneous Items						
3.00	Edge Line marking For Service Road & Junctions	Sqm	375.00	618.00	231,750	R8-8.66
3.01	Center line marking For Service Road & Junctions	sqm	125.00	618.00	77,250	R8-8.66
3.02	Road Studs	Nr.	2,217	149.00	330382.66	R8-8.2
3.03	Road Signs					
a	Route marker	Each	24.00	1,627.00	39048	R8-8.15
b	Stop/Give way Sign, Octogonal	Nr.	24.00	1,525.00	36600	R8-8.8.2.1

3.0 4	Informatory Signs					
a	1200 X 900 junction sign Board	Nr.	24.00	21,176.00	508224	R8-8.36.4
3.0 5	Street Light Single Arm 9 mtr height including Providing fixing and Wiring complete in all respect.	Nr.	42.00	45,000.00	1890000	Market Rate
3.0 6	Street Light Double Arm 11 mtr height including Providing fixing and Wiring complete in all respect.	Nr.	22.00	50,000.00	1100000	Market Rate
3.0 7	Road Marking	Sqm	612.00	618.00	378216	R8-8.66
3.0 8	Total metal beam barrier					
a	Single W beam crash Barrier	m	21,010.00	3,123.00	65614230	R8-8.47
3.0 9	Rain Water Harvesting Structure	Nos	23.00	500,000.00	11500000	Market Rate
3.1 0	LED Solar Blinker	Nos	199.00	6,200.00	1233800	Market Rate
3.1 1	Kerbs Median/Service road	m	1,250.00	203.00	253750	R8-8.3.1.2
3.1 2	Lightened bollard	Nr.	48.00	2,339.00	112272	R8-8.30
3.1 3	Speed Breaker Strip	Rmt.	396.00	750.00	297000	Market Rate
3.1 4	Pedstrian Crossing	Sqm	2,100.00	618.00	1297800	R8-8.66
3.1 5	Stop Line	Sqm	282.53	618.00	174606.01	R8-8.66
3.1 6	Pedestrian Railing	Lin.m.	1,450.00	3,139.00	4551550	R14-14.7
3.1 7	Footpath cum Covered Drain	Rmtr	1,250.00	7,459.03	9323791.69	Rate Analysis
3.1 8	Typical Public Charging Station (PCS)	Nr.	2.00	2,955,000.00	5910000	Market Rate
3.1 9	Solar Panel (10 KW Tata Solar Panels) (Area required = 1000 sqft)	Nr.	2.00	550,000.00	1100000	Market Rate
				Total =	105,960,270	
Bill No. 4 Service Roads/Service Lanes						
4.0 0	Clearing and grubbing of road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable material and stacking of serviceable material upto 100 meters from road boun	Ha.	14.00	30,498.00	427,048	R2-2.3.2.1
4.0 1	Construction of embankment with approved material from BORROW PITS with all leads and lifts complete as per drawings and Technical Specification Clause No. 301 & 305 (with an average distance of transport of 10 KM)	Cu.m.	4,200.75	243.00	1,020,782	R3-3.15
4.0 2	Construction of Sub grade & earthen / un paved shoulders satisfying the requirements of minimum 4% CBR value as indicated	Cu.m.	9,276.25	234.00	2,170,643	R3-3.17

	in the drawings and specification with approved material with all leads & lifts all complete as per Technical Specification Clause					
4.0 3	Earthwork in filling of earthen shoulder with selected earth complete as per Technical Specification Clause 407 with all leads and lifts.	Cu.m.	114.00	234.00	26,676	R3-3.17
4.0 4	Loosening of the ground upto a level of 500 mm below the sub-grade level, watered, graded and compacted in layers to meet requirement of table 300-2 for sub-grade construction as per Technical specifications and as directed by the Engineer-in-charge.	100/sq m	140.03	57.00	79.81	R3-3.18
4.0 5	Constructing Grannular Sub-base complete as per Technical Specification Clause No 401. Grading-I, Table 400-2.	Cu.m.	3,535.50	676.00	2,389,998	R4-4.2.2
4.0 6	Constructing Wet Mix Macadam base (including profile corrective course) complete as per Technical specification Clause No 406.	Cu.m.	4,231.88	1,445.00	6,115,059	R4-4.8
4.0 7	Providing and laying bituminous primer coat over prepared surface of grannular base with bituminous emulsion complete as per Technical Specifications Clause No 502.(Table 500-1)	Sqm	16,927.50	30.00	507,825	R5-5.1
4.0 8	Providing and laying Tack coat over granular surface with bituminous emulsion all complete as per Technical Specifications Clause 503.(Table 500-2) @ 2.5 kg /10 sq.m.	Sqm	16,552.50	9.00	148,973	R5-5.2
4.0 9	Providing and laying Tack coat over bituminous courses with Bituminous emulsion all complete as per Technical Specifications Clause 503.(Table 500-2) @ 2.0 kg/10 sq.m.	Sqm	16,552.50	9.00	148,973	R5-5.2
4.1 0	Providing and laying Dense Bituminous Macadam course as per Technical Specification Clause No.507.					
	B) Grading -II- (Min 4.5% Bituminous Binder by weight of total mixture)	Cu.m.	993.15	6,516	6,471,365	R5-5.4.2
4.1 1	Providing and laying Bituminous Concrete wearing course using Modified Bitumen (PMB 40)complete as per Technical Specifications Caluse 509 & 521.					
	A) With VG 30 Grade Bitumen (60/70 Grade)	Cu.m.	662.10	7,529	4,984,951	R5-5.7.2.1
				Total	24,412,372	
Bill No. 5 Culverts						

5.0 0	Earthwork in excavation of foundation for structures including pipe culverts in all types of soil including lead & lifts complete as per drawings and MORT&H specifications clauses 304 & 2903.	Cum.	274.49	132	36,233	R12-12.1.1.1
5.0 1	Providing filter media behind abutments, wing walls, return walls and box structures with well packed materials to specified thickness with smaller size towards the soil and bigger size towards the wall with all leads and lifts complete as per drg. and MORT&H specifications clauses 305 & 309	Cum.	67.04	689	46,193	R12-12.4
5.0 2	Cement Concrete / Reinforced Cement Concrete in open foundation / levelling course including centering and shuttering but excluding reinforcement all complete as per drg. and MORT&H specifications sections 1500, 1700 and 2100.					
	b) M-15 grade	Cum.	16.97	3917	66,478	R12-12.7.1
5.0 3	Cement Concrete / Reinforced Cement Concrete in sub-structure including form work but excluding reinforcement complete as per drg. and MORT&H specifications sections 1500, 1700 and 2200.					
	d) M-30 grade	Cum.	35.33	4725	166,925	R13-13.3.2.3.1
5.0 4	Supplying, fitting & placing in position HYSD / TMT bar reinforcement complete as per drg. and MORT&H specifications sections 1600. Foundation / Sub-structure / Superstructure	MT	9.50	61150	580,685	R13-13.6.1
5.0 5	Providing weep holes in brick masonry / plain / reinforced concrete abutment, wing walls / return wall with 100mm dia AC pipe, extending through the full width of structure with slope of IV:20H towards draining face complete as per drg. and MORT&H specifications clause 2706.	Nr.	104.00	108	11,232	R13-13.13
5.0 6	Providing & laying stone boulder apron complete as per drg. & MORT&H specifications section 2500.	Cum.	63.35	805	50,995	R15-15.1.1
5.0 7	Providing & laying filter material underneath stone boulder pitching on slopes complete as per drg. and MORT&H specifications section 2500.	Cum.	6.74	572	3,856	R15-15.2
5.0	Providing & laying stone boulder	Cum.		805	10,853	R15-15.3.1

8	pitching on slopes complete as per drg. and MORT&H specifications section 2500.		13.48			
5.09	Providing cement concrete in curtain wall complete as per drg. and MORT&H specifications sections 1500, 1700, 2100, 2200 & clause 2507.					
	a) M-15 grade	Cum.	26.97	3917	105,631	R12-12.7.1
5.10	b) Providing cement concrete crash barrier in M-40 grade including safety kerb, reinforcement and G.I. pipe complete as per drawing & MORT&H Specifications sections 1500, 1600, 1700, 2200 & clause 809.	Cum.	5.20	3293	17,124	R8-8.46
5.11	a) Rigid apron 150mm thick flat stone embedded in 300mm thick M-15 grade concrete as per drawing and technical specification Clause 2505	cu.m.	11.89	4530	53,876	R15-15.4.1
5.12	Painting of crash barrier as technical specification & drawing clause 2500	Sqm.	5.72	85	486	R8-8.76.1
5.13	Back filling for cone	cum	28.67	775	22,218	R12-12.3.1
5.14	Providing Reinforced Cement Concrete M-30 grade in box culvert including centering and shuttering but excluding reinforcement complete as per drg. and MORT&H specifications sections 1500, 1700, 2100, 2200 & 2300.					
b)	M 30	Cum.	56.10	4725	265,073	R13-13.3.2.3.1
5.15	Dismantaling					
a	Parapet wall	m	5.20	280	1,456	R2-2.4.3.2
b	Return wall RCC	cum	29.86	702	20,961	R2-2.4.1.2.2
				Total	1,460,273	
Bill No. 6 Bus Bays						
6.00	Subgrade	Cum	3,694.25	234.00	864,454.50	R3-3.17
6.01	GSB	Cum	1,477.70	676.00	998,925.20	R4-4.2.2
6.02	WMM	Cum	1,545.25	1,445.00	2,232,886.25	R4-4.8
6.03	Prime coat over WMM	Sqm	5,971.00	30.00	179,130.00	R5-5.1
6.04	Tack coat over Granular Surface	Sqm	5,971.00	9.00	53,739.00	R5-5.2
6.05	Tack Coat over Bituminous Surface	Sqm	5,971.00	9.00	53,739.00	R5-5.2
6.06	Passenger shelters	Nr.	7.00	300,000.00	2,100,000.00	Market Rate
6.07	Pedestrian guard rail	Lin.m.	105.00	3,139.00	329,595.00	R14-14.7

6.08	Chequered Tiles	Sqm	367.50	534.00	196,245.00	Market Rate
6.09	Kerb (L type)	Lin.m.	1,610.00	203.00	326,830.00	R8-8.3.1.2
6.1	Earth fill in raised median	Cum	1,322.72	267.00	353,167.17	R4-4.10
6.11	Bollards	Nr.	14.00	2,339.00	32,746.00	R8-8.30
6.12	PCC M-15 grade Median Openings	Cum	7.35	3,917.00	28,789.95	R12-12.7.1
6.13	Lettering	per cm ht. per letter	630.00	3.10	1,953.00	R8-8.73.1
6.14	Barrier lane marking	Sqm	150.50	618.00	93,009.00	R8-8.66
6.15	Drinking water koisk	Nr.	7.00	50,000.00	350,000.00	Market Rate
6.16	Kerb painting	sqm	684.25	85.00	58,161.25	R8-8.76.1
6.17	Chevron Marking	Sqm	307.16	618.00	189,824.88	R8-8.66
6.18	Straight Arrows	Sqm	84.00	100.00	8,400.00	Market Rate
6.19	Combi Arrows	Sqm	7.00	100.00	700.00	Market Rate
6.2	Pedestrian crossing	Sqm	30.63	618.00	18,926.25	R8-8.66
6.21	DBM	Cum	494.48	6,516.00	3,222,031.68	R5-5.4.2
6.22	BC	Cum	247.24	7,529.00	1,861,469.96	R5-5.7.2.1
				Total =	13,554,723.09	

Bill No. - 7 ATMS & TMS						
ATMS Revised Estimate - Palanpur to Aburoad						
	Length	45	Junctions	5	minor junctions	21
			TMC	1	Toll Plaza	1
			Sub-Centre	0	PIU	1
ATMS 2020 policy						
Sr. No.	ATMS Component	Unit	Qty	Rate	Total	Remarks
1	Traffic Monitoring Camera System Equipment (TMCS)					
1.1	PTZ Camera	Nos.	45	185,000	8,325,000	
1.2	Motion Detection surveillance camera, hooter alarm with beacon, and all-in-one solar street light	Nos.	45	49,140	2,211,300	
1.3	Cabinet & 12m Pole with 1m arm at 8m	Nos.	45	45,728	2,057,760	To be replaced during road widening
1.4	Chamber / Manhole and Pole Foundation, PCC, backfilling with sand	Nos.	45	45,000	2,025,000	

1.5	Solar System with UPS, Li-on battery & Pole with SPD, and lighting protection	Nos	45	95,260	4,286,700	
1.6	Industrial 5-port managed Gigabit Ethernet switch with 3x10/100/1000Base-T(X) and 2xGigabit combo ports, SFP socket	Nos.	45	25,000	1,125,000	
1.7	Any other item(s) considered necessary to comply with the Scope of Works				-	
Sub-Total (TMCS)					20,030,760	
2	Video Incident Detection System Equipment (VIDS)		5			
2.1	VIDS Camera - 4 per location	Set	20	80,000	1,600,000	
2.2	Warning amber lights with hooters and solar with at least 96 hours backup, pole and foundation (10 nos. at each junction/ location)	Set	5	74,026	370,130	
2.3	Local Processing unit (LPU)	Nos.	5	100,000	500,000	
2.4	Motion Detection surveillance camera, hooter alarm with beacon, and all-in-one solar street light	Set	5	45,000	225,000	
2.5	Cabinet & 12m Pole with 1m arm at 8m	Nos.	5	45,728	228,640	To be replaced during road widening
2.6	Chamber / Manhole and Pole Foundation, PCC, backfilling with sand	Set	5	95,260	476,300	
2.7	Solar System with UPS/PCU, 48 hour battery & Pole with SPD, and lighting protection	Nos.	5	104,021	520,105	
2.8	Standalone Solar powered Amber Flasher Light of 500 mm Dia with at least 96 hours backup, Pole & Foundation (2 at each median opening)	Nos.	52	10,000	520,000	
2.9	Industrial 8-port managed Gigabit Ethernet switch with 3x10/100/1000Base-T(X) and 2xGigabit combo ports, SFP socket	Nos.	5	55,000	275,000	
2.10	Any other item(s) considered necessary to comply with the Scope of Works					
Sub-Total (VIDS)					4,715,175	
3	Fibre cable-OFC					

3.1	Supply of 24 core single mode armored OFC Multitube (TEC G-652) (Loop 10-15 Mtr every MH/HH) + all accessories	Mtr	49500	35	1,732,500	To be replaced during road widening
3.2	40 mm PLB HDPE duct as per latest TSEC specifications + all accessories	Mtr	49500	65	3,217,500	
3.3	Trenching of 1.5 meters, Laying & Backfilling for PLB HDPE duct, cable pulling, chambers lowering, etc.	Mtr	49500	240	11,880,000	
3.4	1m x 1m x 1.8m (depth) chambers (with concrete cover) with proper reinforcement and minimum M25 grade at every 250m	Nos.	45	15,000	675,000	
3.5	24 core OFC LIU - Bamboo Type	Nos	45	2,500	112,500	
3.6	Fiber Patch Cord Single Mode - 2 Mtr Length	Nos	40	1,281	51,240	
3.7	SFP - 20 km Transmission range	Nos	2	4,800	10,800	
3.8	Any other item(s) considered necessary to comply with the Scope of Works					
Sub-Total (OFC)					17,679,540	
4	Traffic Management Centre & Sub-Centre					
4.1	TMC & Sub-centre Central Processing Server in hot standby configuration (Primary + Secondary)	Nos.	2	2,400,000	4,800,000	
4.2	Video Recording Server with storage (minimum 360 TB)	Nos.	2	2,400,000	4,800,000	
4.3	Backup Video Recording (Only Incidents) Server with 240 TB storage	Nos.	1	2,400,000	2,400,000	
4.4	Facility Monitoring System Controller	Nos.	1	186,200	186,200	
4.5	Graphic Display 4x2 (70" Laser DLP/ 0.9mm Pixel LED)	Set	1	9,600,000	9,600,000	
4.6	Graphic Display Controller and software including Video Switches	Set	1	0	-	
4.7	Internet & SMS Server	Nos.	1	186,200	186,200	
4.8	Command Centre Operator Console with 4 nos. 21 inch touchscreen monitors	Nos.	6	121,943	731,658	
4.9	USB joystick to control PTZ cameras	Nos.	3	85,000	255,000	
4.10	Emergency Telephone (1033) console with 2 nos. 21 inch	Nos.	2	105,000	210,000	

	touchscreen monitors					
4.11	Facility Monitoring System Console with 2 nos. 21 inch touchscreen monitors	Nos.	1	105,000	105,000	
4.12	Operations Laser Printer (Colour)	Nos.	1	387,082	387,082	
4.13	Operations Laser Printer (Black)	Nos.	1	66,933	66,933	
4.14	Firewall, IDS, IPS, Core Switch, and Network Equipment (Bidder shall attach the breakup of Network equipment with unit price of each item)	LS	1	1,582,770	1,582,770	
4.15	Aadhar enabled Biometric Fingerprint machine	Nos.	2	75,000	150,000	
4.16	Power Distribution Board (PDB)	LS	1	149,114	149,114	
4.17	Rack 24"	Nos.	1	51,500	51,500	
4.18	Maintenance Equipment as per ToR and site requirement	LS	1	2,500,000	2,500,000	
4.19	Surge Protection Device (SPD)	LS	4	200,000	800,000	
4.20	Lighting protection	LS	4	100,000	400,000	
4.21	Advance Driver Advisory System (ADAS), GPS tracker, industrial grade rugged (Waterproof) dashboard mounted 10" Tablet, Dashcam with video calling feature, body cam, rear & front view varifocal cameras with vandalproof housing (mounted on vehicle), LPU, storage, UPS, live monitoring provision of cameras from TMC & sub-centres, etc. for patrol, ambulance, and maintenance vehicles.	Set	5	419,000	2,095,000	
4.22	Incident Monitoring System (IMS) for PIU office: Workstation (1 nos. at each location), All-in-one color A4 printer, 100" 4K UHD LED display (commercial grade), UPS as per site requirement, Networking devices, switches, CCTV camera, DG of suitable rating as per site requirement, Connectivity with TMC & Sub-centres, etc.	Set	1	2,058,000	2,058,000	
4.23	ATMS Software package at TMC for entire stretch	LS	1	14,928,292	14,928,292	One Time
4.24	Uninterruptible Power Supply (UPS) For Server Rack (10KVA X 1 nos. Online Double Conversion UPS -IGBT based, arranged in parallel configuration -Warranty 5 years) (1 at TMC and 1 at each Sub-centre)	Set	1	296,000	296,000	

	Battery backup -24000 VAH for Each UPS -Warranty 5 years-100AH X 20nos.	Nos.	20			
	Racks Links DC cable	Nos.	1			
4.25	Uninterruptible Power Supply (UPS) For TMC & Sub centre operator consoles (20KVA Online Double Conversion UPS -IGBT based arranged in parallel configuration -Warranty 5 years)	Set	1	481,150	481,150	
	Battery backup -34560 VAH for Each UPS -Warranty 5 years-100AH X 20nos.	Nos.	20			
	Racks Links DC cable	Nos.	1			
4.26	Power Distribution Board (Essential & Critical Supply)	Set	2	106,700	213,400	
4.27	Any other item(s) considered necessary to comply with the Scope of Works					
Sub-Total (ATMS Control Centre)					49,433,299	
5	Vehicle Speed Detection System Equipment (VSDS) (LHS + RHS)		6			
5.1	ANPR camera with IR flasher for 3 lanes (one each for 2 lanes in each direction + shoulder)	Nos.	18	195,000	3,510,000	
5.2	Local Processing Unit (LPU)	Nos.	6	109,200	655,200	
5.3	Speed Detection Radar (upto 90m range) for 3 lanes (one in each direction for 2+1 lanes)	Nos.	6	458,012	2,748,073	
5.4	Vehicle Actuated Speed Display (VASD) System (one each for 2+1 lanes in each direction + shoulder) with Solar	Nos.	18	40,950	737,100	
5.5	Motion Detection surveillance camera, hooter alarm with beacon, and all-in-one solar street light	Set	6	49,140	294,840	
5.6	Gantry (including manufacturing and galvanizing)	Nos.	6	492,000	2,952,000	
5.7	Cabinet	Nos.	6	49,935	299,610	
5.8	Industrial 12-port managed Gigabit Ethernet switch with 3x10/100/1000Base-T(X) and 2xGigabit combo ports, SFP socket	Nos.	6	75,000	450,000	
5.9	Solar System with UPS, Li-on battery, Pole, cabinet for VSDS, with SPD, and lighting protection	Set	6	280,572	1,683,432	
5.10	Any other item(s) considered necessary to comply with the Scope of Works					
	Total (VSDS) INR				13,330,254	
Total (ATMS Component)					105,189,028	
6	Services					

6.1	Installation, Testing & Commissioning	LS	1	2,103,781	2,103,781	
6.2	ATMS System Technical support staff (without escalation) (Base Yr. 2021)	Years	22	6,163,200		Yearly O&M cost to be paid quarterly from date of Go-live
6.3	ATMS Control Room Operations staff (without escalation) (Base Yr. 2021)	Years	22	12,413,070		
6.4	Spares	Years	22	420,756		
Sub-Total (Services)					2,103,781	
ATMS Grand Total (Covered in EPC (civil) Contractor's scope)					107,292,809	
	Items not include in this cost					
1	Supplying and drawing following sizes of FRLS PVC insulated copper conductor, single core cable in the existing surface/ recessed steel/ PVC conduit as required.					
	6.5 lac /kms	kms	45	650,000	29,250,000	
2	As per NHAI Policy for ATMS -2016 Chapter 14 ATMS Control Centre with ATMS Software					
	The Control Centre shall accommodate following equipment and software:(i) Central Computer Server (with integrated ATMS Software including the trafficManagement and Rescue module, integrated audio communication unit &support for relevant Mobile smartphone applications)(ii) Emergency call management system equipment and software(iii) Integrated Traffic Management (ITM) console consisting of mainly the ITMWorkstation, the Integrated audio communication unit and further integratedwith the1. Large Display Board based on the Video-wall2. CCTV Console,3. VIDS console and4. other equipment(iv) ATMS software(v) Mobile radio operator and configuration equipment and software(vi) Backbone communication equipment and Network Management System forthe same(vii) Printer(viii) Uninterrupted Power Supply with supply system and back up(ix) Mains Power supply system and Diesel Generator set equipment.					

	Consider area of Control Center is (40X80 = 3200 Sqft) rate includes following items:- Civil Works Power Connections Electrical accessories ect. Sitting space arrangements (Furnitures) False ceiling if required Fire detection and alarm systems	Sqft	3200	2500	8,000,000	
				Total	37,250,000	
Grand Total =					144,542,809	
Grand Total With GST @ 12% =					161,887,946	

TMS - Price Schedule for a Toll Plaza with 14 lanes					
Number of Lanes at Toll Plaza:			14		
Part I - System Supply, Installation, Integration and Commissioning					
Sl. no	Item	Unit	Quantity	Unit Rate (Rs.)	Amount (Rs.)
A	Integral Components (Lane level & Plaza Level)				
1	RFID ETC transceiver near Pay-axis - mounted on canopy (1 per lane)	No	14	77,800.00	1,089,200.00
2	Electronics Enclosure - (1 per lane)	No	14	6,670.00	93,380.00
3	Lane Controller with Industrial PC - (1 per lane)	No	14	91,895.00	1,286,530.00
4	AVC including sensors, loop and detector - (1 per lane)	Set	14	150,000.00	2,100,000.00
5	User Fare Display with mounting pole - (1 per lane)	Set	14	14,300.00	200,200.00
6	Automatic Barrier Gate - (1 per lane)	No	14	78,000.00	1,092,000.00
7	Overhead Lane Status light (OHLS) - (1 per lane)	No	14	8,250.00	115,500.00
8	Traffic light with mounting pole - (1 per lane)	Set	14	8,250.00	115,500.00
9	Loops with detector - (2 per lane)	Set	28	4,050.00	113,400.00
10	Incident Capture Camera with mounting pole - (1 per lane)	Set	14	6,400.00	89,600.00
11	License Plate Image Capture Camera with mounting poles - (1 per lane)	Set	14	6,400.00	89,600.00
12	Customized industrial grade keyboard - (1 per lane)	No	14	6,630.00	92,820.00
13	Cabling/Networking/Installation/Commissioning (Lump sum)	LS	1	688,000.00	688,000.00
14	Software – Lane Level - (1 per lane)	No	14	15,000.00	210,000.00
15	Plaza Servers in hot-standby configuration	No	1	565,000.00	565,000.00
16	Workstations for MIS, Cashup, Audit & LSDU (Lane status display unit in control room)	No	4	42,500.00	170,000.00
17	24 Port Network switch (Layer 3)	No	2	70,000.00	140,000.00
18	Outdoor wifi Access Point	No	1	9,250.00	9,250.00
19	Software – Plaza level	Job	1	100,000.00	100,000.00

20	Broadband/Dedicated Internet Lease Line (01 Static IP) with minimum 04 Mbps link for CCH connectivity	Facility	2	80,000.00	160,000.00
21	UPS system as required for complete Hybrid ETC Toll Plaza system	No	2	205,000.00	410,000.00
22	Servo stablizer (60 KVA - 03 phase)	No	1	105,000.00	105,000.00
23	Network Video Recorder (NVR) for CCTV recording with adequate storage	No	1	62,000.00	62,000.00
B	Other components (Lane level & Plaza Level)				
24	TFT Monitor - (1 per lane)	No	14	5,350.00	74,900.00
25	Thermal Receipt Printer - (1 per lane)	No	14	12,500.00	175,000.00
26	RFID Handheld Readers	No	4	68,000.00	272,000.00
27	Violation light & Alarm (on existing pole) and Foot switch in booth - (1 per lane)	No	14	2,400.00	33,600.00
28	Booth CCTV camera with voice recording - (1 per lane)	No	14	7,950.00	111,300.00
29	Intercom Slave unit in booth - (1 per lane)	No	14	3,750.00	52,500.00
30	Lane Level UPS - (1 per lane)	No	14	16,000.00	224,000.00
31	Intercom Master unit - (1 per plaza)	No	1	44,000.00	44,000.00
32	Firewall Hardware	No	1	42,000.00	42,000.00
33	CCTV cameras for Plaza building surveillance (server room, control room, cash room, admin)	No	4	5,250.00	21,000.00
				Total CAPEX Price (A)	10,147,280.00
Part II– Operation & Maintenance (2 years)					
Sl. no	Item	Unit	Quantity	Unit Rate (Rs.)	Amount (Rs.)
34	Quarterly O&M charges	Quarter	8	120,000.00	960,000.00
				Total OPEX Price (B)	960,000.00

Total Price for Toll Plaza (A + B) in Rs. 11,107,280.00

No. of Toll Plaza - 1 = 12,440,153.60
 No. of Toll Plaza - 2 = 24,880,307.20
 No. of Toll Plaza - 3 = 37,320,460.80

NATIONAL HIGHWAY AUTHORITY OF INDIA

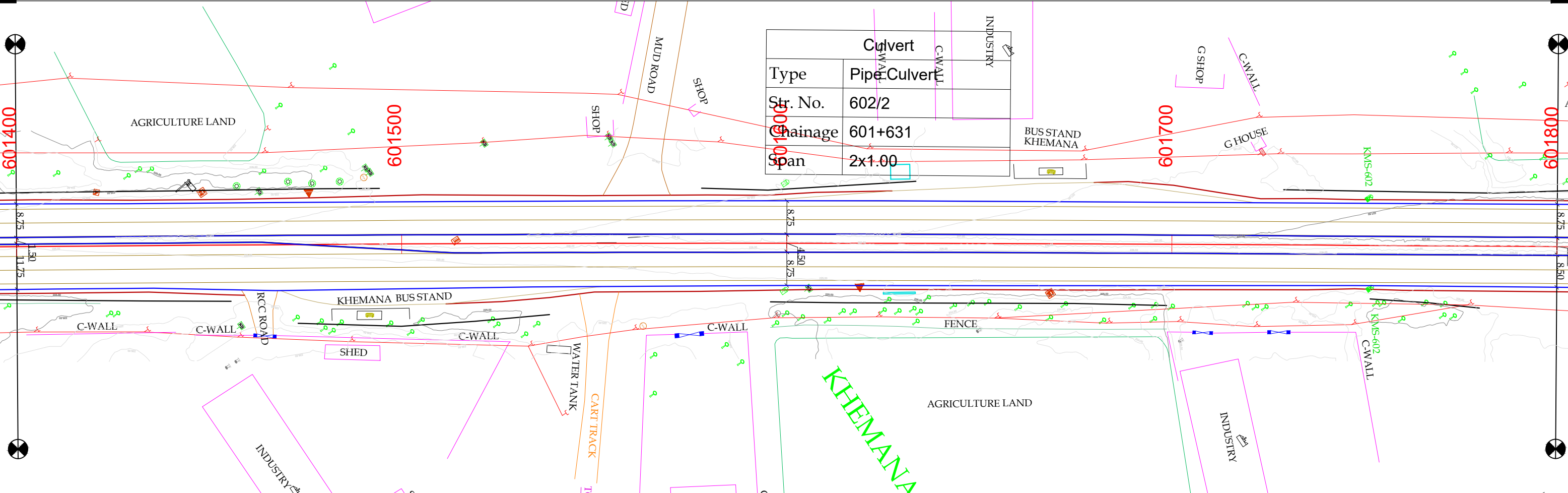
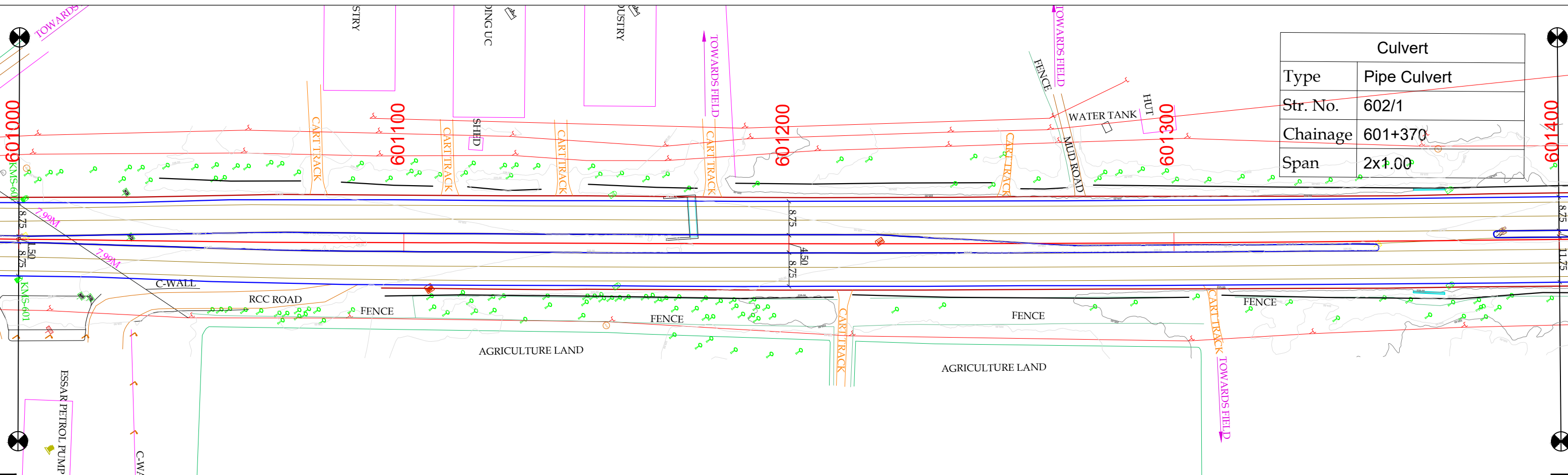





**PROJECT:- PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE NATIONAL HIGHWAY
ON ROADS UNDER (InvIT) MODEL**

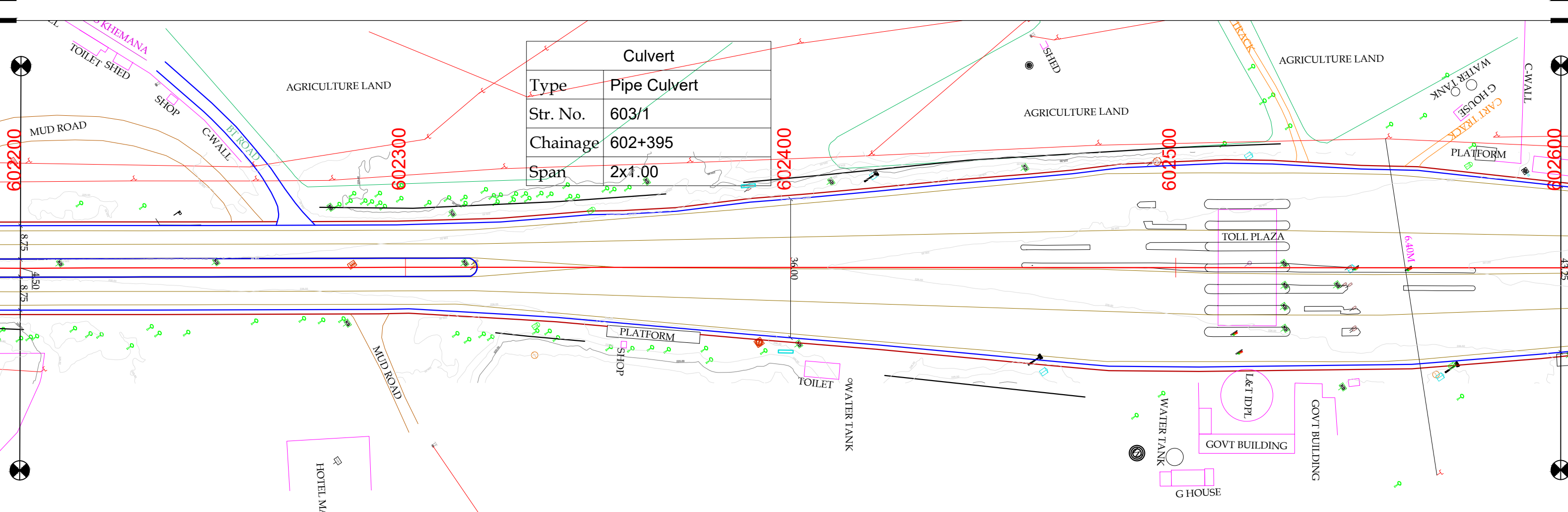
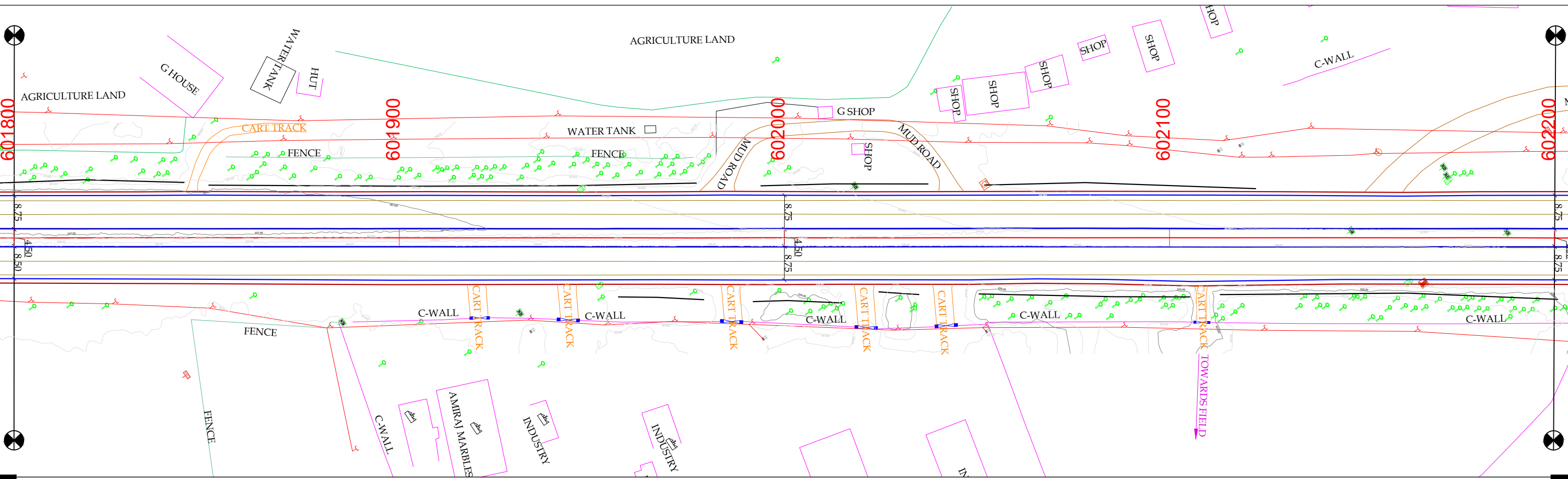
TOPOGRAPHICAL SURVEY MAP (PALANPUR/KHEMANA - ABU ROAD)

Consultant:-
TECNICA Y PROYECTOS, S.A. (TYP SA) in JV
AVANZA Engineering Pvt. Ltd.





			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 601/000 TO 601/800			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
				CHECKED BY				SHEET NO.			
REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				SCALE			
								SIZE			
								REV			
								01			
								1 : 1000			
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								0			



Culvert	
Type	Pipe Culvert
Str. No.	603/1
Chainage	602+395
Span	2x1.00

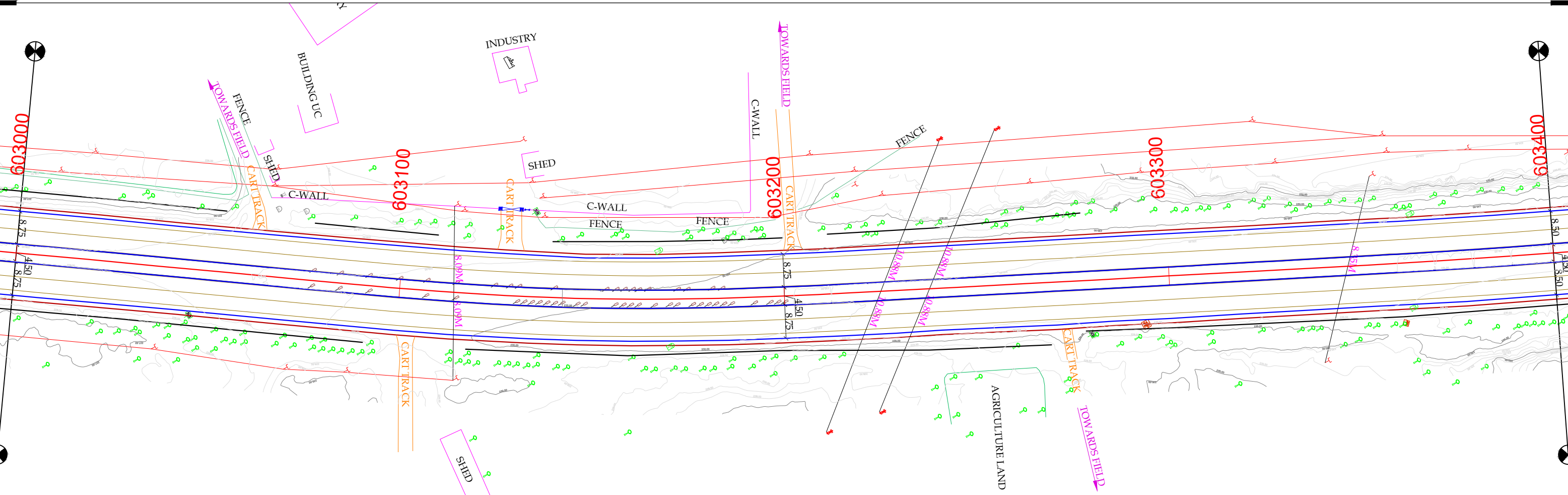
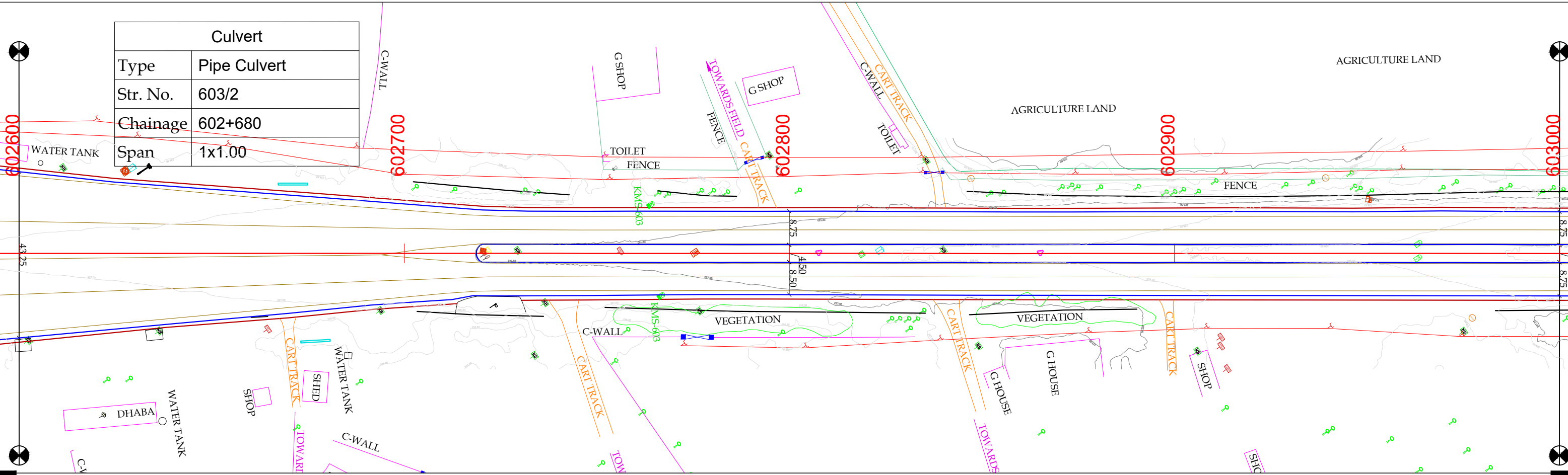
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			DESIGN BY				TYPESA in JV with		Preparation of Report on Physical Condition		DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
			CHECKED BY				AVANZA Engineering Pvt. Ltd.		of the National Highways on Roads under		SHEET NO. SCALE SIZE REV			
			APPROVED BY						(InvIT) Model		02 1 : 1000 A3 0			
REV DATE DESCRIPTION OF REVISIONS														

NATIONAL HIGHWAY
AUTHORITY OF INDIA

TYPESA in JV with
AVANZA Engineering Pvt. Ltd.



Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model



REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-

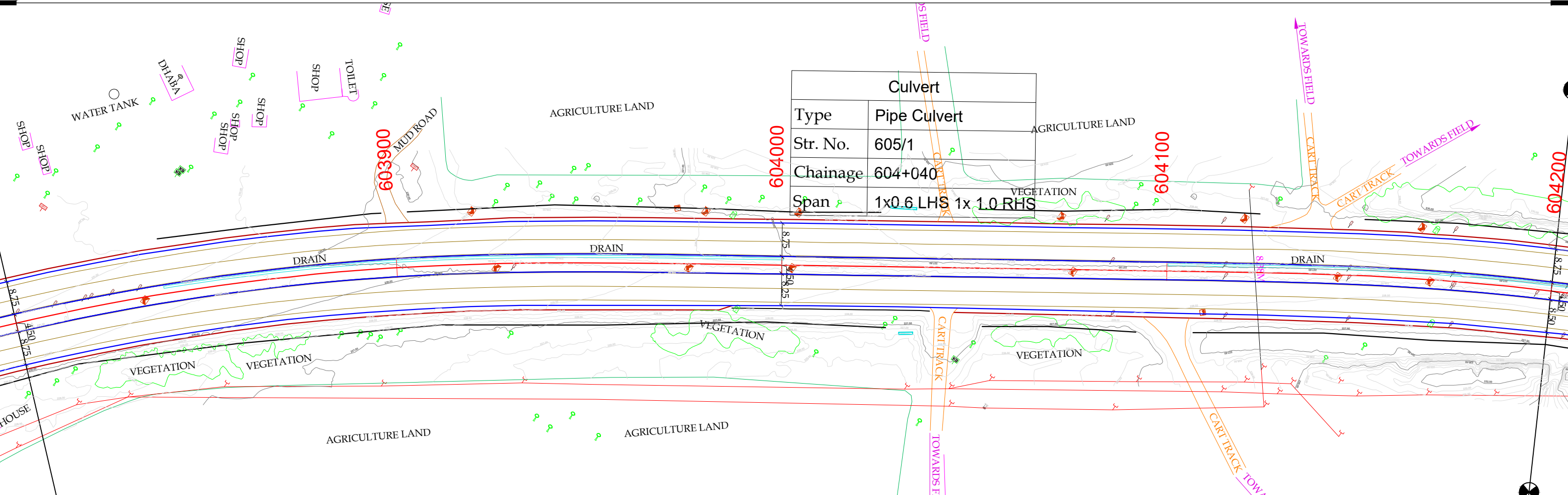
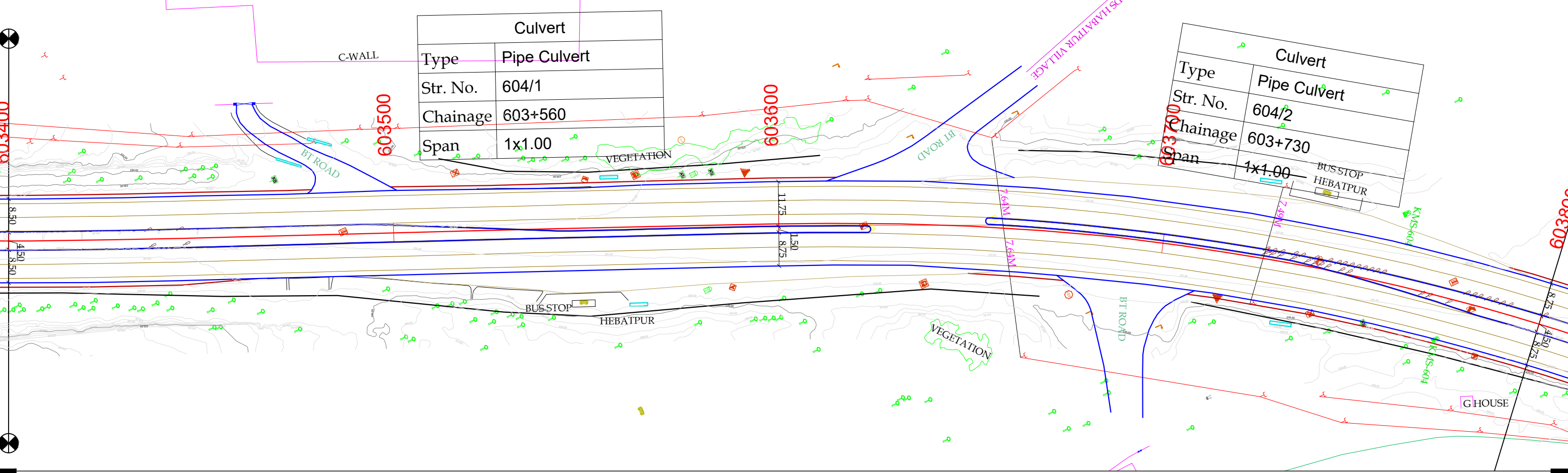
**NATIONAL HIGHWAY
AUTHORITY OF INDIA**




DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-
**TYPESA in JV with
AVANZA Engineering Pvt. Ltd.**

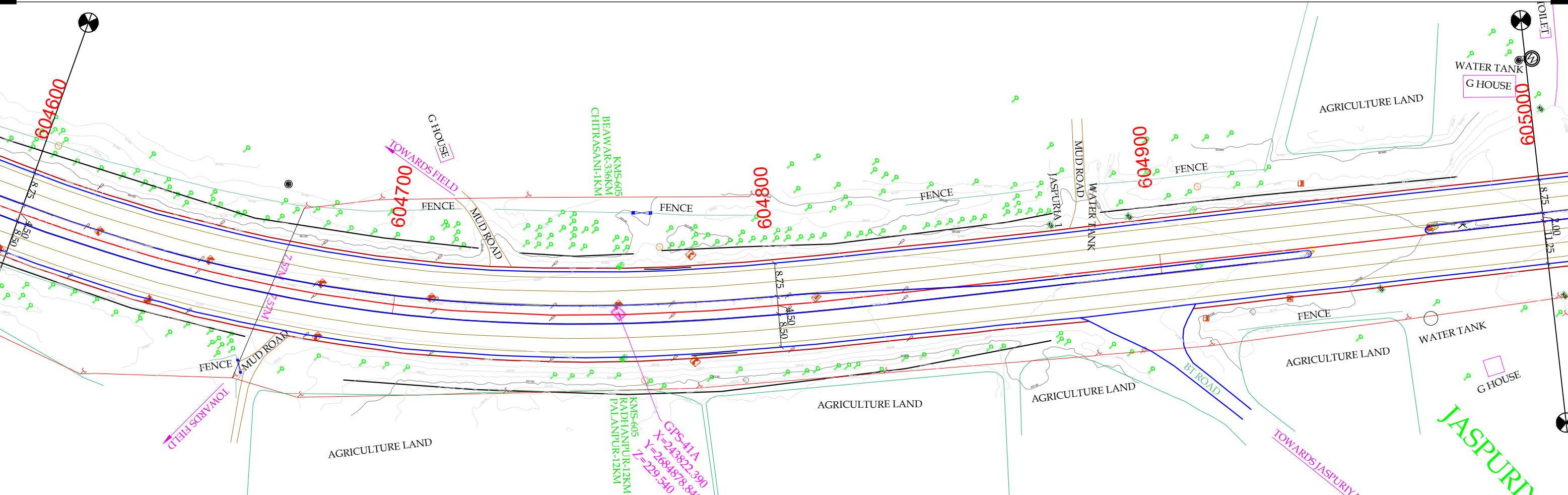
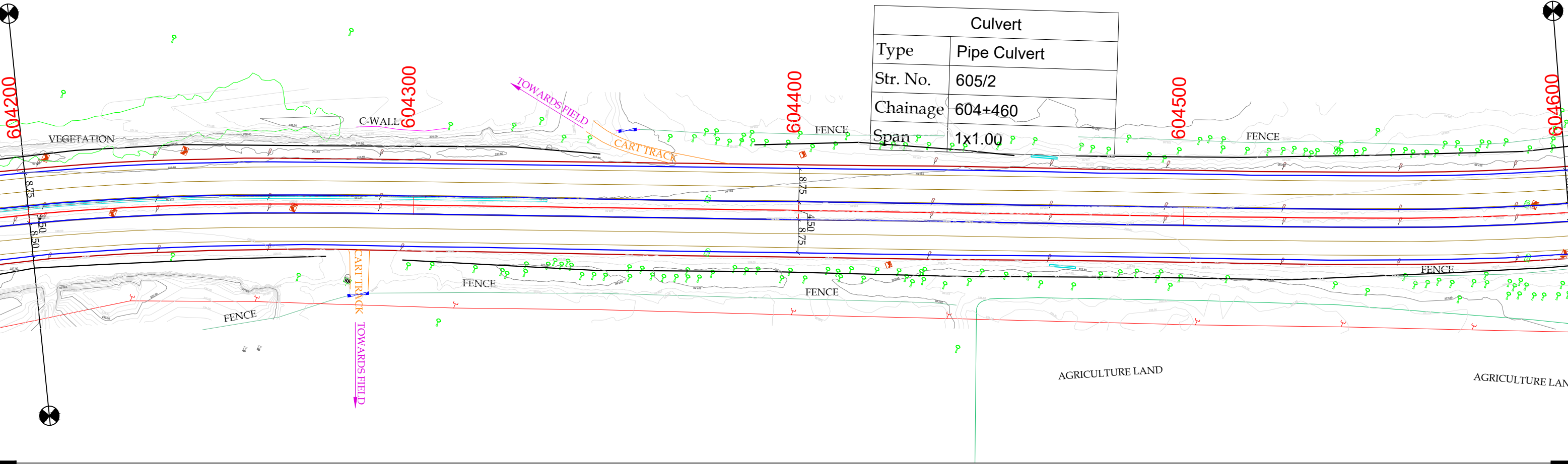
PROJECT :-
**Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model**

TITLE:- KMS 602/600 TO 603/400			
DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
03	1 : 1000	A3	0



			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 603/400 TO 604/200			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
				CHECKED BY				SHEET NO.			
REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				SCALE			
								SIZE	REV		
								04	1 : 1000		
								A3	0		

Culvert	
Type	Pipe Culvert
Str. No.	605/2
Chainage	604+460
Span	1x1.00



REV	DATE	DESCRIPTION OF REVISIONS


CLIENT :-


NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.



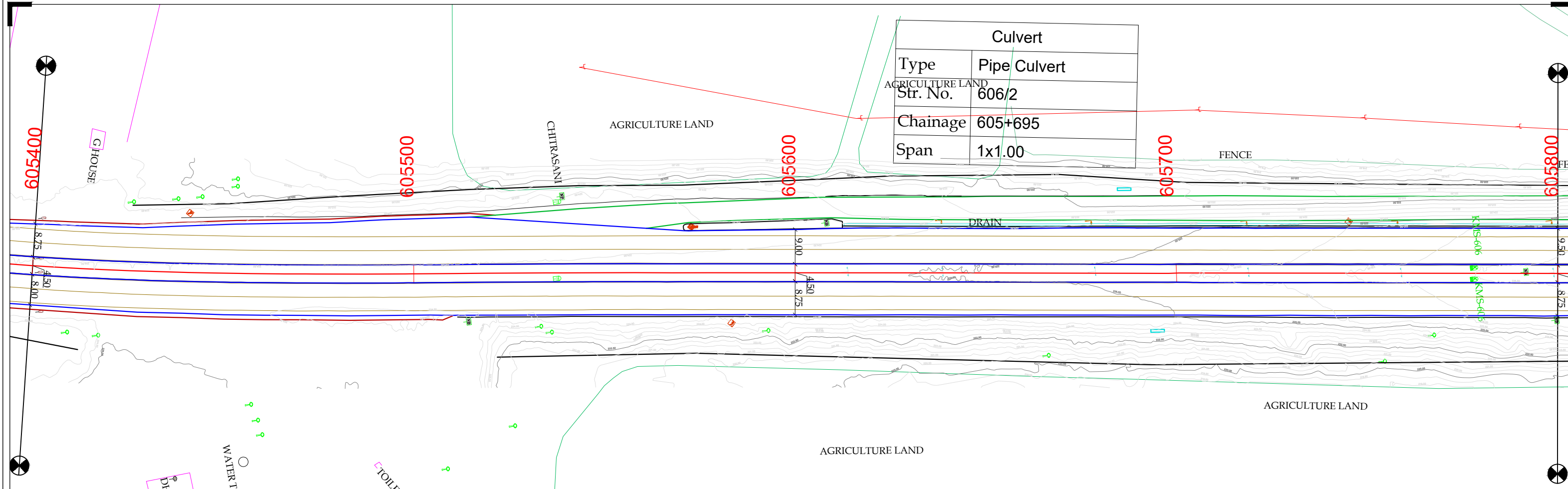
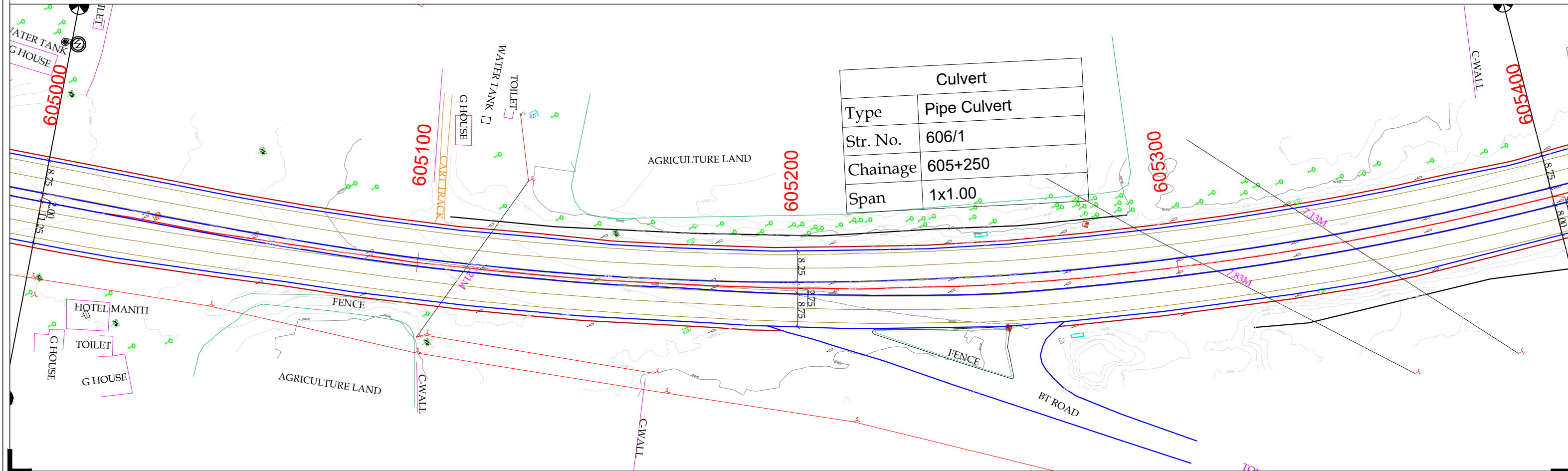

TYPESA
INGENIEROS
CONSULTORES
VARIABLES






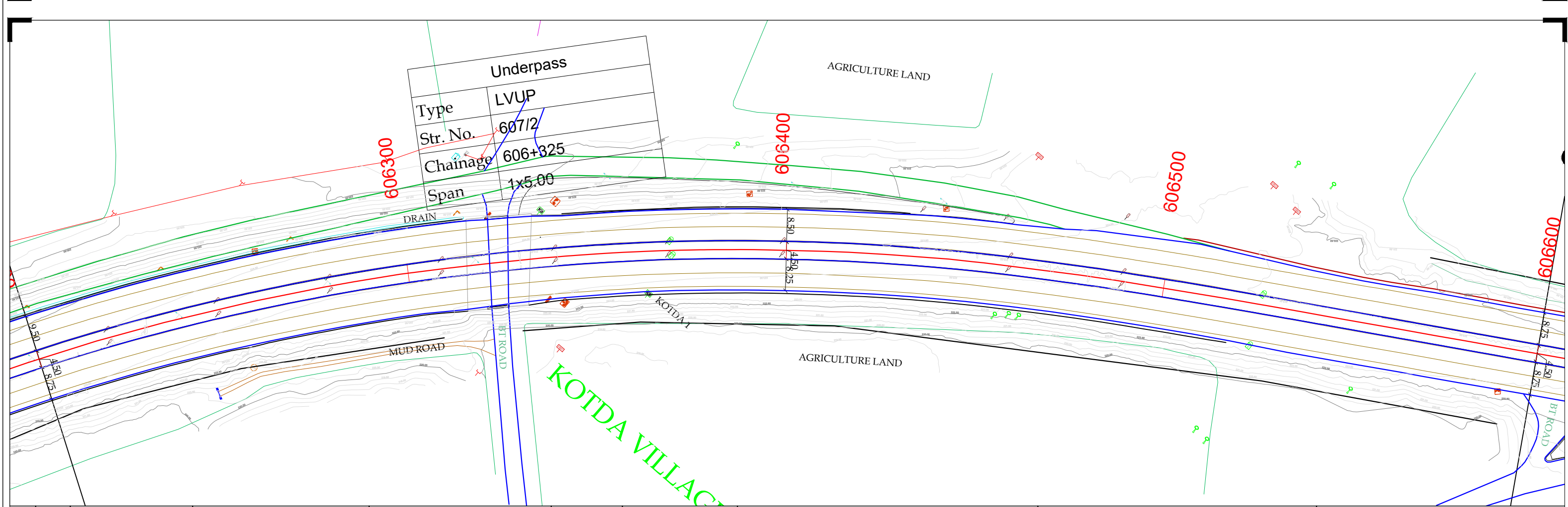
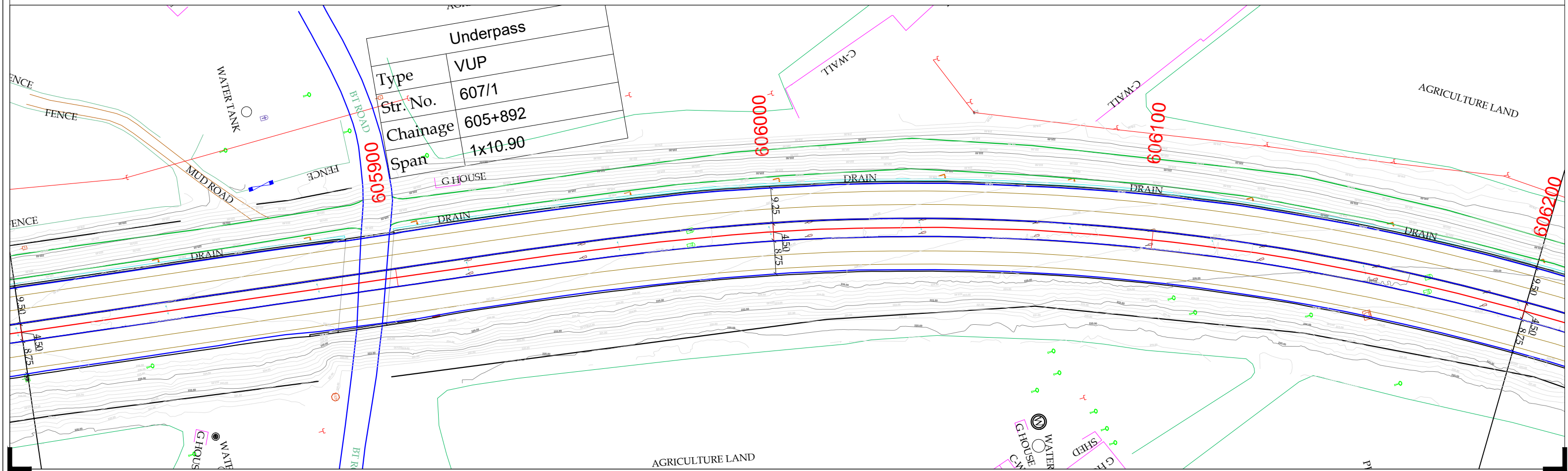
PROJECT :-



Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

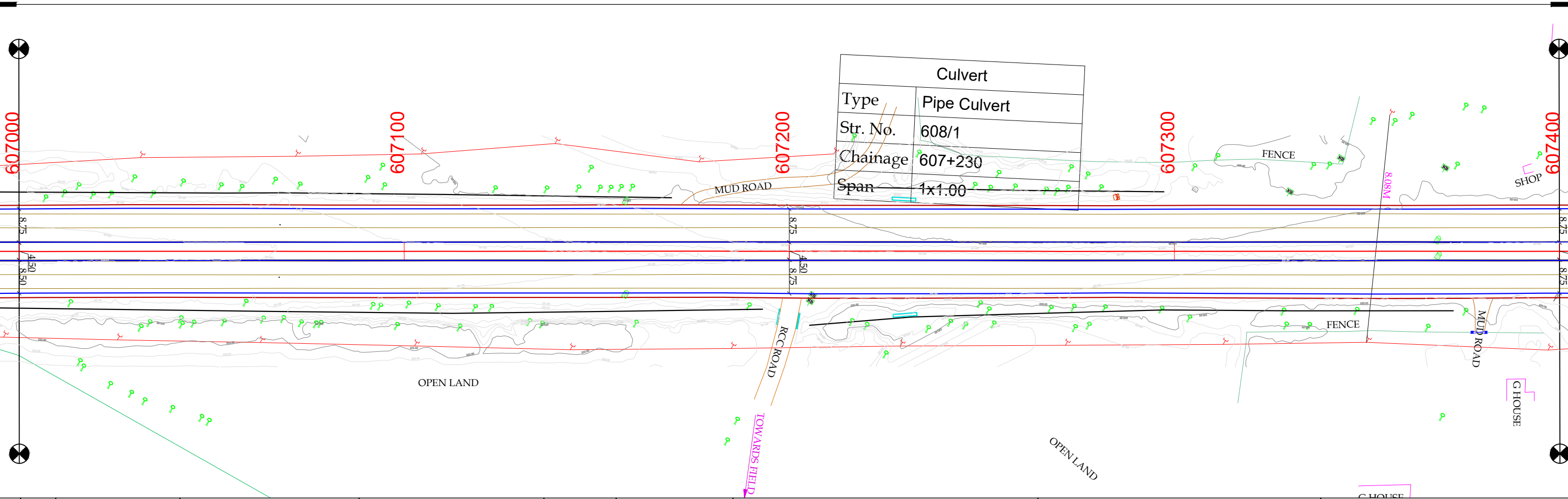
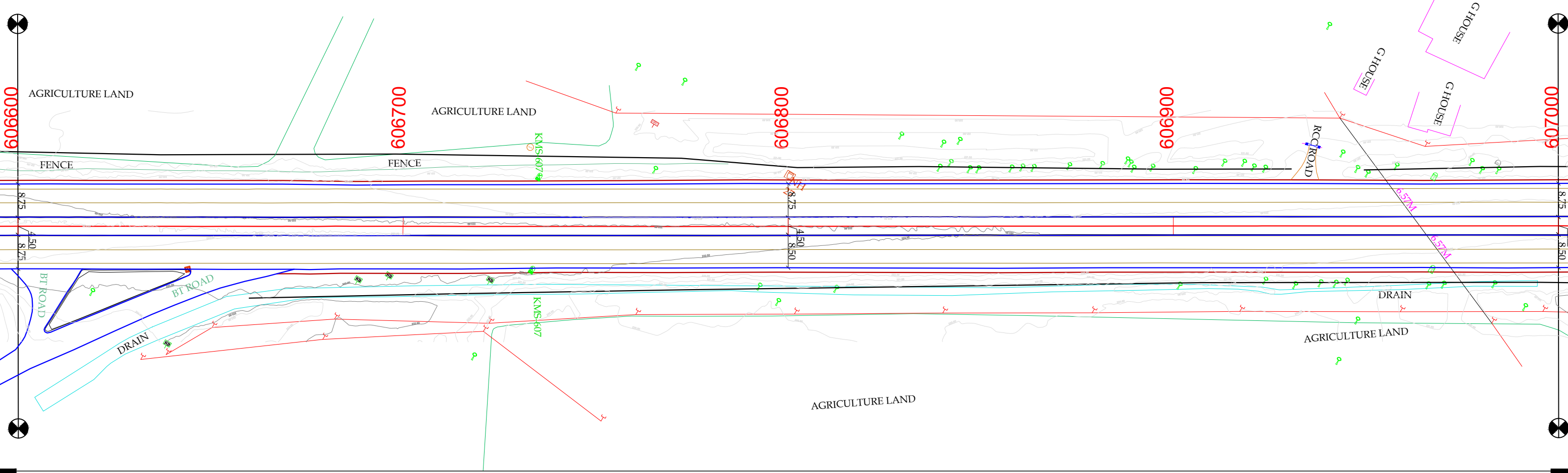
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SHEET NO.	SCALE	SIZE	REV
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			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSA in JV with AVANZA Engineering Pvt. Ltd.  </div>	<div>PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 605/000 TO 605/800			
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REV	DATE	DESCRIPTION OF REVISIONS						SIZE			
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					1 : 1000						
					A3						
					0						



			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd. 	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 605/800 TO 606/600			
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				CHECKED BY				SHEET NO.	SCALE	SIZE	REV
REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				07	1 : 1000	A3	0



Culvert	
Type	Pipe Culvert
Str. No.	608/1
Chainage	607+230
Span	1x1.00

REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-





NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

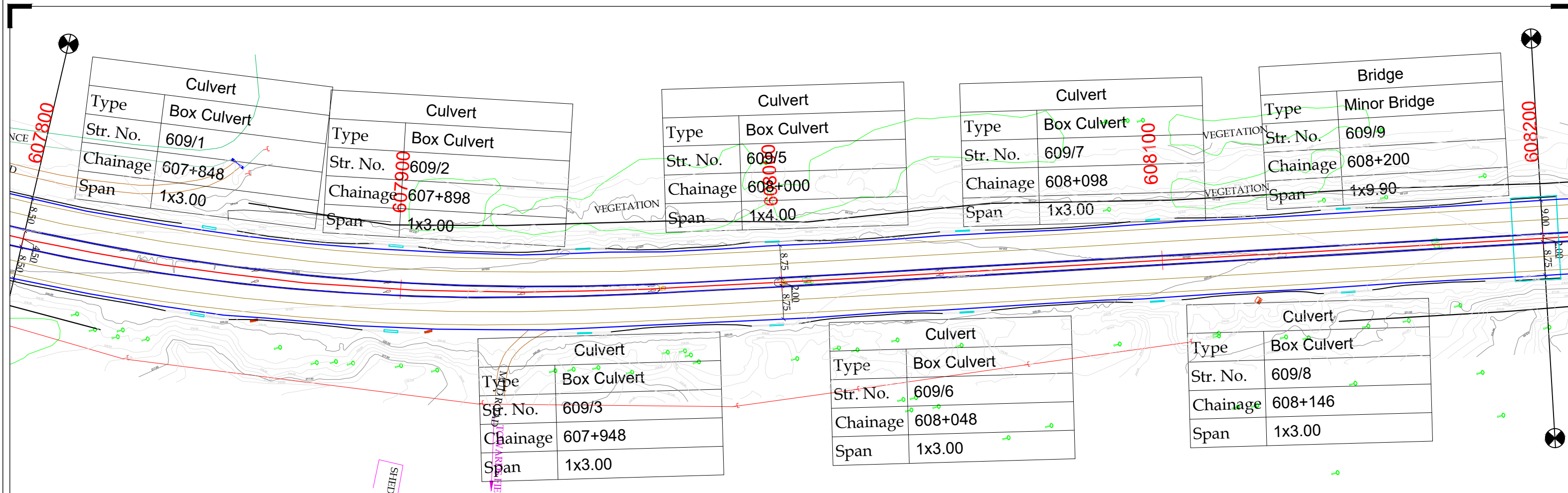
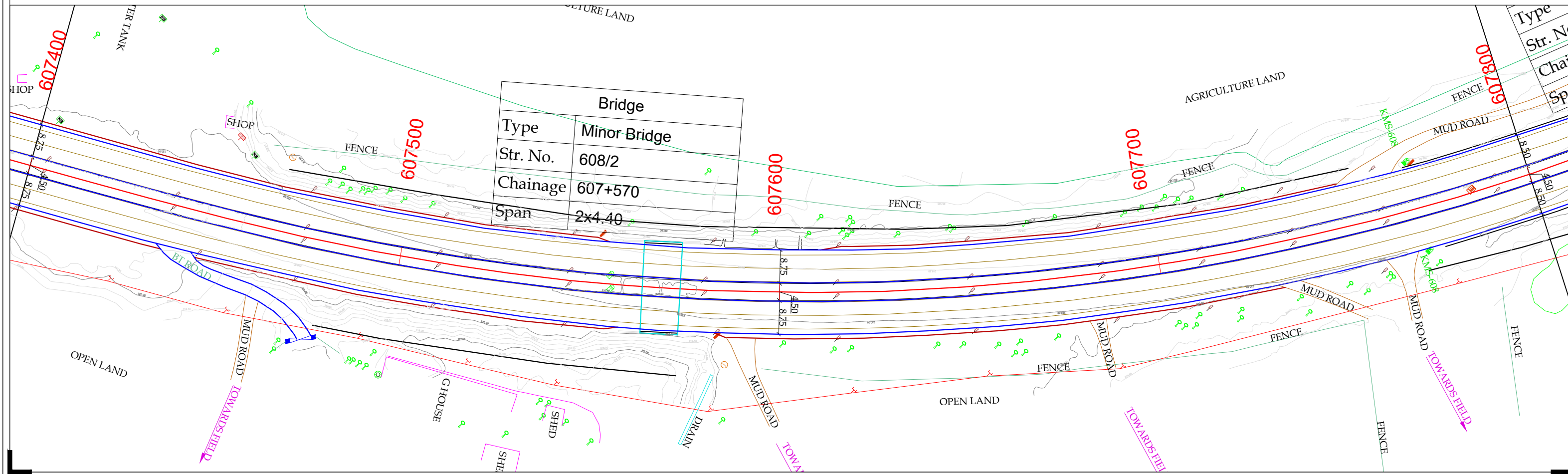

INGENIEROS
CONSULTORES
Y ARQUITECTOS

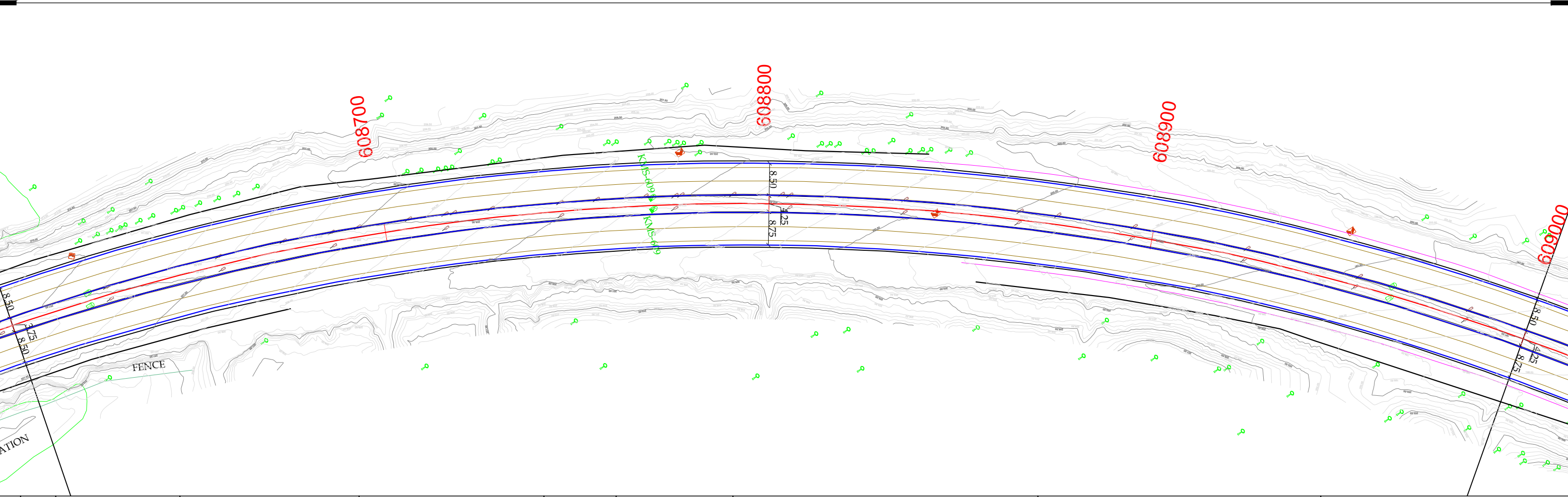
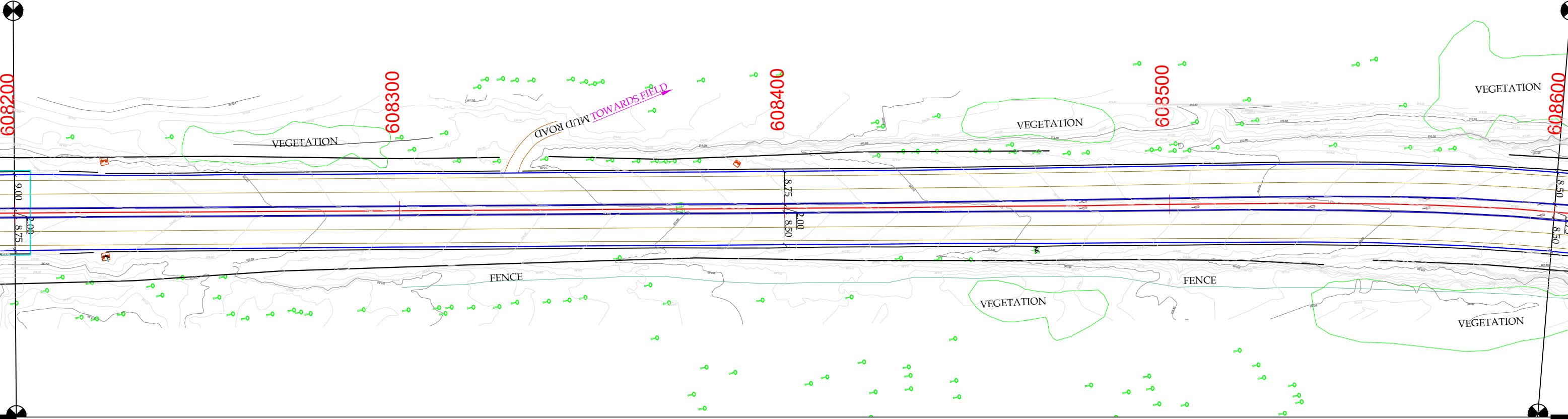

Building Better Future




PROJECT :-

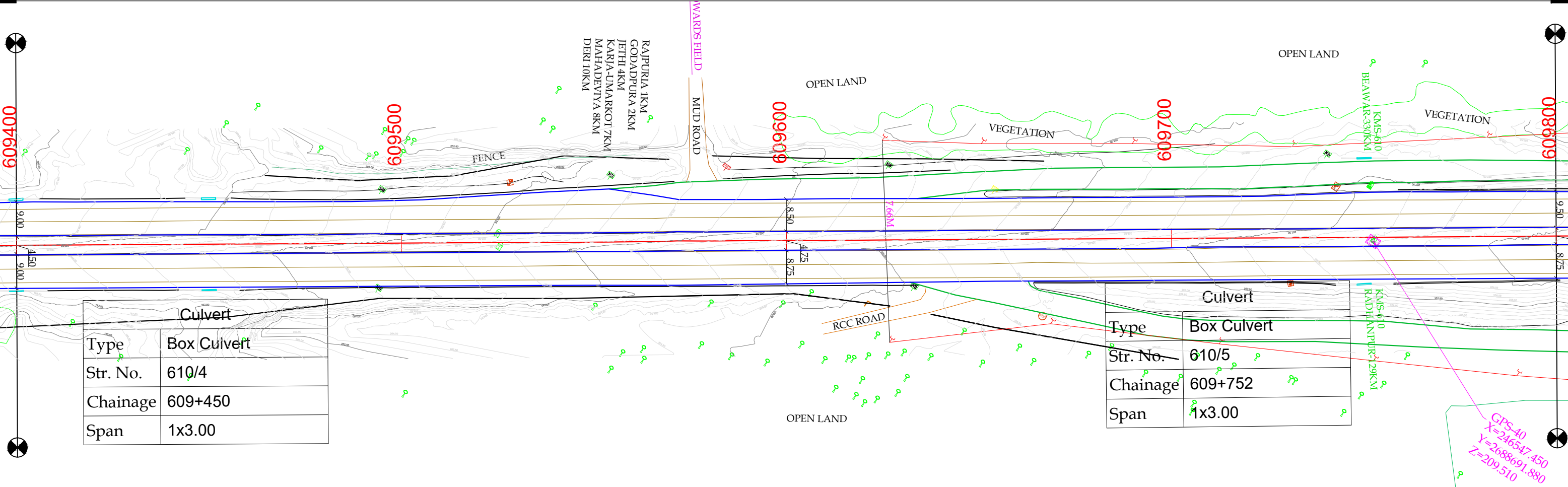
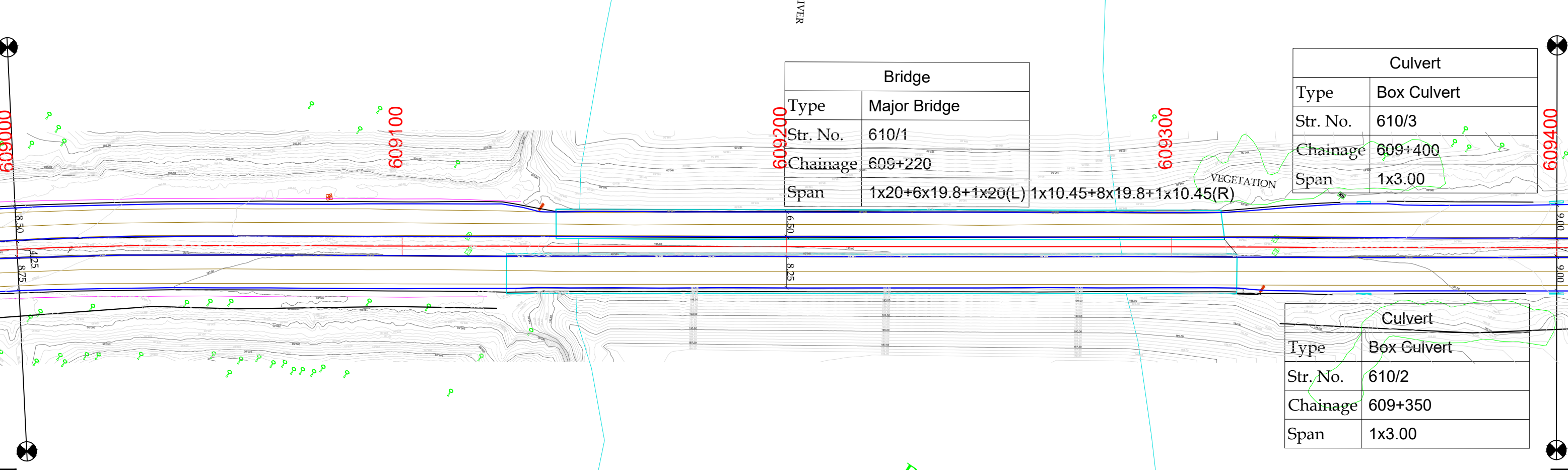
Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

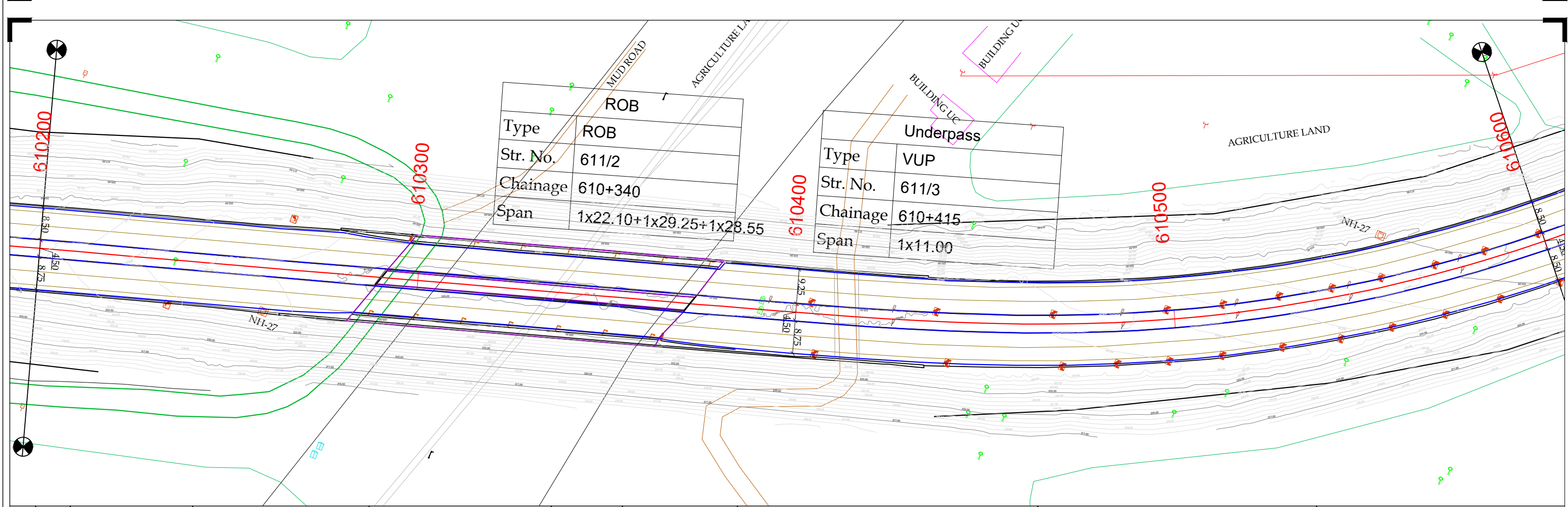
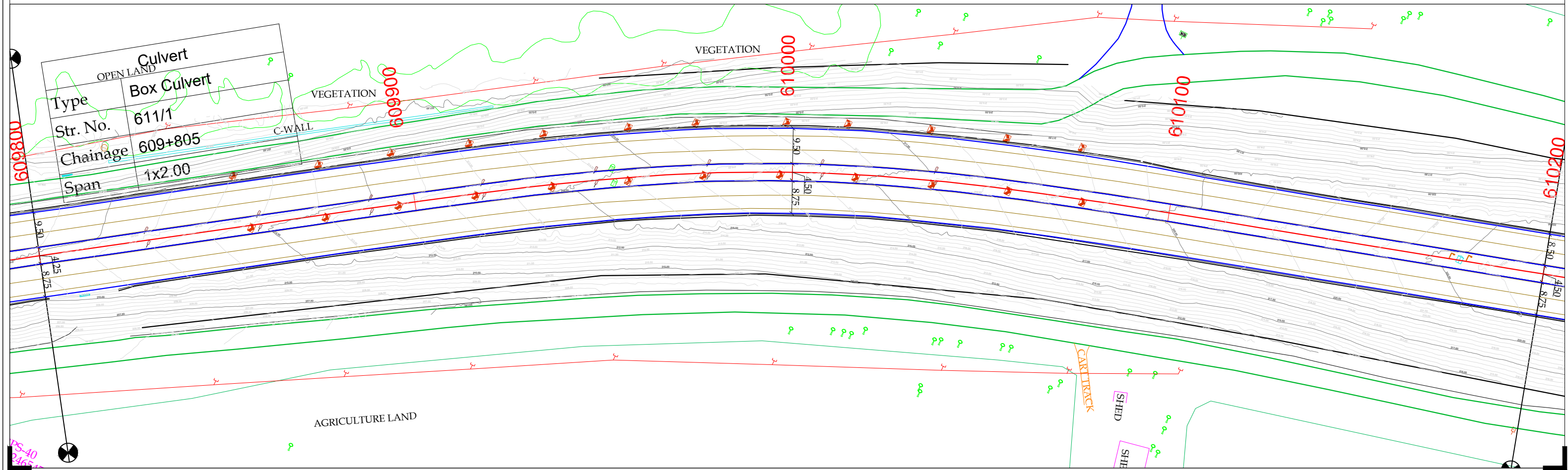
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SHEET NO.	SCALE	SIZE	REV
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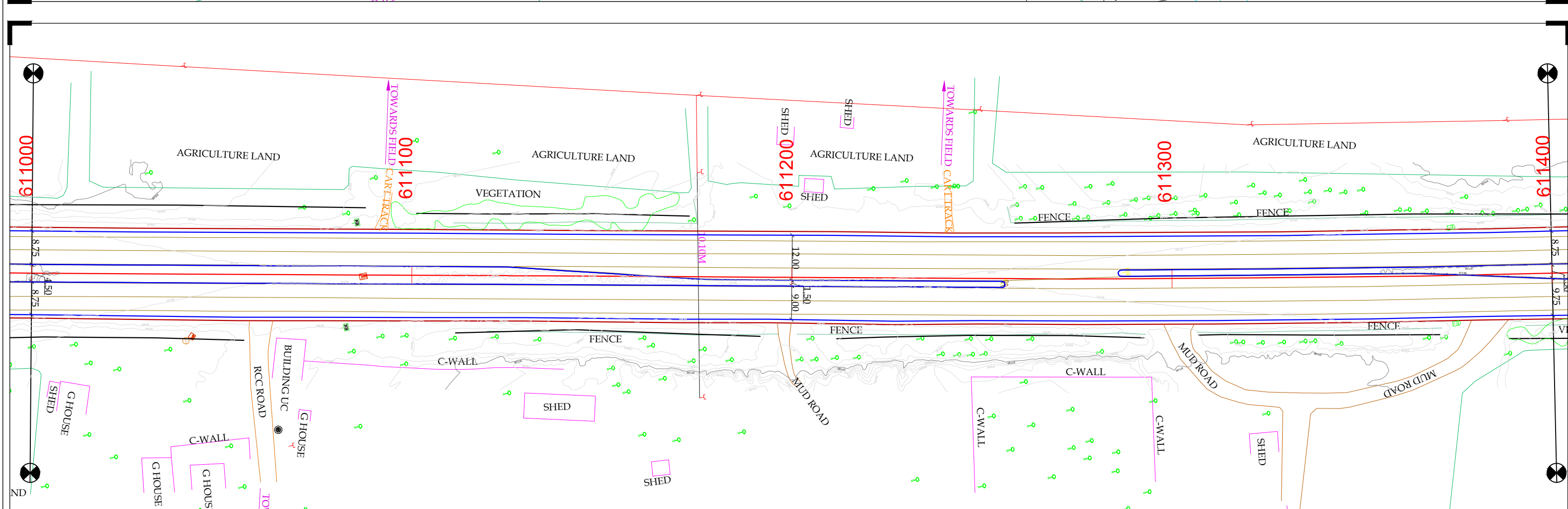





			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPESA in JV with AVANZA Engineering Pvt. Ltd.  </div>	<div>PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 608/200 TO 609/000			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				10	1 : 1000	A3	0

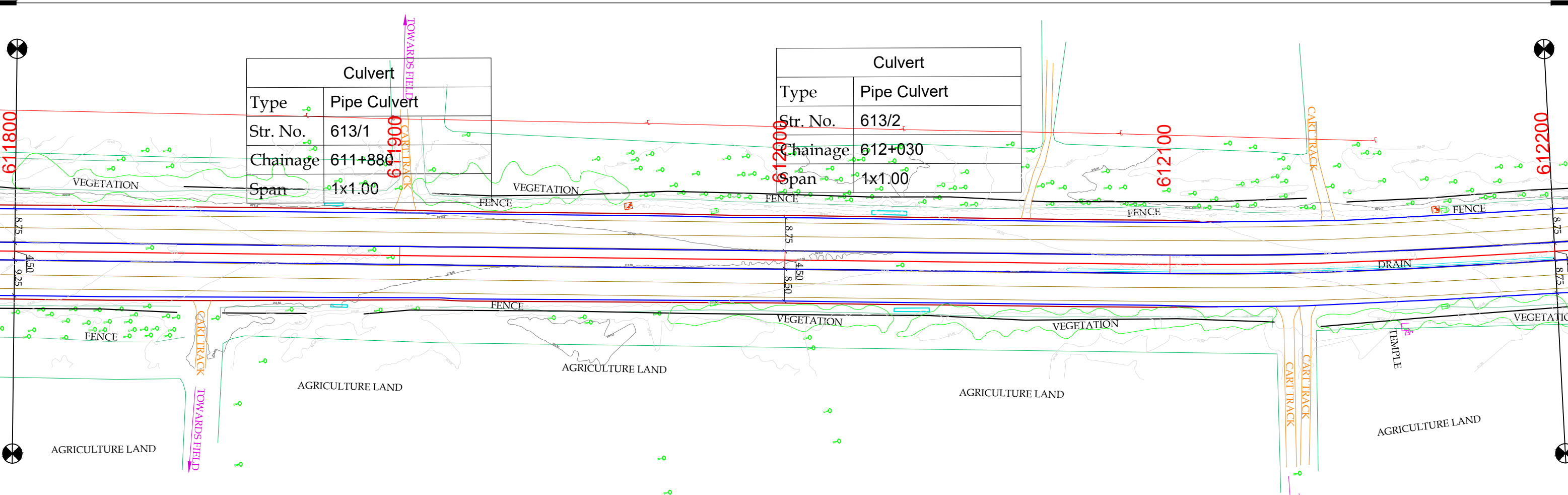
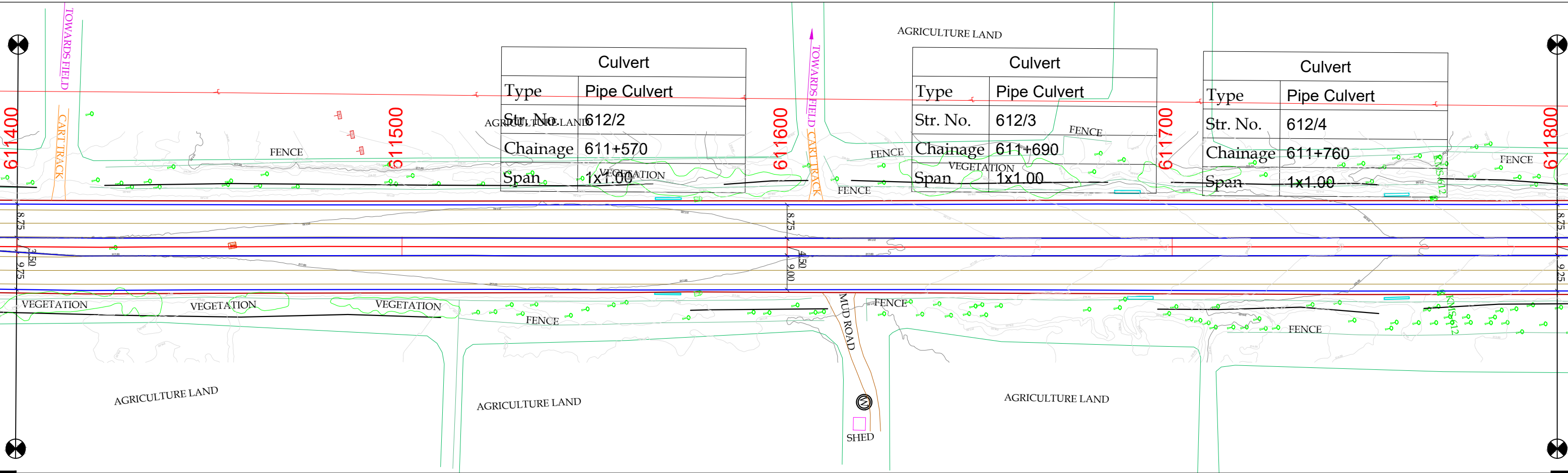




			<div>CLIENT :-</div> <div></div> <div>NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:-</div> <div>TYPSA in JV with AVANZA Engineering Pvt. Ltd.</div> <div> </div>	<div>PROJECT :-</div> <div>Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 609/800 TO 610/600			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
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				APPROVED BY				12 1 : 1000 A3 0			
REV	DATE	DESCRIPTION OF REVISIONS									



			<p>CLIENT :-</p>  <p>NATIONAL HIGHWAY AUTHORITY OF INDIA</p>	DRAWN BY		<p>CONSULTANT:-</p> <p>TYPSA in JV with AVANZA Engineering Pvt. Ltd.</p>  	<p>PROJECT :-</p> <p>Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</p>	TITLE:- KMS 610/600 TO 611/400			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				13	1 : 1000	A3	0



REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-





NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

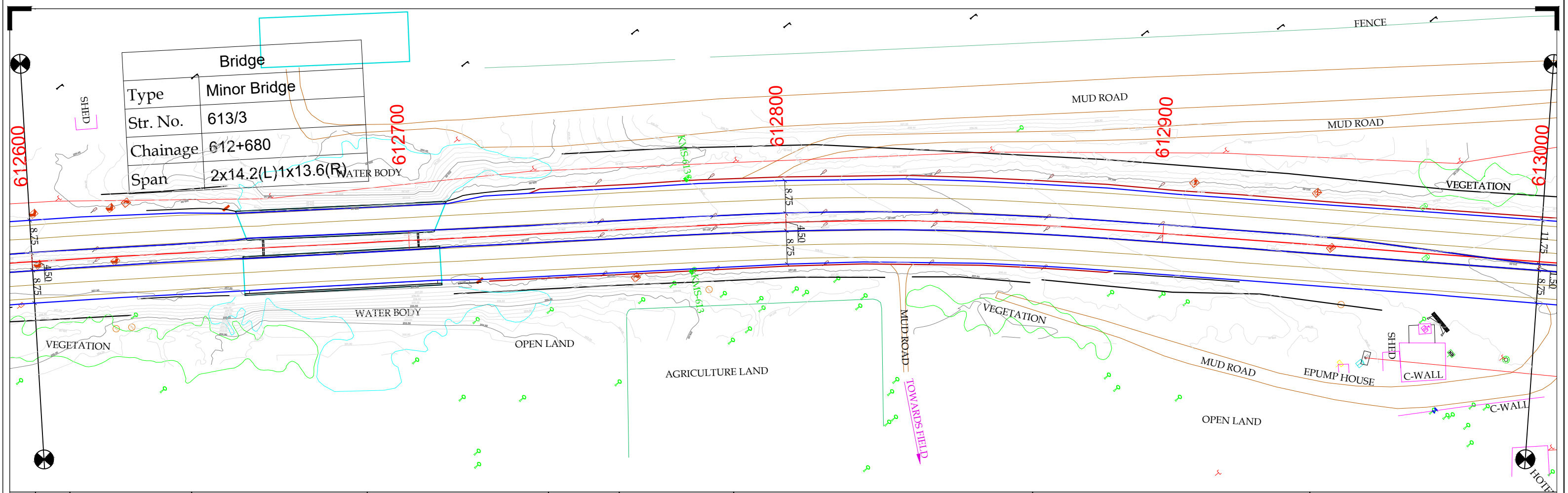
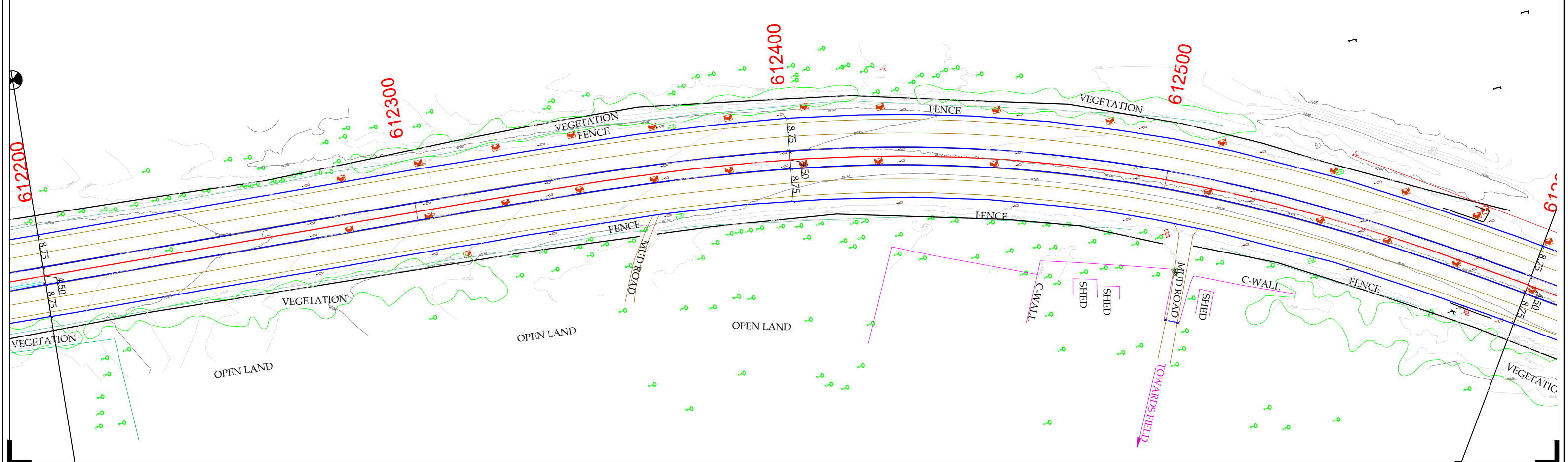

INGENIEROS
CONSULTORES
Y ARQUITECTOS


Building Better Future

PROJECT :-

Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

TITLE:-		KMS 611/400 TO 612/200		
DRAWING NO.		AV_TYPSA/NHAI/InvIT/TOPO_S		
SHEET NO.	SCALE	SIZE	REV	
14	1 : 1000	A3	0	



Bridge	
Type	Minor Bridge
Str. No.	613/3
Chainage	612+680
Span	2x14.2(L)1x13.6(R)

REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-





NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

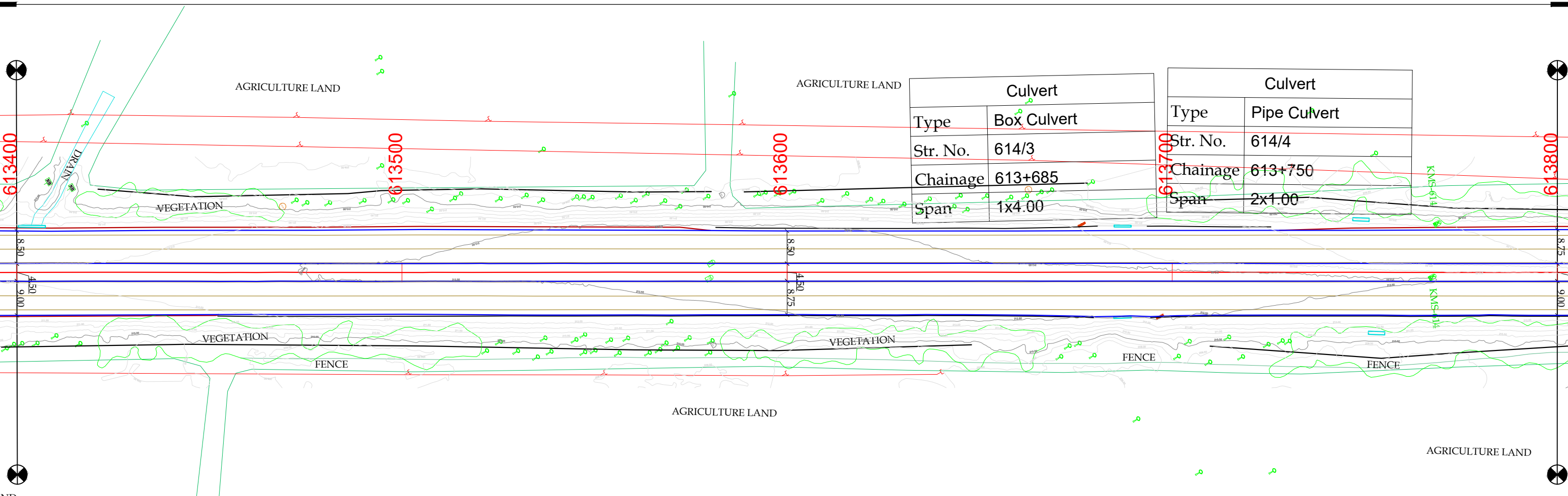
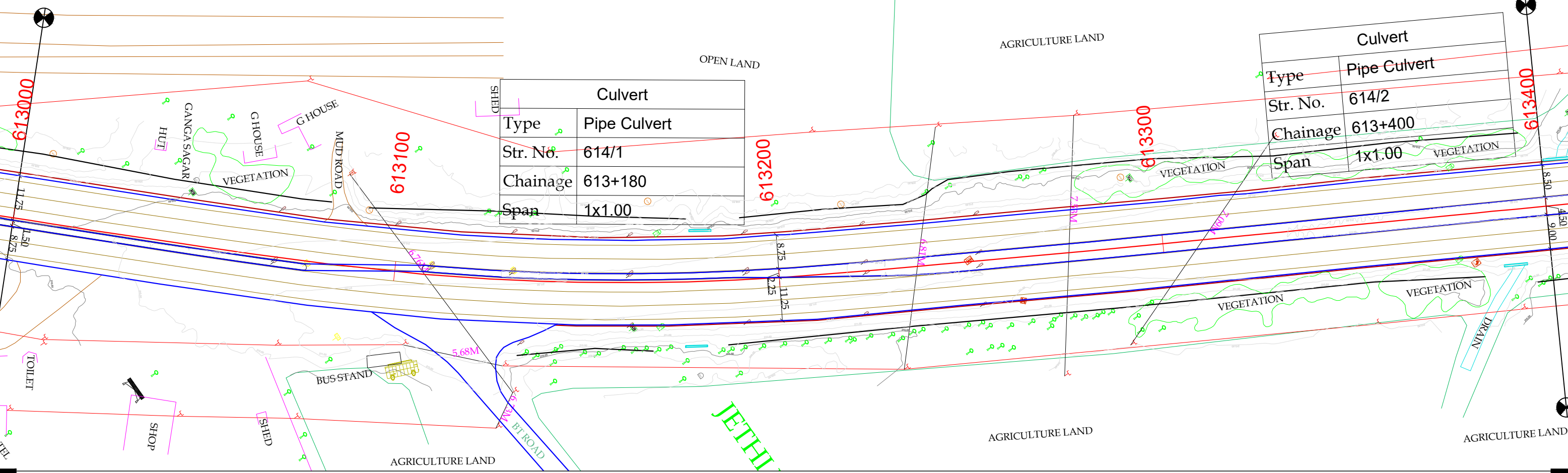

INGENIEROS
CONSULTORES
Y ARQUITECTOS





Building Better Future

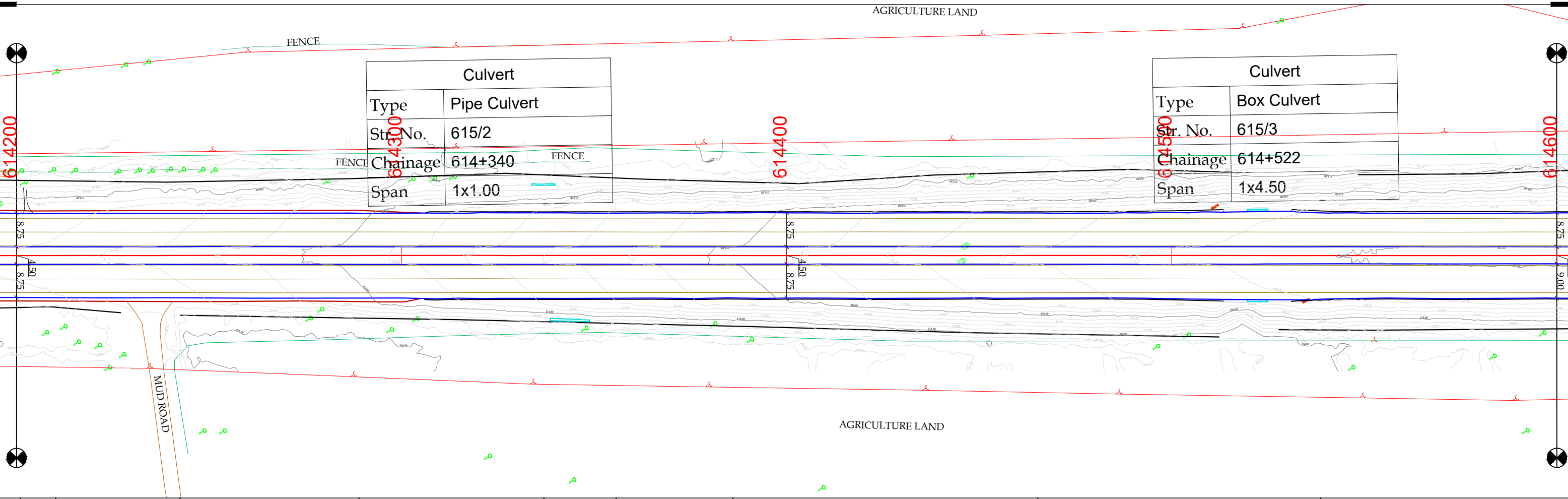
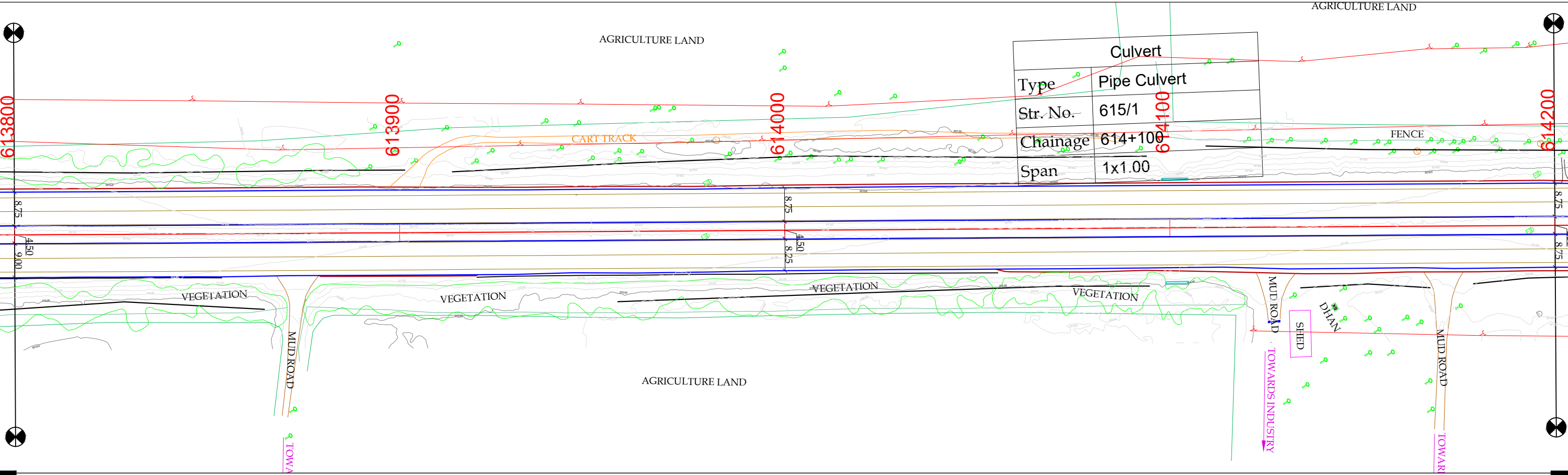
PROJECT :-

Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

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SHEET NO.	SCALE	SIZE	REV
15	1 : 1000	A3	0



			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 613/000 TO 613/800			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				16 1 : 1000 A3 0			



REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-

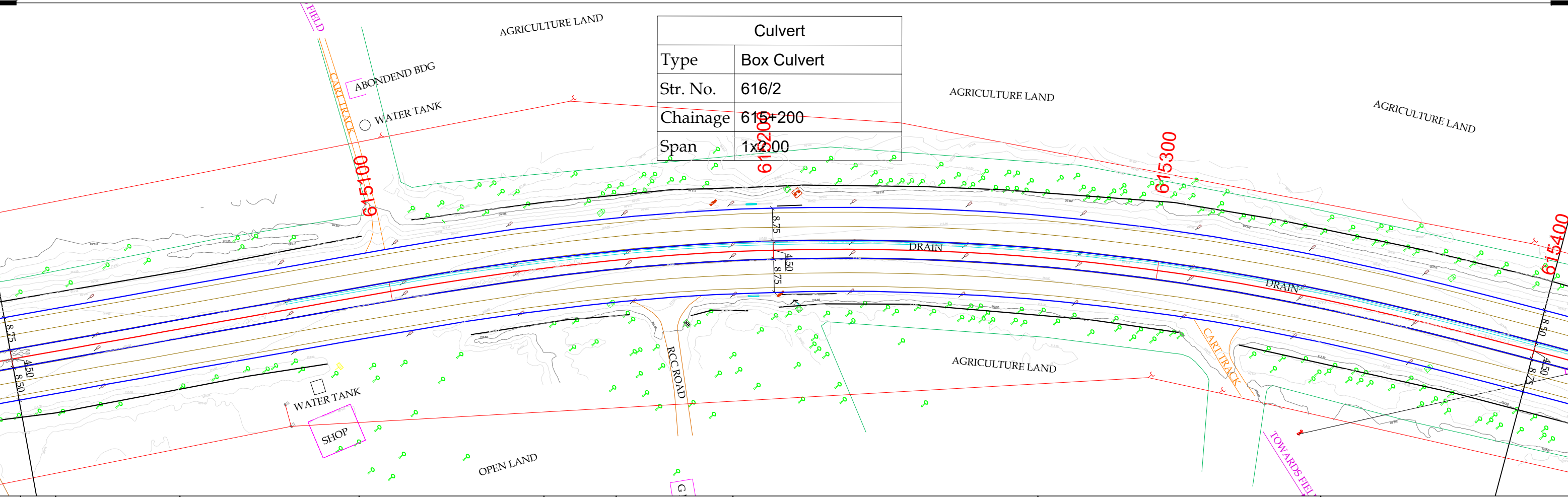
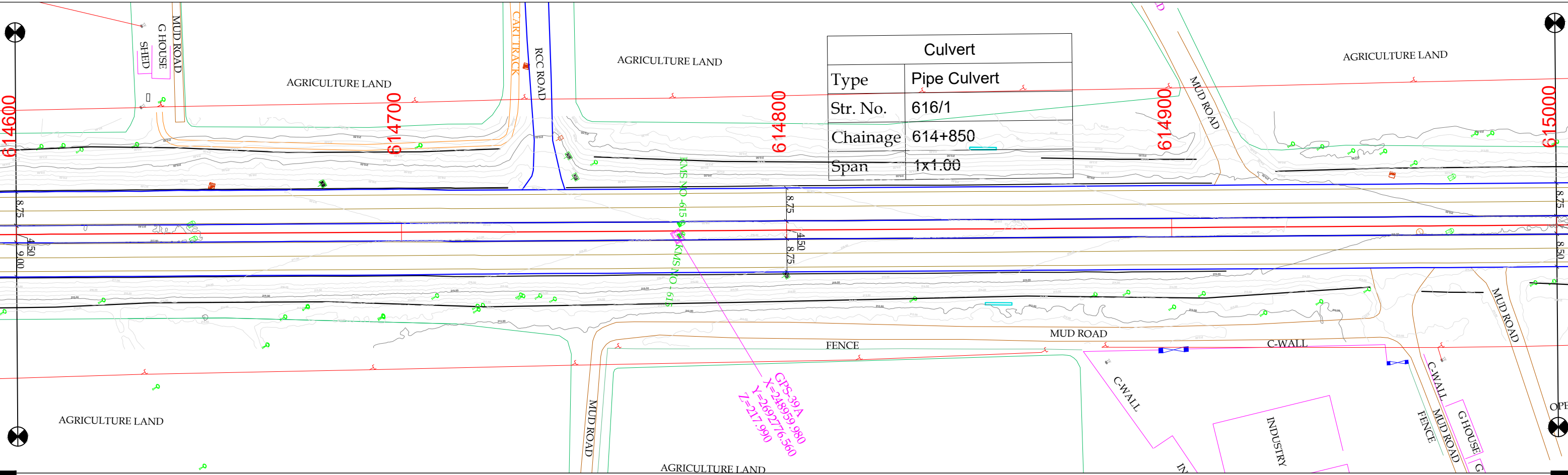
NATIONAL HIGHWAY
AUTHORITY OF INDIA



DRAWN BY	
DESIGN BY	
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APPROVED BY	

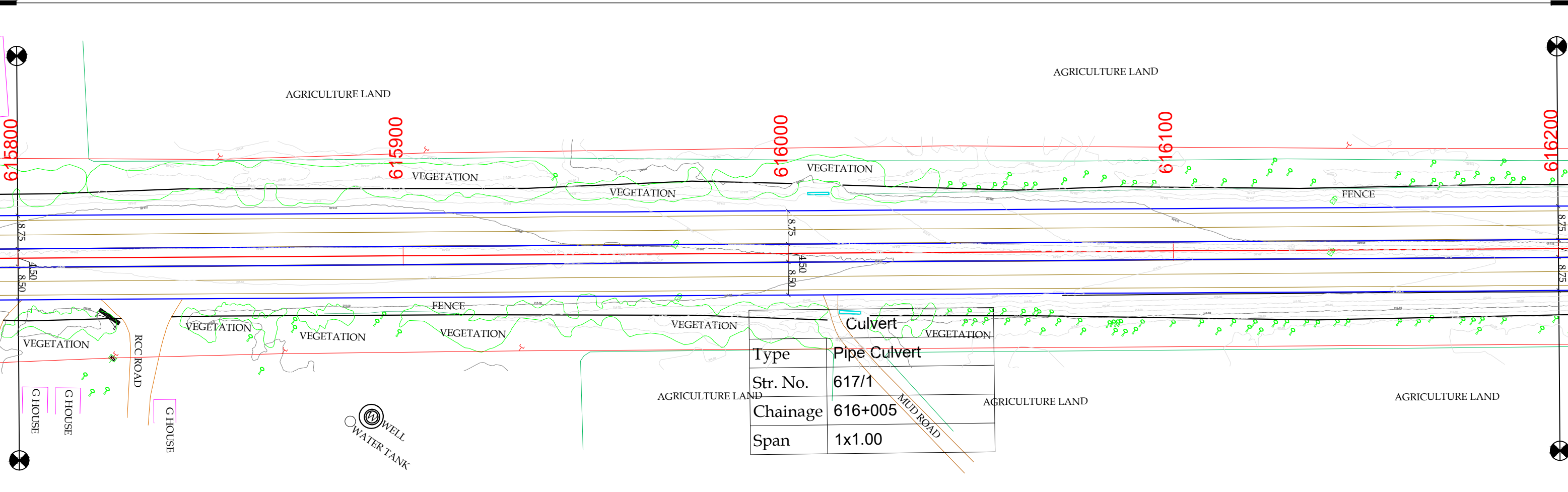
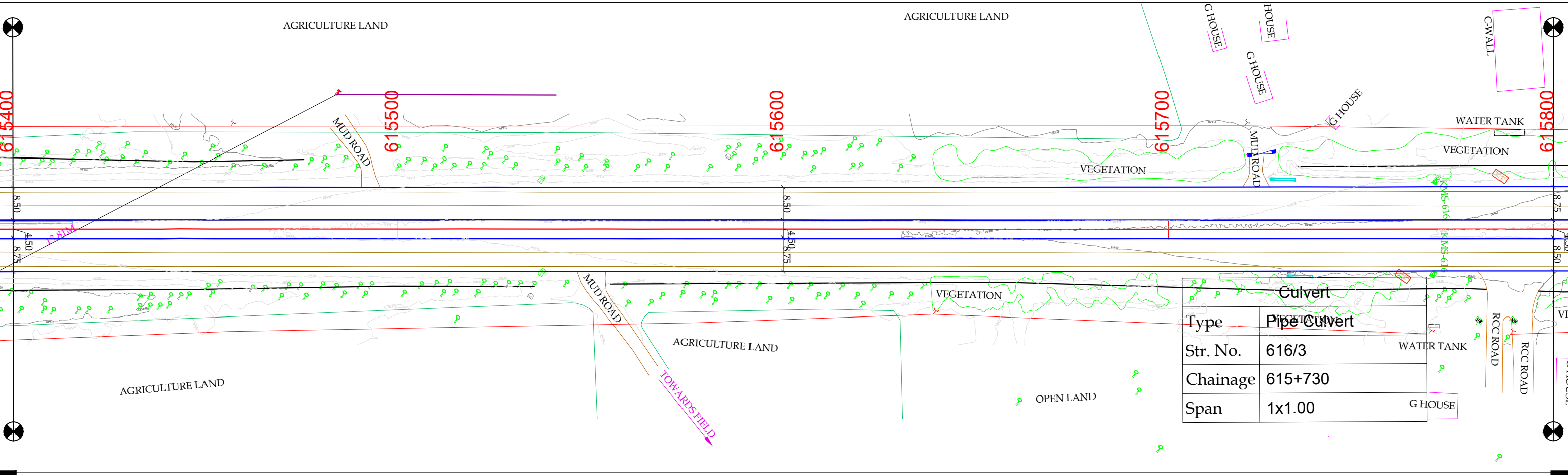
CONSULTANT:-
TYPSPA in JV with
AVANZA Engineering Pvt. Ltd.




PROJECT :-
Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

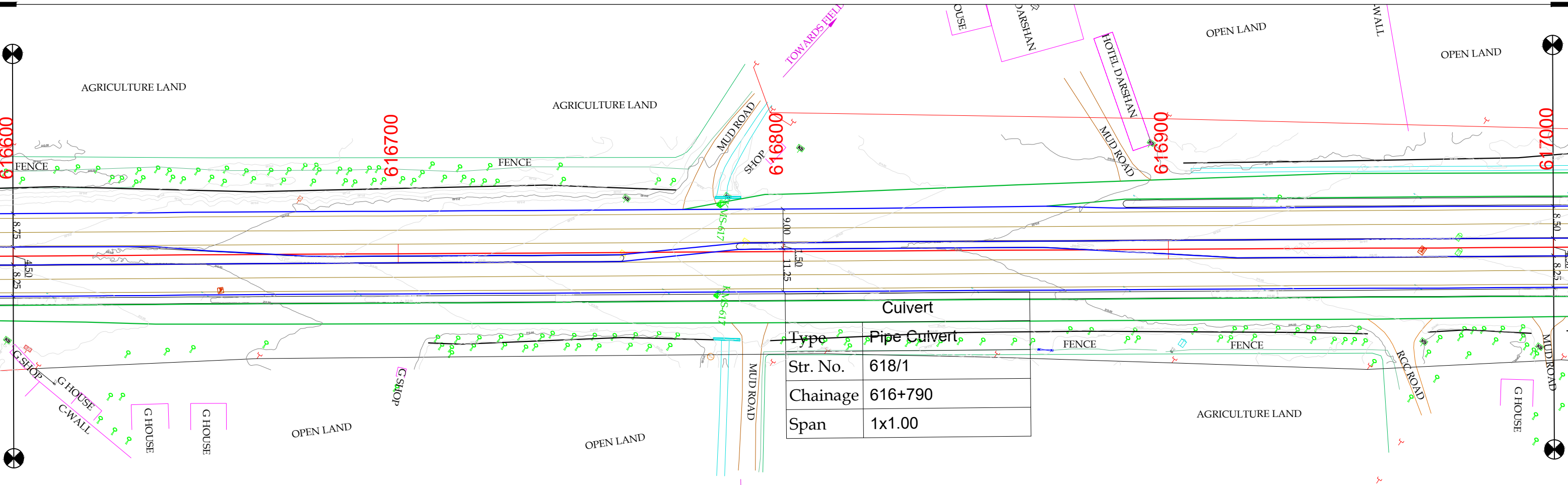
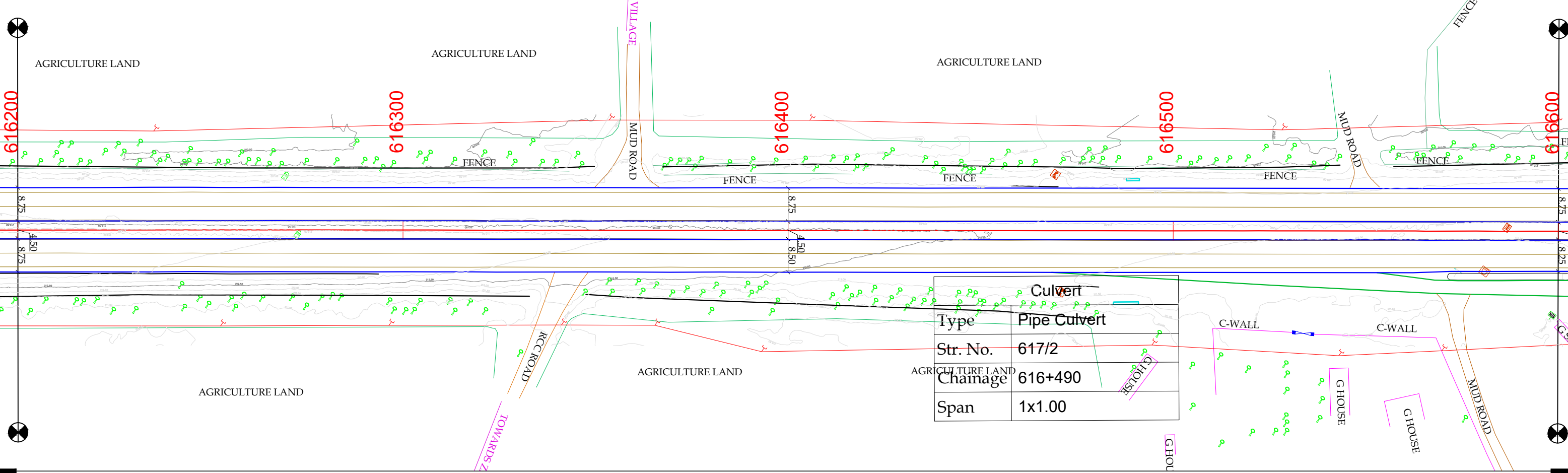
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DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
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			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd. 	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 614/600 TO 615/400			
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REV	DATE	DESCRIPTION OF REVISIONS						18	1 : 1000	A3	0



			<div>CLIENT :-</div> <div></div> <div>NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:-</div> <div>TYPSPA in JV with AVANZA Engineering Pvt. Ltd.</div> <div> </div>	<div>PROJECT :-</div> <div>Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 615/400 TO 616/200				
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				CHECKED BY					SHEET NO. SCALE SIZE REV			
				APPROVED BY								
REV	DATE	DESCRIPTION OF REVISIONS							19 1 : 1000 A3 0			





REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-

**NATIONAL HIGHWAY
AUTHORITY OF INDIA**

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-
**TYPSPA in JV with
AVANZA Engineering Pvt. Ltd.**



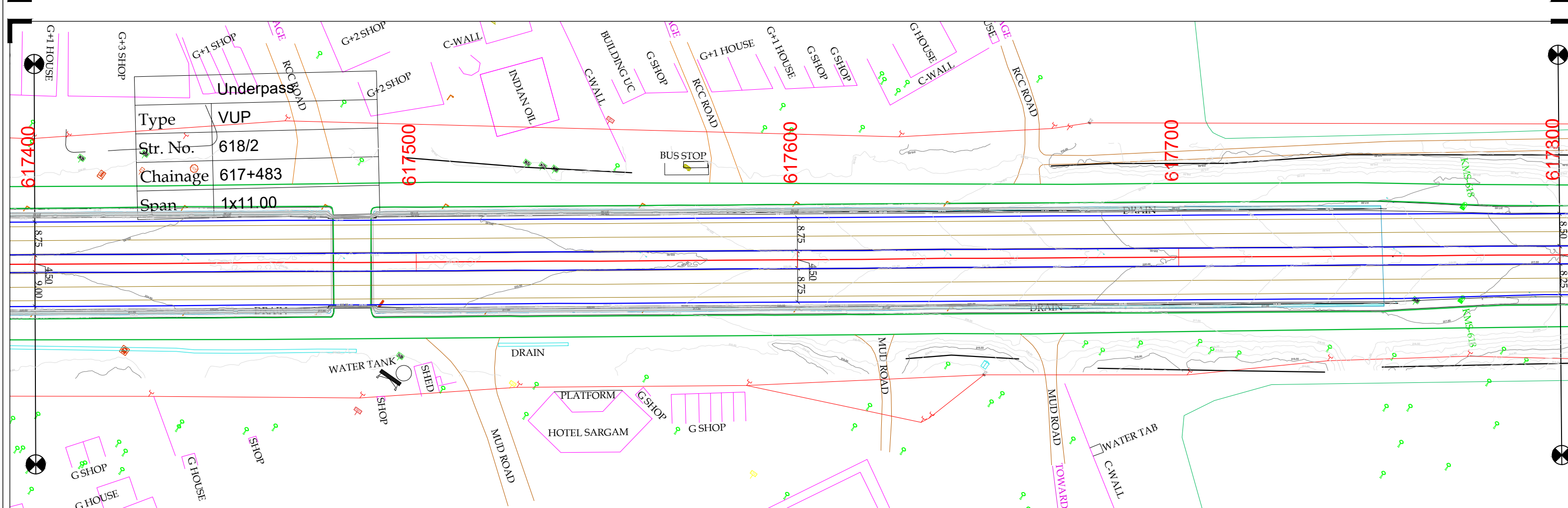
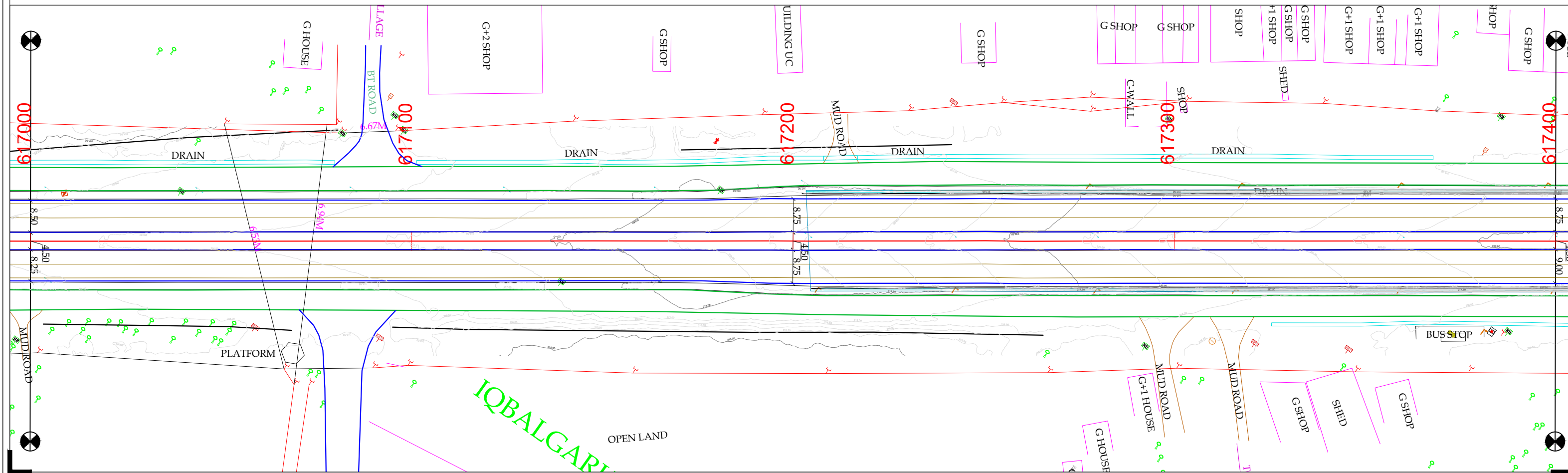
PROJECT :-
**Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model**




TITLE:- KMS 616/200 TO 617/000			
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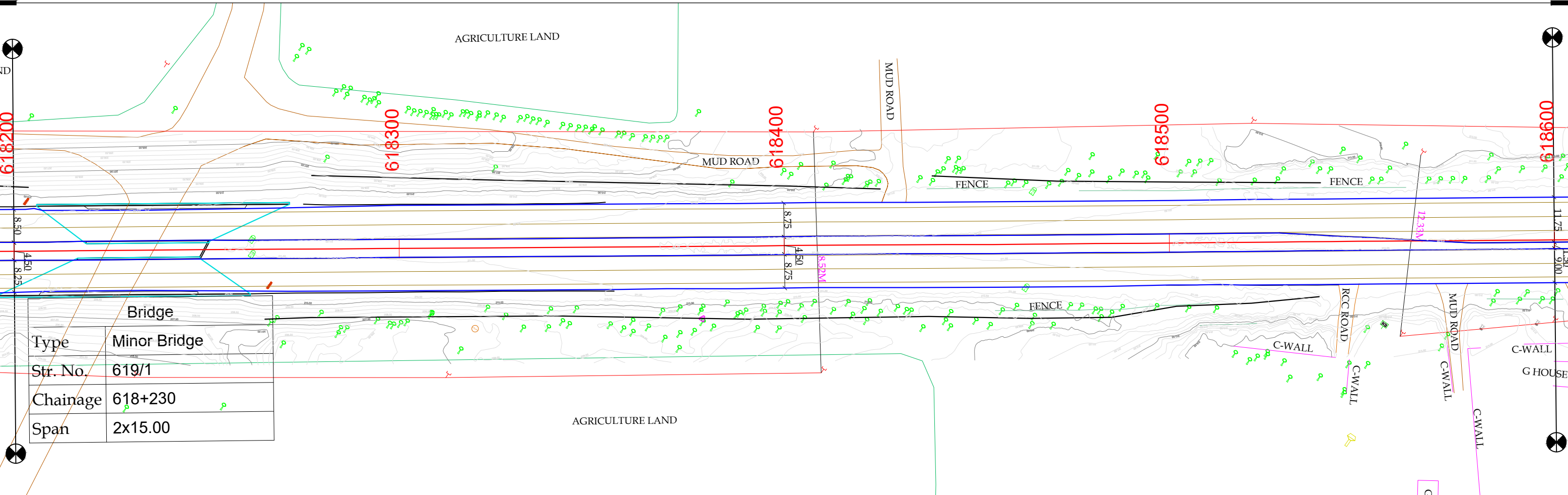
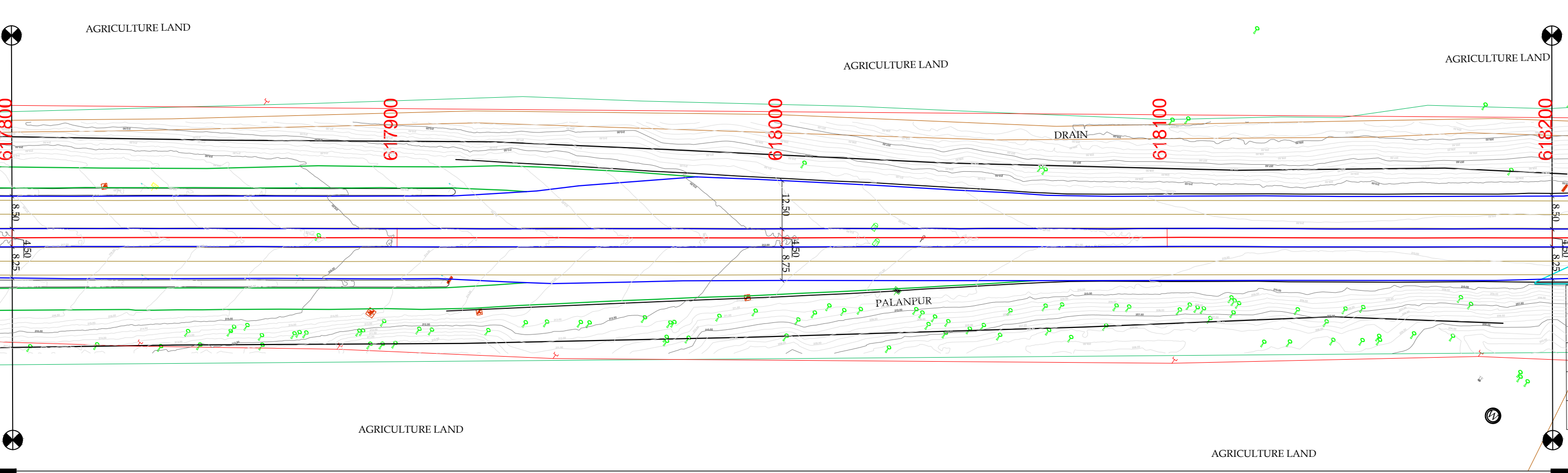
<<< TO PALANPUR

(PALANPUR/KHEMANA - ABU ROAD) TOPOGRAPHICAL SURVEY MAP

TO ABU ROAD >>>



			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 617/000 TO 617/800			
				DESIGN BY				DRAWING NO. AV_TYPSPA/NHAI/InvIT/TOPO_S			
				CHECKED BY				SHEET NO.			
				APPROVED BY				SCALE	SIZE	REV	
REV	DATE	DESCRIPTION OF REVISIONS						21	1 : 1000	A3	0



Bridge	
Type	Minor Bridge
Str. No.	619/1
Chainage	618+230
Span	2x15.00

REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-


NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY



DESIGN BY

CHECKED BY

APPROVED BY

CONSULTANT:-

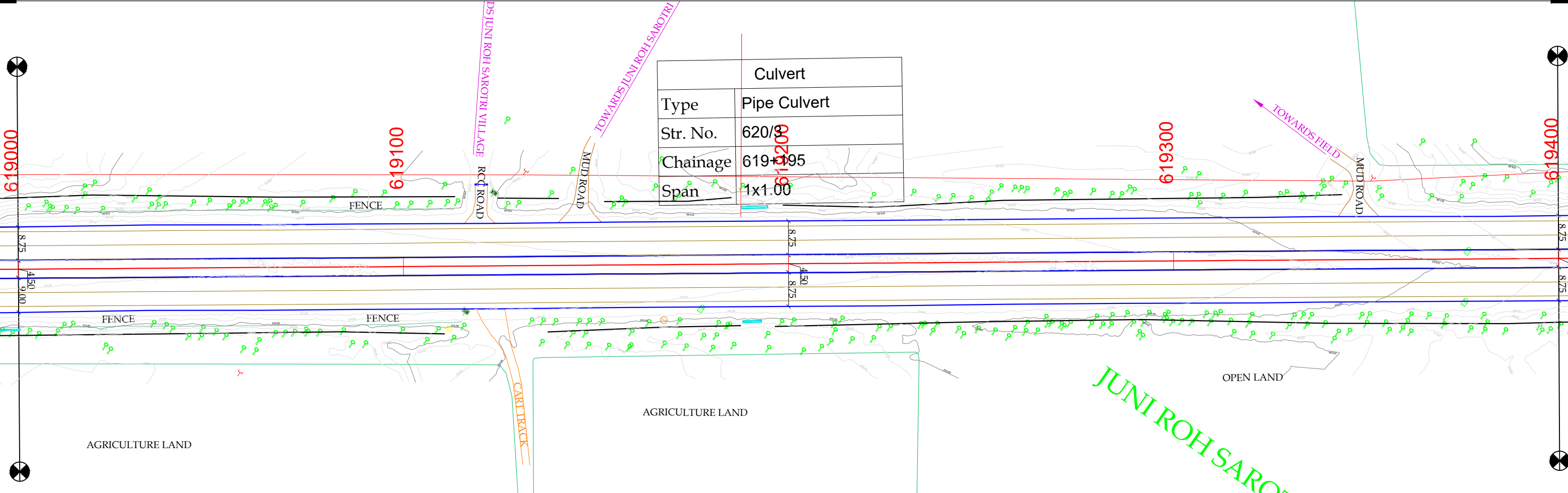
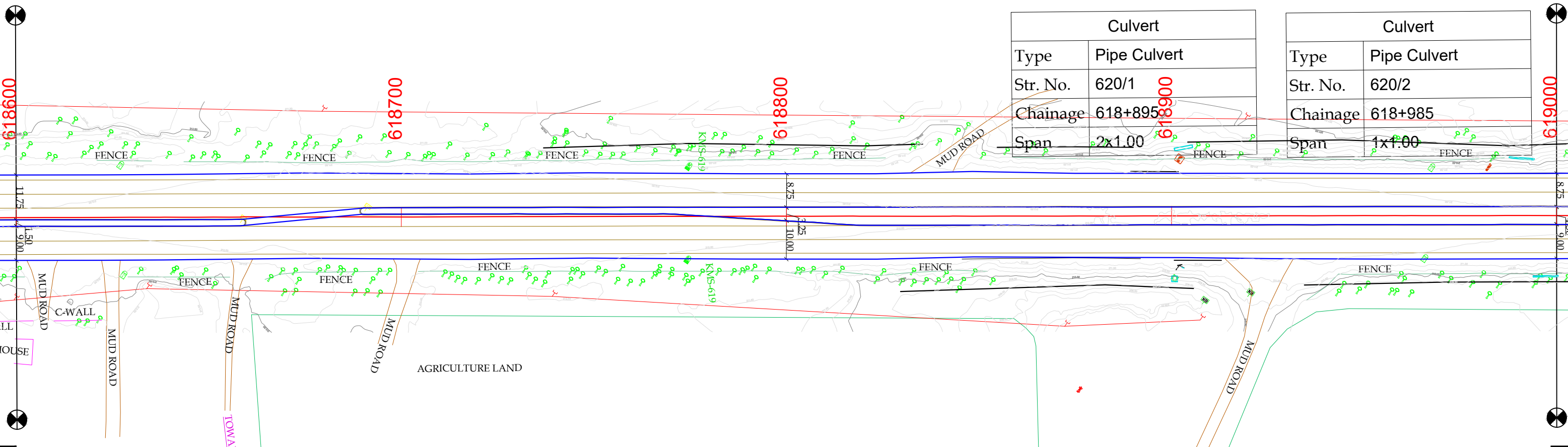
TYPSA in JV with
AVANZA Engineering Pvt. Ltd.







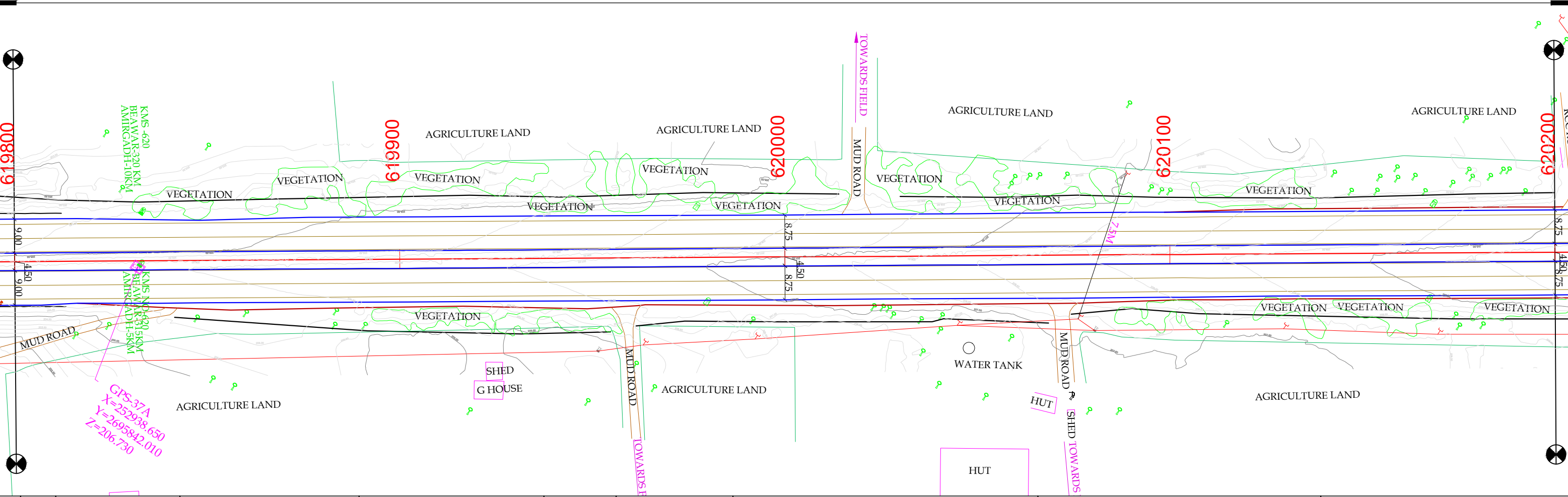
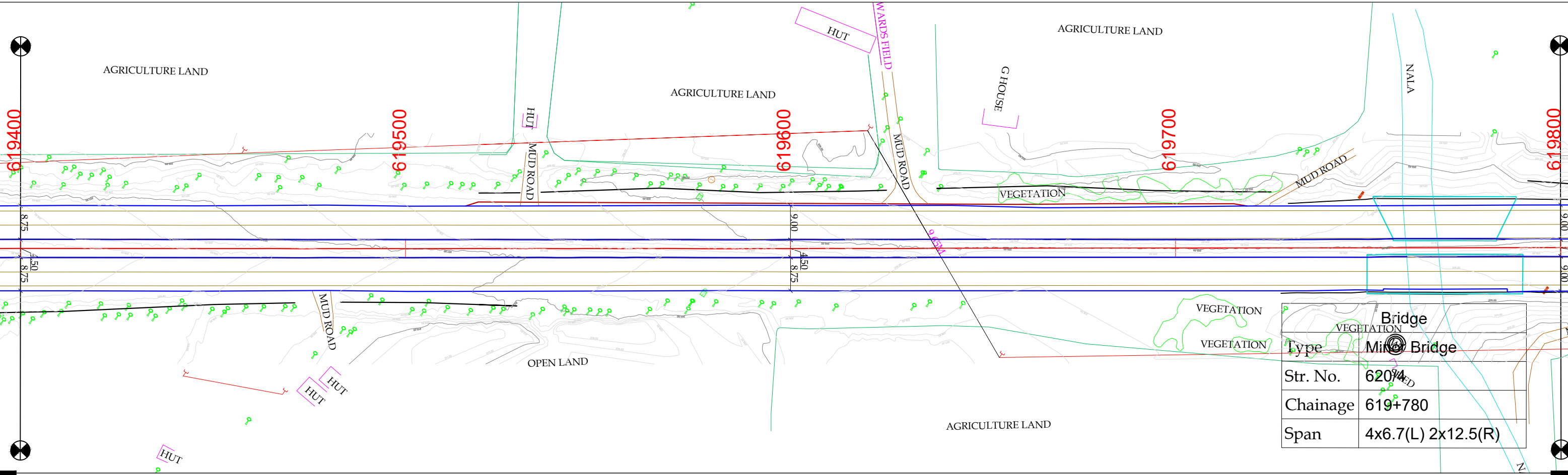
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

Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

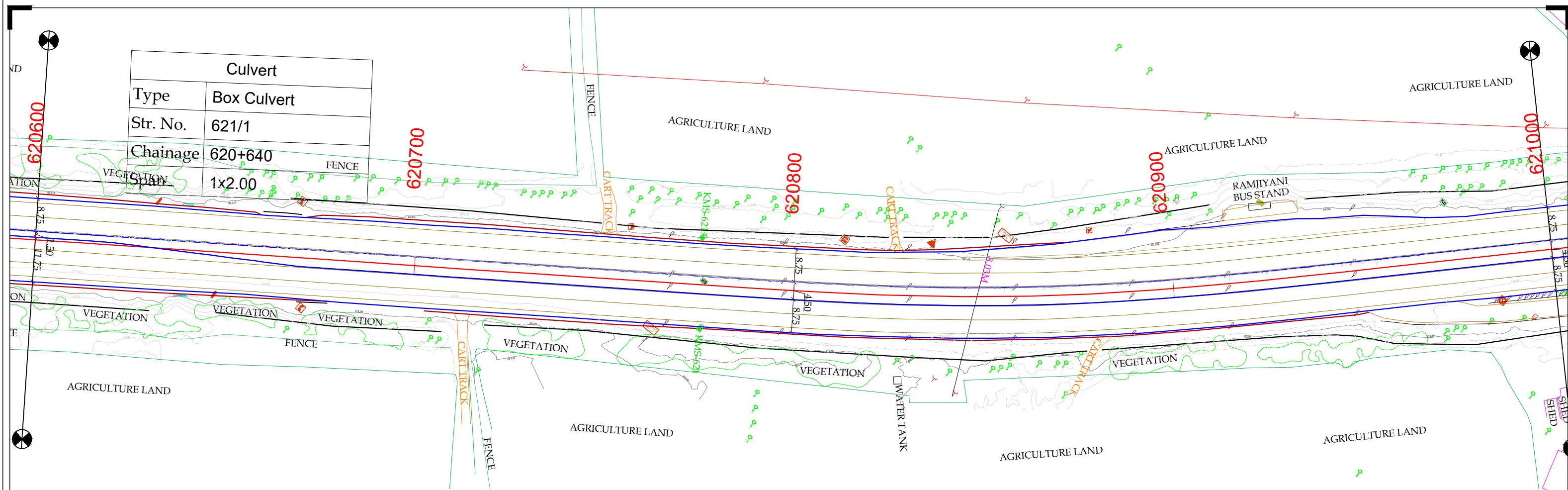
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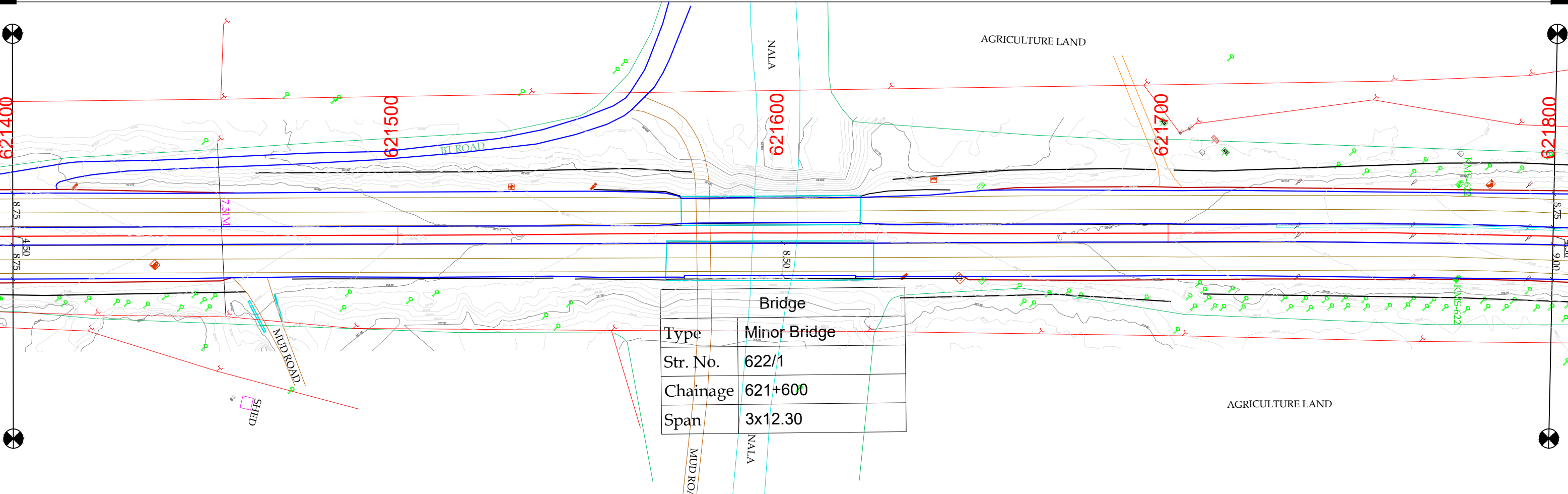
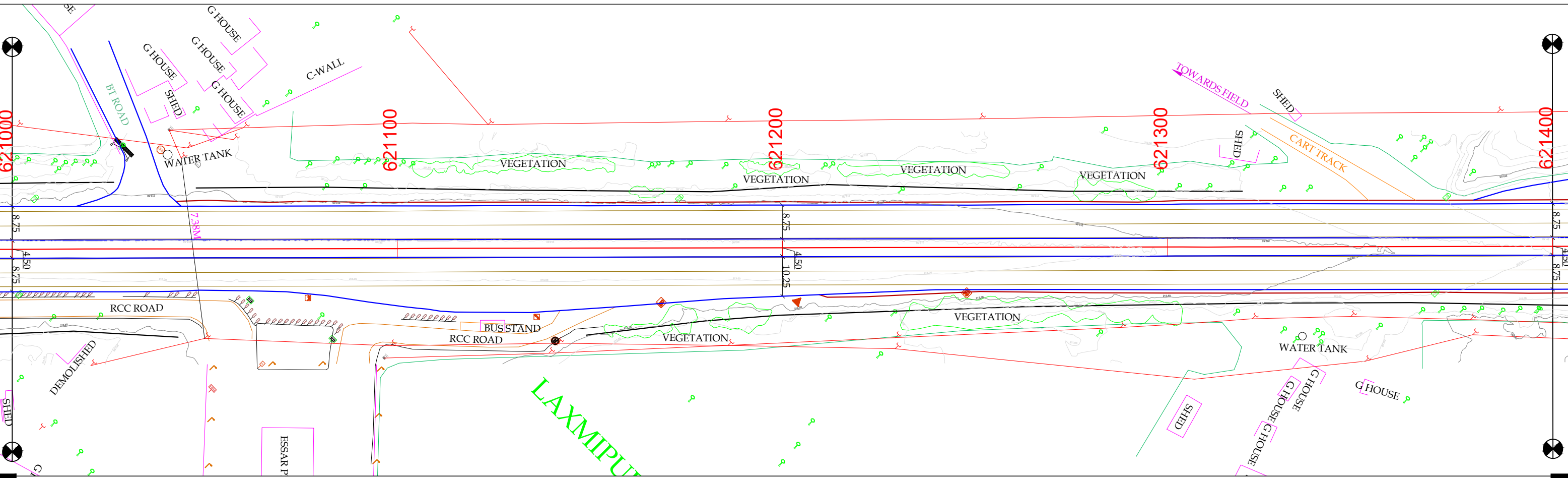


			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 618/600 TO 619/400			
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				CHECKED BY				SHEET NO.			
REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				SCALE			
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								1 : 1000			
								A3			
								0			



			<div>CLIENT :-</div> <div></div> <div>NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:-</div> <div>TYPSA in JV with AVANZA Engineering Pvt. Ltd.</div> <div> </div>	<div>PROJECT :-</div> <div>Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 619/400 TO 620/200			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
				CHECKED BY				SHEET NO. SCALE SIZE REV			
				APPROVED BY				24 1 : 1000 A3 0			
REV	DATE	DESCRIPTION OF REVISIONS									

1518



Bridge	
Type	Minor Bridge
Str. No.	622/1
Chainage	621+600
Span	3x12.30

REV	DATE	DESCRIPTION OF REVISIONS



CLIENT :-


NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

PROJECT :-

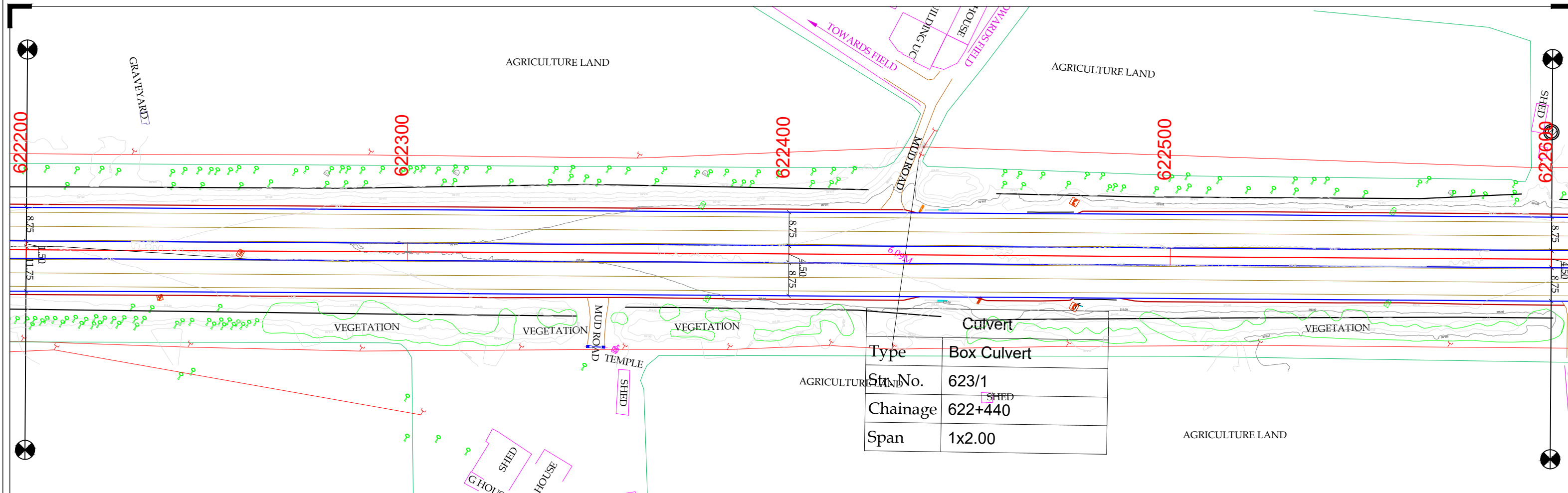
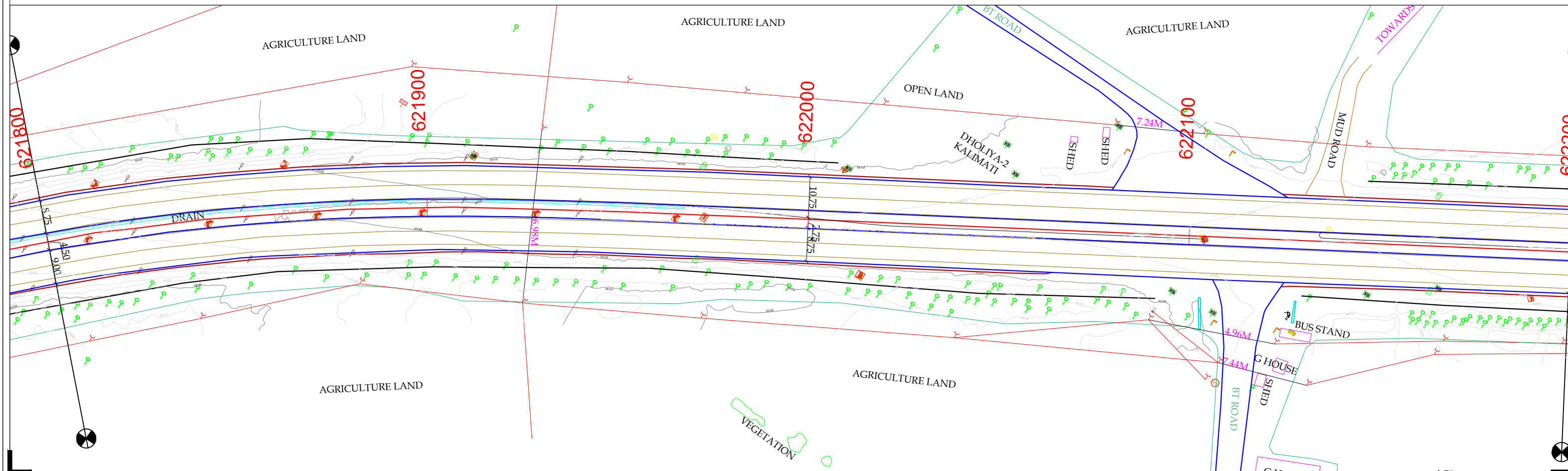
Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

TITLE:- KMS 621/000 TO 621/800			
DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
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<<< TO PALANPUR

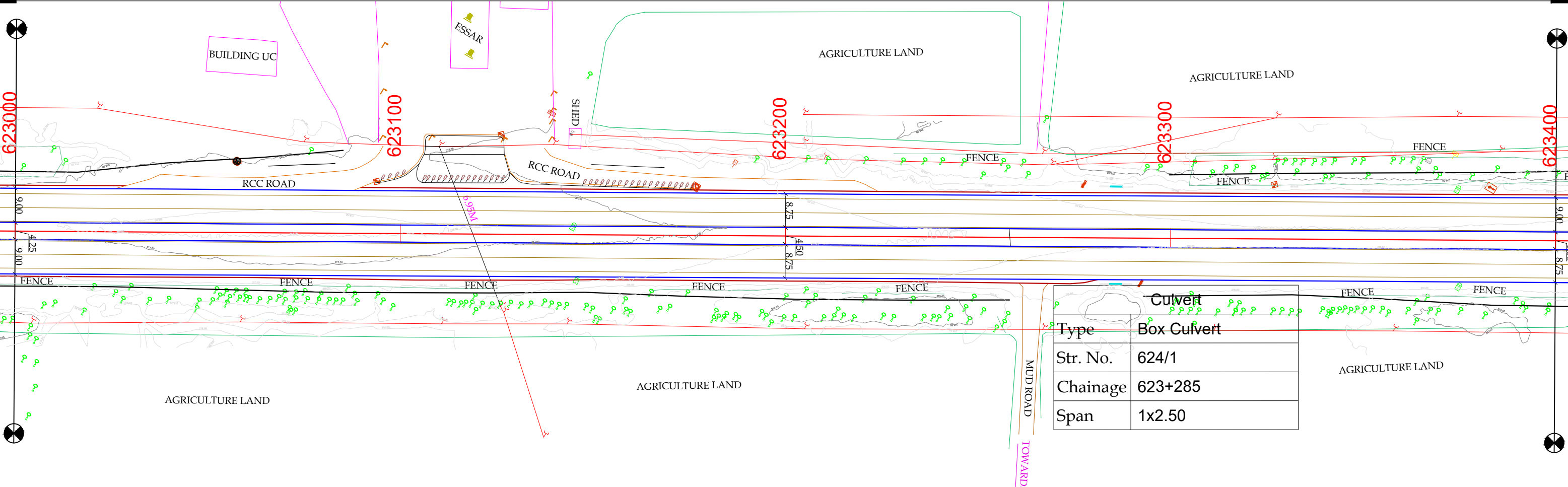
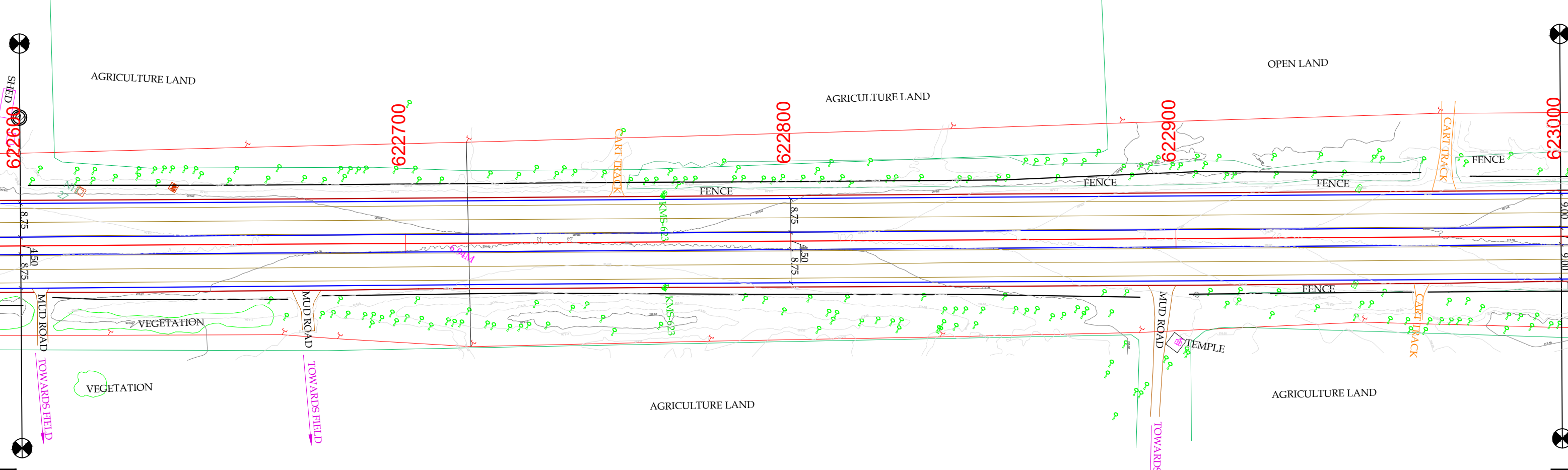
(PALANPUR/KHEMANA - ABU ROAD) TOPOGRAPHICAL SURVEY MAP

TO ABU ROAD >>>



Culvert	
Type	Box Culvert
Sta. No.	623/1
Chainage	622+440
Span	1x2.00

			CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA		DRAWN BY DESIGN BY CHECKED BY APPROVED BY		CONSULTANT:- TYPESA in JV with AVANZA Engineering Pvt. Ltd. 		PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model		TITLE:- KMS 621/800 TO 622/600			
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REV	DATE	DESCRIPTION OF REVISIONS									SHEET NO.	SCALE	SIZE	REV
											27	1 : 1000	A3	0



Culvert	
Type	Box Culvert
Str. No.	624/1
Chainage	623+285
Span	1x2.50

REV	DATE	DESCRIPTION OF REVISIONS



CLIENT :-


NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

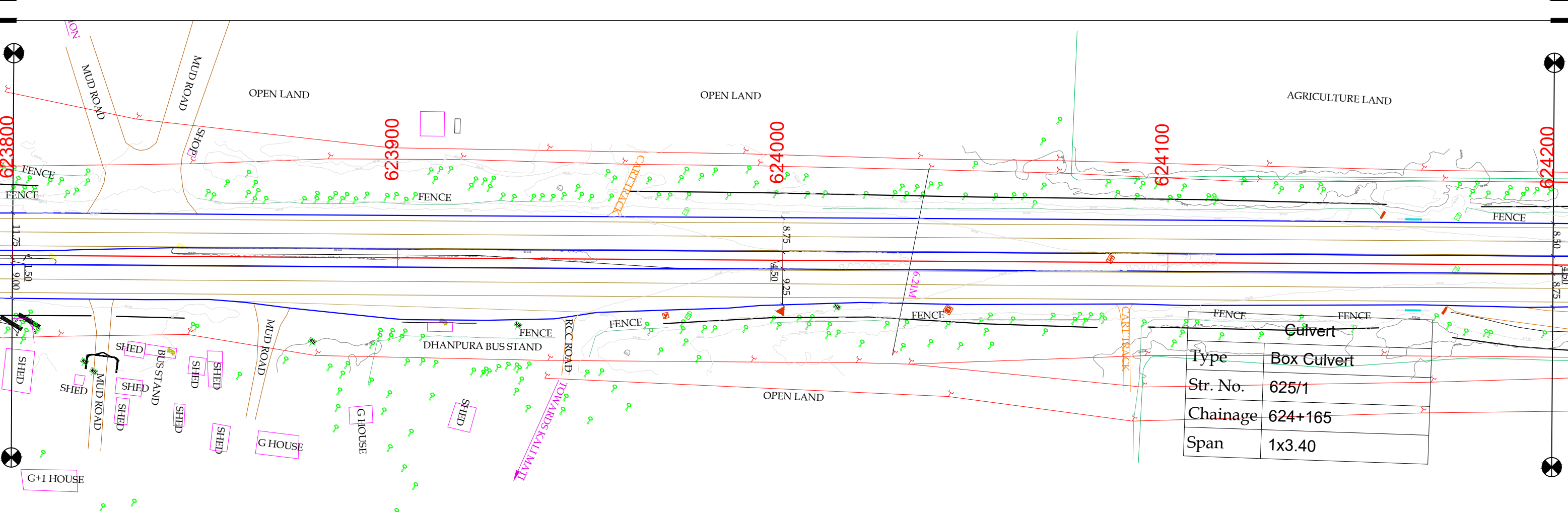
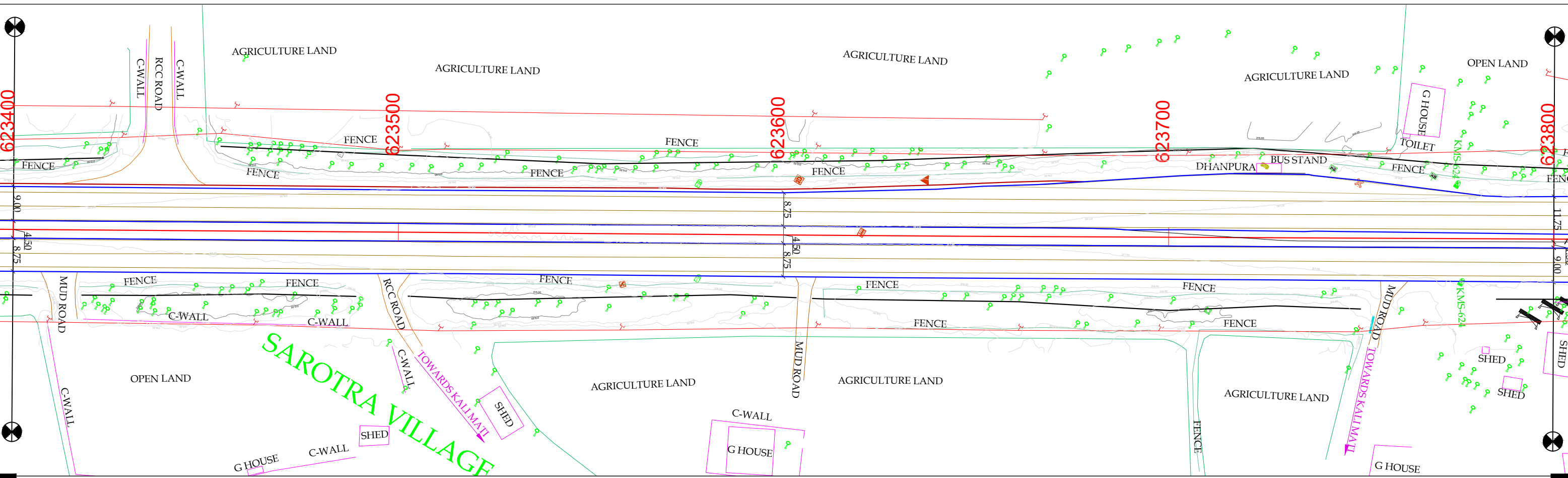
TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

PROJECT :-

Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

TITLE:- KMS 622/600 TO 623/400			
DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
28	1 : 1000	A3	0



Culvert	
Type	Box Culvert
Str. No.	625/1
Chainage	624+165
Span	1x3.40


REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-

**NATIONAL HIGHWAY
AUTHORITY OF INDIA**

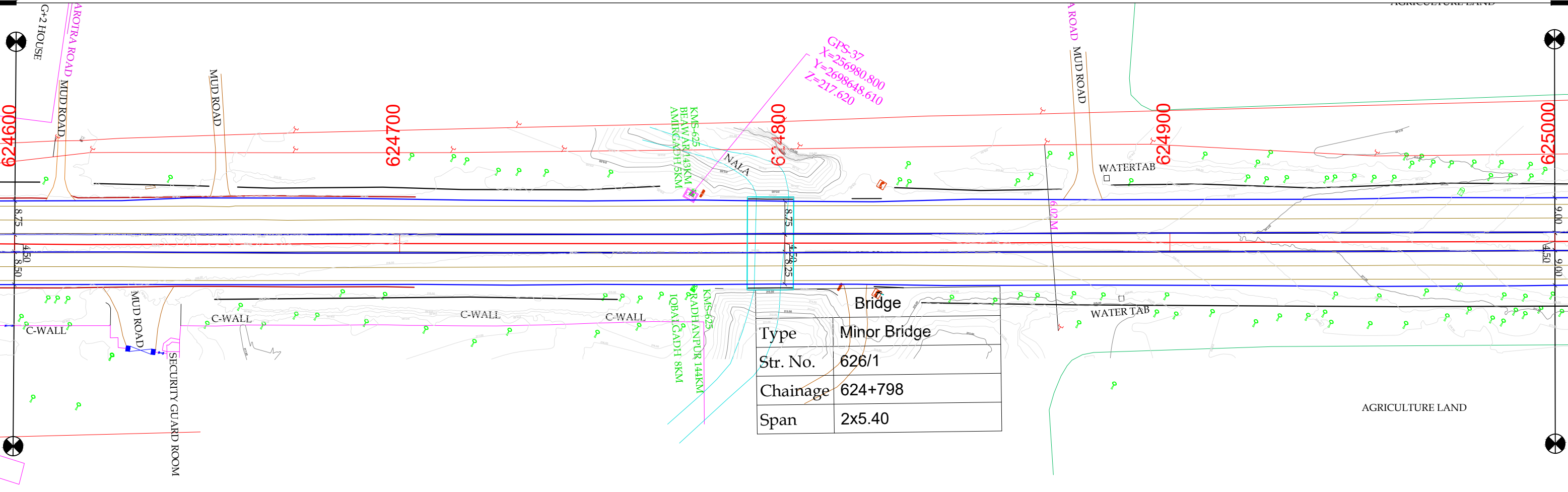
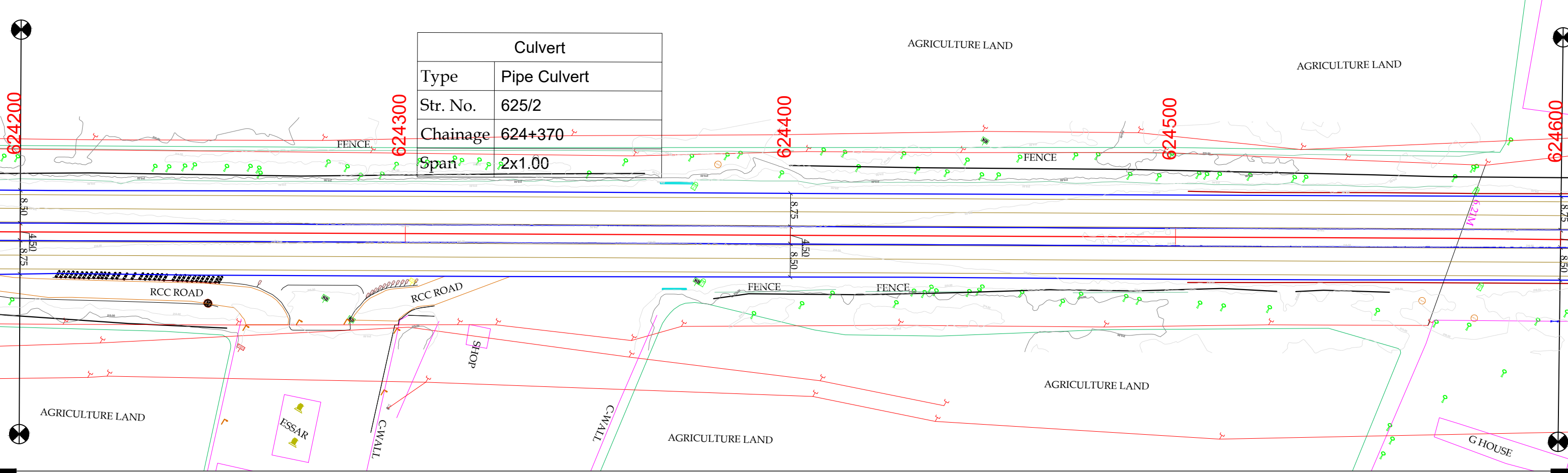
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DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-
**TYPSA in JV with
AVANZA Engineering Pvt. Ltd.**

PROJECT :-
**Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model**

TITLE:- KMS 623/400 TO 624/200			
DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
29	1 : 1000	A3	0



REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-





NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

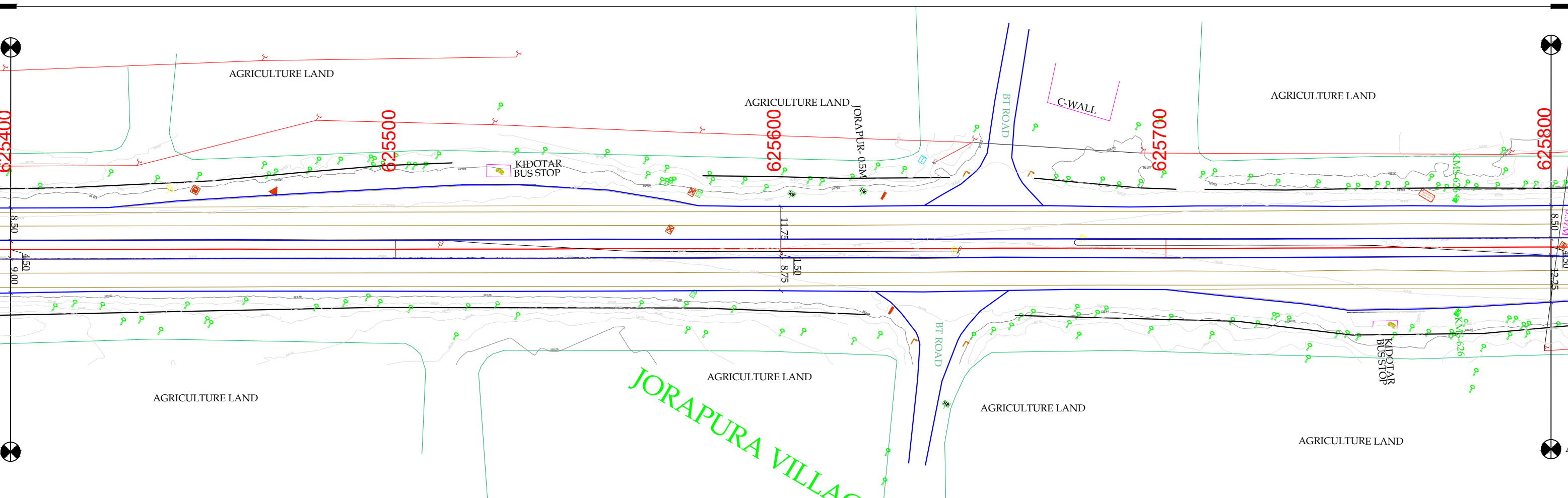
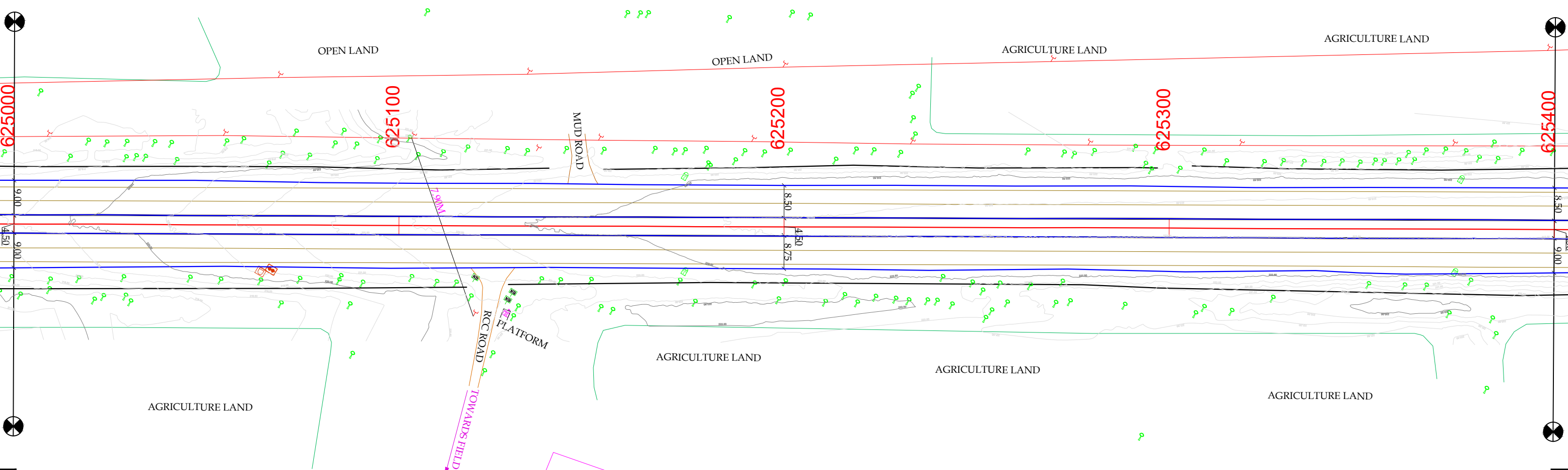

INGENIEROS
CONSULTORES
Y ARQUITECTOS





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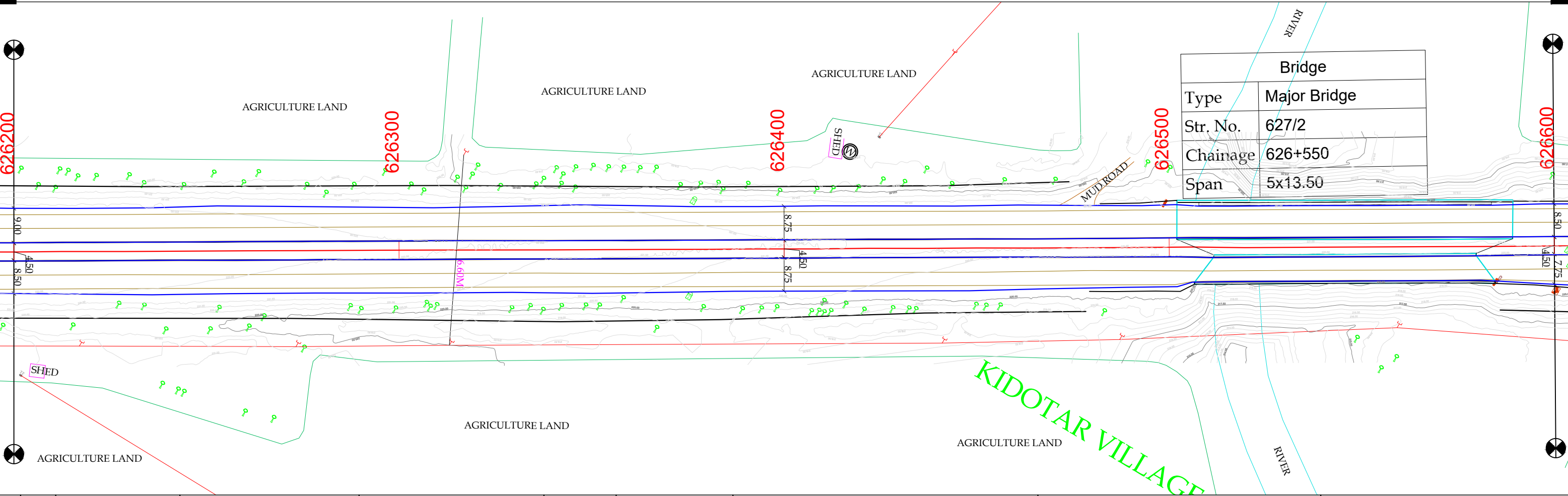
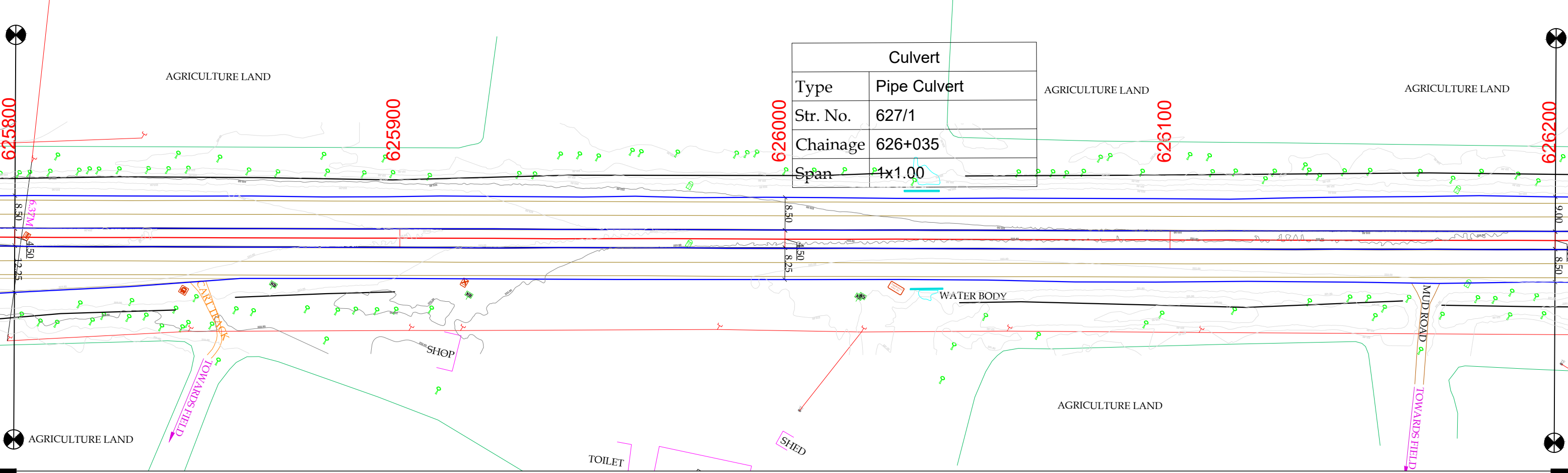
PROJECT :-

Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

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SHEET NO.	SCALE	SIZE	REV
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			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 625/000 TO 625/800			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				31 1 : 1000 A3 0			



REV	DATE	DESCRIPTION OF REVISIONS



CLIENT :-


NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

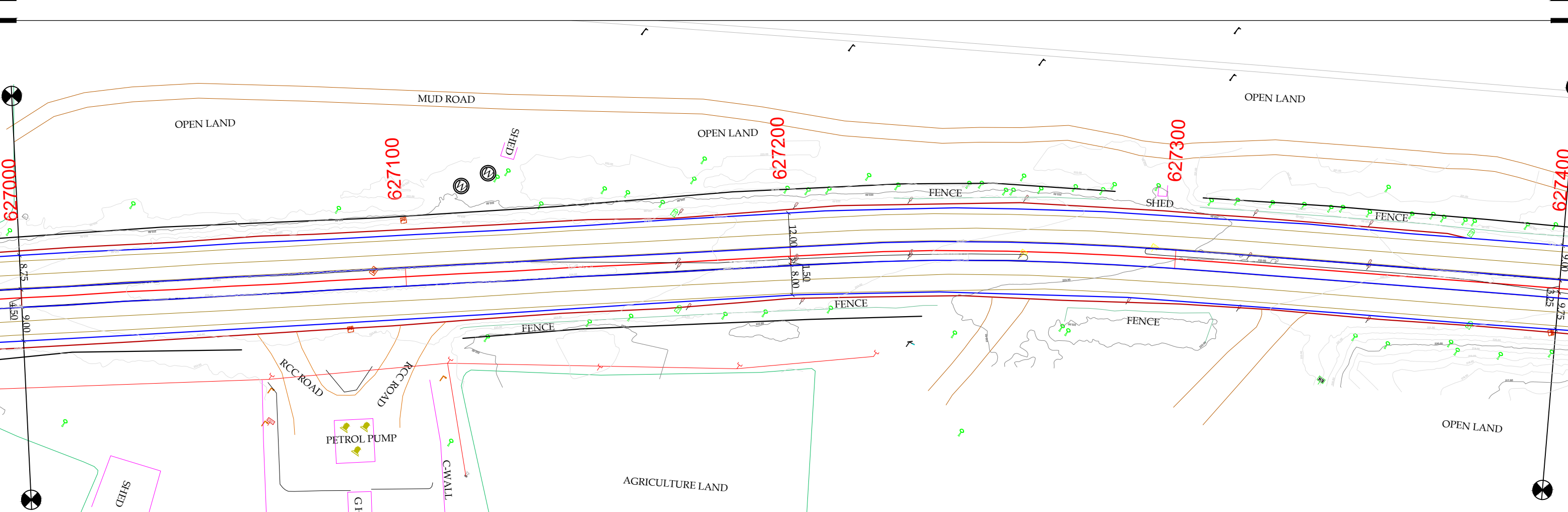
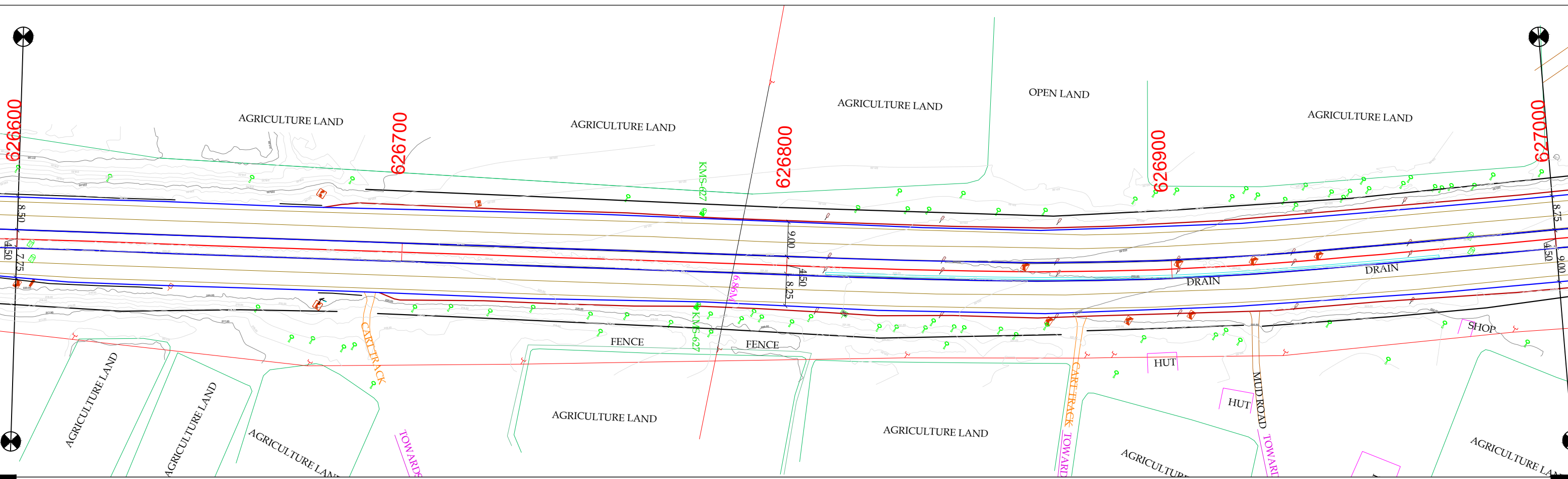
TYPSA in JV with
AVANZA Engineering Pvt. Ltd.







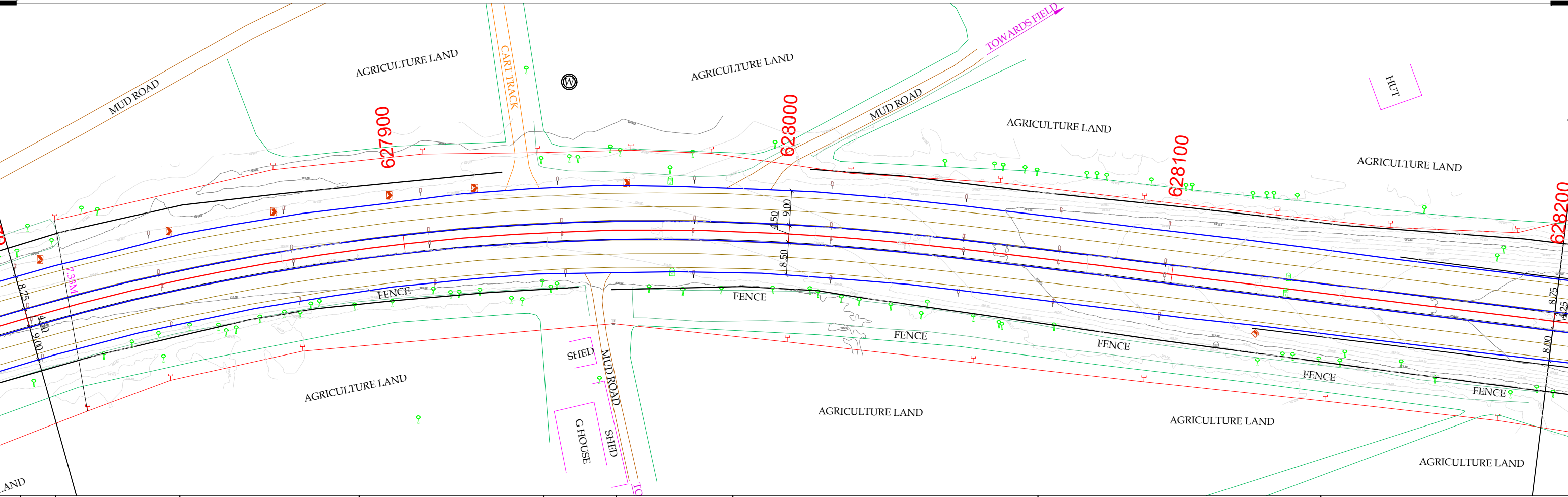
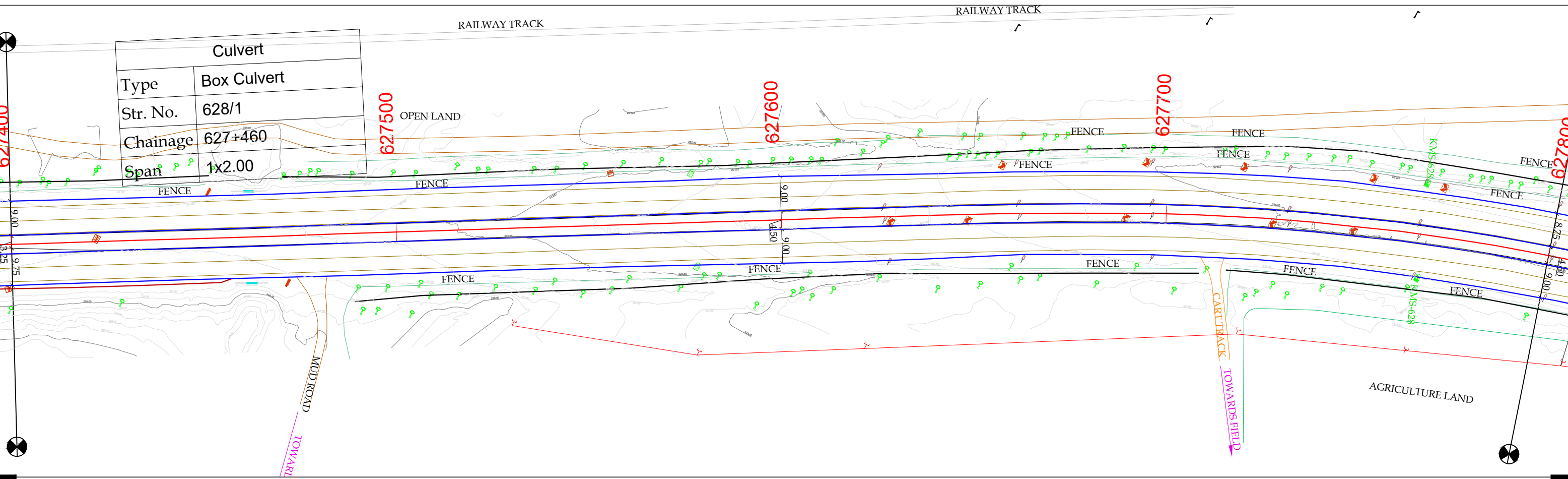
PROJECT :-

Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

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DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
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			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 626/600 TO 627/400			
				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				33 1 : 1000 A3 0			





REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-

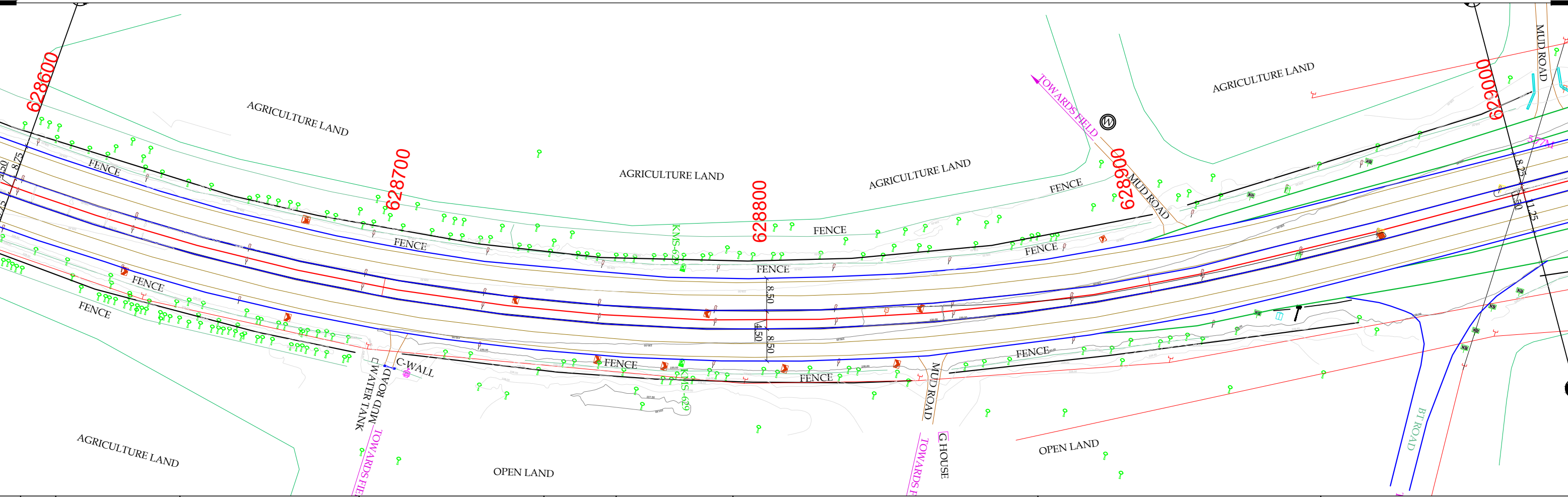
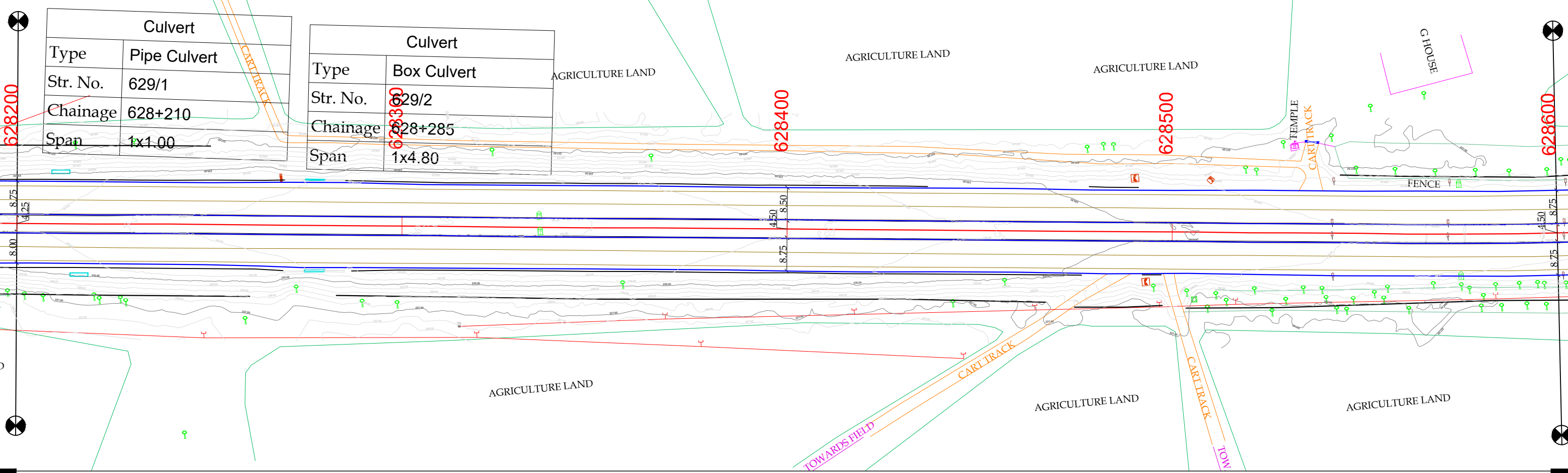
**NATIONAL HIGHWAY
AUTHORITY OF INDIA**




DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

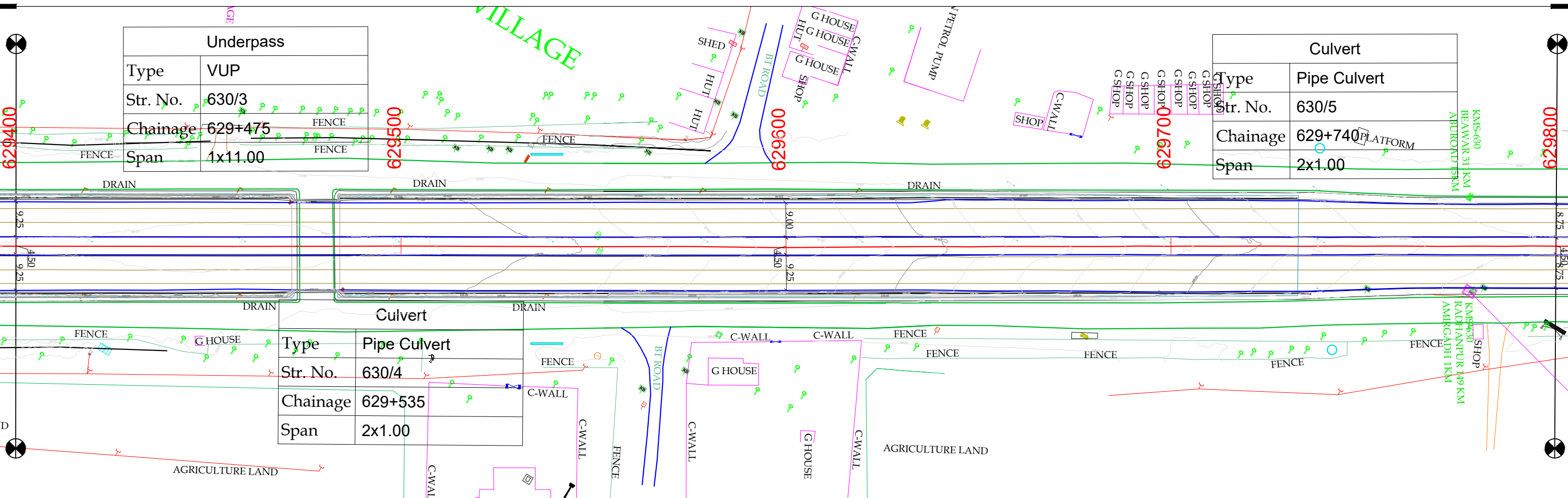
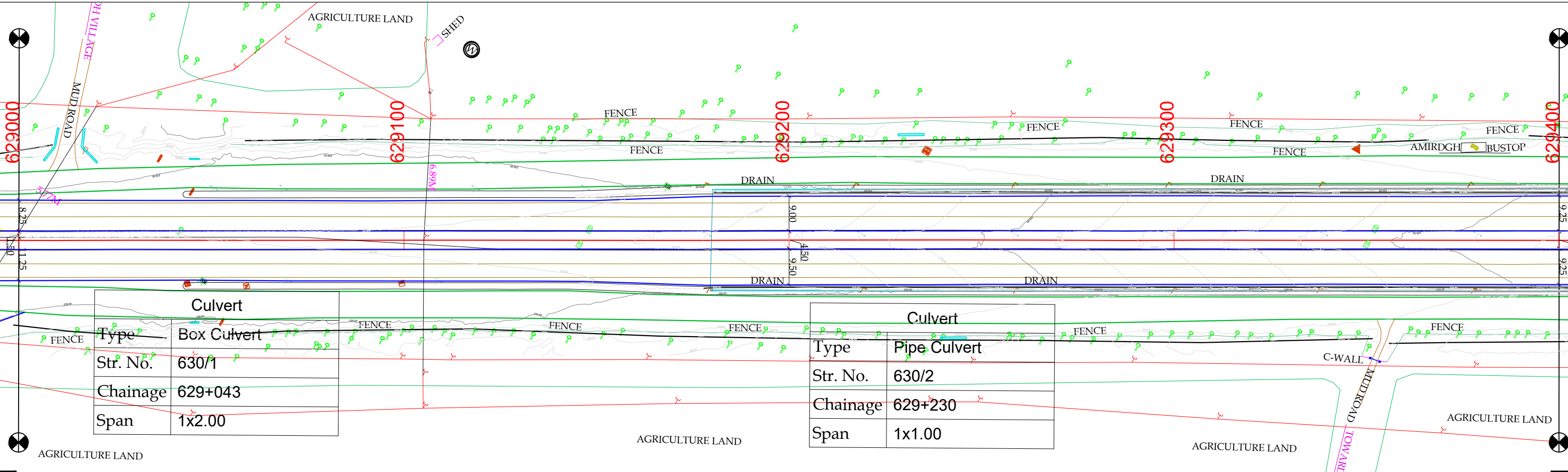
CONSULTANT:-
**TYPSA in JV with
AVANZA Engineering Pvt. Ltd.**



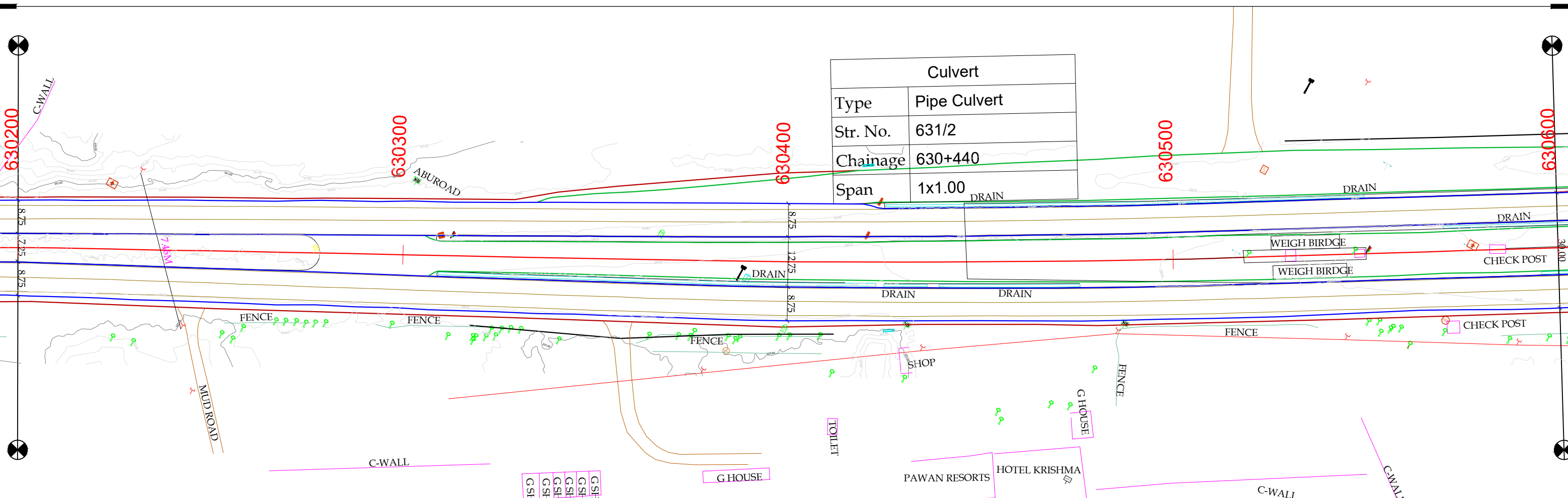
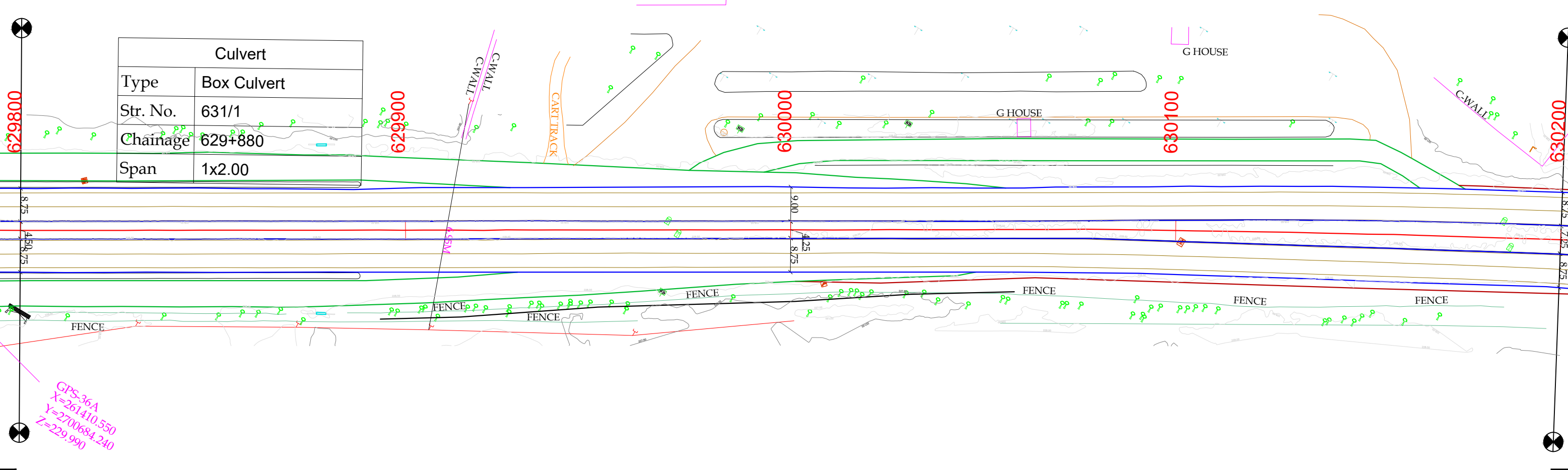
PROJECT :-
**Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model**

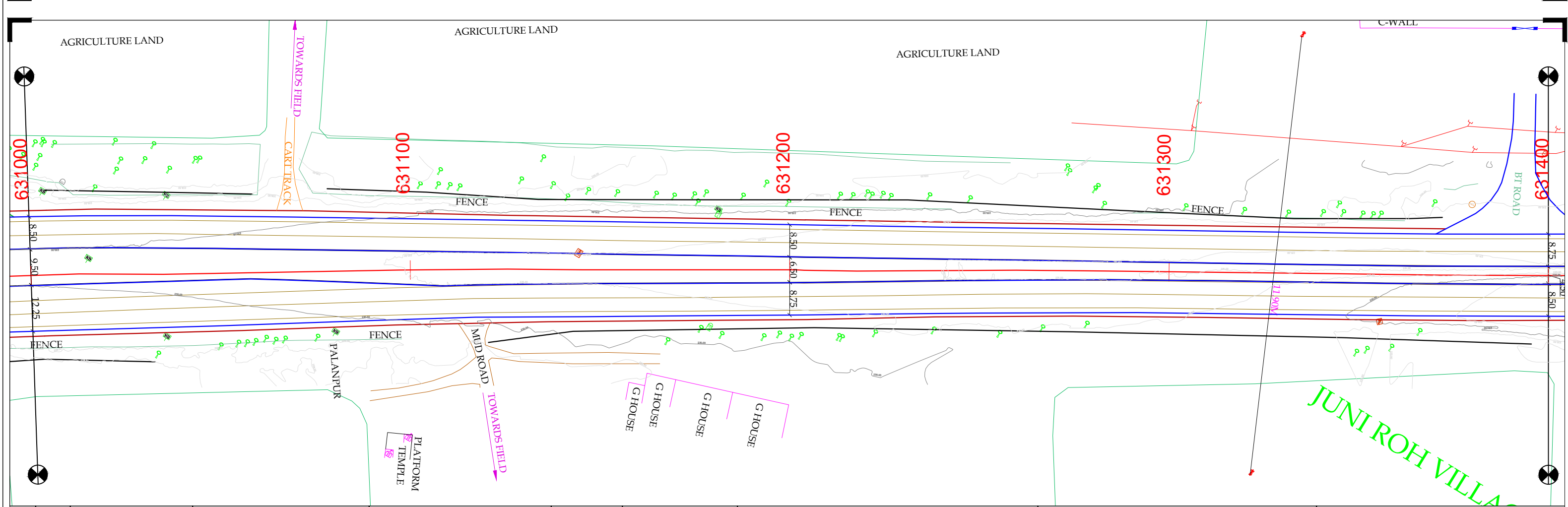
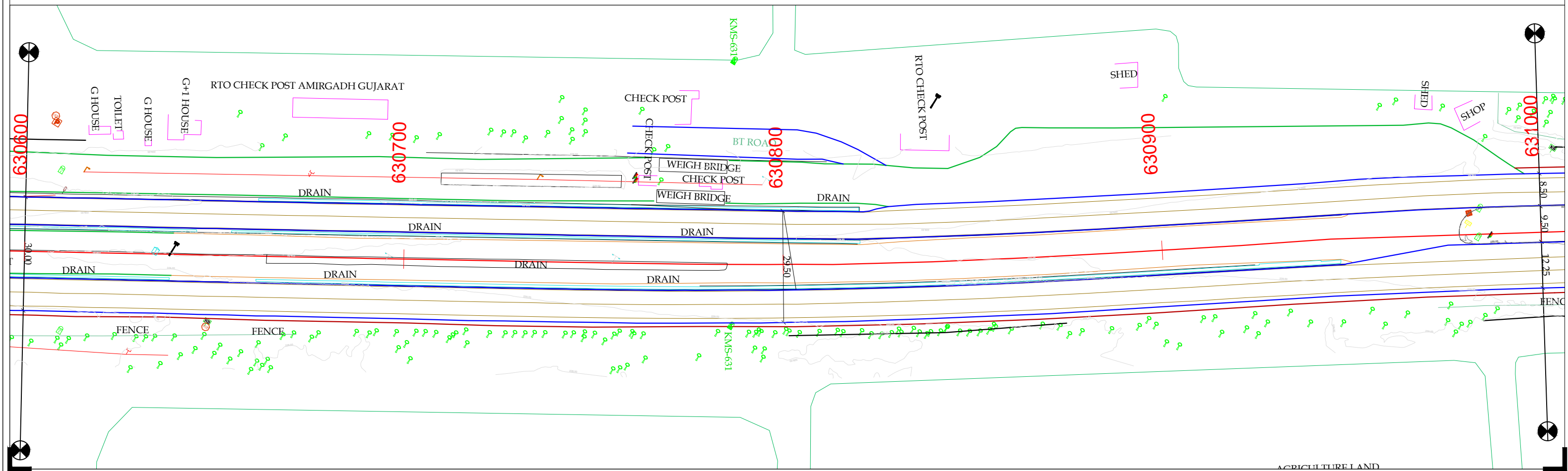
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DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
SHEET NO.	SCALE	SIZE	REV
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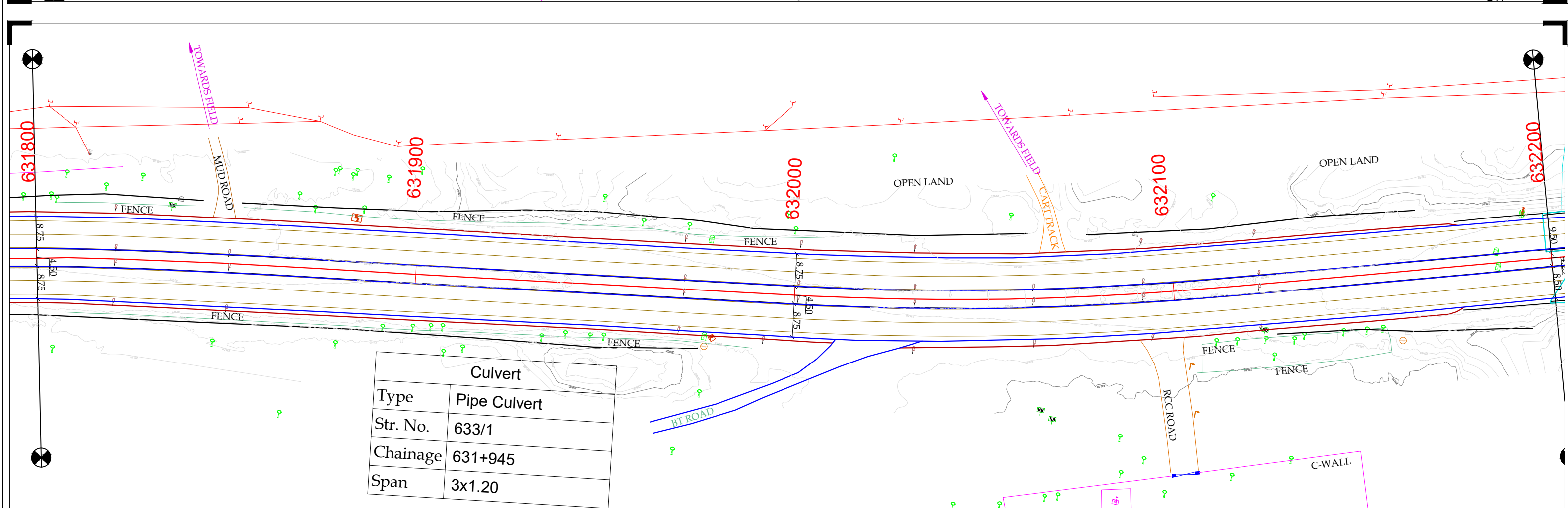
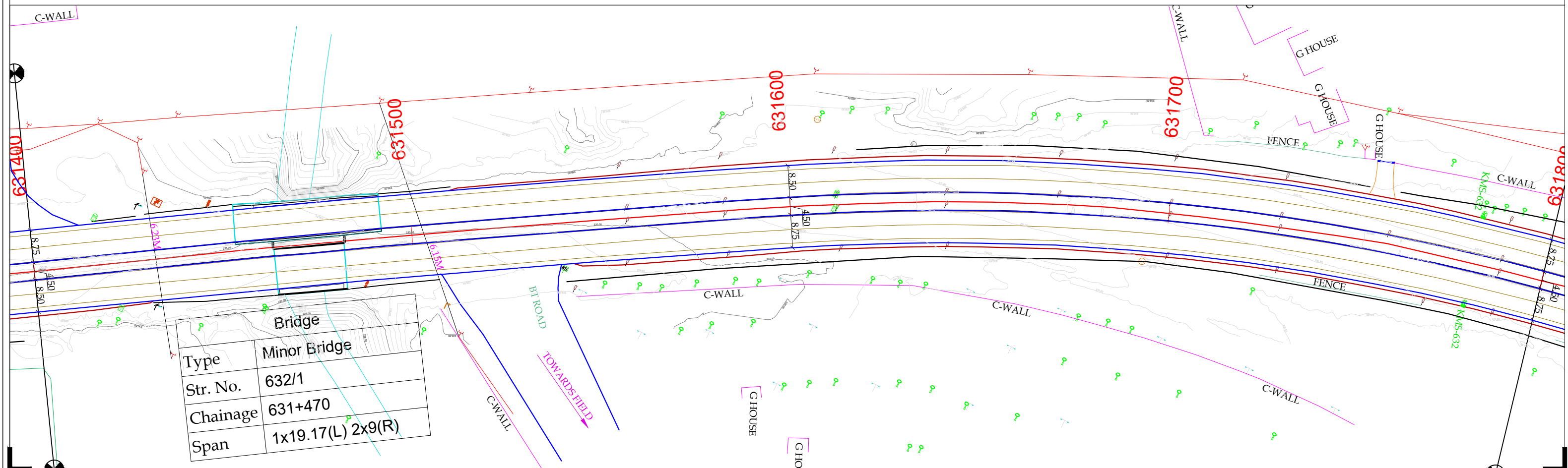
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								DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S					
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY						35	1 : 1000	A3	0
1528													






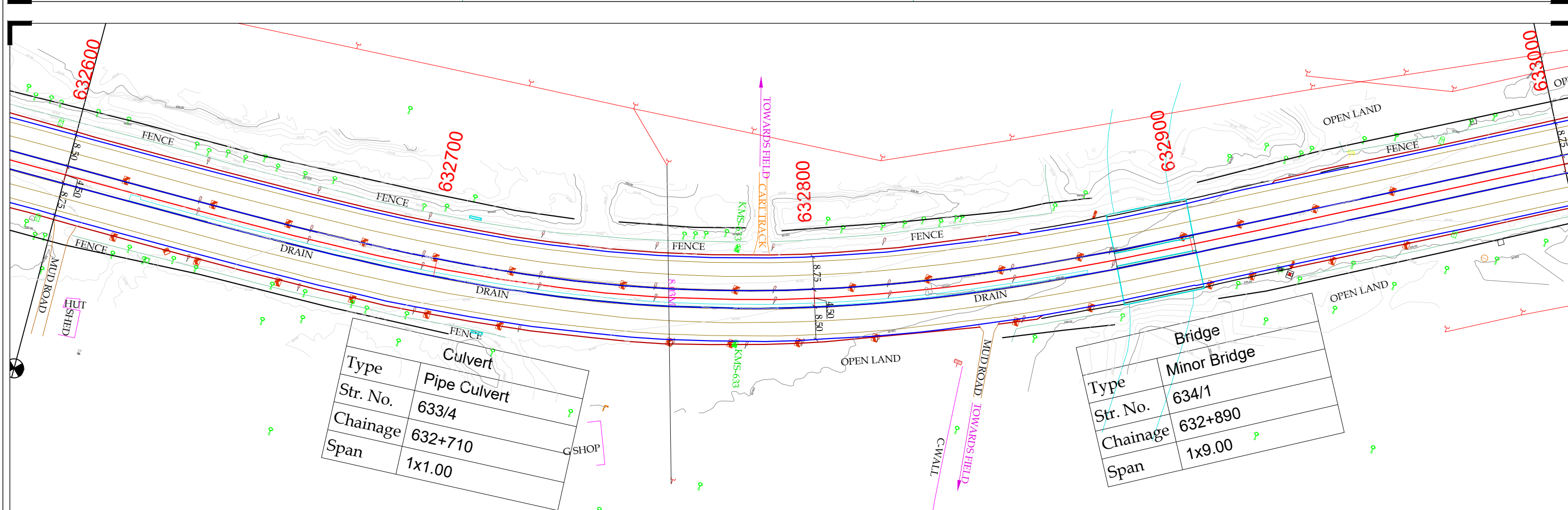
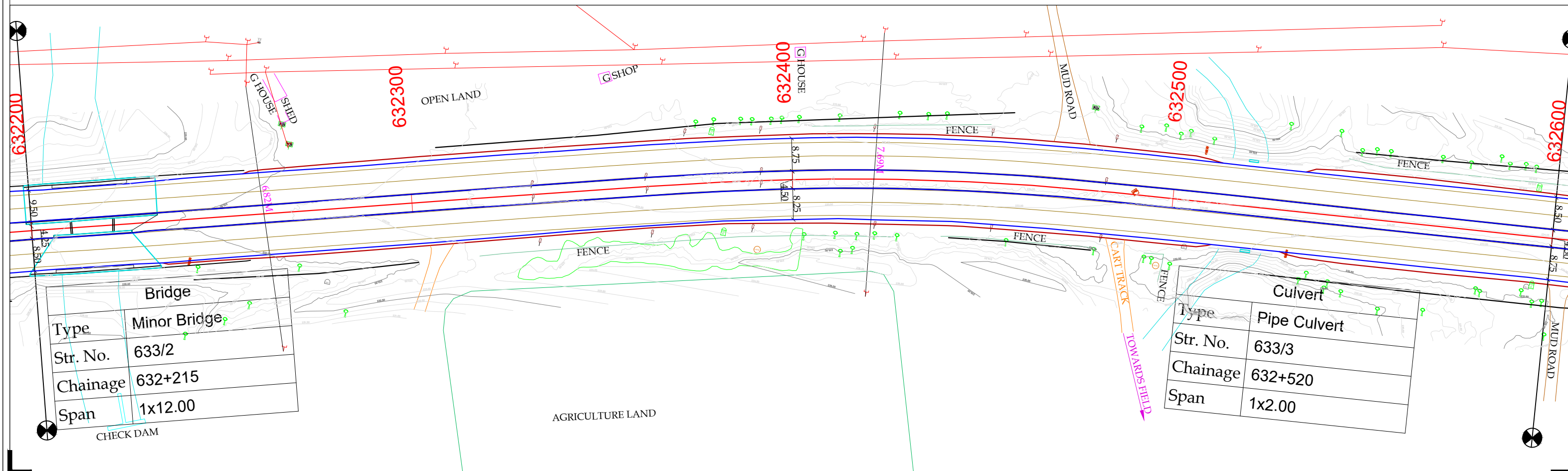







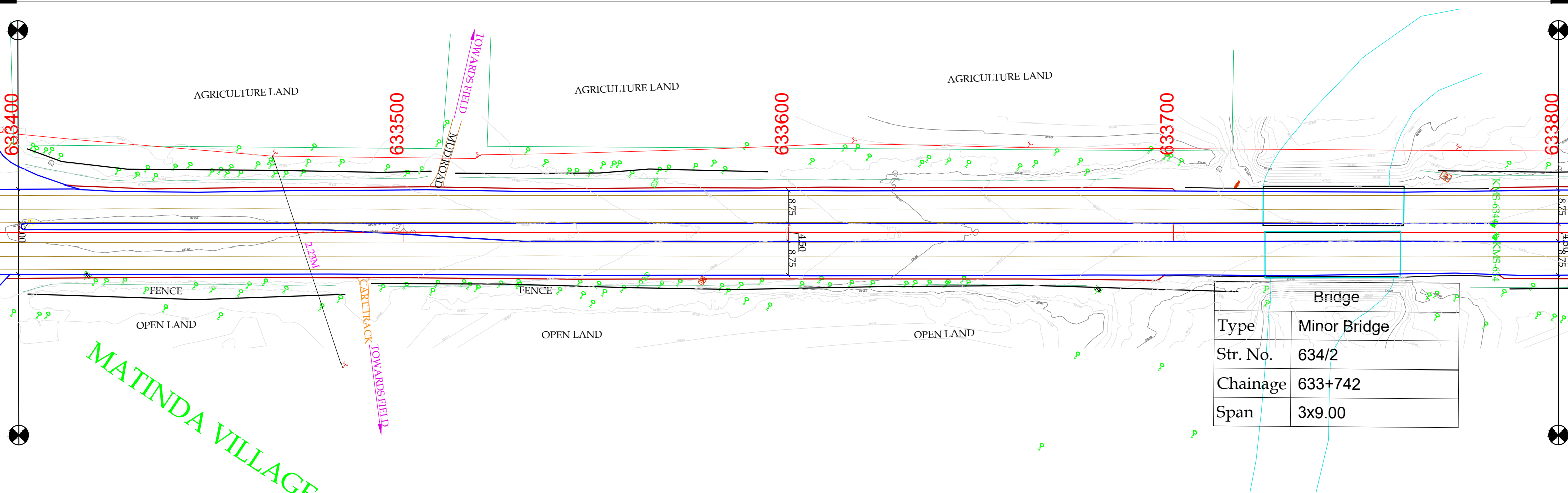
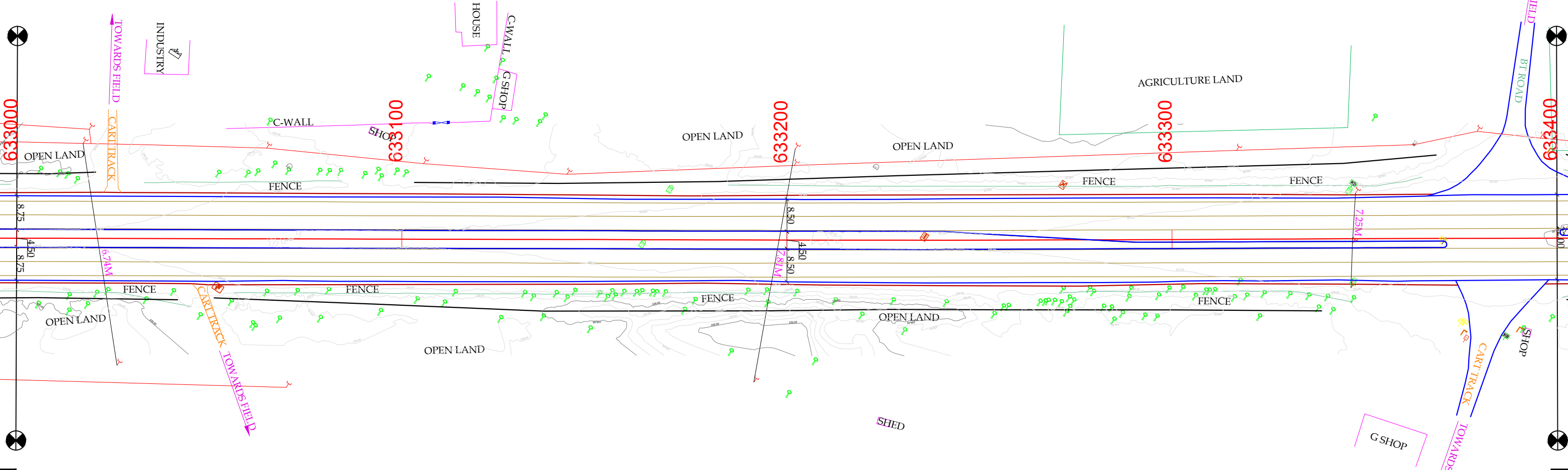
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				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
				CHECKED BY				SHEET NO.	SCALE	SIZE	REV
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REV	DATE	DESCRIPTION OF REVISIONS									



			<div>CLIENT :-</div> <div></div> <div>NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:-</div> <div>TYPSA in JV with AVANZA Engineering Pvt. Ltd.</div> <div> </div>	<div>PROJECT :-</div> <div>Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 631/400 TO 632/200				
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REV	DATE	DESCRIPTION OF REVISIONS										



			<div>CLIENT :-</div> <div></div> <div>NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:-</div> <div>TYPSA in JV with AVANZA Engineering Pvt. Ltd.</div> <div></div> <div></div>	<div>PROJECT :-</div> <div>Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 632/200 TO 633/000				
				DESIGN BY					DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
				CHECKED BY					SHEET NO. SCALE SIZE REV			
REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY					40 1 : 1000 A3 0			



Bridge	
Type	Minor Bridge
Str. No.	634/2
Chainage	633+742
Span	3x9.00

REV	DATE	DESCRIPTION OF REVISIONS

CLIENT :-





NATIONAL HIGHWAY
AUTHORITY OF INDIA

DRAWN BY	
DESIGN BY	
CHECKED BY	
APPROVED BY	

CONSULTANT:-

TYPSA in JV with
AVANZA Engineering Pvt. Ltd.

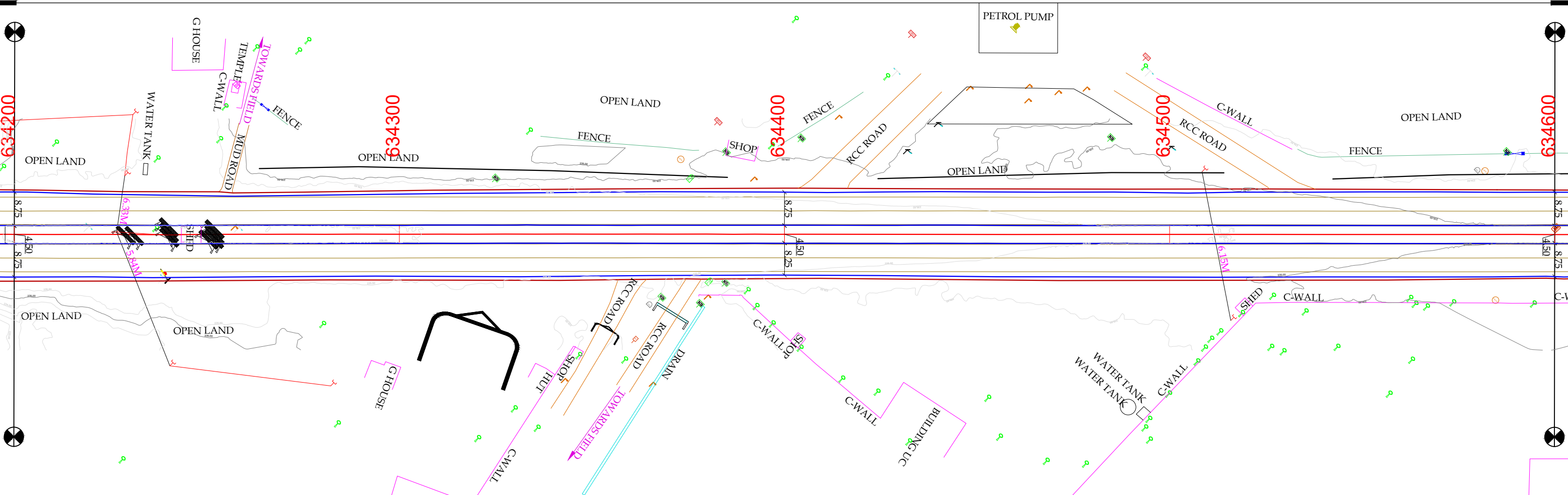
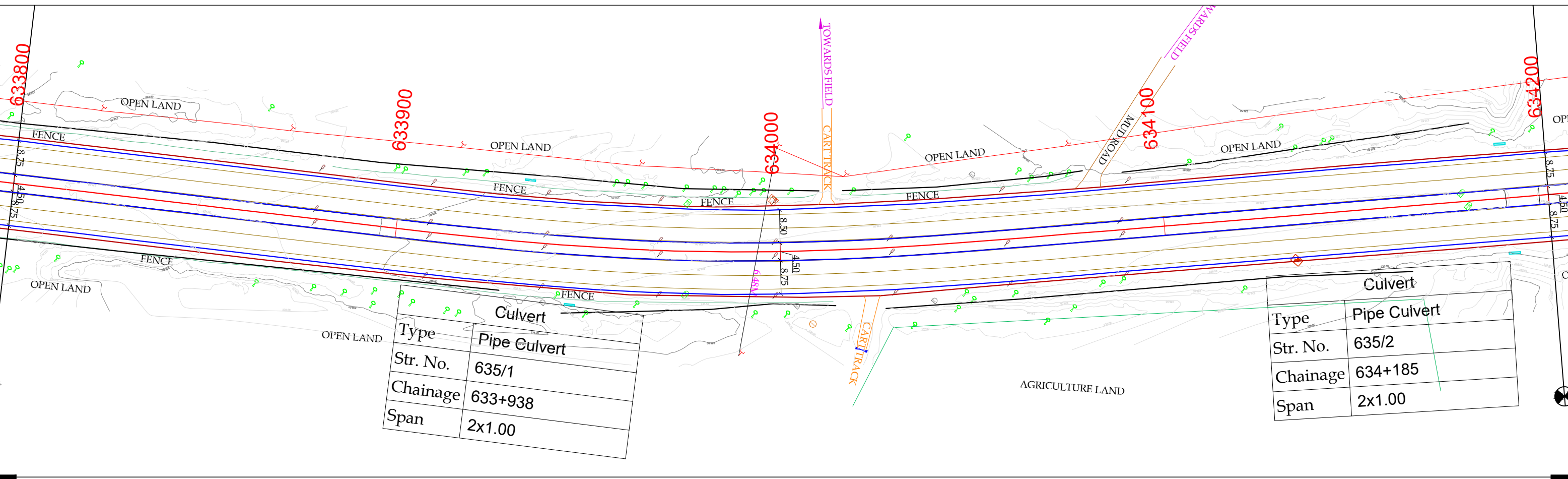

INGENIEROS
CONSULTORES
VIAFECTORES





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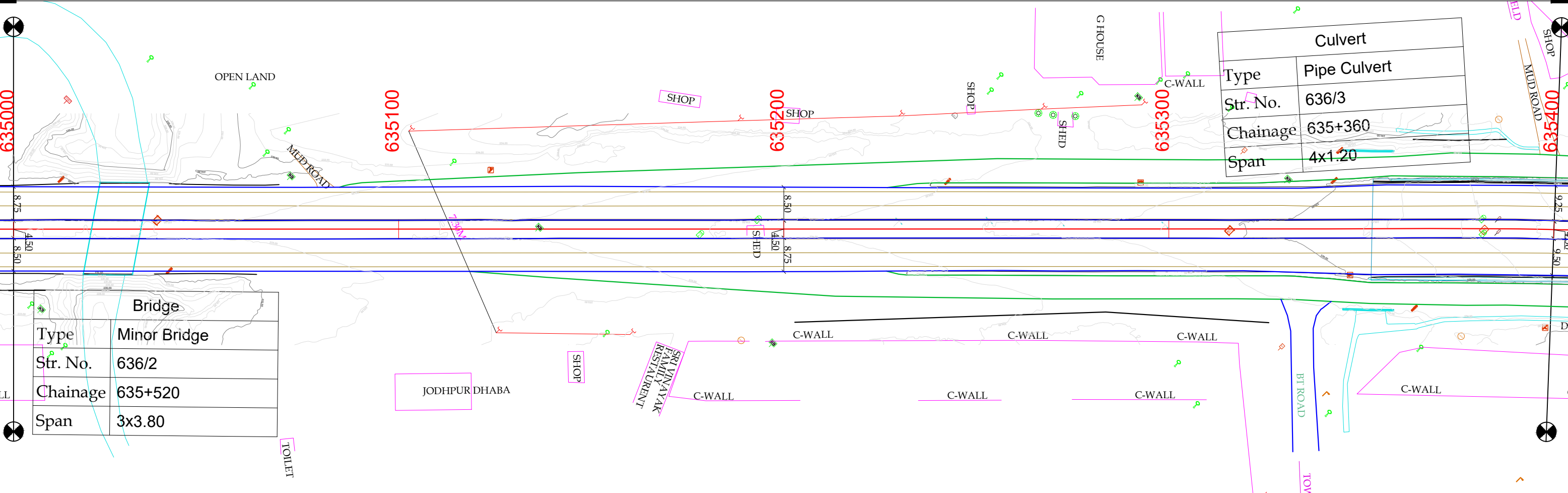
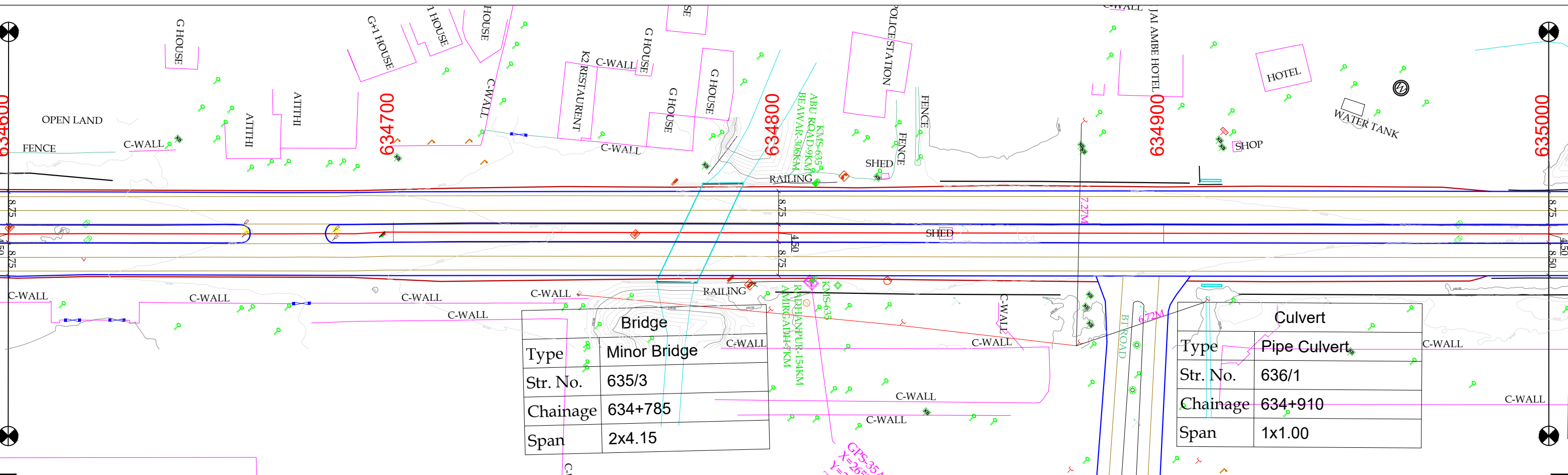
PROJECT :-

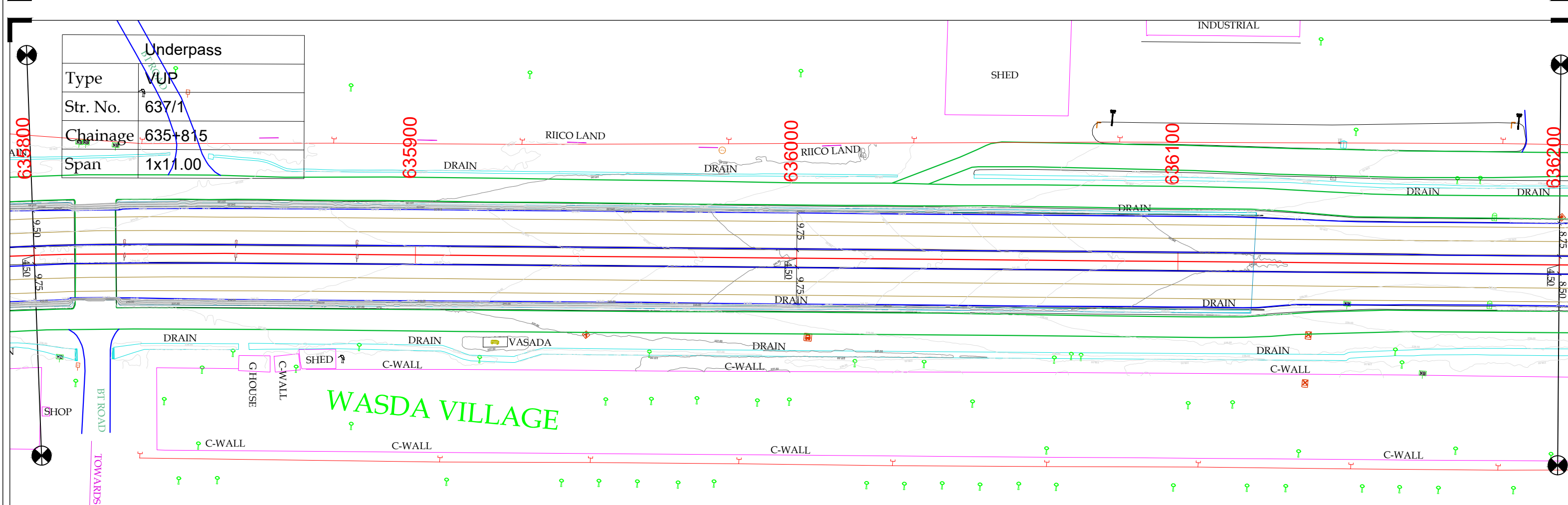
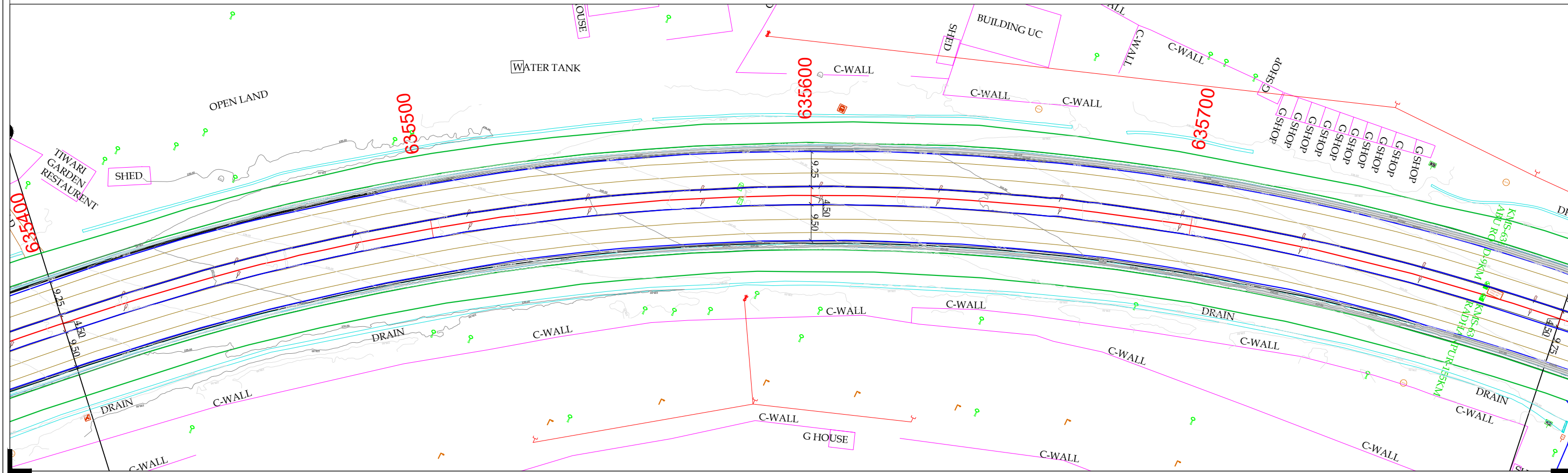
Preparation of Report on Physical Condition
of the National Highways on Roads under
(InvIT) Model

TITLE:- KMS 633/000 TO 633/800			
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SHEET NO.	SCALE	SIZE	REV
41	1 : 1000	A3	0





			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd.  </div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 633/800 TO 634/600			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				SCALE			
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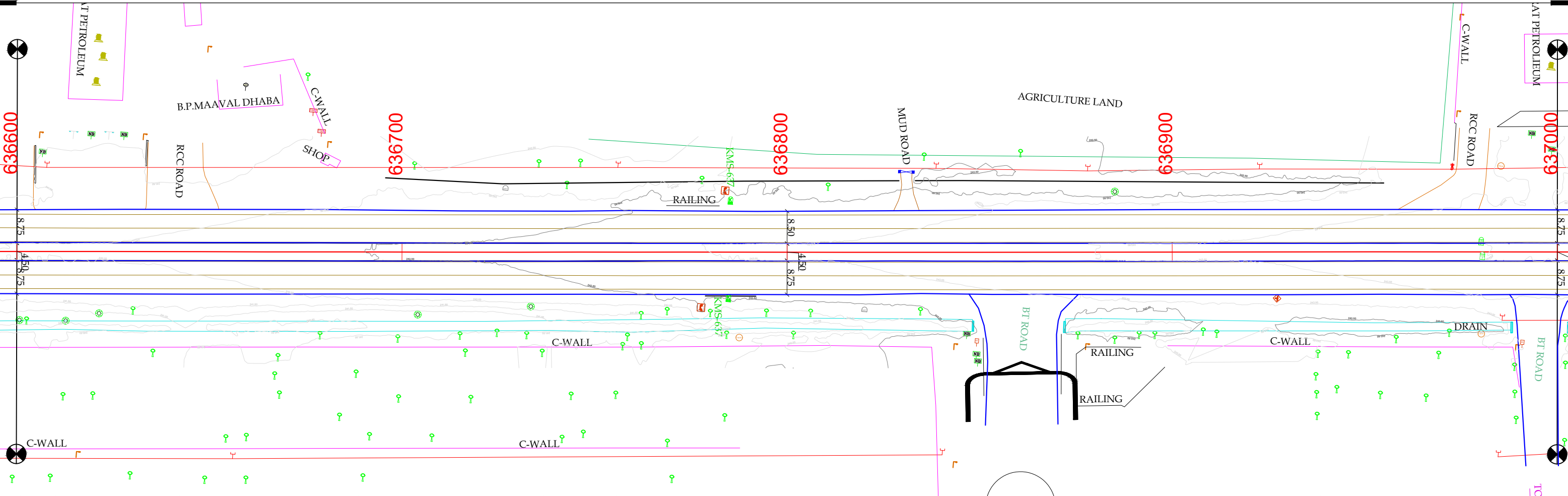
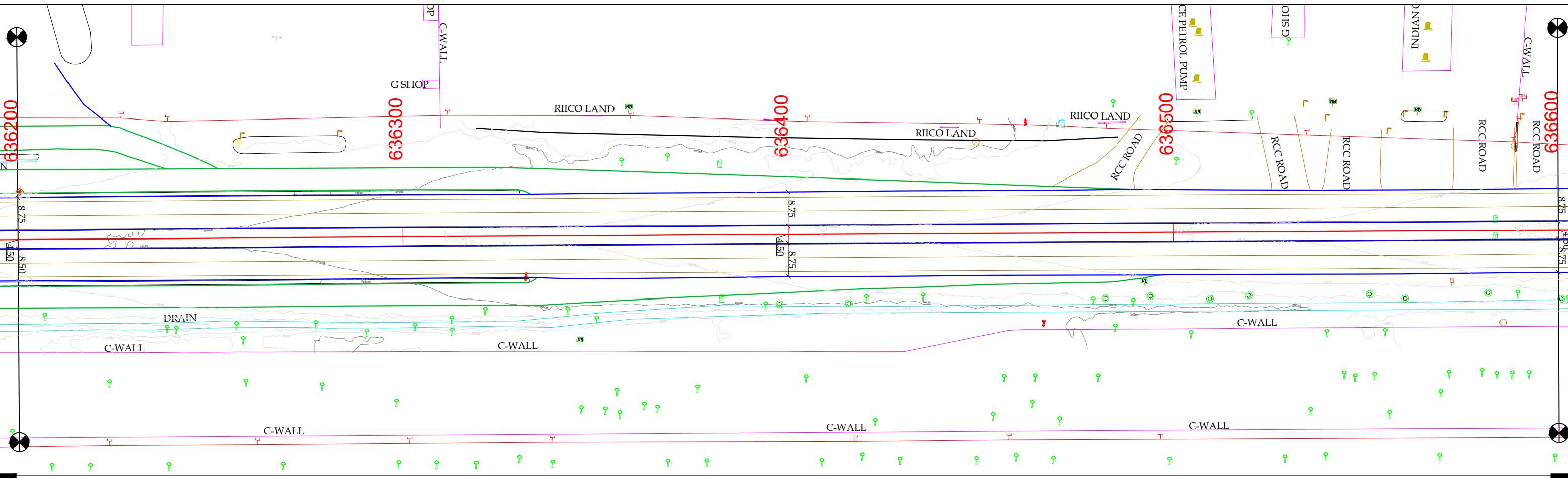
Underpass	
Type	VUP
Str. No.	637/1
Chainage	635+815
Span	1x11.00




			CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA		DRAWN BY DESIGN BY CHECKED BY APPROVED BY		CONSULTANT:- TYPSPA in JV with AVANZA Engineering Pvt. Ltd. 		PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model		TITLE:- KMS 635/400 TO 636/200			
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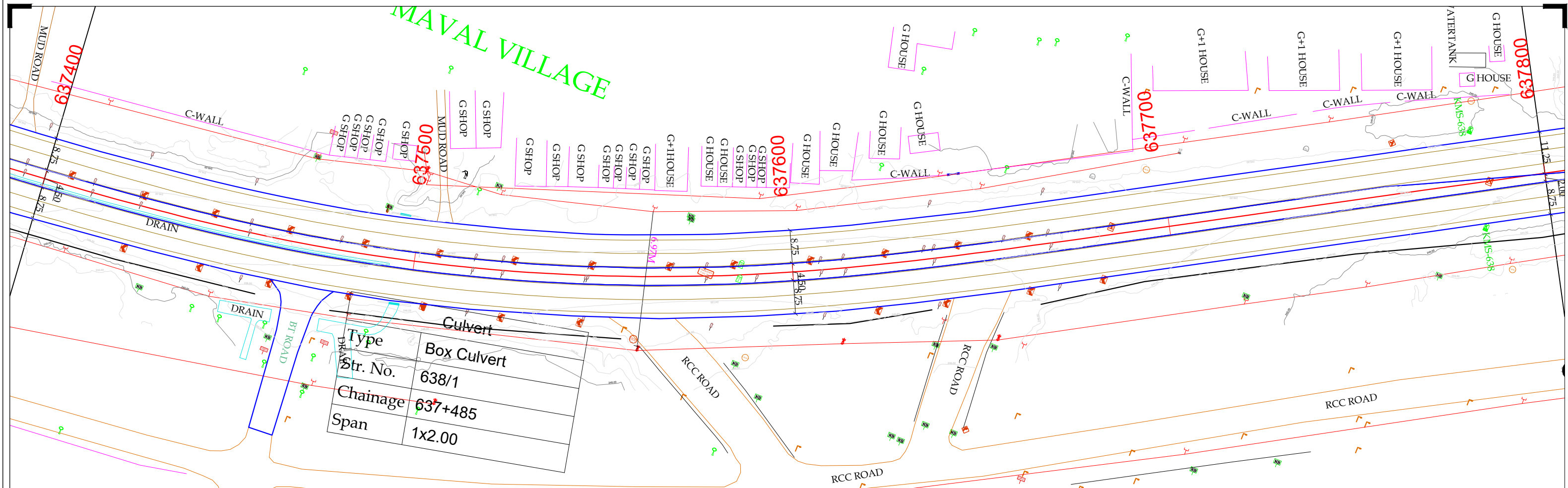
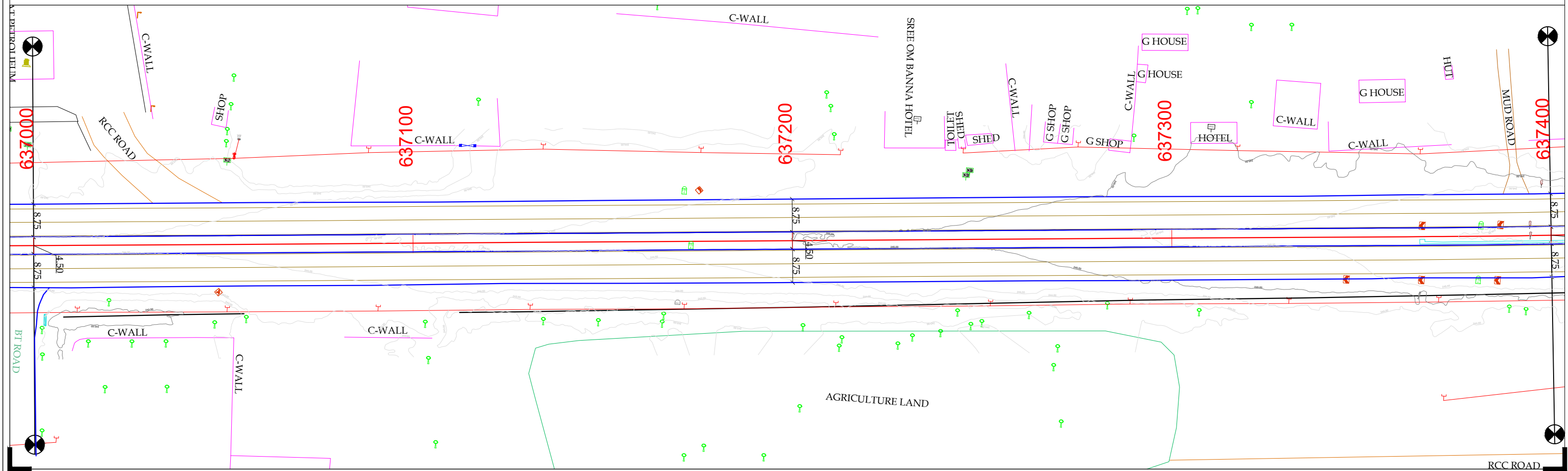
<<< TO PALANPUR




(PALANPUR/KHEMANA - ABU ROAD) TOPOGRAPHICAL SURVEY MAP

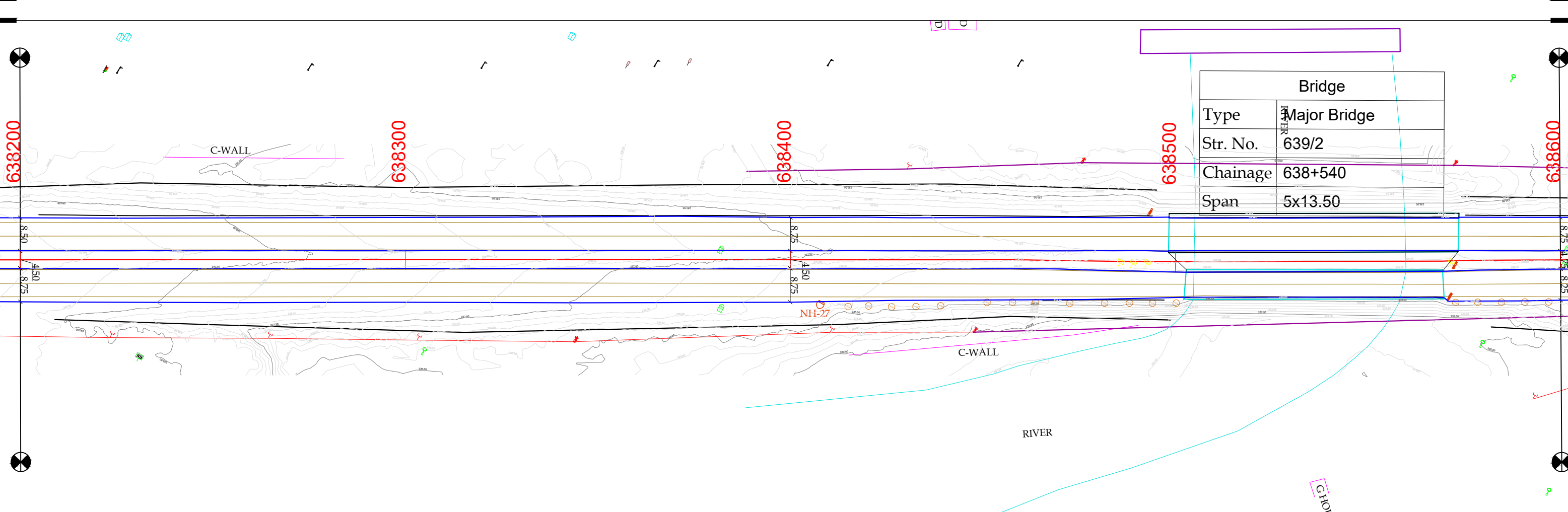
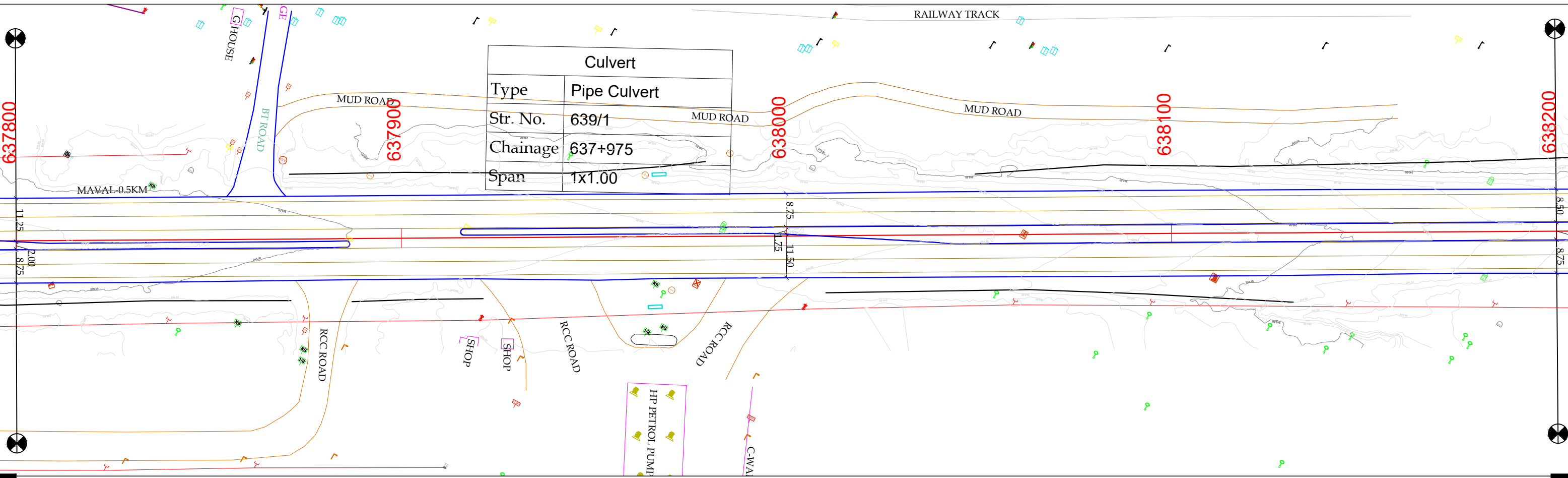
TO ABU ROAD >>>






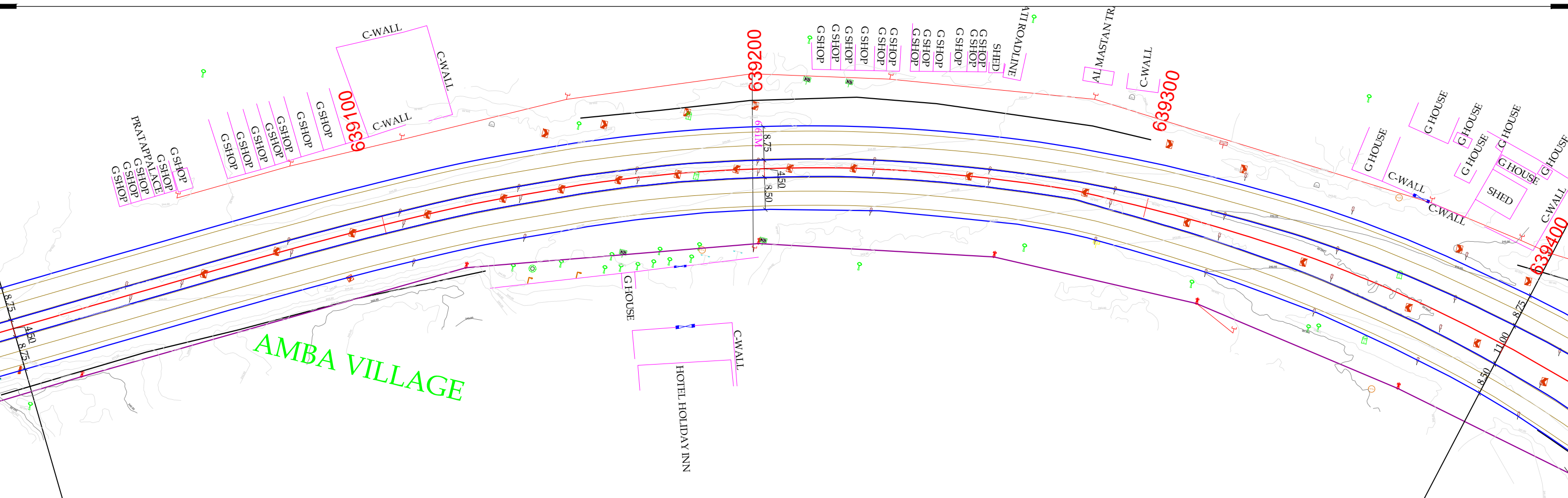
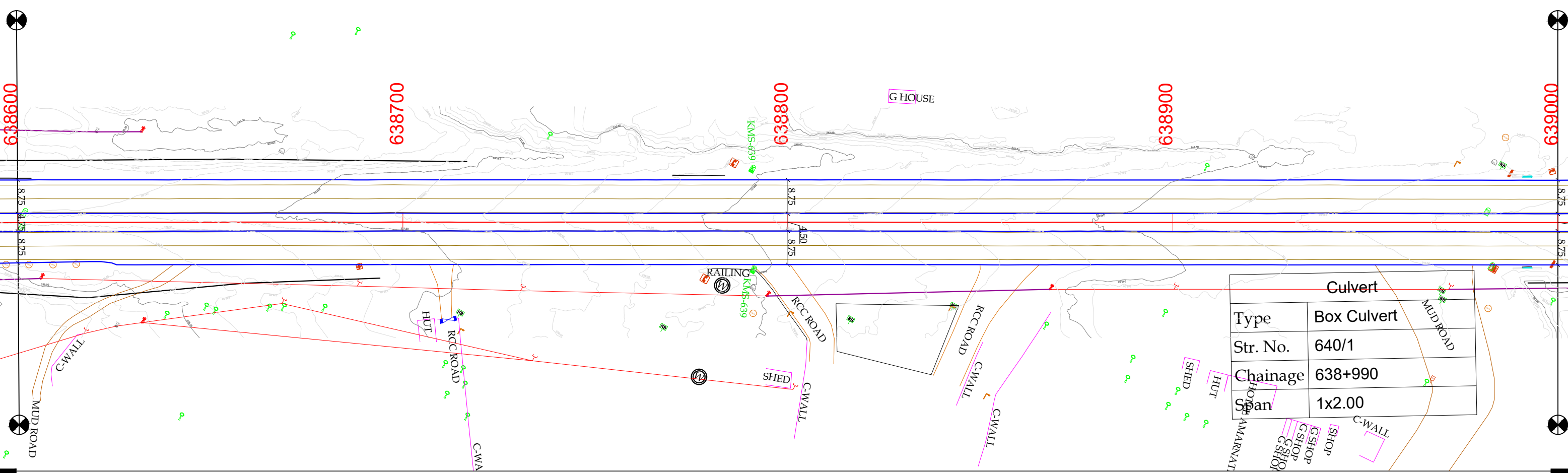
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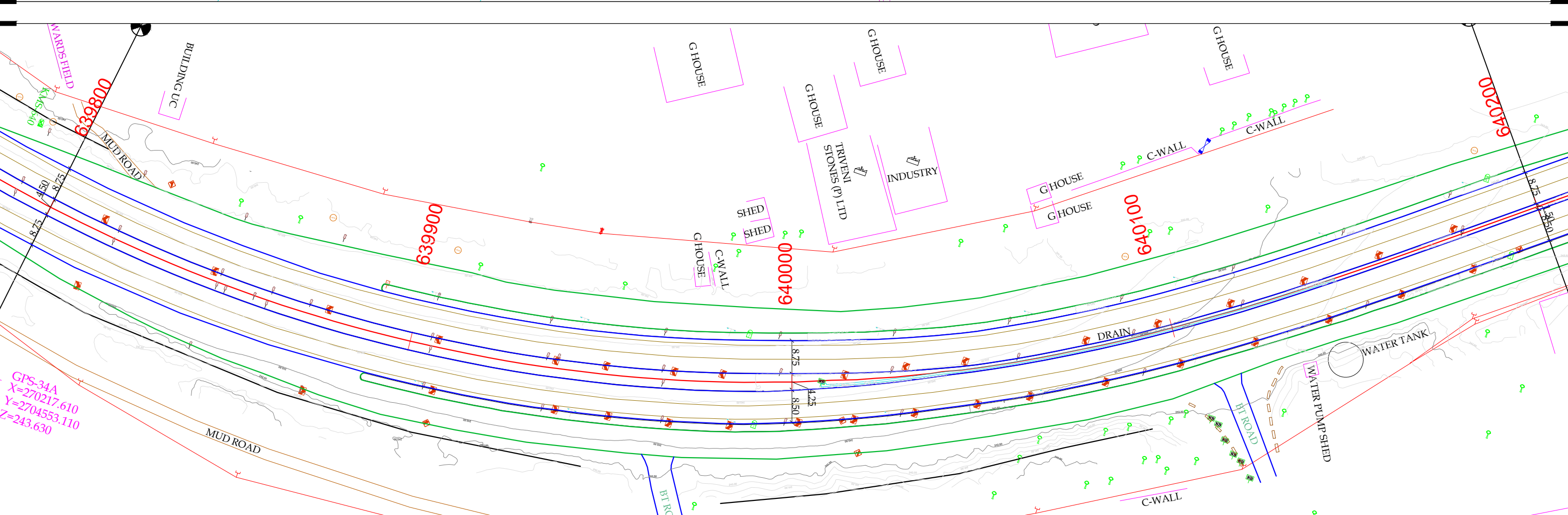
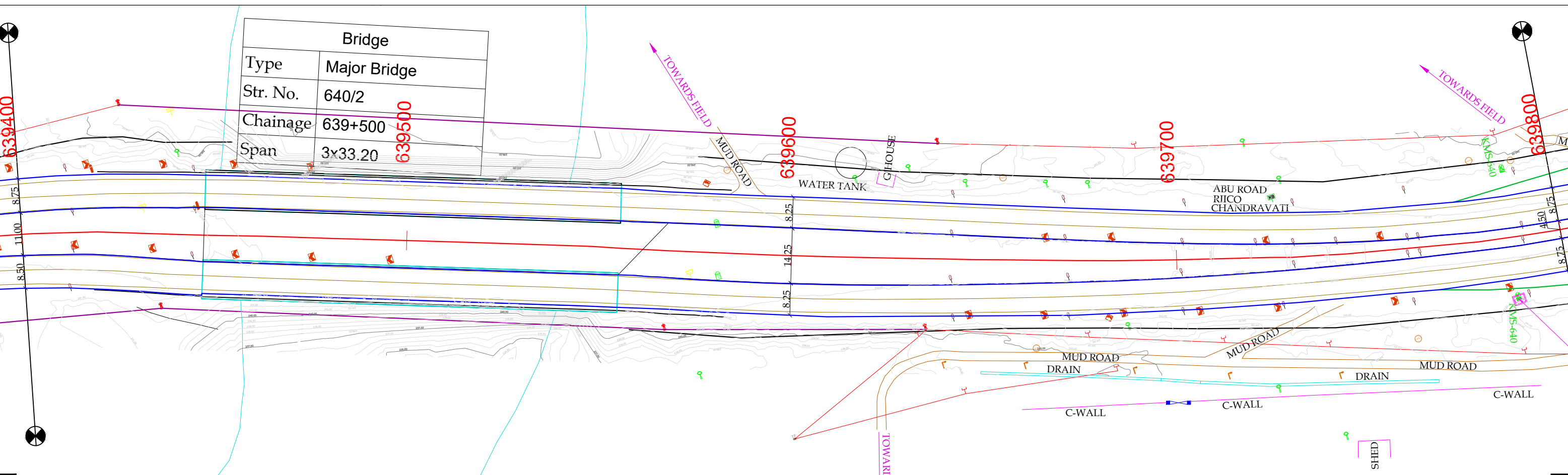
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REV	DATE	DESCRIPTION OF REVISIONS									






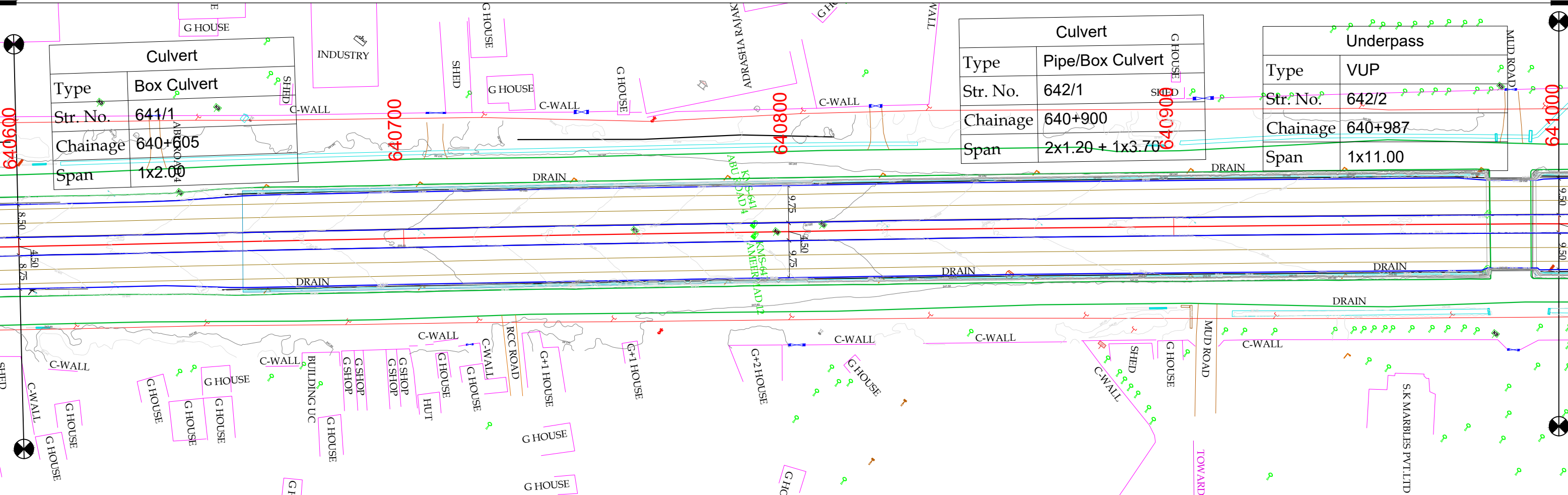
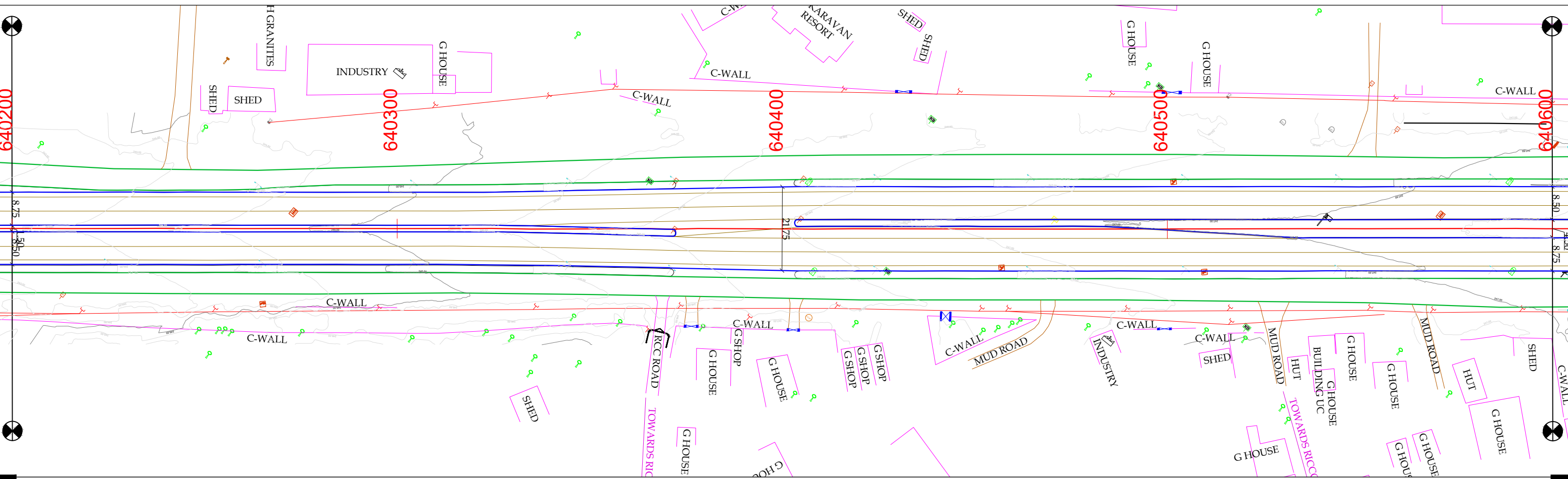
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				47 1 : 1000 A3 0			






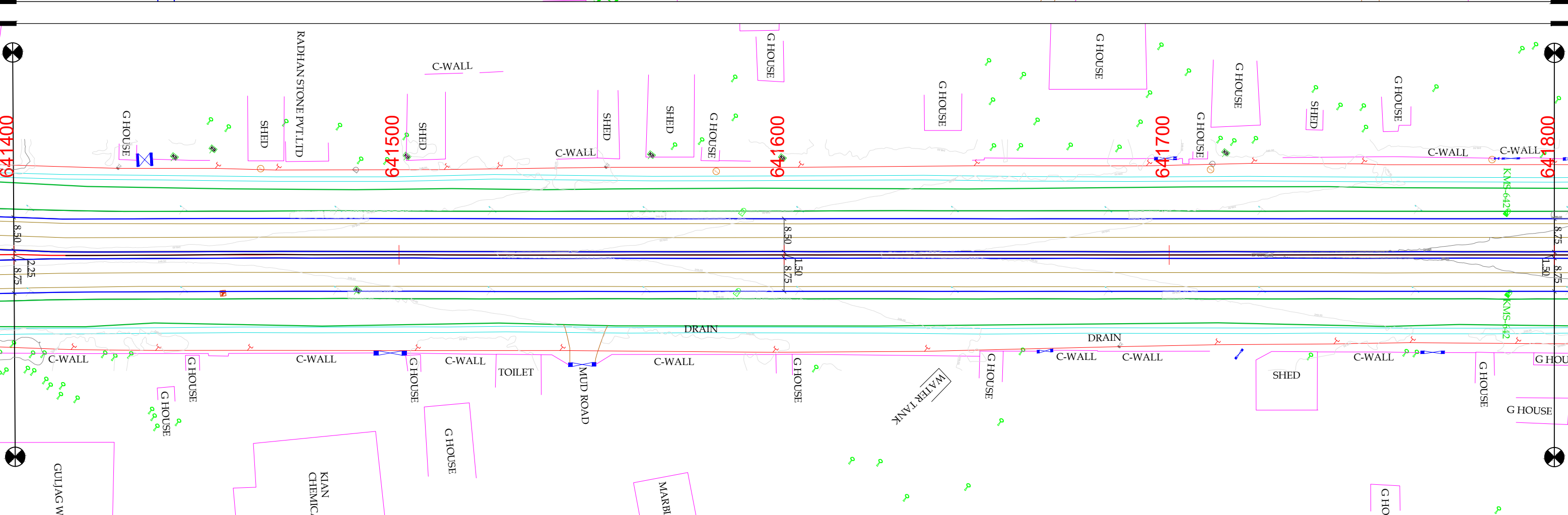
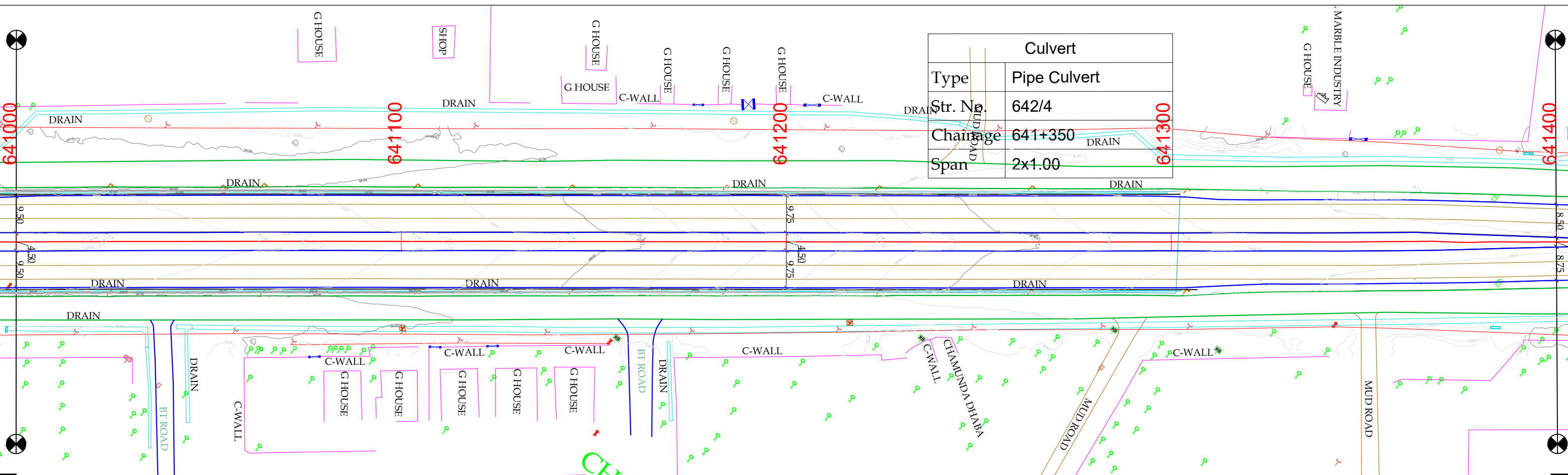
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				48	1 : 1000	A3	0			





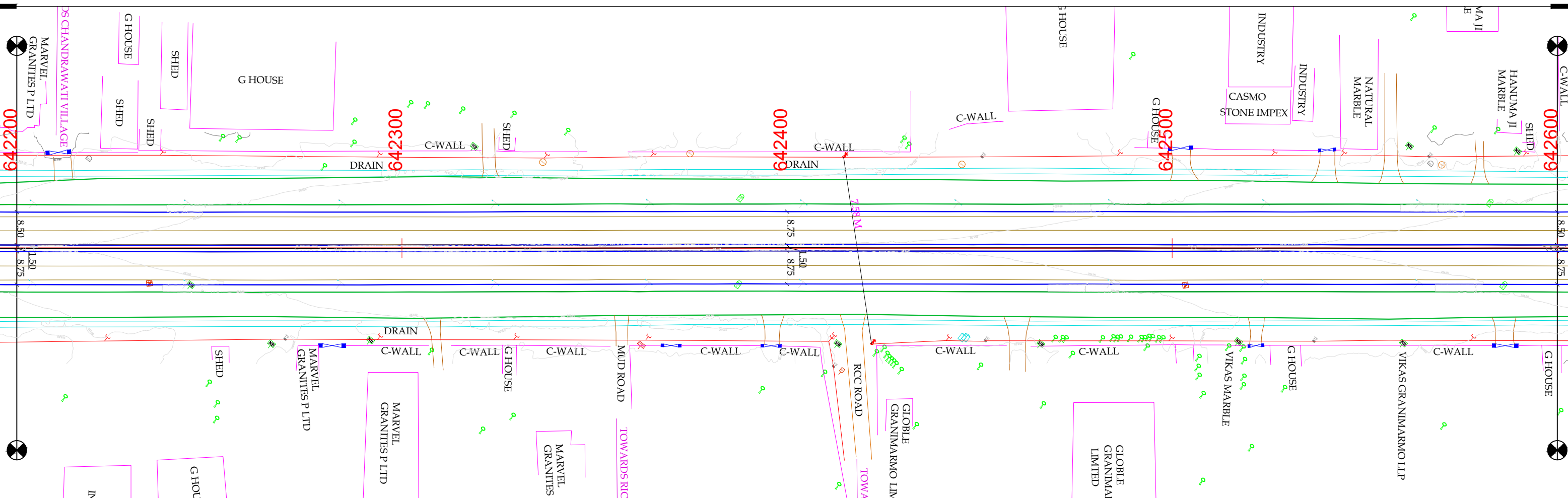
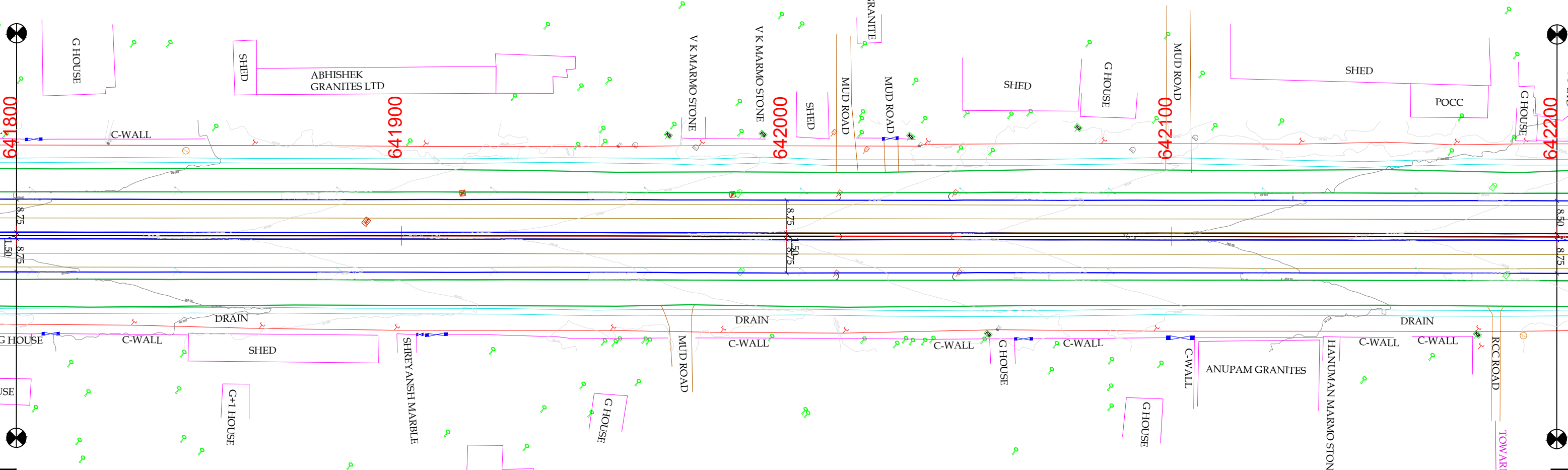
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				DESIGN BY				DRAWING NO. AV_TYPSA/NHAI/InvIT/TOPO_S			
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REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY				49 1 : 1000 A3 0			






			<div>CLIENT :-</div> <div></div> <div>NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:-</div> <div>TYPSPA in JV with AVANZA Engineering Pvt. Ltd.</div> <div></div> <div></div>	PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model	TITLE:- KMS 640/200 TO 641/000				
				DESIGN BY					DRAWING NO. AV_TYPSPA/NHAI/InvIT/TOPO_S			
				CHECKED BY					SHEET NO. SCALE SIZE REV			
REV	DATE	DESCRIPTION OF REVISIONS		APPROVED BY					50	1 : 1000	A3	0



			<div>CLIENT :-  NATIONAL HIGHWAY AUTHORITY OF INDIA</div>	DRAWN BY		<div>CONSULTANT:- TYPSA in JV with AVANZA Engineering Pvt. Ltd. </div>	<div>PROJECT :- Preparation of Report on Physical Condition of the National Highways on Roads under (InvIT) Model</div>	TITLE:- KMS 641/000 TO 641/800			
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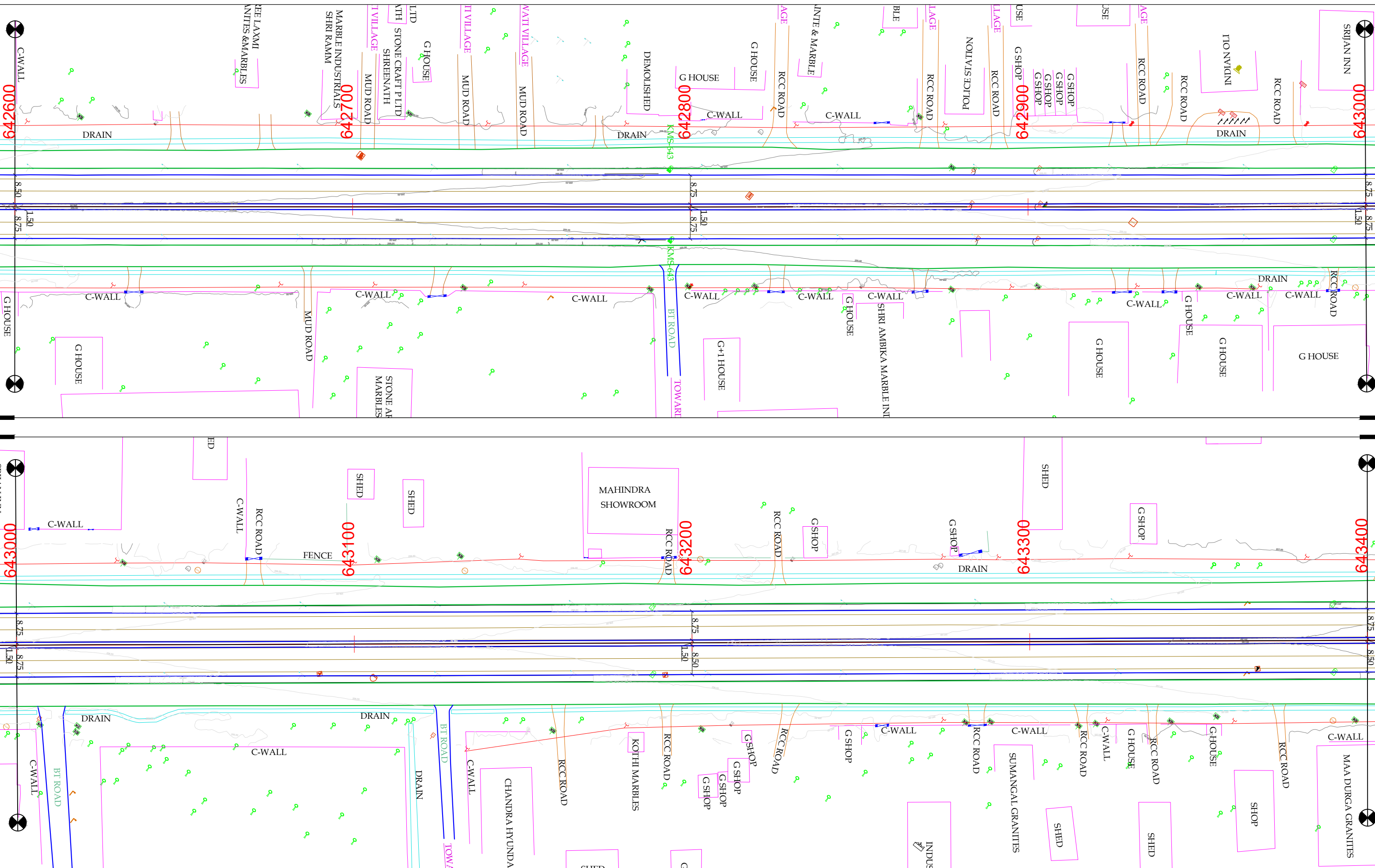





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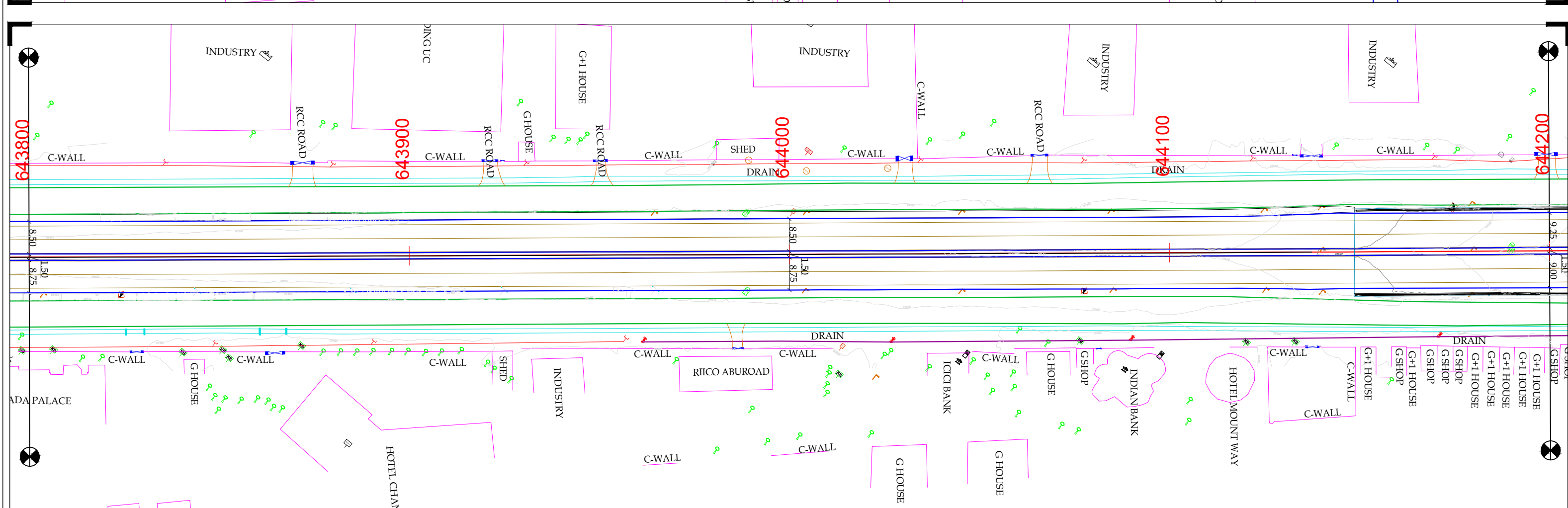
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(PALANPUR/KHEMANA - ABU ROAD) TOPOGRAPHICAL SURVEY MAP

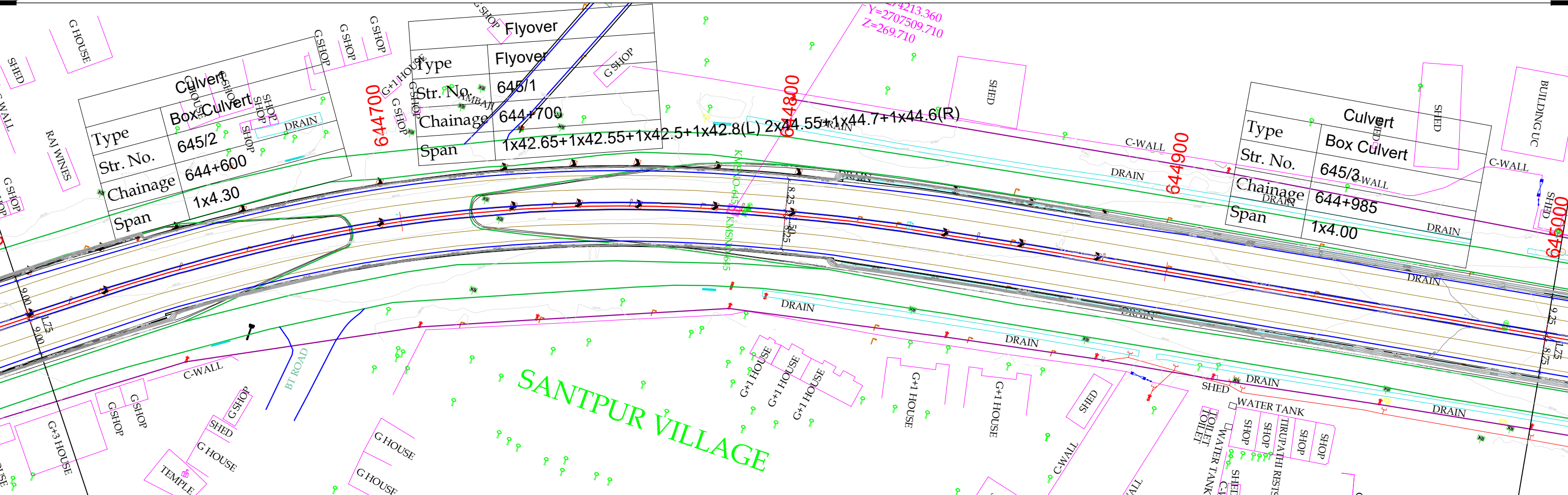
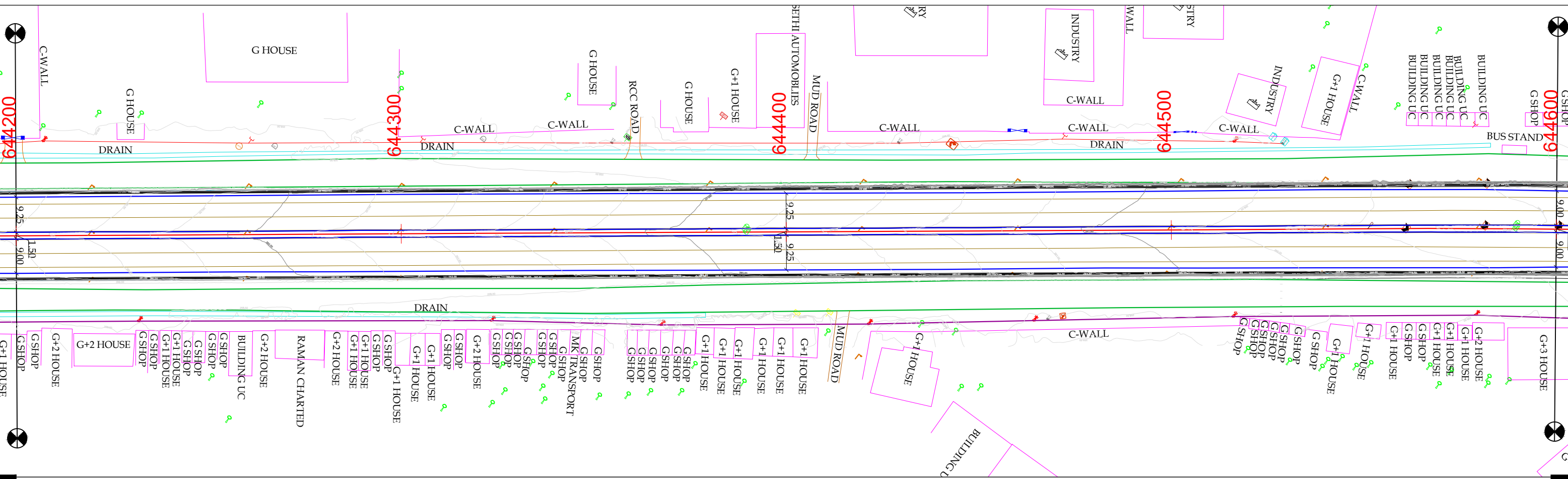
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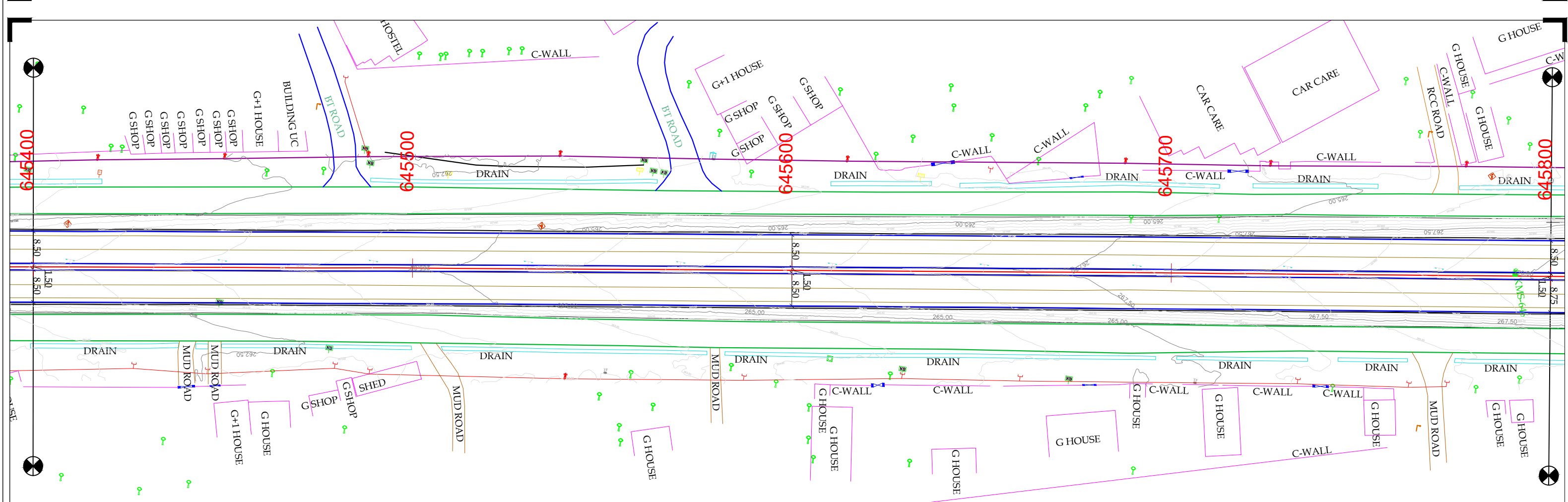
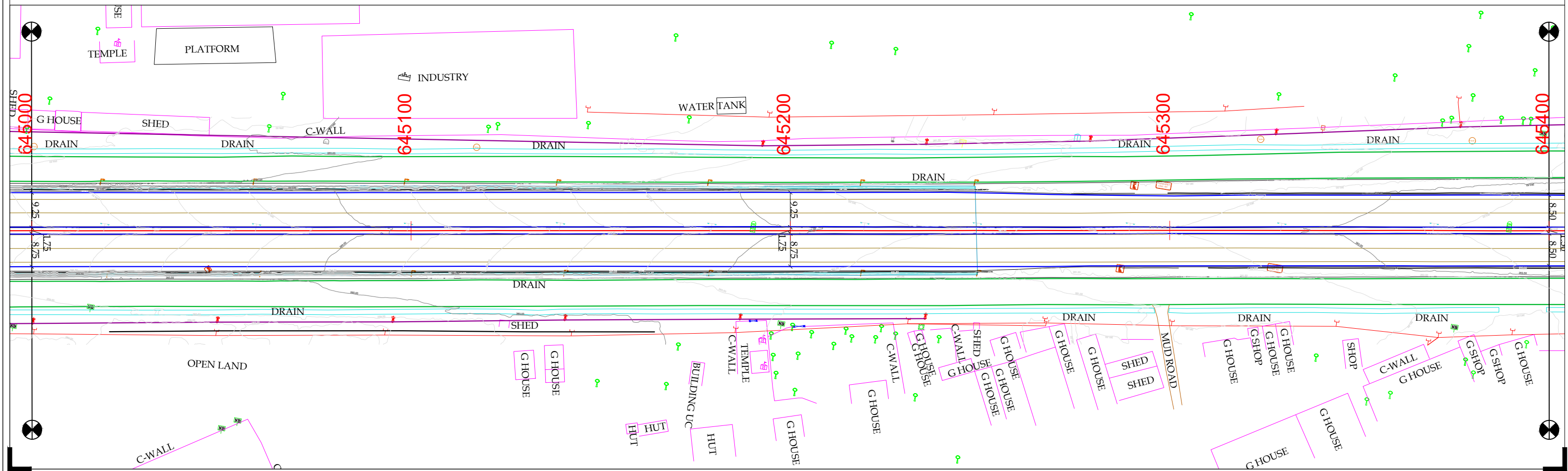
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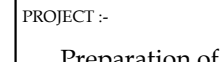


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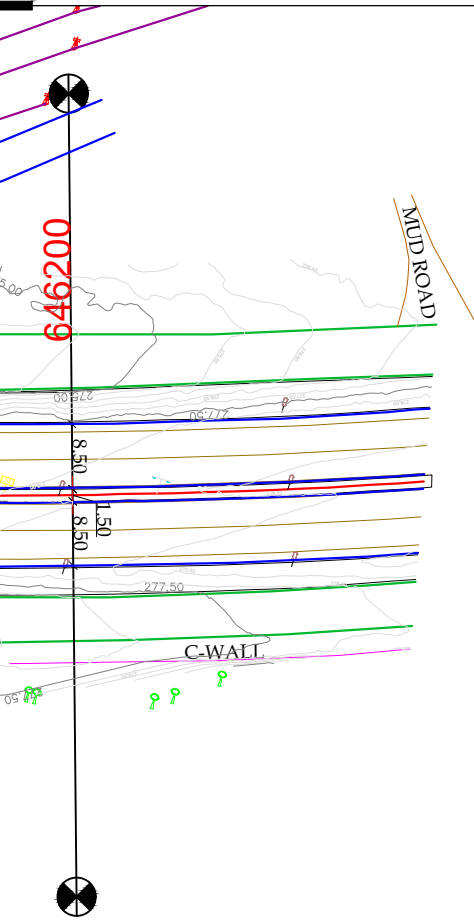
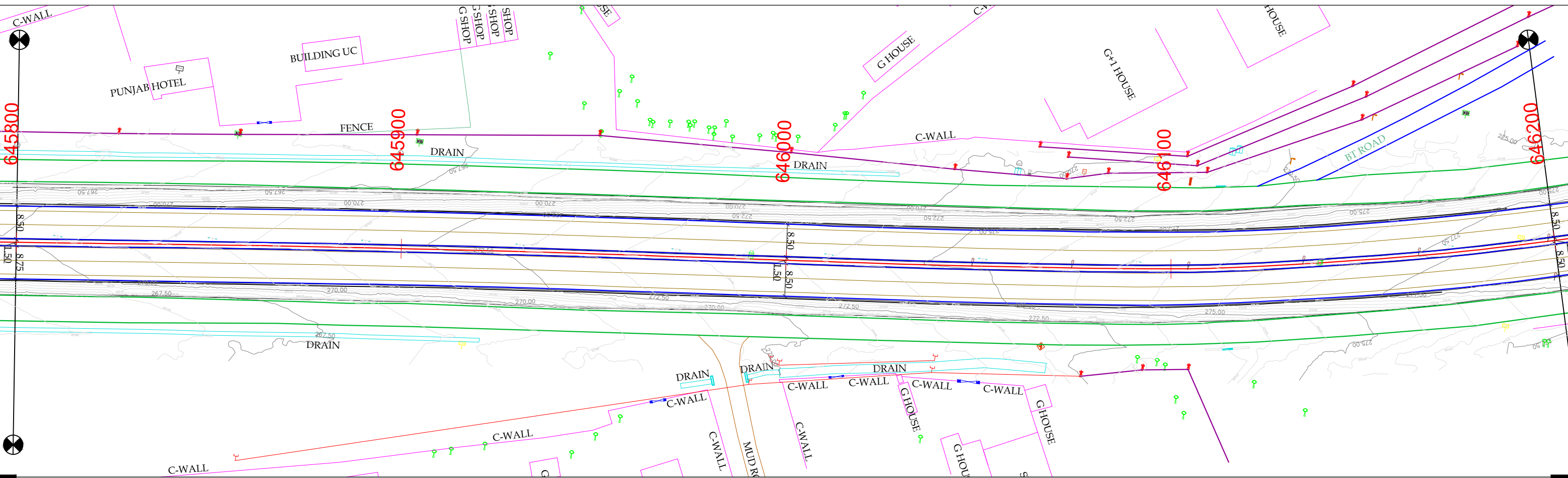




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REV	DATE	DESCRIPTION OF REVISIONS									

Ref. No.: TYP SA-AVANZA/TOT/2020-21/1546

Date: 26.03.2021

To,
Shri R. K. Rathee
General Manager (T)
InvIT
National Highways Authority of India (NHAI)
G-5& G-6, Sector-10, Dwarka, New Delhi-110075

Subject: Technical Due Diligence of the National Highway stretches viz:(1)Abu road – Swaroopganj, (2)Chittorgarh – Kota & Chittorgarh Bypass, (3)Palanpur / Khemana – Abu road, (4)Kothakota Bypass – Kurnool and (5)Maharashtra/Karnataka Border (Kagal) to Belgaum in the States of Rajasthan, Gujarat, Karnataka and Telangana.
Reg: Submission of final report for stretch Abu road – Swaroopganj.

Dear Sir,

Reference to above subject please find enclosed final report dated March 21 of **Abu road – Swaroopganj stretch** along with Annexes as mentioned below

Annexure A (survey data 2018)
Annexure B (data provided by Authority)
Annexure C (cost estimates)
Topo survey map
Drone video

For TYP SA Avanza Joint Venture



Authorized Signatory

Enclosed- Annexure A
Annexure B
Annexure C
Topo survey map
Drone video



■ QUALITY CONTROL SHEET			
DOCUMENT	Technical Due Diligence Report of NH27 (NH14) Abu road – Swaroopganj (Stretch1)		
PROJECT	Preparation of report on physical condition of the National Highways on Roads Asset Under (InvIT) model		
CODE	IM4663-FR-STRETCH_1 (Main Volume)		
AUTHOR	INITIALS	NKS	
	DATE	March -2021	
VERIFIED	INITIALS	AB	
	DATE	March -2021	
RECIPIENT	National Highways Authority of India		
NOTES			
TECHNICAL CONSULTANT	Tecnica Y Proyectos, S.A (TYPSA) In JV with AVANZA Engineering Pvt. Ltd. D-75 VASHALI NAGAR JAIPUR (RAJ.), 302021 TEL NO. – 0141 - 4022513		



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ABBREVIATIONS

■ a1	Structural Coefficient for BC Layer (AASHTO and HDM-4)
■ a2	Structural Coefficient for DBM Layer (AASHTO and HDM-4)
■ AADT	Annual Average Daily Traffic
■ AASHTO	American Association of State Highway and Transportation Officials
■ ACRA	Total area of carriageway cracked
■ ACW	Wide Structural Cracking
■ ADT	Average Daily Traffic
■ ATMS	Advanced Traffic Management System
■ AVC	Automatic Vehicle Classification System
■ FWD	Falling Weight Deflectometer
■ GOI	Government of India
■ GQ	Golden Quadrilateral
■ HDM	Highway Development and Maintenance Management System
■ IRC	Indian Roads Congress
■ IRI	International Roughness Index
■ JV	JV Between TYPSA and AVANZA. The Consortium
■ LiDAR	Light Detection and Ranging
■ MBIU	Mobile Bridge Inspection Unit
■ MORTH	Ministry of Road Transport and Highways
■ MSA	Millions of Standard Axle (8,2 ton) (AASHTO and HDM-4)
■ NHAI	National Highways Authority of India
■ NHDP	National Highways Development Project
■ NSV	Network Survey Vehicle
■ Old BT Thickness	Old Bituminous Thickness (AASHTO and HDM-4)
■ P ₀	Initial serviceability
■ PIA	Project Influence Area
■ P _t	Terminal serviceability index
■ ROW	Right of Way



■ SFC	Side Friction Coefficient
■ SN	Structural Number (AASHTO and HDM-4)
■ SNP	Adjusted Structural Number
■ ToR	Terms of Reference
■ TOT	Toll Operate and Transfer
■ InvIT	Infrastructure Investment Trust

EXECUTIVE SUMMARY

1. INTRODUCTION

National Highways Authority of India (NHAI), an autonomous agency of the Government of India (GoI), is responsible for the development, maintenance and management of National highways network in India.

There are currently approximately 1,32,500 kilometers of national highways in India, constituting approximately 2.2% of India's entire road network but carrying approximately 40% of total road traffic.

To meet the growing need for further industrialization and development of the country, GoI has planned to expand the network of National Highways across the length and width of the country at a rapid pace. The various programmes which have been taken by GoI through NHAI are:

Phase I: Golden Quadrilateral (GQ) Comprising 4/6-laning of National Highways connecting four metro cities, namely, Delhi, Mumbai, Chennai and Kolkata with a total length of approximately 5846 km (which is mostly complete), and

Phase II: North-South and East-West Corridors (NSEW) comprising 4/6-laning of National Highways connecting Srinagar to Kanyakumari and Silchar to Porbandar. Total length this NSEW corridor is approximately 7300 km. The projects of NSEW are mostly awarded and construction is also largely complete.

Bharatmala Pariyojana: A flagship highway development programme which envisions the development of 50 economic corridors, provide connectivity to 550 districts in the country through National Highway linkages and improve the average speed of road travel in India.

In addition to this, various NHDP programs has been taken up by NHAI to match the rapid pace of modernization and industrial development of the country. The Government has planned to continue developing the National Highways at a rapid pace, which will require significant funding in the near future.

The National Highways Authority of India (NHAI) has initiated the process of setting up an infrastructure investment trust (InvIT) to monetize its road assets. This will be a private listed InvIT, through which institutional investors may invest in operational road projects offered by NHAI to the InvIT. In this model, the offered road assets are acquired by the InvIT while the investors acquire the units issued by the InvIT. Income generated from the underlying road assets would be paid out as distributions to the unit holders in the form of interest, dividend and return of capital. The InvIT would be managed by a competent Investment Manager staffed with experts to manage the assets efficiently.

Under the InvIT frame work, the right of collection of user fees of selected NH projects is proposed to be assigned for a specific time period to a Concessionaire. During this period, the O&M responsibility will also vest with the selected Concessionaire (unless costs are to be borne by existing concessionaires as per extant agreements). In return, the Concessionaire will pay an upfront quoted Concession Fee to NHAI.

Roads under InvIT include the following 5 stretches:

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
1	Abu Road - Swaroopganj	31.000	Undavariya	646.000	677.000
2	Chittorgarh - Kota & Chittorgarh Bypass	160.500	Bassi	891.929	1052.429
			Aroli		

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
			Dhaneshwar		
3	Palanpur / Khemana - Abu Road	45.000	Khemana	601.000	646.000
4	Kothakota Bypass - Kurnool	74.622	Pullur	135.469	211.000
5	Maharashtra Karnataka Border - Belgaum	77.705	Hattargi Kognoli	515.000	592.705

In order to assist potential investors in their evaluation, NHAI has requested for the preparation of a detailed report of inventory & physical condition of the highway, to be conducted through a selected consultant(s).

[TYPESA in a JV with Avanza Engineering Pvt. Ltd. have been appointed as the selected consultant for preparation of the aforesaid report]

2. STUDY OBJECTIVE

The general scope of the service is given in the sections that follow. However the entire scope of services would, inter-alia, include the items mentioned in the letter of invitation and the TOR. The consultant is responsible to make suitable proposals for improvement of the existing road and strengthening of pavement, as required and at the appropriate time to maintain the level of service over the design period. The consultant will prepare a report for each road asset.

The Consultant has conducted study for the possible location of a new toll plaza, if required. The local and slow traffic needing segregation from the main traffic was identified and provision of service and slip roads has been recommended, wherever necessary to improve efficiency and safety.

All the technical and maintenance schedules have been prepared as required by NHAI under the items mentioned in the letter of invitation and the TOR.



3. PROJECT STRETCH

Project Stretch starts from km 646+000 at Abu road NH-27 and ends at km 677+000 in Swaroopganj in the state of Rajasthan. The length of Project Stretch is 31km and has 4-lane configuration with toll plaza at km 670+750 (Undavariya) near Swaroopganj.

This project stretch has been constructed under (BOT) annuity scheme and last annuity payment is due on 24/03/2024. Up to this date, the road will be maintained by the BOT Contractor, M/s L&T Infrastructure.

Various investigations were carried out for assessing physical condition of the Project Stretch. List of all investigations and its schedule is presented in table below.

Stretch - 1 (Abu Road - Swaroopganj)			
S.No	Type of Investigations		Location
1	Traffic Surveys	TVC Survey	UndavariyaToll Plaza
		OD Survey	
		Axle Load Survey	
2	Topographical Survey through LiDAR		Entire Stretch
3	NSV		Entire Stretch
4	FWD		Locations are mentioned in Ch. 4
5	Pavement	Test Pits	Locations are mentioned in Ch. 4
	Material Testing	Core Cutting	Locations are mentioned in Ch. 4
		DCPT	Locations are mentioned in Ch. 4

Stretch - 1 (Abu Road - Swaroopganj)			
S.No	Type of Investigations		Location
		Borrow Area Inventory	Locations are mentioned in Ch. 8
6	Structural Investigations	Visual Inspection	All Structures
		NDT	Distressed structures cited in Ch. 5
7	Road Safety Audit		Entire Stretch
8	Toll Plaza Audit		Undavariya Toll Plaza

4. TRAFFIC STUDY

4.1. AVERAGE DAILY TRAFFIC AND AVERAGE ANNUAL DAILY TRAFFIC

TVC survey was carried out with video recording in both the direction of traffic movement continuously for seven days.

Based on these surveys ADT and AADT has been calculated using seasonal factors as per clause 6.2 of IRC-SP-19.

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
2 Wheeler	4,384	4,384	2,192
3 Wheeler	489	489	489
Passenger Car	6,515	6,515	6,515
Mini LCV	423	423	423
Mini Bus	77	77	116
Standard Bus	568	568	1,704
LCV -4 Tyre	462	462	462
LCV - 6 Tyre	0	0	0
2 - Axle trucks	719	719	2,157
3 - Axle trucks	1,062	1,062	3,186
MAV (4 - 6)	5,354	5,354	24,093
Oversized vehicles >6	112	112	504
HCM/EME	46	46	207
Tractors	29	29	44
Tractor with Trailer	54	54	243
Cycles	7	7	4
Cycles rickshaw	0	0	0

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
Animal Cart	21	21	128
Hand Cart	4	4	33
Exempted vehicles	24	24	49
Total Tollable	15,338	15,338	39,367
Total	20,351	20,351	42,547

4.2. O-D SURVEY

O-D survey was conducted for 24 Hrs on a working day at proposed location by road side interview method using sampling of vehicles passing the stretch. During O-D survey information like trip origin, destination, location of origin and destination from toll plazas and frequency of route was derived, in addition to this other information's like purpose of trip, occupancy of passenger trip, local commodity movement etc were collected. The finding of O-D survey is used to establish discounts as per concession agreement and to outline project influence area (PIA).

Zone No.	Zone From / To	Passenger	Goods
1	Swaroopganj side	7.1%	3.8%
2	Mount Abu, Abu road	12.1%	4.2%
3	Palanpur	1.8%	1.7%
4	Ahmedabad	3.4%	2.7%
5	Kandla Side, Rest of Gujarat	0.0%	0.7%
6	Udaipur, Kota, Chittorgarh side	4.1%	5.6%
7	Jodhpur, Falna side of Rajasthan	28.9%	20.2%
8	Rest of Rajasthan	33.4%	39.8%
9	MP, UP, Bihar, WB, Jharkhand, Odisha	1.7%	3.8%
10	Delhi, Punjab, Haryana, Himachal, J&K	3.4%	11.7%
11	Maharashtra and South India	4.0%	5.8%

4.3. TOLL TRAFFIC SEGMENTATION

Toll traffic segmentation as reported by Toll Plaza Management is tabulated below:

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commer cial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
No. of Monthly Passes	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
All types of Single Entry	86.3%	94.6%	98.0%	99.0%	98.9%	97.0%

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commer cial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
Multiple Entry	0.6%	1.2%	0.3%	0.1%	0.1%	0.0%
Reuse of Multiple Entry Ticket	0.6%	1.1%	0.3%	0.1%	0.1%	0.0%
Reuse of Monthly Passes	4.4%	0.1%	0.3%	0.0%	0.2%	0.0%
Concession Entry/LDV's	0.0%	0.1%	0.0%	0.1%	0.2%	0.0%
Exempted	7.9%	2.8%	1.0%	0.7%	0.6%	3.0%

4.4. TRAFFIC GROWTH RATES

Traffic growth rates for the study, to be used subsequently for forecasting traffic on the Project Stretch, have been estimated by adopting the Elasticity of Transport Demand method as stipulated in IRC 108, which is a proven and therefore most commonly used technique in India. The method relies on the correlation between:

- Past trends in traffic growth on the Project Stretch / Traffic passing through Toll Plazas.
- Vehicle registration in the area of influence.
- Time series data on Net/Gross State Domestic Product (NSDP or GSDP) for project influence area.

Based on the moderated elasticity values and the projected economic indicators (India GDP), the future average annual compound traffic growth rates by vehicle type have been thus estimated and recommended for normal conditions.

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.64%	2.77%	2.68%	3.71%	3.24%	2.77%	2.37%	2.03%	1.73%
Bus	0.00%	3.22%	3.37%	3.26%	4.52%	3.94%	3.37%	2.88%	2.47%	2.11%
LCV	0.00%	3.26%	3.42%	3.30%	4.58%	4.00%	3.42%	2.92%	2.50%	2.14%
2 AT	0.00%	-0.80%	-0.84%	-0.81%	-1.13%	-1.20%	-1.25%	-1.31%	-1.37%	-1.43%
3 AT	0.00%	-0.93%	-0.98%	-0.94%	-1.31%	-1.40%	-1.46%	-1.53%	-1.59%	-1.67%
MAV	0.00%	4.28%	4.48%	4.33%	6.01%	5.24%	4.48%	3.83%	3.27%	2.80%

The construction of Mumbai-Delhi Railway Freight Corridor is in progress and expected to be operational by year 2025. Due to this corridor operation, a partial reduction in the traffic of heavy commercial vehicles (trucks and MAVs) is expected. Based on the O-D pattern, it has been considered a 18% total reduction of the 3-axle and 21% reduction in MAV commercial long distance traffic, and 25% reduction of the 2-axle trucks traffic in year 2026.

Traffic projections for Tollable Vehicles on AADT basis:

Tollable traffic		
Year	Total vehicle	Total PCU
2021	15,338	39,367
2025	15,656	38,933
2030	17,122	40,689
2035	20,131	48,869
2040	23,198	57,403
2045	26,249	66,062
2050	29,221	74,636

As per the Concession Agreement for InvIT projects, NHAI may undertake or cause to undertake the process for capacity augmentation of the Project Stretch to 6/8-lane configuration in case that the average daily tollable traffic in any accounting year exceeds the designed capacity of 40,000 PCUs for Project Stretch and continues to exceed the designed capacity for three consecutive accounting years, and until the Level of Service C of the highway is reached, 60,000 PCU. According to the estimated traffic projections, the Authority could undertake the process for capacity augmentation of this project stretch at anytime from 2030 to 2042, when the level of service C is reached, and the construction period for capacity augmentation can be assumed to be 2.0 years.

4.5. AXLE LOAD SURVEY AND CALCULATION VDF

Axle load survey in both directions has been carried out at Undavariya with 871 samples. The survey has been conducted for 2 normal days (48hrs) using axle load pads. Methodology and procedure stipulated in IRC 37 has been followed.

VDF has been computed for various categories of commercial vehicles and presented is below.

Type	Swaroopganj to Abu Road	Abu Road to Swaroopganj
LCV	1.46	0.42
2A	2.39	1.15
3A	3.55	3.14
4A	3.85	3.33
5A	12.80	15.22
6A	13.97	9.54

5. SUMMARIZED ROAD INVENTORY

Detailed inventory of Project Stretch is captured through NSV, LiDAR and field reconnaissance. Salient features like built-up settlements, carriageway dimensions, surface type, junctions, service roads, road furniture etc. are recorded for entire Project Stretch. The road inventory is linked to the existing km stones established along the roadside. Overview of all road inventory is presented in table below.

S.No.	Description	Details
1	Project Stretch	Abu Road - Swaroopganj

S.No.	Description	Details	
2	Length of Project Stretch (in km)	31.000 km	
3	Road Type (length in km)	BT	31.000 km
		CC	-
4	Length of Urban Section (in km)	5.000 Km	
5	Length of Slip/Service Road (in km)	LHS	7.70 km
		RHS	9.90 km
6	No. of Bypasses	01	
7	No. of Major Junctions	05	
8	No. of Minor Junctions	28	
9	No. of Major Bridges	02	
10	No. of Minor Bridges	08	
11	Culverts	58	
	No. of Slab Culverts	02	
	No. of Pipe Culverts	07	
	No. of Box Culverts	49	
12	No. of Flyovers	Nil	
13	No. of ROBs	01	
14	No. of Tunnels	Nil	
15	No. of RUBs	Nil	
16	No. of Vehicular Underpasses	06	
17	No. of Pedestrian Cattle Underpasses	Nil	
18	No. of Toll Plazas	01	
19	No. of Bus Bays	RHS-08 & LHS-08	
20	No. of Truck Lay Bays	Nil	
21	No. of Toilet Blocks	RHS-01 & LHS-01	
22	No. of Way Side Amenities	Nil	

6. REVIEW OF PAVEMENTS

The existing pavement along the entire project is flexible except for the rigid pavement in Toll Plaza (Undavariya); and the project road has four lanes (2+2) with paved shoulder.

It should be noticed that this project road is under a BOT (Annuity) **Contract with tenure up to 24/03/2024**; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should stay directly under the responsibility of BOT and O&M present contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road under the InvIT transaction. Knowing this issue, this section of the project will be out of the pavement initial scope of works.

Field Survey for Surface Distress and Riding Quality was carried out using Network Survey Vehicle (NSV). NSV is a highly-specialized survey Vehicle designed and developed for in time assessment of Pavement Surface Condition by getting information with respect to distress type and its severity.

NSV is equipped with a fully integrated data collection system obtained from a Multi-Laser Profiler, Digital Imaging System and Video camera unit whose outputs are all linked via a highly accurate distance measuring instrument and this data is later processed with the help of adequate software applications to get for rutting, graveling, roughness (IRI), cracking etc; and subsequently many of this data was used to calculate the Pavement Condition Index (PCI) values.

Roughness and Rutting of pavement are measured using a Digital Laser Profiler (DLP), Integrated into the NSV.

The profiler is capable of measuring:

- Pavement Roughness (one laser in each wheel path and centre)
- Rutting (full transverse pavement measurement)

Roughness and Rutting are two most important quality parameters of pavement describing its riding quality and durability and are very significant in gaining negative or positive feedback from road users.

PCI provides a numerical rating for the condition of road segments within the road network, where 0 is the worst possible condition and 100 is the best possible condition as per ASTM.

6.1. PAVEMENT CONDITION INDEX (PCI)

Regular monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI can also provide feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.

In this project, the PCI is calculated as per the international guidelines provided in ASTM-D6433. For different pavement condition, according to ASTM-D6433, PCI values are presented in the following table.

PCI condition details length wise for both the direction given in tables below:

Condition	PCI Range	Length LHS Outer (km)	PCI %	Length LHS Inner (km)	PCI %
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	0	0	13	42
Fair	55 - 70	25	81	15	48
Poor	40 - 55	6	19	3	10
Very Poor	25 - 40	0	0	0	0
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Condition	PCI Range	Length RHS Outer (km)	PCI %	Length RHS Inner (km)	PCI %
Good	85 - 100	1	3	2	6
Satisfactory	70 - 85	1	3	8	26
Fair	55 - 70	12	39	17	55
Poor	40 - 55	16	52	4	13

Condition	PCI Range	Length RHS Outer (km)	PCI %	Length RHS Inner (km)	PCI %
Very Poor	25 - 40	1	3	0	0
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

6.2. INTERNATIONAL ROUGHNESS INDEX (IRI)

The National Highway Authority of India (NHAI), via letter no. 11041/218/2007 –Admn. dated 03.11.2009 on POLICY MATTERS –TECHNICAL (37/2009) has approved the use of Laser Profiling devices for NHAI works. Consequently, IRI measurement has been progressively introduced in India. IRI correlation with BI values can be calculated by the following formula:

$$BI = 630 \cdot (IRI)^{1.12}$$

Where:

BI: Bump Integrator Roughness or Unevenness Index (mm/km).

IRI: International Roughness Index.

It is observed that roughness index is lower in outer lane as compared to inner lane in both directions.

Condition	Range	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	IRI < 2.8	24	77	6	19
Fair	2.8 - 4.0	7	23	24	77
Poor	IRI > 4.0	0	0	1	3

Condition	Range	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	IRI < 2.8	26	87	9	29
Fair	2.8 - 4.0	4	13	21	68
Poor	IRI > 4.0	0	0	1	3

6.3. RUTTING

Rutting is one of the important factors which determine the functional performance of pavement. Rutting is characterized by permanent deformation of the pavement in wheel path due to heavy load vehicles. It is one of the main modes of failure in asphalt mixes.

Rutting condition details length wise for both the direction given in table below.

Condition	Rut Depth Range (mm)	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	< 5	1	3	20	65
Fair	5 - 10	19	61	11	35
Poor	> 10	11	35	0	0

Condition	Rut Depth Range (mm)	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	< 5	4	13	20	63
Fair	5 - 10	6	20	11	37
Poor	> 10	21	67	0	0

6.4. ESTIMATED DESIGN TRAFFIC

The design traffic is calculated in terms of the cumulative number of standard axles in two directions of the carriageway during the design life of the road. The estimated cumulative design traffic (In Million Standard Axles, MSA) considering the traffic and VDF parameters is presented in the figure below.

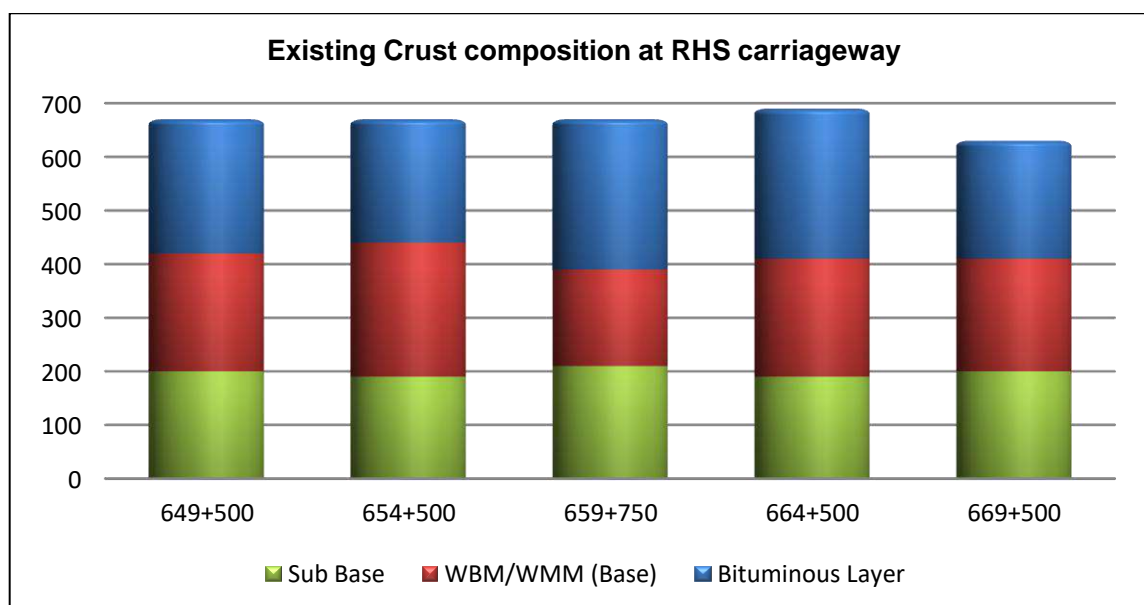
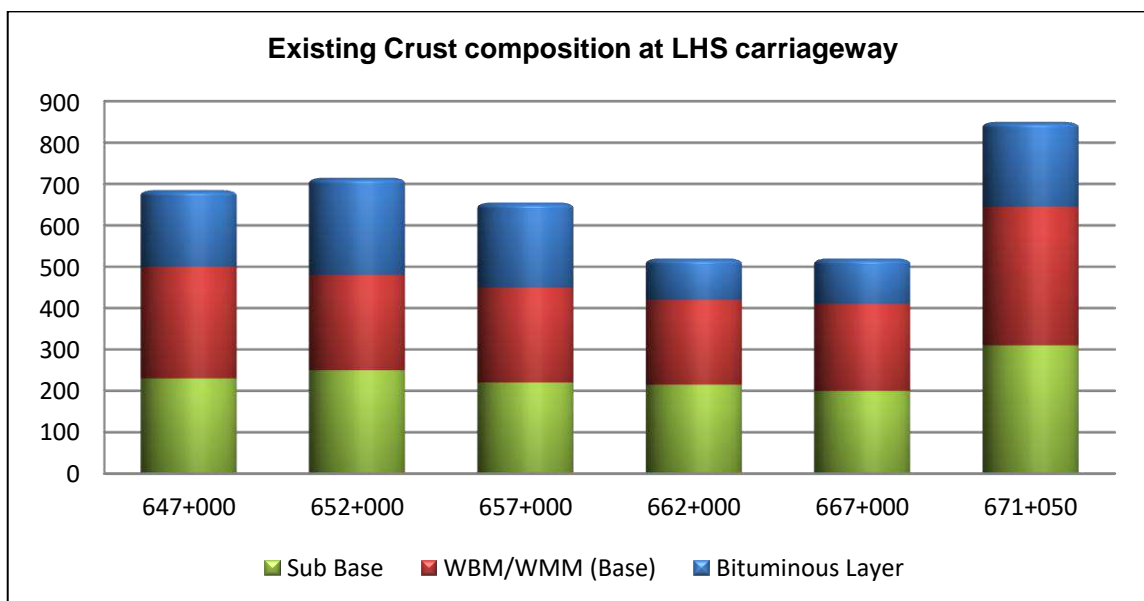
Section	Traffic in year (i.e. 2020)	10 years (i.e. 2030)	20 years (i.e. 2040)	30 years (i.e. 2050)
I : Abu Road – Swaroopganj LHS	9.7	83.0	145.5	213.4
I : Abu Road – Swaroopganj RHS	8.7	74.6	130.5	191.2

As can be observed from the figure above, the cumulative estimated design traffic in LHS is slightly higher to RHS.

6.5. PAVEMENT CRUST COMPOSITION

Pavements are layered structures comprising a combination of materials. These materials, their associated properties, and their interactions determine properties of the resultant pavement. Therefore, a good understanding of these materials, how they are characterized, and how they perform is fundamental for understanding pavement behaviour and deterioration.

Details of existing pavement composition (pavement course, material type, and thickness) were recorded at every 5.0 km interval by measuring thickness of each crust layer in test pit excavated to evaluate the sub-grade strength along the Project Stretch. Core samples of bituminous layers were also extracted from both carriageways.



The average thickness of bituminous layer was observed as 173mm LHS side and 252mm RHS side and granular layer thickness of 485mm in LHS side and 414mm in RHS side.

6.6. PAVEMENT MATERIAL INVESTIGATION

Pavement material investigations were carried out to know the properties of the existing sub-grade, Granular Sub Base (GSB) Wet Mix Macadam (WMM) and Bituminous/Concrete layers. Visual inspection of the existing pavement condition was carried out prior to commencement of material investigation work. The existing subsoil is generally consistent throughout the Project Stretch and is predominantly Silty sand, Silty sand with Clay soil and some of silty sand with low plasticity. Because of this soil type, Liquid Limit (LL) is ranging between 25-34%, and these values are within the limit as per MoRT&H 5th Revision Specifications (<50%). All the measured PI and FSI values are also within the acceptable limits as per

MoRT&H 5th Revision Specifications. Soaked CBR is ranging from 10% to 21% with an average value of 17.82% and DCPT values for Exposed base CBR values varies from 20% to 64.8% with average value of 41.3% and sub grade base CBR value varies from 8.2% to 48.7% with average of 24.3% both direction.

The existing granular layer material was tested for determination of its gradation and all other parameters. Most of the obtained gradations of existing WMM materials are confirming to the specified MoRTH 5th Revision Specifications except two WMM samples which are slightly coarser on 53 mm and 11.2 mm sieves. The GSB materials tested are conforming to Grade I /II/III of granular Sub-base as per Table 400-1 of MORT&H 5th Revision Specifications.

The existing bituminous layer material was also tested for determination of its gradation and its bitumen content (%). And the existing concrete layer material is also tested for compressive strength (N/mm²) and details are presented in chapter -4 of this report and Annexure.

6.7. ANALYSIS OF PAVEMENT CONDITION DATA – STRUCTURAL CONDITION OF PAVEMENT

Structural Condition of pavement has been evaluated using Falling Weight Deflectometer (FWD) and subsequent analysis was carried out to ascertain the relative performance of the pavement for entire Project Stretch, in the context of evaluating its residual life, overlay and other maintenance requirements.

The results are provided at below table:

Side	Initial Kilometric Point (Km)	Final Kilometric Point (Km)	Average Deflection (mm/100)	Characteristic deflection (mm/100)
LHS	646+000	650+000	22	35
LHS	650+000	655+000	20	32
LHS	655+000	660+000	22	33
LHS	660+000	665+000	25	36
LHS	665+000	670+000	23	32
LHS	670+000	675+000	24	34
LHS	675+000	677+000	25	35
RHS	677+000	675+000	21	35
RHS	675+000	670+000	23	36
RHS	670+000	665+000	14	27
RHS	665+000	660+000	19	32
RHS	660+000	655+000	19	32
RHS	655+000	650+000	20	34
RHS	650+000	646+000	20	33

6.8. MATERIAL TESTING

Field testing on the pavement materials were done as well as samples were collected and brought to laboratory for further testing on various layers i.e. sub-grade, granular sub base, wet mix macadam and bituminous mixes and results are tabulated below.

SUBGRADE SOIL:

Chainage 646+000 to 677+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	FSI [IS :2720-Pt- 40]	Max. Dry density (gm/cc)	OMC (%)	Soaked CBR at 3 energy level	Unsoaked CBR at 3 energy level
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Maximum	34.00	21.00	14.00	12.00	2.12	11.00	21.00	31.00
Minimum	25.00	20.00	5.00	6.23	2.02	8.00	10.00	13.00
Average	27.64	20.11	8.00	9.81	2.08	9.59	17.82	24.09

GRANULAR SUB BASE:

Chainage 646+000 to 677+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. Dry density (gm/cc)	OMC (%)	CBR Value at 98 % dry density (Soaked) %	Specific Gravity
Maximum	24.00	Nil	NP	2.21	7.00	39.00	2.80
Minimum	22.00	Nil	NP	2.16	6.00	32.00	2.72
Average	23.09	Nil	NP	2.19	6.64	35.00	2.76

BITUMINOUS MIXES:

Two types of mixes compose basically the bituminous layers of the highway:

- **BITUMINOUS CONCRETE (BC):** BC is a Dense Graded Bituminous Mix used as Wearing Course for roads with intense traffic. BC Mix consists of Coarse Aggregates, Fine Aggregates, Filler and Binder blended as per Marshall Mix Design.
- **DENSE BITUMINOUS MACADAM (DBM):** DBM is a Closely Graded Mix used as a binder course for pavements subjected to heavy traffic.

Subsequent review and analysis of the collected data analysis was carried out by using KGP back application. IRC: 115-2014 and IRC:37-2012 procedures were used as reference and guideline to ascertain the relative performance of the pavement for all Project Stretches, in the context of evaluating residual life, overlay and other maintenance requirements.

Back calculated elastic modulus values have been obtained and tabulated below:

Layer	Condition	Modulus Range	Length in km	
			LHS	RHS
Bituminous	Good	More than 3000	-	-
	Fair	3000 - 750	31.00	31.00
	Poor	Less than 750	-	-
Granular	Good	More than 500	-	-
	Fair	500 - 100	31.00	31.00
	Poor	Less than 100	-	-
Subgrade	Good	More than 298	-	-
	Fair	75 - 298	15.00	31.00
	Poor	Less than 75	16.00	-

The in-service three-layer pavement system has been analysed with the back-calculated corrected layer moduli and layer thicknesses. The critical strains have been calculated by IITPAVE program. From the performance criteria equations, the residual/remaining rutting and fatigue life have been estimated.

6.9. DETERMINATION OF MAINTENANCE REQUIREMENT

Based on the pavement investigation survey results (Surface Distress, Riding Quality, Material Investigations and Structural Condition), the sections along the Project Stretch were identified for overlay requirement and routine maintenance requirement, if any. The sections have been rated based on four criteria, namely PCI, Roughness, Rutting and Remaining Life (based on FWD).

The limits and ranges for each criterion are mentioned in table below as per AASHTO.

Ratings	PCI	Roughness index	Rut Depth	Remaining life of Pavement
Good	>70	<2000	<5	>Design life for 10 years
Average	40-70	2000 - 3000	5-10	
Poor	<40	>3000	>10	<Design life for 10 years

In order to show current pavement conditions, the following figure shows the sections were have been marked with the appropriate colours based on the distress values for entire Project Stretch.

Ratings	Remaining life of pavement	Roughness (BI) [mm/km]	Rutting [mm]	Pavement Condition Index (PCI)
Good	>10	<2000	<5	>70
Average		2000-3000	5-10	40-70
Poor	<10	>3000	>10	<40

LHS	Overall																															
	R-life																															
	Roughness																															
	Rutting																															
	PCI																															
Outer	R-life																															
	Roughness																															
	Rutting																															
	PCI																															
Inner	R-life																															
	Roughness																															
	Rutting																															
	PCI																															
Chainage		646+990	647+990	648+990	649+990	650+990	651+990	652+990	653+990	654+990	655+990	656+990	657+990	658+990	659+990	660+990	661+990	662+990	663+990	664+990	665+990	666+990	667+990	668+990	669+990	670+990	671+990	672+990	673+990	674+990	675+990	676+790
Inner	R-life																															
	Roughness																															
	Rutting																															
	PCI																															
Outer	R-life																															
	Roughness																															
	Rutting																															
	PCI																															
RHS	Overall																															

6.10. MAINTENANCE PLAN

The AAHSTO-HDM analysis results show that:

- Both for LHS and RHS structural and functional overlays have been established to be attended according to NHAI BOT annuity contract (Operation and Maintenance) and to be completed by 2024.
- Both for LHS and RHS, periodic renewal at every 6th years on 2030, 2036 and 2042, 40mm BC overlay in the whole stretch have been established, except the thickness for service/slip roads overlay of 30mm have been established due to functional reasons.
- Some patching works are required due to expected cracking in 2023, 2024, 2025, 2032, 2038, 2039, 2045 and 2046.

Since the project stretch is under the maintenance responsibility of present BOT (annuity) concessionaire up to 2024 recommendations have been made basis on that the present concessionaire has to be maintained the stretch as per their contract agreement and perform periodical maintenance works on their last renewal cycle i.e 2024 expiry of concession period.

7. REVIEW OF STRUCTURES

One of the objectives of this assignment was to carry out inventory of all the existing structures, condition surveys for all the highway structures and also to analyse their condition and propose defect rehabilitation if require. There are total of 75 structures along the Project Stretch, out of which, there are 2 Major Bridges, 8 Minor Bridges, 1 ROB, 6 VUPs, 49 Box Culverts, 2 Slab Culverts and 07 Pipe Culverts.

S No.	Type of Structure	Nos.
1	Box Culvert	49
2	Slab Culvert	02
3	Pipe Culvert	07
4	Major Bridge	2
5	Minor bridge	8
6	Vehicular Underpass	6
8	Road Over Bridge	1
9	Flyover	0
10	Tunnel	0
Total		75

Visual inspections and condition surveys were carried out as per IRC: SP:35 on all structures in the Project Stretch. For all non-accessible structures, Mobile Bridge Inspection Unit (MBIU) was used during inventory and condition surveys.

For structures identified to be in a distressed condition based on the visual survey, supplementary testing was carried out as per IRC SP:35 and IRC SP:40. However, selection of particular test or particular element of structure was made based on specific requirement of the structure. The following NDT were conducted to analyse the distresses on major bridge only.

- Rebound Hammer Test (RHT)
- Ultrasonic Pulse Velocity test (UPV)
- Carbonation test

Following are locations of NDT test conducted on the Major Bridge along the Project Stretch:

S.No	Str. No.	Chainage	Type of Structure	Side	Pier	No. of samples			Remarks
						UPV	RHT	Carbonation	
1	653/3	652+745	Major Bridge	LHS	II	2	2	-	Overall structure is in good condition.
2	659/3	658+475	Major Bridge	LHS	III Central	2	1	3	UPV reading is doubtful. Rebound hammer gives strength of 26 MPa and below. The strength of the span appears to be low. Pressure Grouting is recommended to achieve proper strength.
					III	1	2	1	UPV reading is doubtful. Rebound hammer gives strength of 21 MPa and below. The strength of the span appears to be low. Pressure Grouting is recommended to achieve proper strength.

After reviewing the condition survey and supplementary test results obtained from NDT, suitable repair and rehabilitation measures have been proposed.

As per condition survey findings it is evident that most of the structures are in good condition except one major bridge at km 658+475 where Pressure Grouting is recommended to achieve proper strength.

BOQ has been prepared for routine maintenance viz. greasing of bearings, expansion joint cleaning and repairs, cleaning of drainage ducts, repair of parapet walls and crash barriers and repair of pitching and accidental damages.

8. ROAD SAFETY ASSESMENT AND IDENTIFICATION OF IMPROVEMENT STRATEGIES

Road Safety Audit (RSA) along the Project Stretch Abu Road-Swaroopganj (Chainage Km 646.000 to Km 677.000) of total length 31 Km was carried out in order to:

- Identify issues related to Road Safety along the Project Stretch.
- Improvement Proposals for identified issues/locations along the Project Stretch.

8.1. PROVISION OF ATMS

The following Specifications and Standards shall be applied in addition to 'Manual on Specifications and Standards for Highways' published as IRC: SP: 99-2013 with all amendments and additions till date. Provision of ATMS in latest NHA policy in vogue (currently, NHA Policy Circular-Technical (214/2016) dt.15.09.2016 is being practiced which may be amended in due course of time) will govern the implementation. Latest Policy / Circular at the time of execution shall prevail.

The ATMS implementation shall cover design, supply, installation, commissioning and operation and maintenance of Advanced Traffic Management Systems.

The system would include out-door equipment including emergency call boxes, variable message sign systems, vehicle actuated speed system, meteorological data system, close circuit TV camera (CCTV) system, traffic counting and classification system, mobile radio communication system and transmission system. The indoor equipment would comprise a large display board, central computer (with Network Management System – NMS), CCTV monitor system, call centre system or management of emergency call boxes housed in a control centre with uninterrupted power supply. The systems shall meet following objectives:

- Smooth and uninterrupted traffic flow
- Enhance road safety
- Real time information and guidance to users
- Emergency assistance round the clock
- Alerts for abnormal road and weather conditions
- Reduced journey time and inconvenience

8.2. ACCIDENT DATA ANALYSIS & SUMMARY OF SAFETY RECOMMENDATIONS

The first task of the team was to collect and review the available Accident data from the accidents that have occurred in this highway stretch. The analysis of accident data can help to identify patterns that could be linked to safety deficiencies on the road. The accident data for the last year in the Project Stretch is given in Table.

Accident Summary for April 2018- March 2020 Undavariya Toll						
Month	Total Accidents Nos	Fatal Accident Nos	Major Nos	Minor Nos	Severity Index	No. of Persons Injured per 100 accidents
April	3	0	2	1	0.00	100
May	11	0	4	7	0.00	100
June	3	0	1	2	0.00	100
July	4	0	2	2	0.00	100
August	5	1	2	2	20.00	80
September	6	0	3	3	0.00	100
October	2	1	0	1	50.00	50
November	6	1	1	4	16.67	83.33
December	1	0	1	0	0.00	100
January	1	0	0	1	0.00	100
February	3	0	2	1	0.00	100
March	2	0	2	0	0.00	100
Total	47	3	20	24	7.22	93

Based on the Road Safety Audit conducted at site the following is recommend:

S.No	Safety issue	Discriptionof safety issue	Proposed safety improvements
1	Safety Issues on Junctions along the Project Stretch	There are a total of 33 junctions on this highway project (Abu Road-Swaroopganj) which require an improvement. These junctions can be classified as T- junctions, Y- junctions and Cross junctions.	Junctions, Rumble strips, stop line marking and Stop Signage, Channelizing island, and acceleration and deceleration lanes are required. In 10 nos. Junctions, acceleration and deceleration lanes are required.
2	Deficiencies in Safety Barriers	800m Slide Risk of Stone or Impact risk along Project road 3950m High embankment along the Project road.	W-Beam Barrier is required. Safety barriers as per provision in IRC SP 84-2019& IRC 119-2015.
3	U-Turn – Median opening	2 improper median along the Project road. One unnecessary median cut along Project road.	At location 657+300 a Median cut is on curve and should be closed. Improper median needs improvement. At location 649+100 Bus Stand /Built up area. Median opening should be provided
4	Unauthorised Ramps/Accesses along the Project Stretch	Unauthorised ramps were observed along the project stretch at places where the majority of farmers' access to their fields and un-paved road have been developed. Most of the unauthorised ramps were thus leading towards agricultural fields, local residences, roadside restaurants, etc	A properly designed T or Y-Junction might be recommended for those ramps which lead to small habitations and groups of agriculture fields where the number and type of vehicles can justify their cost. Also, some of those ramps should be closed if alternatives are identified to access to and from the highway.
5	Improper Pedestrian Crossing along the Project Stretch	It is observed that required pedestrian crossing facilities have not been provided and in the absence of these, the local population devise their own unauthorized ways to cross the highway affecting the safety of road users and their own safety.	According to IRC SP 88-2010 controlled form of crossing in populated areas nearby and along the highway shall be achieved through provision of Zebra Crossings, whether at signalized intersection or pedestrian actuated signal. When located appropriately and used correctly, these crossings can be effective in reducing pedestrian-vehicular traffic conflicts.
6	Current Situation of Truck lay-byes, Bus bays and Bus Stops along the Project Stretch	Built Up area Both side Hotel's	According to IRC:SP 84 2019 proposed truck lay bye and bus bay proposed to following location: 656+800 Truck lay bye and 657+050 location bus bay.
7	ProvisiónofServiceRoads	Service road is necessary in built up area to segregate slow and fast moving vehicles. It is also required to achieve an easy access to the highway.	4560m service road required in built up area along the Project road.

9. TOLL PLAZA

Toll Plaza on this project stretch is located near Undavariya village at Km 670+750. Aerial view of the Toll Plaza is given below. Aerial View of these toll plazas is given below:



- Today, this toll plaza does not require on urgent basis any extra lanes to accommodate current traffic, but as per NHAI guidelines, the minimum number of toll lanes must be six in each direction (total 12), therefore two lanes in each direction (total 4) are required to be added. This number of lanes will manage traffic demand with appropriate service level for the next 20 years. The location of the toll plaza is suitable to accommodate extra lanes and all other required facilities for its expansion.
- It is recommended that for the 12 lanes of the plaza, 10 remain ETC dedicated, and the 2 center lanes (1+1) to be reversible.
- Since overloading of vehicles has been identified as a major problem of road failures it is recommended that separate space for unloading and storage of goods from overloaded vehicles should be provided.

10. COSTS ESTIMATES

The Project cost estimates have been prepared based on various items of works required such as

- Toll Plaza
- Intersections improvements
- Traffic Signs & Markings
- Service Roads/Service Lane
- New proposed structures (VUP/LVUP/ROB/Other Structures)
- Bus bays & Truck Lay Bays
- ATMS& TMS

Provision of granular sub-base and WMM base courses has been considered for the service roads, Truck lay bays, Bus bays, Toll plaza. Provision of 'bituminous courses', has been considered of DBM and Bituminous Concrete for service roads, Overlaying in carriageway, pavement for Truck Terminals, Bus bays and provision of Cement Concrete pavement for Toll plaza lanes. Repair and Rehabilitations of existing culverts, bridges & other structures is also proposed base on the NDT Tests and Inventory of the structures.

*Initial minor Operation & Maintenance of Pavement / Structures/Road Appurtenance/Road markings etc. Should be taken up by Authority and should be completed in all respect at the time of handover to InvIT Concessionaire.

Table A (Work to be taken up as proposed by Authority)		
S No	Item	Remark
1	Repair of Flexible Pavement by filling of pot holes	All the works shall be completed by Authority prior handing over to InvIT Concessionaire.
2	Jungle Clearance in ROW including Shoulders & Slops	
3	Cleaning of Road Surface	
4	Cleaning/ clearing of all the culverts	
5	Cleaning of Lined/ Unlined drains	
6	Placement of Road Furniture, wherever required	
7	Road Marking including Centreline/ Edge line/ Kerb line, Painting of mile stone & Crash Barrier etc.	
8	Replacement of W-Beam/ RCC Crash Barrier	
9	Repair and Rehabilitation of Major Bridge pressure Grouting is recommended at one major bridge to achieve proper strength	
10	Providing missing cats eyes	
11	Installation of missing/ damages delineators/ roadway indicators	
12	Providing & Fixing of missing Retro-reflective stickers	
13	Providing missing Solar Blinkers at median openings	
14	Maintenance of damaged kerb/ drains	
15	Maintenance of Street Lights	
16	Filling of expansion joints	
17	Repair of Parapet walls, Protection Walls	

Initial Cost for Engineering and Safety Improvements for Base year 2020-2021:

Abu road - Swaroopganj Section (from km 646+000 to km 677+000) of NH-27 in the State of Rajasthan			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	BT Works	53264145	5.33
2	Toll Plaza	52830702	5.28
3	Intersections Improvements	30730107	3.07
4	Miscellaneous Items	124939563	12.49
5	Service Roads/Service Lanes	81502562	8.15
6	Bus/ Truck Lay Bays	8035550	0.80
7	Culvert	8245442	0.82
9	ATMS & TMS	149577258	14.96
	Total	509125330	50.91

Abu road - Swaroopganj Section (from km 646+000 to km 677+000) of NH-27 in the State of Rajasthan			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
	Escalation @ 5% per Annum for 1 year	25456266	
	Total Amount with Escalation	534581596	
	Contingency Charges @ 5.0 %	26729080	
	Total Amount	561310676	56.13

Operation and Maintenance Cost for Base year 2020-2021:

The Project Operation and Maintenance cost estimates have been prepared based on various circulars and analysis:

- Routine Maintenance for BT works at MCW consider as @ 7lacs/km/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 $7 \times 1.05^{10} = 11.40$ lacs/km/year) circular NHAI/11033/CGM(Fin)/2011
- Routine Maintenance for BT works at Service/Slip roads consider as 60% of @ 7lacs/km/year for 2010-2011
- Equipment Based Survey Works (Annual/Periodic as per Maintenance Schedule) based on market rate
- Contingency @ 3 %
- Toll Plaza operation and maintenance charges @ 32.5 lacs/lane/year
- System Integrator maintenance charges @ 5.04 lacs/lane/year
- Electricity & Patrolling expenses @ 2.03 lacs/km/year
- Additional RPV(Route patrolling vehicle) for state police department and Ambulance services for state government health authority to be provided
- The ATMS systems shall cover design, supply, installation, commissioning and operation and maintenance including charges for electricity to be provided
- SPV charges or Other Office expenses @ 407 lacs/year
- Insurance cost
- And GST @ 12% on all above item has been added in total Operation and Maintenance cost

FOR PERIODIC MAINTENANCE WORKS:

- Periodic maintenance works for main carriageway and service road is proposed as per MoRTH circular (RW/NH-33044/10/2022-S&R dated 21-August-2018)
- Periodic renewal is proposed at every 6th year after completion of existing annuity period i.e 2024. For Main carriageway 40mm BC and for Service/Slip roads/bus bays/ truck lay bay/junction etc. 30mm BC is proposed for every successive renewal period.

Total Operation and Maintenance cost for (30 Years)	
Particular	Str-1
Routine Maintenance	108.09
Toll Plaza Operation and Maintenance	151.37
Electricity & Patrolling expenses	43.18

Total Operation and Maintenance cost for (30 Years)	
Other office expenses	132.35
Insurance	24.38
GST @ 12%	55.12
Total Routine Maintenance cost	514.48
Major/Periodic Maintenance :- (Cycles)	
Ist2029-2030	29.51
IIInd2035-2036	29.51
III rd2041-2042	32.34
Construction Period for 2 Years from (2044-2046) DLP Period 5 years from(2046-2051)	

NHAI may require the capacity augmentation of the Project Stretch to 6/8-lane configuration in case the average daily traffic of PCUs in any accounting year exceeds the designed capacity of 40,000 PCUs (Target Traffic) for Project Stretch and continues to exceed the designed capacity for three consecutive accounting years. In this case, traffic is estimated to reach the 40,000 PCUs in 2030 and in years 2032 and 2033 the traffic also exceeds the target of 40,000 PCU. Consequently, it can be assumed that during 2030-2042 the Authority may undertake or cause to undertake the preparation of DPR for capacity augmentation (widening to 6-lane configuration) and the subsequent Tender for construction works. The construction period for capacity augmentation can be assumed to be 2.0 years.

The Authority could undertake the process for capacity augmentation of this project stretch at any time from 2030 to 2042, when the level of service C is reached.

It should be noted that this project stretch remains under a BOT (Annuity) contract that terminates on 2024, therefore, this issue should be closely monitored by Authority.

Capacity Augmentation Cost: Based on Year 2020-2021:

Abu road - Swaroopganj Section (from km 646.000 to km 677.00) of NH-27 in the State of Rajasthan)			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Bituminous Courses Overlay	391019244.00	39.10
2	Clearing and Grubbing	26445.53	0.003
3	Road Widening 4 Lane to 6 Lane	1097068992.40	109.71
4	Widening of Structure	291130620.00	29.11
5	Repair & Rehabilitation of Existing Structure	12802665.07	1.28
6	Toll Plaza	36126275.08	3.61
7	Intersections Improvements	147885716.59	14.79
8	Miscellaneous Items	401825005.10	40.18
9	Service Roads	74712537.44	7.47

10	Structure Approaches	377598921.27	37.76
11	Bus/ Truck Lay Bays	39096321.83	3.91
12	Drain	118061579.86	11.81
13	Land Scaping and Tree Plantation	4609589.00	0.46
14	ATMS & TMS	275827853.91	27.58
	Total	3267791767.08	326.78
	Escalation @ 5% per Annum for 1 year	163389588.35	
	Total Amount	3431181355.43	343.12
	Cost for Capacity Augmentation	3431181355	343.12

All cost are mentioned in this report are based on year 2020. And the cost for Major Maintenance Work /Routine maintenance and Operational maintenance works would be escalated for their consecutive appearance years on the basis of Price index.

Note:-

Detailed investigations have been conducted in year 2018. From 2018 to 2020 Authority has taken up below mentioned major maintenance works. However, considering these major maintenance works, improvement proposals i.e. Initial Maintenance Cost has been taken accordingly and final estimate/BOQ is prepared.

Since only 40mm BC in overlay was laid by Concessionaire, therefore using IITPAVE considering 40mm BC, residual life for design MSA was calculated again for which 40mm bituminous concrete can sustain for next 5 years i.e 2024. Afterwards major maintenance is again required to maintain the structural strength of existing flexible stretch. Then, a successive periodical maintenance for every 6th year is recommended.

S No	Description	Remark
1	Renewal by BC overlay 40 mm thickness without milling in entire stretch full carriageway width.	Executed in August 2019

1. INTRODUCTION

National Highways Authority of India (NHAI), an autonomous agency of the Government of India (GoI), is responsible for the development, maintenance and management of National highways network in India.

There are currently approximately 1,32,500 kilometers of national highways in India, constituting approximately 2.2% of India's entire road network but carrying approximately 40% of total road traffic.

To meet the growing need for further industrialization and development of the country, GoI has planned to expand the network of National Highways across the length and width of the country at a rapid pace. The various programmes which have been taken by GoI through NHAI are:

Phase I: Golden Quadrilateral (GQ) Comprising 4/6-laning of National Highways connecting four metro cities, namely, Delhi, Mumbai, Chennai and Kolkata with a total length of approximately 5846 km (which is mostly complete), and

Phase II: North-South and East-West Corridors (NSEW) comprising 4/6-laning of National Highways connecting Srinagar to Kanyakumari and Silchar to Porbandar. Total length this NSEW corridor is approximately 7300 km. The projects of NSEW are mostly awarded and construction is also largely complete.

Bharatmala Pariyojana: A flagship highway development programme which envisions the development of 50 economic corridors, provide connectivity to 550 districts in the country through National Highway linkages and improve the average speed of road travel in India.

In addition to this, various NHDP programs have been taken up by NHAI to match the rapid pace of modernization and industrial development of the country. The Government has planned to continue developing the National Highways at a rapid pace, which will require significant funding in the near future.

The National Highways Authority of India (NHAI) has initiated the process of setting up an infrastructure investment trust (InvIT) to monetize its road assets. This will be a private listed InvIT, through which institutional investors may invest in operational road projects offered by NHAI to the InvIT. In this model, the offered road assets are acquired by the InvIT while the investors acquire the units issued by the InvIT. Income generated from the underlying road assets would be paid out as distributions to the unit holders in the form of interest, dividend and return of capital. The InvIT would be managed by a competent Investment Manager staffed with experts to manage the assets efficiently.

Under the InvIT frame work, the right of collection of user fees of selected NH projects is proposed to be assigned for a specific time period to a Concessionaire. During this period, the O&M responsibility will also vest with the selected Concessionaire (unless costs are to be borne by existing concessionaires as per extant agreements). In return, the Concessionaire will pay an upfront quoted Concession Fee to NHAI.

The following 5 stretches which shall be awarded on InvIT model:

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
1	Abu Road - Swaroopganj	31.000	Undavariya	646.000	677.000
2	Chittorgarh - Kota & Chittorgarh Bypass	160.500	Bassi	891.929	1052.429
			Aroli		
			Dhaneshwar		
3	Palanpur / Khemana - Abu Road	45.000	Khemana	601.000	646.000

Start & End Kms details & Tollable Length by Toll Plaza for Roads Under InvIT					
S. No.	Name of Section	Total Length	Toll Plaza	Start Kms	End Kms
4	Kothakota Bypass - Kurnool	74.622	Pullur	135.469	211.000
5	Maharashtra Karnataka Border - Belgaum	77.705	Hattargi Kognoli	515.000	592.705

Table 1. List of Roads under InvIT

Accordingly detailed reports on inventory & physical condition have been carried out for all stretches including a study of improvement proposals.

Below general details of Abu road - Swaroopganj is presented.

1.1. GENERAL

Project Stretch starts from km 646.000 of NH-27 at Abu Road and ends at km 677.000 of NH-27 at Swaroopganj in the State of Rajasthan. The length of Project Stretch is 31.000 km and has 4-lane configuration with toll plaza at Undavariya. Alignment of Project Stretch is presented in Figure 1.

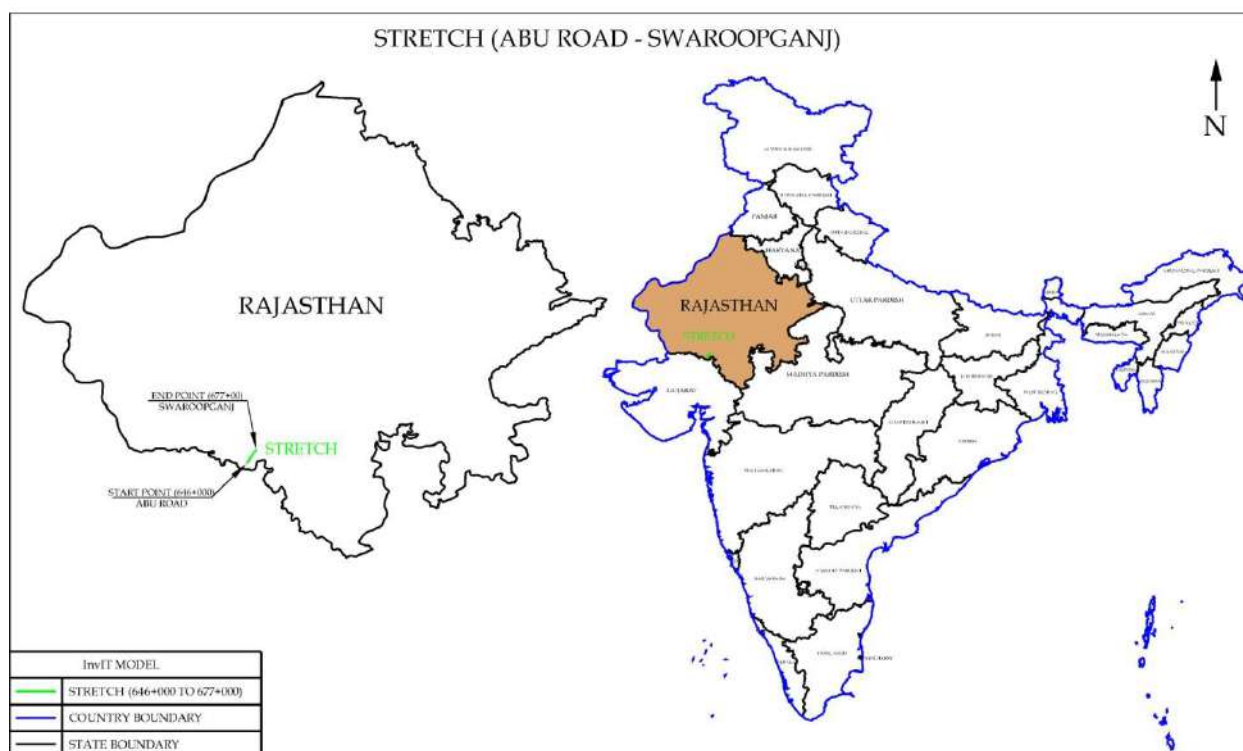


Figure 1. Alignment Map

Various investigations were carried out for assessing the physical condition of the Project Stretch. List of all investigations carried out are tabulated below.

Stretch - 1 (Abu Road - Swaroopganj)			
S.No	Type of Investigations		Location
1	Traffic Surveys	TVC Survey	UndavariyaToll Plaza
		OD Survey	
		Axle Load Survey	
2	Topographical Survey through LiDAR		Entire Stretch
3	NSV		Entire Stretch
4	FWD		Locations are mentioned in Ch. 4
5	Pavement	Test Pits	Locations are mentioned in Ch. 4
	Material Testing	Core Cutting	Locations are mentioned in Ch. 4
		DCPT	Locations are mentioned in Ch. 4
		Borrow Area Inventory	Locations are mentioned in Ch. 8
6	Structural Investigations	Visual Inspection	All Structures
		NDT	Distressed structures cited in Ch. 5
7	Road Safety Audit		Entire Stretch
8	Toll Plaza Audit		UndavariyaToll Plaza

Table 2. Detail list of Survey

Existing inventory of features of Project Stretch is captured through NSV, LiDAR and field reconnaissance survey. Features like built-up settlements, carriageway dimensions, service roads, junctions, road furniture etc. are recorded for entire Project Stretch. The highway inventory is linked to the existing kilometre posts established along the Project Stretch. Detailed inventory including an overview of the Project Stretch is presented in this chapter.

1.1.1. START AND END POINT

All details of Project Stretch are given below.

Road No	Chainage in Km		Description of Road	Easting	Northing	Length (Km)
	From	To		Start & End Point	Start & End Point	
Stretch-1	646+000	677+000	Abu Road - Swaroopganj	72°47'9.73"E	24°28'1.84"N	31.000
				72°56'15.28"E	24°35'48.29"N	

Table 3. Detail list of Survey Dates

1.1.2. INVENTORY

While inventory is captured chainage-wise with their existing physical condition, an overview of all inventories is presented in table below for quick reference.

S.No.	Description	Details
1	Project Stretch	Abu Road - Swaroopganj

S.No.	Description	Details	
2	Length of Project Stretch (in km)	31.000 km	
3	Road Type (length in km)	BT	31.000 km
		CC	-
4	Length of Urban Section (in km)	6.000 Km	
5	Length of Slip/Service Road (in km)	LHS	7.10 km
		RHS	9.90 km
6	No. of Bypasses	01	
7	No. of Major Junctions	05	
8	No. of Minor Junctions	28	
9	No. of Major Bridges	02	
10	No. of Minor Bridges	08	
11	Culverts	68	
	No. of Slab Culverts	02	
	No. of Pipe Culverts	07	
	No. of Box Culverts	49	
12	No. of Flyovers	Nil	
13	No. of ROBs	01	
14	No. of Tunnels	Nil	
15	No. of RUBs	Nil	
16	No. of Vehicular Underpasses	06	
17	No. of Pedestrian Cattle Underpasses	Nil	
18	No. of Toll Plazas	01	
19	No. of Bus Bays	RHS-08 & LHS-08	
20	No. of Truck Lay Bays	Nil	
21	No. of Toilet Blocks	RHS-01 & LHS-01	
22	No. of Way Side Amenities	Nil	

Table 4. Inventory on Project Stretch

Soft copy of full inventory is provided as complementary data.

1.2. OBJECTIVE OF STUDY & SCOPE OF WORK

General Scope of Services shall cover but be not limited to the following major tasks:

- Review of all available reports and published information about the project road and the project influence area;
- Detailed reconnaissance;
- Traffic studies including traffic surveys and Axle load survey and demand forecasting for next thirty years;
- Inventory and condition surveys for road and highway assets;

- Inventory and condition surveys for bridges, cross-drainage structures, other Structures, river training/Protection works and drainage provisions;
- Pavement investigations;
- Sub-grade characteristics and strength: investigation of required sub-grade and sub-soil characteristics and strength for road and embankment design and sub soil investigation;
- Identification of sources of construction materials;
- Provide all inputs required for financial analyses;
- Contract packaging and implementation schedule with regard to Facilities/works that are to be executed in specified contract period;
- Strip plan indicating the predominant features of the project corridor, location of all existing utility services (both over- and underground) and the scheme for their relocation;
- Design for up gradation of toll plaza and identification of their numbers and location and office cum residential complex.

1.2.1. REVIEW OF DATA AND DOCUMENTS

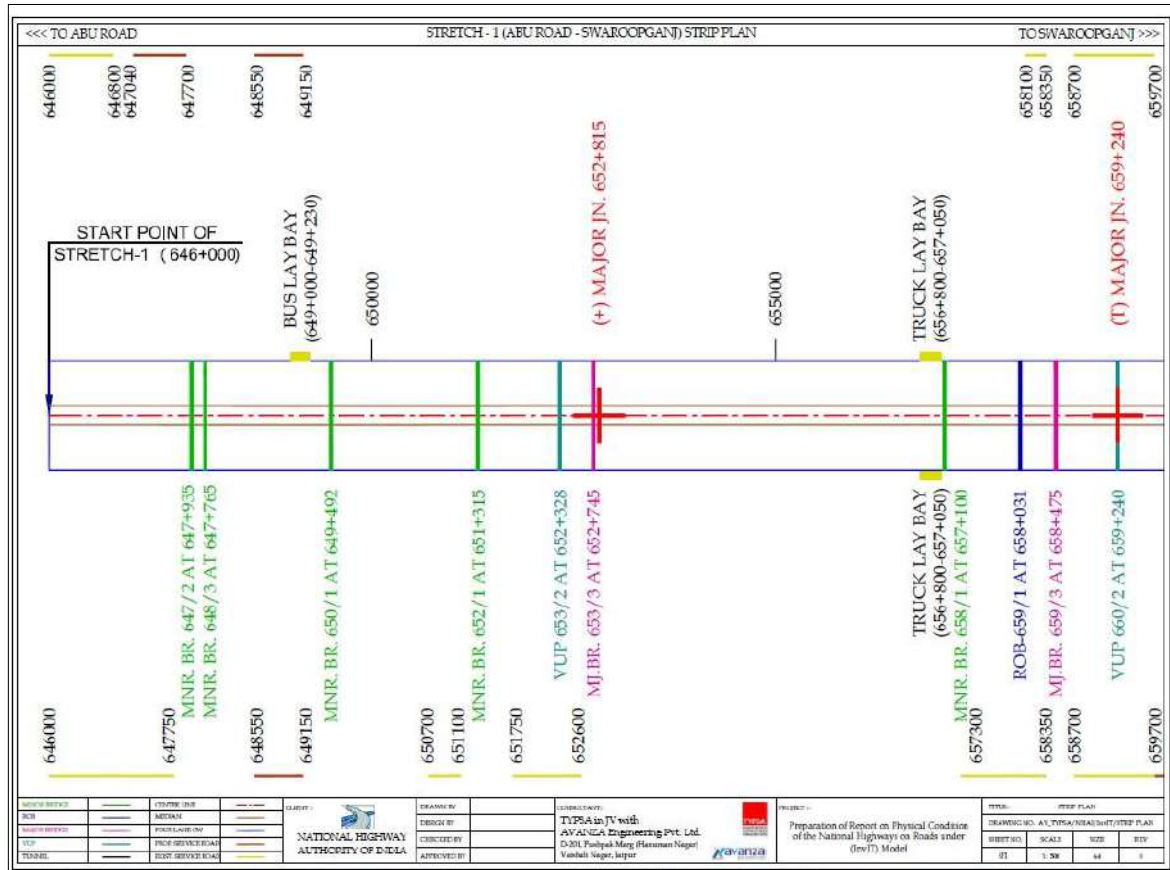
- Project Report based on which the execution work was carried out;
- Deviations from the design during execution (based on the-then site conditions);
- As-Built drawings of the executed works;
- Road inventory;
- Road condition, year of original construction, year and type of major maintenance/rehabilitation works(maintenance history);
- Condition of bridges and cross-drainage structures;
- Sub-surface and geo-technical data for existing bridges;
- Hydrological data, drawings and details of existing bridges;
- Existing geological maps, catchment area maps, contour plans etc. for the project area;
- Condition of existing river bank / protection works, if any;
- Details of sanctioned / on-going works on the stretch sanctioned by NHAI/other agencies for Tie-in purposes;
- Survey and evaluation of locally available construction materials;
- Historical data on classified traffic volume (preferably for 5 years or more);
- Type and location of existing utility services (e.g. Fiber Optical Cable, O/H and U/G Electric, telephone line, Water mains, Sewer, Trees etc.).

12.2 TEAM COMPOSITION

- Team Leader
- Senior Highway Engineer
- Pavement Design Expert
- Senior Bridge Engineer
- Traffic and Transportation Expert
- HDM Expert
- Highway Rehabilitation Expert
- Sr. Geotechnical Expert
- Sr. Tolling Systems Expert
- Sr. Financial & Costing Analysis Expert
- Quantity Surveyor
- GIS Executive
- Sr. CAD Engineer
- Sr. CAD Draftsman

- Sr. Surveyor

1.3. STRETCH STRIP KEY MAP



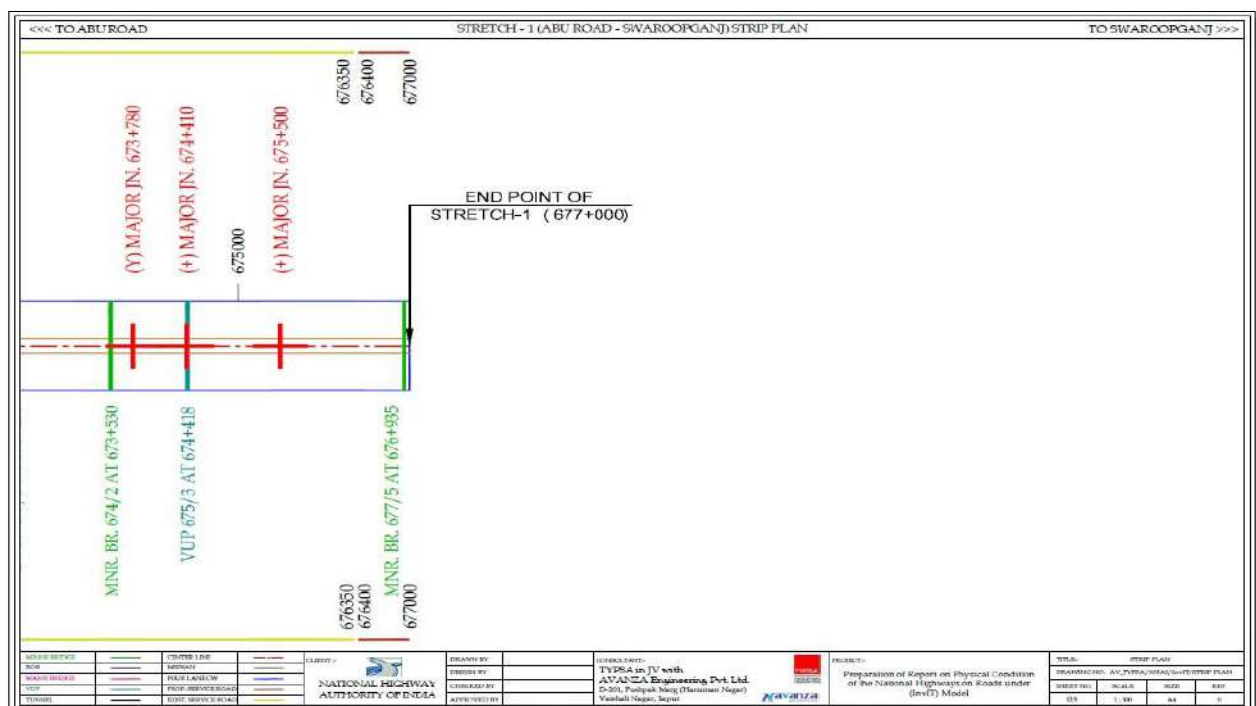
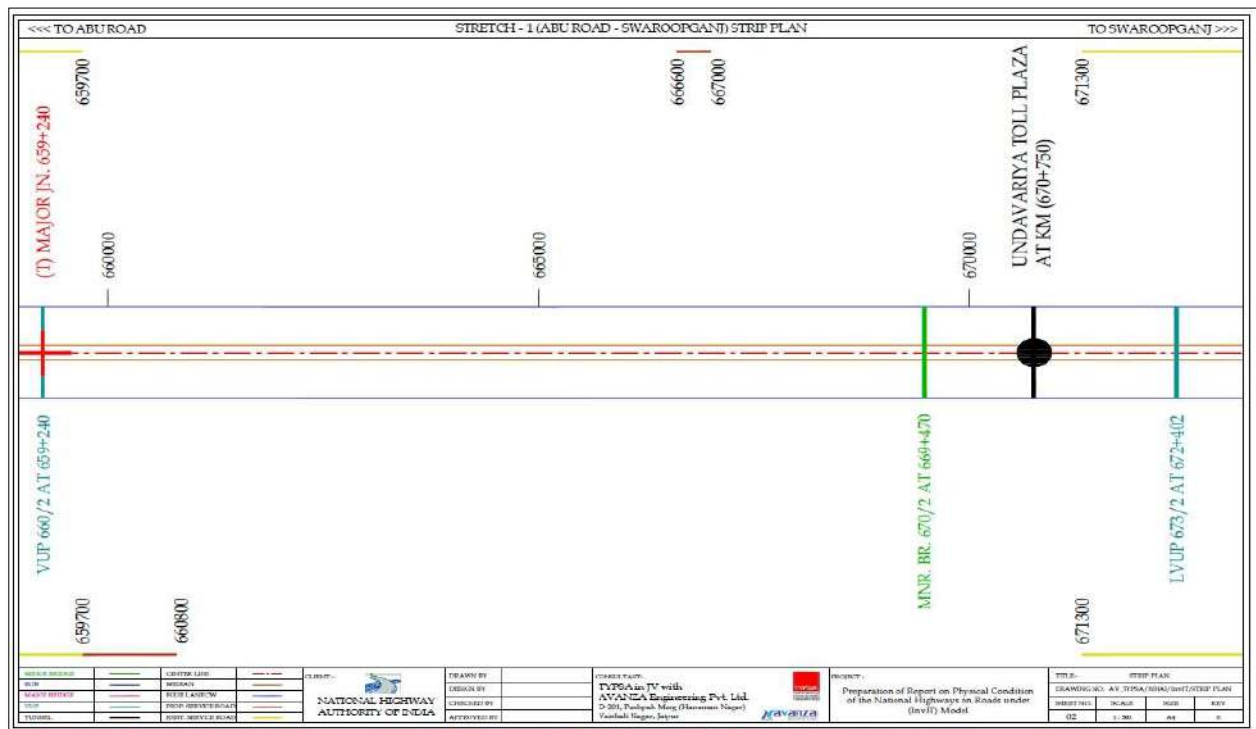


Figure 2. Stretch Strip key map

1.4. DESCRIPTION OF THE PROJECT

Project Stretch starts from km 646.000 of NH27 at Abu road and ends at km 677.000 of NH27 at Swaroopganj in the State of Rajasthan. The length of Project Stretch is 31.00 km and has 4-lane configuration with toll plaza at Undavariya. This stretch has been constructed under BOT (Annuity) by L&T Construction and Toll is being collected by Toll Collection Agency appointed by NHAI through open competitive bidding. Last Annuity payment is due on 28.03.2024.

The project road was initially part of NH14 (old no.). All national highways have been renumbered in recent past and now the project stretch is part of NH-27 Starting from Porbandar in Gujarat and ending at Silchar in Assam. The corresponding start and end chainages have become km 646.000 and km 677.000 of NH27 and revised location of toll plaza at Undavariya is now at km 670+750 (new chainage).

DFCC: The construction of Mumbai-Delhi Railway Freight Corridor runs parallel to this stretch and is being constructed at present. It is expected to be operational by year 2025. Due to this corridor operation, a partial reduction in the traffic of heavy commercial vehicles (trucks and MAVs) is expected. Based on the O-D pattern, it has been considered a 21% total reduction of the 3-axle and 24% total reduction in MAV commercial long distance traffic, and 20% reduction of the 2-axle trucks traffic in year 2026.

1.4.1. BUILT-UP SECTION

Sr.No.	Name of Village/Town	Chainage		Length (km)	Side
		Start	End		
1	Abu Road	646+000	647+700	1.700	LHS
2	Ore	652+200	652+400	0.200	BOTH
3	Swaroopganj	673+700	676+600	2.900	RHS

Table 5. List of Villages/Towns

1.4.2. KILOMETRE STONES

Existing Km stones are available all along the project stretch.

1.4.3. RIGHT OF WAY

Available ROW along the project corridor in open areas varies between 45 m to 60m.

1.4.4. CARRIAGEWAY

The existing carriageway is of four lane divided standards. The carriageway width slightly varies at merging and diverging at junctions, median openings, at approaches to structures and on structures deck. It may be noted that, details of carriageway on structures shall be referred from Structures Inventory section of this chapter. Details of carriageway along the Project Stretch are provided below.

S.No	Chainage (km)		Length (km)	LHS width (m)		Median width (m)	RHS width (m)	
	From	To		Carriageway	Paved Shoulder		Carriageway	Paved Shoulder
1	646+000	677+000	31.000	7.00	1.50	4.50	7.00	1.50

Table 6. Details of carriageway of Stretch

1.4.5. INTERSECTION

List of Major road intersections across the project road (i.e. intersection with SH & NH):

S.No.	ExistingChainage	Typeofjunction	Direction		Type Cross Road	Remarks	
			Left	Right			
1	652+815	+	Toonka	Deladar	BT	Grade Separator	
2	659+240	T	Talhati	-	BT	VUP	
3	673+780	Y	-	Swaroopganj	BT	VR	AT GRADE
4	674+410	+	Bhavri	Swaroopganj	BT	VUP	
5	675+500	+	-	Swaroopganj	BT	VR	AT GRADE

Table 7. Major Intersections

1.4.6. MEDIAN OPENINGS

In addition to the regular median openings as per approved plan & profile several unauthorized median cuts are observed along the project stretches which need to be closed as these are potential safety hazards.

1.5. NEED OF THE PROJECT

National Highways Authority of India (NHAI) proposes to launch an Infrastructure Trust (InvIT) with an aim to monetize the operational highways and attract large institutional investors to invest in this sector. These highways are expected to offer long term growth in traffic in line with the overall economic growth in the country and provide stable financial returns to investors. The funds raised by NHAI will enable it to construct new roads and expand the national highways network in the country. Once established, the InvIT platform will be able to get more operating road assets from NHAI thereby expanding its scope and scale.

StretchsUnderInvITModel				
S. No.	Name	NH No.	Lanes	Length (kms)
1.	Palanpur – Abu Road (Gujarat – Rajasthan)	NH 27	4	45.00
2.	Abu Road – Swaroopganj (Rajasthan)	NH 27	4	31.00
3.	Chittorgarh-Kota &Chittorgarh Bypass (Rajasthan)	NH 27	4	160.50
4.	KothaKotaBypass To Kurnool (Telengana)	NH44	4	74.622
5.	Maharashtra Border – Belgaum (Karnataka)	NH 4	4	77.705

This report deals with one of the highways (S.No.2) selected for InvIT model by the government.



The InvIT will enable NHA to monetize selected national highways having reasonable toll collection records and provide an attractive platform to long term investors as the operating highway infrastructure assets will yield stable and regular dividends. This is a monetization exercise of existing operating highway infrastructure with securitization of toll receipts and likely to generate upfront cash through asset recycling.

2. SOCIO ECONOMIC PROFILE OF PROJECT INFLUENCE AREA

2.1. DEMOGRAPHIC CHARACTERISTICS OF RAJASTHAN

The relationship between demographics and transportation is a complex one. Some demographic variables are obviously related to transportation systems. The overall size of the population, density of population, and rural/urban proportion of population impacts on transportation demand. Rajasthan state has Geographical area of 342,239 Sq. km which is 10.4% of total area of country. As per Census of 2011 the Rajasthan state population 68,548,437 with a density of 200/sq.km. The literacy rate of state is 68%.

According to census off 2011, Rajasthan has a total population of 68,548,437. Rajasthan's population is made up mainly of Hindus, who account for 88.49% of the population. Muslims make up 9.07%, Sikhs 1.27% and Jains 0.91% of the population. The state of Rajasthan is also populated by Sind his, who came to Rajasthan from Sindh province (now in Pakistan) during the India-Pakistan separation in 1947.

Project road starts from Abu road connecting villages are Chitrasani, Jethi, Amirgadh, Chandrawati and ends at Swaroopganj. This chapter tell us about socio-economic profile of Rajasthan state, and various districts, cities in Project Influence Area in terms of Demography, Climate, Terrain, Irrigation, Industry and Transportation etc. It also presents various developments proposed in the Project Influence Area.

Largest cities of Rajasthan by population	
City Name	Population
Jaipur	3,073,349
Jodhpur	1,138,300
Kota	1,001,694
Bikaner	647,804
Ajmer	551,101
Udaipur	474,531
Bhilwara	360,009
Alwar	341,422
Bharatpur	252,838
Sri Ganganagar	249,914

Table 8.Largest cities of Rajasthan by population

2.2. LANGUAGE

Hindi is the official and the most widely spoken language in the state (90.97% of the population as per the 2001 census), followed by Bhili (4.60%), Punjabi (2.01%), and Urdu (1.17%).

The languages taught under the three-language formula are:

- First Language: Hindi.
- Second Language: English.
- Third Language: Urdu/Sindhi/Punjabi/Sanskrit/Gujarati.

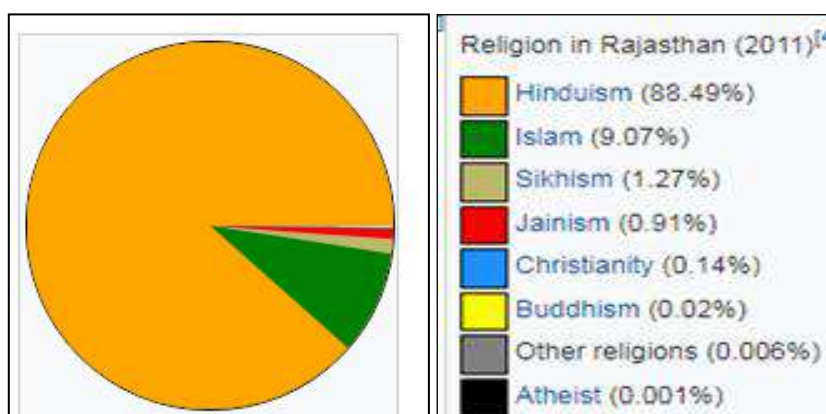


Figure 3. Languages in project area

2.3. GEOLOGY AND SOIL CONDITION

Geologically, the state can be broadly divided into three natural regions, viz Aeolian sand, alluvium and gravallis. The Aeolian deposits belong to the Pleistocene and recent times, While dune free area of Barmer, Bikaner and Jaisalmer, contains ex-posed marine deposits of Jurassic and Eocene periods showing an anomaly in nature of rock deposits in the region . Besides the Vindhyan system crops out around Jodhpur where there are small patches of Malani Volcanic and granite rocks formation.

The types of soil available in Rajasthan are mostly sandy, saline, alkaline and chalky (calcareous). Clay, loamy, black lava soil and nitrogenous soils are also found. The districts of Jaisalmer, Bikaner, Barmer, Jalor, Jodhpur, Ganganagar, Sirohi, Jhunjhunu, Pali and Sikar have alkaline and saline soils with a calcareous base. There is some nitrate concentration in the soil of these regions. The Jaisalmer region has Aeolian sand that varies from sandy to sandy loam. In fact Jaisalmer is renowned for its sandstone. Due to lack of water availability vegetation comprises of only thorny bush and cactuses. There is only seasonal vegetation such as a few grass species, shrubs and dwarf trees.

The whole district of Ganganagar North western plains consist of alluvial and Aeolian soil as it is flooded by the Ghaggar River. The four districts of Dausa, Tonk, Jaipur and Ajmer are watered by river Banas and its tributaries and thus the fertile soil sustains mixed xerophytic and mesophytic vegetation.

The flood plains of Rajasthan consist of the districts of Bharatpur, Alwar and Dhaulpur and the northern region of SawaiMadhopur which are flooded by the river Ghambhiri and Banganga. Thus this region is the repository of alluvial, clay and loamy soil. The Bhilwara district and the major parts of Udaipur district, Chittorgarh district, Sirohi district and the tract of Aravali Hills forms a part of inter-mountain plateau and consists of dark- lava soils. Major cash crops like cotton and sugarcane are grown in this black soil region. Other food crops are also grown. The Hadauti plateau includes the districts of Baran, Bundi, Jhalawar and Kota and so on that have black soil. This region is fertile owing to the presence of the Chambal River and its distributaries and cotton, sugarcane and opium are grown. Some districts of Rajasthan such as Dungarpur, Banswara, Udaipur, Bhilwara and Chittaurgarh have red and yellowish soils.

2.4. DEMOGRAPHIC FACTORS OF PROJECT ROAD

As of the 2011 India census, Abu Road had a population of 55,595. Males constitute 52% of the population and females 48%. Abu Road has an average literacy rate of 80.81%, higher than the state average of 66.11%. 89.63% of the males and 70.97% of females are literate. 11.89% of the population is under 6 years of age.

City Name	Population	PopulationCensus 1991-03-01	PopulationCensus 2001-03-01	PopulationCensus 2011-03-01
Abu Road	Sirohi	39,802	47,337	55,599

Table 9. Demographic Feature of Project Districts

Town	Population	Hindu	Muslim	Christian	Sikh	Buddhist	Jain	Others	Not Stated
Abu Road	55,599	86.85%	11.25%	0.64%	0.23%	0.00%	0.91%	0.03%	0.08%

Table 10. Demographic Feature of Project Districts by Religion

2.5. CLIMATE

Abu Road is hot and humid in summer with an average temperature of 40 degrees with hot sandy winds. In winter, it's 7 to 14 degrees, which is quite cold as compared to other cities in Rajasthan and in Monsoon; the average rainfall is about 14 to 20 inches per season.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Averagehigh °C (°F)	17.3	20.4	24.3	29.4	31.5	29.1	24.5	22.7	24.5	26.7	23.8	19.2	24.5
	63.1	68.7	75.7	84.9	88.7	84.4	76.1	72.9	76.1	80.1	74.8	66.6	76.0
Averagelow °C (°F)	4.5	6.8	11.1	18.7	21.0	19.8	18.7	17.8	17.6	15.8	9.3	5.1	13.9
	40.1	44.2	52.0	65.7	69.8	67.6	65.7	64.0	63.7	60.4	48.7	41.2	56.9
Avg precipitation mm (inches)	5.3	4.4	6.5	2.6	16.4	101.6	573.2	600.3	214.2	19.4	7.9	2.4	1,554.2
	0.21	0.17	0.26	0.10	0.65	4.00	22.57	23.63	8.43	0.76	0.31	0.09	61.2

Table 11. Climate data for Abu Road

2.6. POPULATION

Abu Road is a Municipality city in district of Sirohi, Rajasthan. The Abu Road city is divided into 31 wards for which elections are held every 5 years. The Abu Road Municipality has population of 55,599 of which 29,454 are males while 26,145 are females as per report released by Census India 2011.

Population of Children with age of 0-6 is 6613 which is 11.89 % of total population of Abu Road. In Abu Road Municipality, Female Sex Ratio is of 888 against state average of 928. Moreover Child Sex Ratio in Abu Road is around 833 compared to Rajasthan state average of 888. Literacy rate of Abu Road city is 80.81 % higher than state average of 66.11 %. In Abu Road, Male literacy is around 89.63 % while female literacy rate is 70.97 %.

Abu Road Municipality has total administration over 11,269 houses to which it supplies basic amenities like water and sewerage. It is also authorize to build roads within Abu Road Municipality limits and impose taxes on properties coming under its jurisdiction. Currently our website doesn't have information on schools and hospital located within Abu Road.

2.7. TOURISM

Mount Abu town, the only hill station in Rajasthan, is at an elevation of 1,220 m (4,003 ft). It has been a popular retreat from the heat of Rajasthan and neighboring Gujarat for centuries. The Mount Abu Wildlife Sanctuary was established in 1960 and covers 290 km² of the mountain. The mountain is home to several

Hindu temples, including the Adhar Devi Temple (also known as Arbuda Devi Temple), carved out of solid rock; the Shri Raghunath ji Temple; and a shrine and temple.

2.8. INDUSTRY

The Mount Abu is full of minerals therefore the industries based on minerals were developed rapidly. These industries produces port land cement, Synthetics Yarn, High Tension Insulators, TirupatiFibers, R.P.R.L. Marble, Granite, Polymers/ Resin and mineral powder. Similarly, medium scale industries produces tiles and slabs of cement, marble and granites, HCL acid, ERW tubes, HDPE pipes and fittings state's economy. During 1995- 96 and 2001-02, the industrial sector of Rajasthan experienced growth at the rate of 6.9% per annum.

Industry at a Glance Sr No	Head	Unit	Particulars
1	Registered Industrial Unit	NO.	6,383
2	Total Industrial Unit	NO.	6,585
3	Registered Medium & Large Unit	NO.	10
4	Estimated Avg. no. of Daily Worker Employed In Small Scale Industries	NO.	30,000
5	Employment In Large And Medium Industries	NO.	7,235
6	No. of Industrial Area	NO.	12
7	Turnover Of Small Scale Ind.	IN LACS	11,058.89
8	Turnover Of Medium & Large Scale Industries	IN LACS	16,865

Table 12. List of Industries in Mount Abu

S.No.	NAME OF MINERAL	PRODUCTION in tones 2010-2011
1	LimeStone (Cement Grade)	11,400,211
2	Calcite	83,163
3	Wollestonite	124,744
4	Masonry stone	654,150
5	Granite	51,371
6	Marble Block &Khanda	231,060
7	Lime stone (Crucher)	455,109

Table 13. Details of Mineral for Abu District

2.9. CONNECTING ROADS

Abu Road is a Town in Abu Road Tehsil in Sirohi District of Rajasthan State, India. It belongs to Udaipur Division. It is located 55 KM towards South from District head quartersSirohi. It is a Tehsil head quarter. Abu Road Pin code is 307026 and postal head office is Aburoad. Sadar Bazar (2 KM), Siyawa (5 km), Kyariya (5 km), AkraBhatta (5 km), Khadat (5 km) are the nearby Villages to Abu Road. Abu Road is surrounded by Mount Abu Tehsil towards North, Amirgadh Tehsil towards west, Reodar Tehsil towards west, Danta Tehsil towards South. Mount Abu, Palanpur, Pindwara, Sirohi are the nearby Cities to Abu Road. This Place is in the border of the Sirohi District and BanasKantha District. BanasKantha District Amirgadh is west towards this place. It is near to the Gujarat State Border.

3. TRAFFIC STUDY

3.1. GENERAL

Traffic surveys have been carried out on the project road in order to identify present and likely future traffic scenarios so as to propose suitable measures and to evolve appropriate design methods. The primary objectives of these traffic surveys are to establish and assess the characteristics of traffic movement on the project road, pavement design, capacity augmentation proposals, junction improvement etc.

3.1.1 Project Background

National Highways Authority of India (NHAI) has decided to set up Infrastructure Investment Trust (InvIT) and monetize national highway projects. InvITs are instruments on the pattern of mutual funds and are designed to pool small sums of money from several investors to invest in assets that give cash flow over a period.

3.2. OBJECTIVES OF TRAFFIC STUDY

The objective of traffic study is to provide basic input for the following:

- Finding out the present level of traffic flow and its various characteristics (through Classified Traffic Volume Count).
- Capacity assessment based on demand forecasting for next 30 years.
- Identifications of zone of influence of the project stretch as per O-D Survey and Commodity Movement Characteristics survey.
- Axle Load Survey to determine the Vehicle Damage Factor (V.D.F) as input to pavement design.
- Deriving Growth Factor for Traffic demand Forecasting.
- Study traffic leakages through local alternative routes.
- Study of possible location & design of toll plaza.

3.3. PROJECT DESCRIPTION

The project site starts from Swaroopganj and ends at Abu Road covering a length of 31.0km. As shown in Figure , project road is shortest communication in length between Swaroopganj and Abu Road. Hence there is no alternative competing road and no leakages at Toll Plazas.



Figure 5.Key Map of Highway

3.3.1 METHODOLOGY

The methodology of the study is briefly described below:

1. Establish the base line traffic on the corridor based on the traffic surveys and analysis.
2. Identify key traffic generators for the study.
3. Estimate the induced and diverted traffic.
4. Establish the traffic growth rates using elasticity analysis.
5. Forecast the traffic for different horizon years.
6. Recommend the right capacity for the elements of the project corridor.

3.3.2 Organization of the Report

The Traffic chapter has organized into sections as discussed below:

Section 1 gives Introduction

Section 2 discusses the Project Characteristics

Section 3 discusses the Traffic Surveys and Analysis

Section 4 presents the Traffic Forecast

Section 5 presents the Capacity Analysis

3.4. PROJECT CHARACTERISTICS

3.4.1 Regional Setting

Project stretch mostly fall in the state of Rajasthan. It is one of main highway corridor connecting Gujarat with important tourist destination Mount Abu.



Figure 4: Project Corridor in Regional Perspective

The project road fall in closeness of web of national highways connecting important cities of Rajasthan and Gujrat. Palanpur, Ahmedabad, Mount Abu, Udaipur are some of important cities which are used by traffic plying on this stretch.

Other major highways along the project road are

Beawar – Pali Pindwara – NH -62

Kishangarh-Udaipur- Ahmedabad – NH 58

3.5 TRAFFIC SURVEY LOCATIONS AND ANALYSIS

The classified traffic count station, Axle load and Origin Destination surveys location was decided near to the toll plaza to reassess the requirements. Traffic survey location was as under (Undavariya Toll Plaza). Traffic survey locations are as under.

3.5.1 Survey Plan

The feasibility and design of any highway facility (or a corridor) depends on the volume and intensity of traffic likely to flow on it in the design year. The estimation of the likely traffic scenario in the design year on the highway/corridor proposed for improvement, with an optimal lane configuration as in the present case, requires basic information regarding the current level of traffic and its characteristics on it. Thus, the collection of basic data on the nature and extent at present of different traffic parameters assumes greater significance.

The traffic on the Project corridor is characterized by a high degree of motorized vehicles, which consist of two wheelers, commercial vehicles, cars and buses. Non-motorized vehicles are mainly cycles.

3.5.2 Homogeneous sections

Reconnaissance survey carried out to understand the travel pattern on the project road. Based on the reconnaissance survey, only one homogeneous section is considered for analysis.

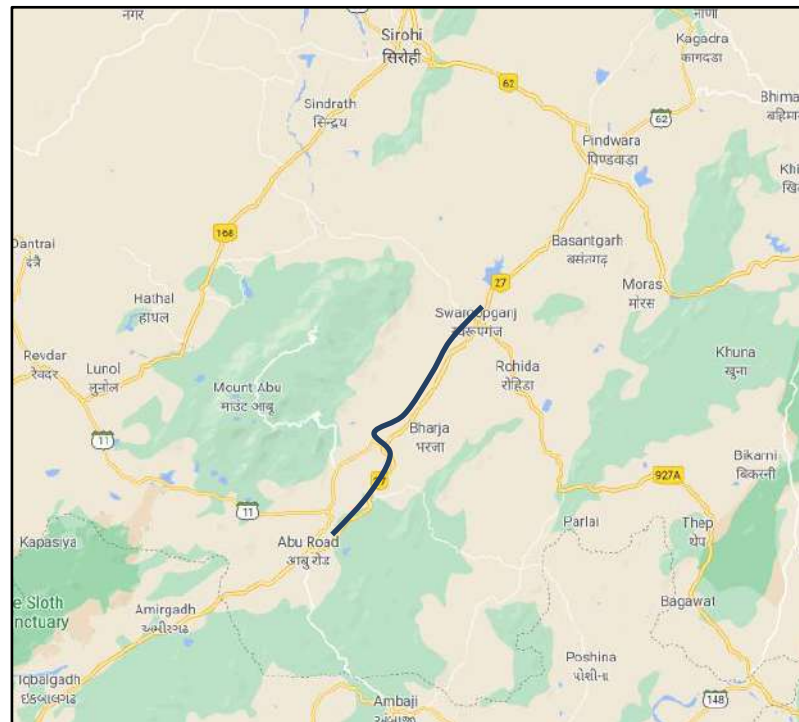


Figure 5. Toll Plaza cum Traffic Survey Locations (Undvariya Toll Plaza)

3.5.3 Traffic survey locations

Traffic studies detail mode wise traffic estimates, travel pattern of passenger and freight (goods) vehicles, speed and delay (travel time) characteristics and axle load characteristics. Traffic surveys conducted as per the guidelines given in IRC: SP-19. The locations and type of various traffic surveys have carefully finalized based on reconnaissance survey as well as requirements of the RFP.

The following traffic surveys carried out on the project corridor as well as competing corridors to assess and estimate the potential traffic on the project corridor.

Following traffic surveys had been conducted to assess the traffic on the project road.

Traffic surveys have been conducted during the month of November-2020 as specified in Table 14.

Sr. No.	Type Of Survey	Survey Location Name	Start Date	End date	Total Days
1	Classified Traffic Volume Count	Undvariya Toll Plaza	25-11-2020	01-12-2020	7
2	OD Survey	UndvariyaToll Plaza	-	-	-
3	Axle Load Survey	Undvariya Toll Plaza	-	-	-

Table 14. Schedules of Traffic Surveys

3.6 VEHICLE CLASSIFICATION

The classified traffic volume counts were carried out for 7 continuous days at the selected survey stations as per IRC guidelines on the subject (IRC: 9-1972) using video-graphic method.

The following classes of vehicles are counted separately:

S. No.	VehicleCategory	
1	Car, Jeep and Van	
2	TwoWheeler	
3	Auto Rickshaw	
4	Passenger and Goods Vehicles	Minibus
5		Bus
6		Mini LCV
7		LCV
8		2 - axle Truck / Bus
9		3 - axle Truck / Bus
10		MAV up to 6 – axles
11		Oversized Vehicles (more than 6 - axles)
12	Heavy Machinery & Earth Moving Equipment	
13	Tractors	WithoutTrailer
14		WithTrailer
15	SlowMovingvehicles	Cycle
16		CycleRickshaw
17		Animal DrawnCart

Table 15. Classifications of vehicles

The traffic count data analyzed to depict hourly and daily variations, traffic volume count per day and weekly Average Daily Traffic (ADT) for each vehicle type. The Annual Average Daily Traffic (AADT) is worked out by applying seasonal factors.

3.7 SURVEY METHODOLOGY

The methodology carried out is as follows:

- Traffic surveys have been carried out in accordance with the guidelines specified by IRC: 9-1972, IRC SP 19 -2001 and IRC: 102-1988. The methodology adopted for the traffic study is detailed as below.
- The project road corridor is considered a homogeneous section based on traffic flow pattern.
- The traffic surveys including classified traffic volume count is carried out for this traffic homogeneous section.
- The classified directional traffic volume counted over seven consecutive days for 24 hours on each day. The vehicle classification considered was in accordance with IRC:64. Number of vehicles in either direction was noted at 1-hour intervals in accordance with their classification by observers specially trained for this purpose.
- The classified traffic count data collected has been analyzed for hourly and daily traffic intensity, traffic composition, peak hour factor (PHF), directional distribution, average daily traffic (ADT) and finally annual average daily traffic (AADT) by applying the seasonal correction factors.
- Traffic volume analysis has been carried out to assess the volume of traffic, composition, hourly variation in traffic over 24 hours, and the daily variation in the traffic over 7 days at the project locations. The compiled data obtained from field traffic survey has been analyzed to work out the average daily traffic in terms of total vehicles and total PCUs. The PCU factors used in the analysis, as referred from IRC:64 is presented in Table-16.

VehicleType	PCU Factor
FastMovingVehicle (FMV)	
Two Wheeler	0.5
Three Wheeler	1.0
Car/ Jeep/ Van/ Taxi	1.0
Mini Bus	1.5
Full Bus	3.0
LCV	1.5
2-Axle Truck	3.0
3 - Axle Truck	3.0
Article/ Semi Artic Truck	4.5
Tractor with Trailer	4.5
Tractor without Trailer	1.5
SlowMovingVehicle (SMV)	
Cycle	0.5
Cycle Rickshaw	2.0
Bullock Cart	8.0
Horse Drawn Cart	4.0

Table 16.Vehicle Classification and PCU Factors

3.8 TRAFFIC VOLUME ANALYSIS

The analysis of classified volume counts observed at the counting location (collected for seven continuous days) was carried out to arrive the:

- Average Daily Traffic (ADT) for fast and slow moving vehicles.
- Traffic Composition
- Annual Average Daily Traffic (AADT)

3.8.1 SEASONAL FACTOR

The traffic plying on any road generally varies over different periods of the year depending on the cycle of different socio-economic activities in the regions through which it generates or terminates. Therefore, in order to have a more realistic picture of the traffic on the project road, it is required to assess its seasonal variation to estimate the annual average daily traffic (AADT). The ADT observed during the survey duration has been multiplied by a seasonal correction factor (SCF) to arrive at AADT. The seasonal correction factors have been derived for the month of November from past monthly toll plaza traffic as we had available the classified monthly number of vehicles from 2015 to 2017 as provided by PIA NHAI. The following tables show the number of vehicles for 2017 and the average monthly number of vehicles for the years 2015/2016/2017:

Undvariya Toll Plaza –Past Traffic 2017									
Month	Bus	CJV	LCV LGV	MAV (+4 axle)	3-wheel	Truck 2 Axle	Truck 3 Axle	2-wheel	Bus
January	7,090	87,335	3,893	113,155	7,489	18,074	54,409	76,826	162
February	9,066	99,737	5,881	91,963	6,843	20,637	61,429	70,592	1,775
March	11,930	113,323	4,979	38,135	7,407	23,574	75,275	74,227	8,973
April	13,865	139,687	49,999	31,232	7,977	25,477	76,712	77,312	9,335
May	12,613	139,964	4,330	66,221	7,307	22,192	63,243	70,413	6,135
June	8,657	105,637	3,530	127,774	8,442	19,126	52,882	84,969	150
July	5,945	62,405	3,144	92,461	4,735	12,922	41,102	55,924	137
August	7,498	80,851	3,357	128,824	8,525	17,900	59,630	117,264	51
September	8,480	82,965	3,177	131,157	8,030	19,188	58,933	101,911	86
October	10,181	120,293	3,299	140,049	8,097	21,269	54,384	91,091	100
November	10,013	95,619	3,547	132,895	7,941	21,307	58,740	84,208	102
December	10,475	107,243	3,955	147,353	7,758	22,851	63,024	81,917	123

Table 17. Actual Monthly Past Traffic for 2017

Undavariya Toll Plaza – Average Past Traffic 2015 – 2017									
Month	Bus	CJV	LCV LGV	MAV (+4 axle)	3-wheel	Truck 2 Axle	Truck 3 Axle	2-wheeler	Bus
January	7,751	106,539	4,389	52,182	6,868	22,753	72,348	59,079	97
February	8,574	112,597	4,960	44,873	6,703	24,129	75,495	58,616	648
March	10,208	125,769	4,893	27,177	7,616	27,122	82,019	65,358	3,035
April	11,247	133,418	4,673	23,807	7,844	17,416	78,228	72,911	6,128
May	11,388	141,565	4,640	34,856	7,554	23,270	73,073	67,817	4,937
June	9,304	118,061	4,855	62,890	8,318	21,512	69,518	76,283	100
July	6,274	78,324	5,329	80,259	6,245	16,193	54,510	68,520	994
August	5,939	78,861	7,272	87,545	7,334	16,700	60,638	91,739	786
September	7,233	83,409	5,125	84,127	7,133	19,136	61,004	87,816	571
October	8,432	100,681	4,129	84,345	7,345	20,833	59,056	78,764	626
November	8,703	105,563	4,093	76,854	6,729	19,054	53,702	70,106	738
December	8,863	100,091	4,190	85,297	6,637	20,932	61,585	66,960	192

Table 18. Actual Average Monthly Past Traffic for the Period 2015 - 2017

As discussed above seasonal correction factor is calculated based on toll collection data. As survey is conducted in month of November, following table give the SCF of various vehicles:

Undavariya Toll Plaza - Seasonal Factors for November based on actual Traffic								
Scenario	Bus	CJV	LCV LGV	MAV + 4 axle	3 - wheeler	Truck - 2 Axle	Truck - 3 Axle	2 - wheeler
SCF	1.00	1.01	1.19	0.81	1.07	1.09	1.24	1.00

Table 19. Estimated Seasonal Factors for the Month of November

Due to the COVID – 19 a certain uncertainty is perceived in the travel behaviour pattern of road users a SCF of 1.0 is used for all vehicle categories in this report.

3.8.2 ANNUAL AVERAGE DAILY TRAFFIC (AADT)

Using the seasonal factors is 1, the ADT (Average Daily Traffic) has been converted into AADT (Annual Average Daily Traffic) applying seasonal correction factor as per Clause 6.2 IRC SP: 19, using this procedure, AADT has been worked out and presented in below table.

Vehicle Type	ADT	AADT (Vehicle)	AADT (PCU)
2 Wheeler	4,384	4,384	2,192
3 Wheeler	489	489	489
Passenger Car	6,515	6,515	6,515
Mini LCV	423	423	423
Mini Bus	77	77	116

Standard Bus	568	568	1,704
LCV -4 Tyre	462	462	462
LCV - 6 Tyre	0	0	0
2 - Axle trucks	719	719	2,157
3 - Axle trucks	1,062	1,062	3,186
MAV (4 - 6)	5,354	5,354	24,093
Oversized vehicles >6	112	112	504
HCM/EME	46	46	207
Tractors	29	29	44
Tractor with Trailer	54	54	243
Cycles	7	7	4
Cycles rickshaw	0	0	0
Animal Cart	21	21	128
Hand Cart	4	4	33
Exempted vehicles	24	24	49
Total Tollable	15,338	15,338	39,367
Total	20,351	20,351	42,547

Table 20. Annual Average Daily Traffic (AADT) (Red box above: Tollable traffic)

3.8.3 PAST TRAFFIC GROWTH

The pattern of yearly traffic growth varies due to the changes of commercial and industrial use, and the capacity changes along the highway segment. Growth between year 2018 to 2020 has been worked out and presented in below table.

Vehicle	2018	2020	Yearly Growth	Remarks
Passenger Car	4,321	6,515	34%	A CAGR of 8-9% is normal for cars on a highway, since due to COVID higher traffic growth is coming in the month from September to till date due to unlocking of traffic movement . Normal traffic growth will occur in long run.
Mini LCV	496	462	-7%	Small Distance Vehicle and

				changed travel pattern due to COVID. Long Run traffic growth will be normal
Minibus	58	77	25%	Normal
Standard Bus	501	444	-13%	Long Run traffic growth will be normal, some effect of COVID-19 is perceived
LCV -4 Tyre	72	77	6%	Conversion of Vehicles to higher Axles due to loading of road transportation cost. And COVID Effect is also contributing to the growth observed. Post COVID a normal growth rate is likely to Prevail.
LCV - 6 Tyre	217	46	-372%	
2 - Axle trucks	524	719	27%	
3 - Axle trucks	1109	1,062	-4%	
MAV (4 - 6)	3,473	5,354	35%	

Table 21.Past Traffic Growth 2018 to 2020 (ADT)

3.8.4 COMPOSITION OF TRAFFIC

Analysis was carried out to find the composition of traffic in terms of fast and slow moving traffic and in terms of various types of vehicles. Predominantly cars, MAV's and two-wheeler traffic has been observed on the project road. The observed vehicular compositions are shown in Figure 8.

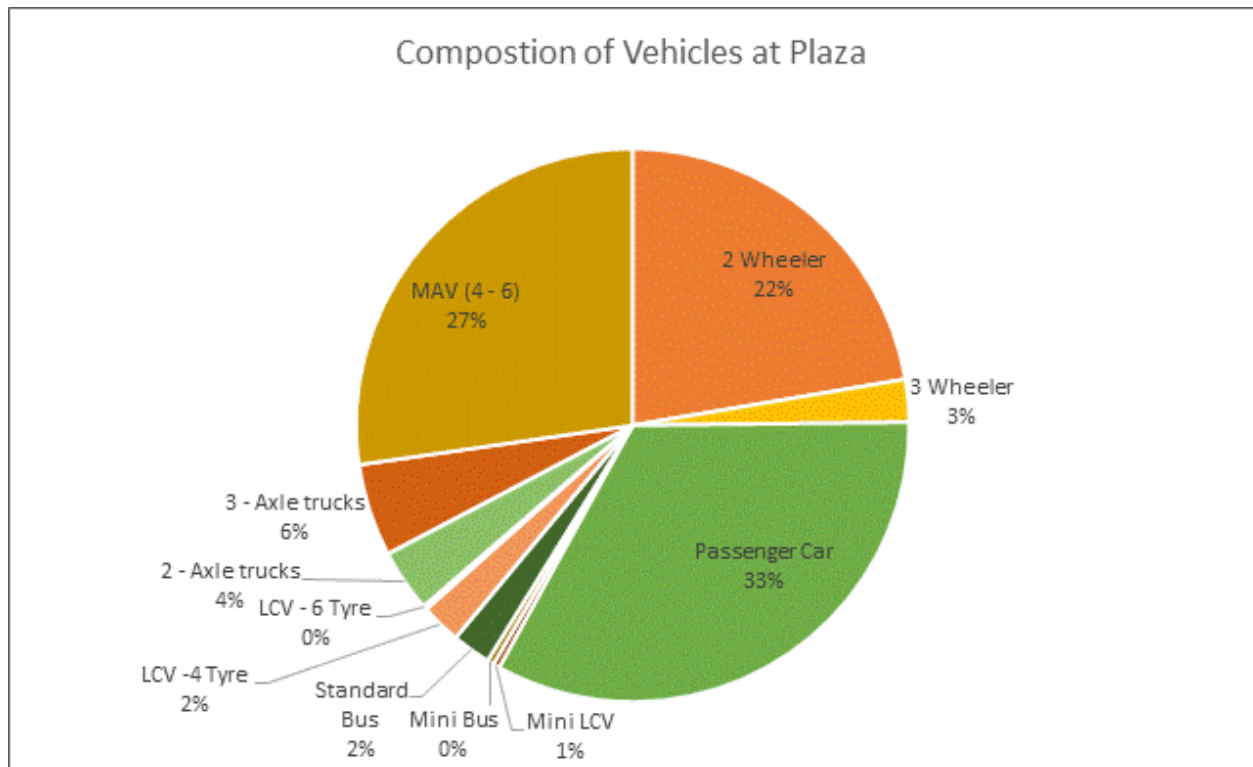


Figure 6. Traffic Composition at Undavariya

3.8.4.1 HOURLY VARIATION OF TRAFFIC

Analysis has carried out to study the hourly variation and peak-hour traffic characteristics. The hourly variation of traffic at survey locations is presented graphically below Figure 9.

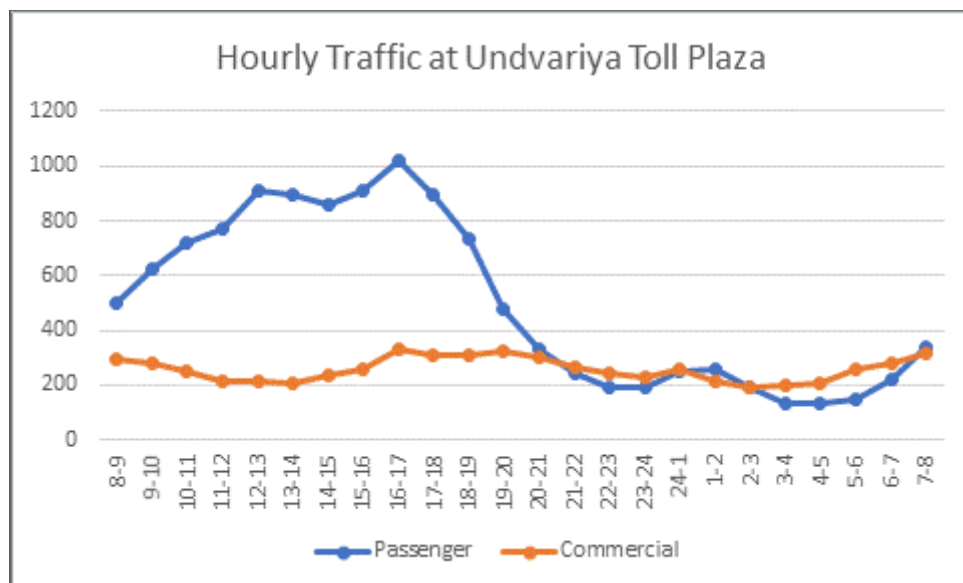


Figure 7. Hourly Variation of Traffic at Undviriya

Above figure suggest peak commercial traffic at nighttime or and passenger vehicle peak at midday time.

3.8.4.2 PEAK HOUR FACTOR ANALYSIS

The Peak-hour traffic has been estimated based on hourly traffic volumes observed at the Toll Plaza.

Estimated Peak hour details, traffic analyzed from ADT, peak-hour volume of total traffic and tollable traffic have been estimated and presented in Table 23.

Location	PeakHour	PeakHourVehicles		PeakHourFactors		Directional Split (Tollable)
		Total	Tollable	Total	Tollable	
Undawariya	10:00 – 11:00 am	2,894	1,384	7.11%	7.00%	47.0% SwaroopganjtoAburoad
						53.0% AburoadtoSwaroopganj

Table 22. Peak-Hour and Peak-Hour Factors

3.8.4.3 DAILY VARIATION OF TRAFFIC

Daily variation of Traffic flow has studied and presented below at all the traffic survey location. There is some variation in the daily traffic and the pattern is on expected line. Daily variation has been analyzed for toll plaza locations and presented in below figure.

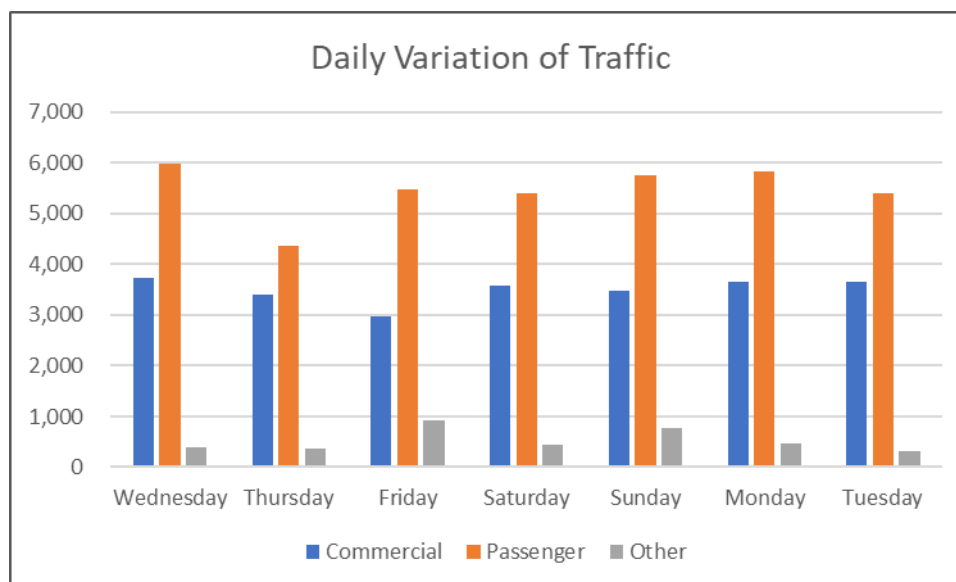


Figure 8. Daily Variation of Traffic at Undavariya

The Salient Features for the traffic are:

- Freight vehicles are around 40%. This is expected as the highway is bordering Gujarat and Rajasthan
- LCV and 2 Axle vehicles are similar in numbers
- Passenger vehicles is around 60% on project corridor

- Two wheelers are high in numbers due to the presence of villages and towns on the corridor.

3.9 ORIGIN DESTINATION SURVEY

During the OD survey all the relevant information was collected from the vehicle operators in pre designed format by stopping vehicles at random sample basis. The collected data includes vehicle number, origin and destination place, commodity carried, distance travelled, no. of trips in a month, willingness to pay toll etc. The table presents relevant O/D zones locations.

Zone No.	Place Name
1	Swaroopganj side
2	Mount Abu, Abu road
3	Palanpur
4	Ahmedabad
5	Kandla Side, Rest of Gujarat
6	Udaipur, Kota, Chittorgarh side
7	Jodhpur, Falna side of Rajasthan
8	Rest of Rajasthan
9	MP, UP, Bihar, WB, Jharkhand, Odisha
10	Delhi, Punjab, Haryana, Himachal, J&K
11	Maharashtra and South India

Table 23. Coding details of various OD Zones

3.9.1 ANALYSIS OF ORIGIN AND DESTINATION AND COMMODITY MOVEMENT SURVEY

The origin destination survey was carried out at Undavariya Toll Plaza. Data collected has been analyzed by checking incorrect and inconsistent records with original field data sheets. The checked and corrected data were used for final analysis. Table presents the percentage sample size collected.

Vehicle Type	ADT	Sample	Sample %
Car	6515	385	6%
Mini bus	77	13	17%
Bus	444	15	3%
LCV	123	39	32%
2A	719	86	12%
3A	1062	365	34%
MAV	5354	903	17%
Total	14294	1806	13%

Table 24. Percentage Sample Size for all locations in OD Survey

3.9.2 COMMODITY ANALYSIS

Different commodities recorded during the O-D survey were classified into different categories and due consideration has been given to include all possible commodities moving along the project road. After coding of Origin – Destination data, commodity movements found on corridor has been analyzed commodity wise vehicle category wise. The analysis results are presented in Table 25 shown below. Composition of commodity movement on the corridor has been presented in Figure 9.

CommodityType	LCV	Bus	2 - Axle	3 - Axle	MAV	Total %
Empty	26%	19%	13%	15%	16%	16%
Agriculture Product	5%	6%	6%	6%	0%	5%
Perishable products	10%	5%	4%	3%	5%	4%
Building Materials	23%	15%	15%	13%	12%	14%
Cement	3%	3%	6%	6%	9%	6%
Chemical Products	3%	3%	7%	7%	5%	6%
Coal	5%	6%	3%	5%	9%	6%
Consumer Products	0%	2%	0%	0%	0%	0%
Diesel	3%	6%	6%	6%	3%	5%
Machine and Machine Parts	8%	9%	13%	8%	8%	9%
Manufacturing Products	0%	2%	4%	4%	5%	4%
Metals	3%	5%	4%	3%	4%	3%
Milk	0%	5%	7%	5%	0%	4%
Minerals & Ores	3%	0%	0%	1%	1%	1%
Parcel & paper Products	0%	0%	4%	2%	4%	2%
Petroleum Products	0%	3%	6%	6%	8%	5%
Rubber & Plastic Products	3%	1%	2%	2%	4%	2%
Textile Products	3%	5%	0%	6%	8%	4%
Wood and Forest Products	5%	3%	0%	2%	0%	2%
Miscellaneous	0%	1%	1%	1%	0%	1%

Table 25. Vehicle wise Commodity Distribution (%)

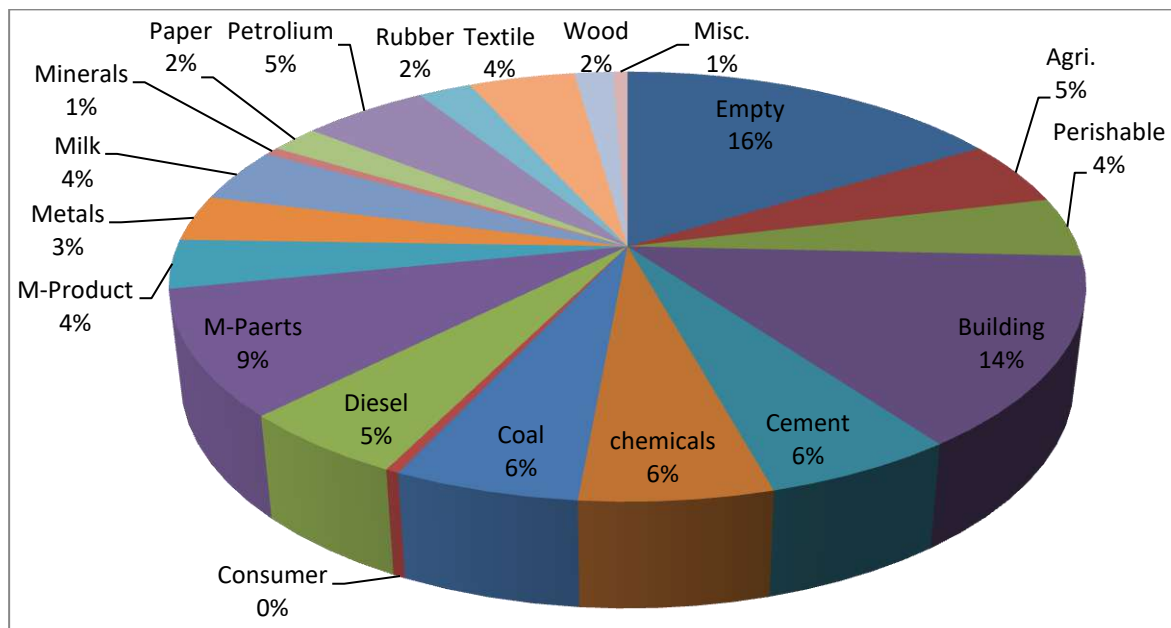


Figure 9. Commodity Distribution

3.9.3 TRAVEL PATTERN

The travel pattern of different categories about different locations between these broadly classified zones is presented in Table 27 and 28

ZoneFrom/To	Swaroopganj side	Mount Abu, Aburoad	Palanpur	Ahmedabad	Kandla Side, Rest of Gujarat	Udaipur, Kota, Chittorgarh side	Jodhpur, Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB, Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Total
Swaroopganj side	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	4.1%	0.0%	0.0%	0.2%	7.1%
Mount Abu, Aburoad	0.0%	0.2%	0.1%	0.0%	0.0%	4.8%	6.5%	0.0%	0.0%	0.4%	12.1%
Palanpur	0.0%	0.1%	0.0%	0.0%	0.0%	0.6%	1.0%	0.0%	0.0%	0.1%	1.8%
Ahmedabad	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	1.9%	0.0%	0.0%	0.4%	3.4%
Kandla Side, Rest of Gujarat	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	2.4%	0.0%	0.0%	0.8%	4.1%
Udaipur, Kota, Chittorgarh side	2.8%	4.8%	0.6%	1.1%	0.8%	3.1%	13.1%	0.2%	1.2%	1.1%	28.9%
Jodhpur, Falna side of Rajasthan	4.1%	6.5%	1.0%	1.9%	2.4%	13.1%	0.0%	1.3%	2.2%	0.8%	33.4%
Rest of Rajasthan	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	1.3%	0.0%	0.0%	0.1%	1.7%

ZoneFrom/To	Swaroopganj side	Mount Abu, Aburoad	Palanpur	Ahmedabad	Kandla Side, Rest of Gujarat	Udaipur, Kota, Chittorgarh side	Jodhpur, Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB, Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Total
MP, UP, Bihar, WB, Jharkhand, Odisha	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	2.2%	0.0%	0.0%	0.0%	3.4%
Delhi, Punjab, J&K, Haryana, Himachal	0.2%	0.4%	0.1%	0.4%	0.8%	1.1%	0.8%	0.1%	0.0%	0.0%	4.0%
Total	7.1%	12.1%	1.8%	3.4%	4.1%	28.9%	33.4%	1.7%	3.4%	4.0%	100%

Table 26.Zone wise Passenger Vehicle Movement

ZoneFrom/To	Swaroopganj side	Mount Abu, Aburoad	Palanpur	Ahmedabad	Kandla Side, Rest of Gujarat	Udaipur, Kota, Chittorgarh side	Jodhpur, Falna side of Rajasthan	Rest of Rajasthan	MP, UP, Bihar, WB, Jharkhand, Odisha	Delhi, Punjab, Haryana, Himachal, J&K	Maharashtra and South India	Total
Swaroopganj side	0.0%	0.3%	0.2%	0.2%	0.0%	0.0%	0.3%	2.5%	0.2%	0.0%	0.1%	3.8%
Mount Abu, Aburoad	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	1.2%	2.3%	0.0%	0.1%	0.1%	4.2%
Palanpur	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.0%	0.2%	1.7%
Ahmedabad	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.4%	2.7%
Kandla Side, Rest of Gujarat	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%	0.3%	0.0%	0.0%	0.0%	0.7%
Udaipur, Kota, Chittorgarh side	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	4.5%	0.4%	0.1%	0.2%	5.6%
Jodhpur, Falna side of Rajasthan	0.3%	1.2%	0.0%	0.0%	0.3%	0.3%	1.8%	14.3%	0.2%	0.2%	1.4%	20.2%
Rest of Rajasthan	2.5%	2.3%	1.3%	2.0%	0.3%	4.5%	14.3%	0.0%	2.6%	8.9%	1.0%	39.8%
MP, UP, Bihar, WB, Jharkhand, Odisha	0.2%	0.0%	0.0%	0.0%	0.0%	0.4%	0.2%	2.6%	0.0%	0.2%	0.2%	3.8%
Delhi, Punjab, J&K, Haryana, Himachal	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.2%	8.9%	0.2%	0.2%	1.9%	11.7%
Maharashtra and South India	0.1%	0.1%	0.2%	0.4%	0.0%	0.2%	1.4%	1.0%	0.2%	1.9%	0.2%	5.8%
Total	3.8%	4.2%	1.7%	2.7%	0.7%	5.6%	20.2%	39.8%	3.8%	11.7%	5.8%	100%

Table 27.Zone wise Goods Vehicle Movement

Zone No.	Zone From / To	Passenger	Goods
1	Swaroopganj side	7.1%	3.8%
2	Mount Abu, Abu road	12.1%	4.2%
3	Palanpur	1.8%	1.7%
4	Ahmedabad	3.4%	2.7%
5	Kandla Side, Rest of Gujarat	0.0%	0.7%
6	Udaipur, Kota, Chittorgarh side	4.1%	5.6%
7	Jodhpur, Falna side of Rajasthan	28.9%	20.2%
8	Rest of Rajasthan	33.4%	39.8%
9	MP, UP, Bihar, WB, Jharkhand, Odisha	1.7%	3.8%
10	Delhi, Punjab, Haryana, Himachal, J&K	3.4%	11.7%
11	Maharashtra and South India	4.0%	5.8%

Table 28. Zone wise Goods and Passenger Vehicle Movement (%)

Major OD pairs are highlighted in pink in above table. From above tables it is derived that 80 % of passenger vehicles are through traffic at Toll Plaza and 90% of Freight vehicles are through.

3.9.4 ORIGIN AND DESTINATION DESIRE LINES

The desire lines have been prepared based on the analysis of Origin and destination travel trips and Trip desire patterns for the station used on project road. The details of OD desire lines are shown in Figure 12 and Figure 13.



Figure 10. Map Showing Pattern of Goods Traffic

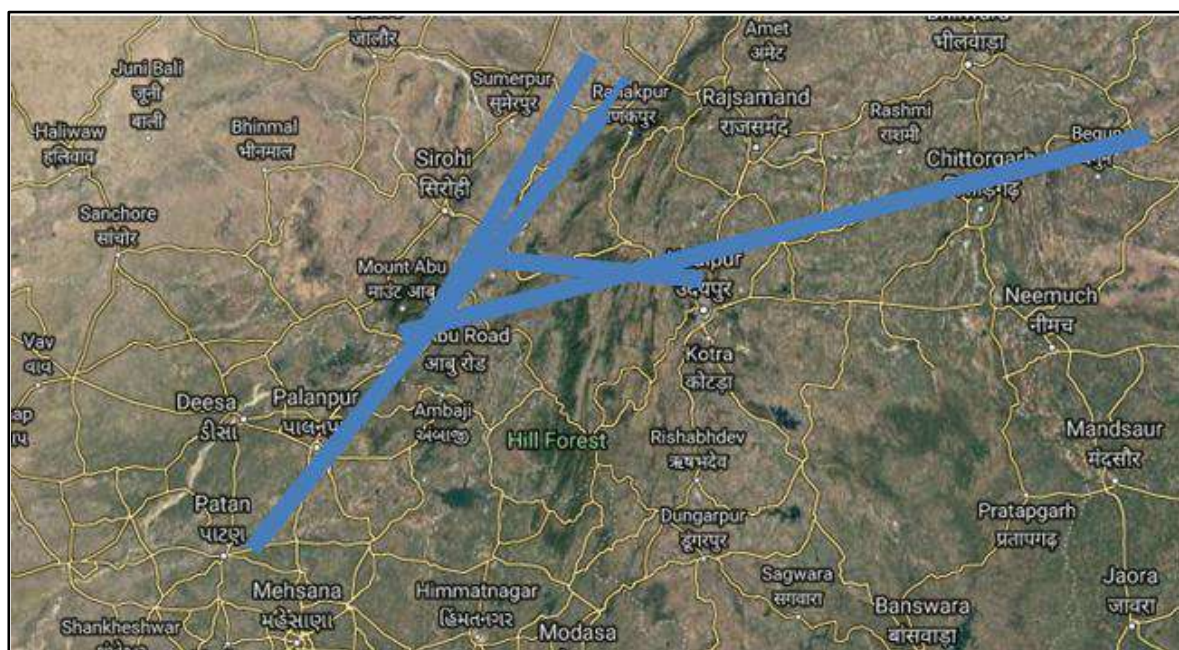


Figure 11. Map Showing Major Passenger Traffic

3.9.5 LEAD AND LOAD ANALYSIS

The survey data was analyzed to assess the lead and load distribution for commercial vehicles. Location wise Trip length frequency distribution for goods vehicles is shown in Table 30.

Trip Length (km)	2A	3A	4A	5A	6A
0 – 25	0%	0%	0%	0%	0%
25 – 50	0%	5%	3%	2%	2%
50 – 100	0%	3%	3%	3%	4%
100 – 250	18%	8%	6%	7%	8%
250 – 500	0%	8%	8%	14%	24%
500 – 1000	45%	44%	41%	35%	35%
1000 – 1500	36%	15%	26%	22%	12%
1500 – 2000	0%	8%	6%	8%	12%
More than 2000	0%	10%	8%	9%	4%
Total	100%	100%	100%	100%	100%

Table 29. Trip Length Frequency Distribution (%)

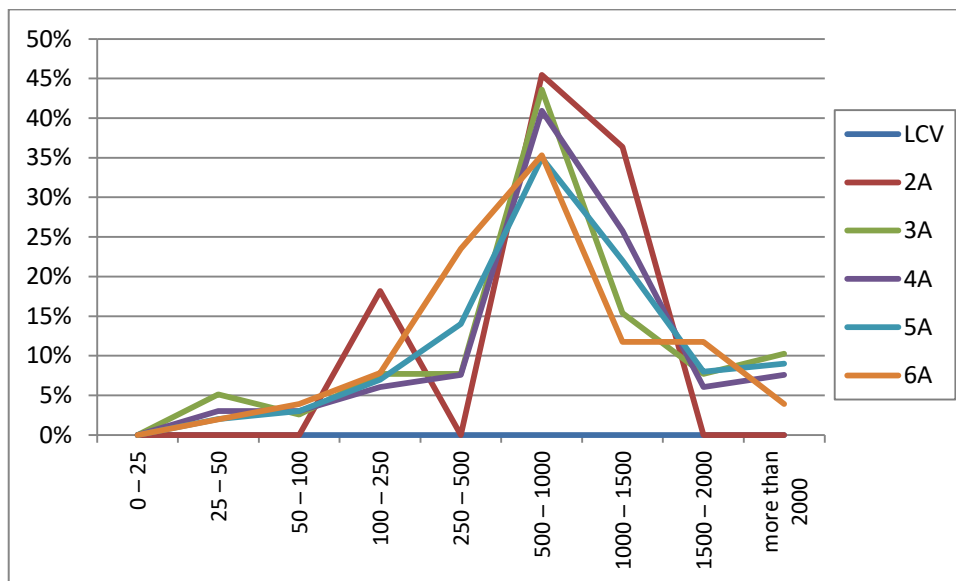


Figure 12. Trip Length Frequency Distribution (km)

Predominant traffic movement has been reported between 500 and 1500 km category

3.10 TRAFFIC GROWTH

3.10.1 GENERAL

This section presents estimates of traffic growth rates. Traffic growth rates for the study, to be used subsequently for forecasting traffic on the Project Stretch, have been estimated by adopting the Elasticity of Transport Demand method as stipulated in IRC: 108, which is a proven and therefore most commonly used technique in India. The method relies on the correlation between:

- Past trends in traffic growth on the Project Stretch / Traffic passing through Toll Plazas.
- Time series data on Gross State Domestic Product (GSDP) for project influence area.

For all modes, GSDP has been considered as independent variable and elasticity estimate associated with GSDP has been considered for estimating traffic growth. GSDP can be forecasted more reliably as compared to other economic parameters as it can be correlated with the National GDP.

Regression analysis has been carried out using past trends on traffic, vehicles registration and economic indicators, to estimate elasticity for each type of vehicle. Toll plaza traffic collected from PIA NHAI has been used for regression analysis.

The projected growth rates worked out for major vehicle groups, namely, car, LCV, bus/ trucks, MAV and Oversized vehicles. The likely future shift among the vehicle categories, like, the probable shift of vehicle ownership from 2-axle trucks to 3-axle trucks, 3-axle trucks to MAVs and 2/3 wheeler market to car, etc., have also been taken into account while adjusting the elasticity values.

3.10.2 PAST TRAFFIC GROWTH

Following table presents the actual traffic growth registered for Undawariya Toll Plaza as provided by PIA NHAI. The traffic numbers have been normalized and presented in below table.

Vehicle Category	2017	2016	2015	2014	2013	2012	2011	2010
------------------	------	------	------	------	------	------	------	------

Bus	9,651	8,057	8,037	6,200	7,569	6,921	5,281	4,132
Car / Jeep / Van (CJV)	102,922	116,462	100,052	66,148	81,249	76,280	59,239	51,930
LCV / LGV	7,757	5,203	5,390	3,273	4,057	3,106	2,800	2,026
MAV (more than 4 axle)	103,435	59,493	26,473	29,417	8,690	7,237	6,988	5,878
Three wheeler	7,546	6,709	7,179	5,717	5,952	6,407	5,725	4,701
Truck - 2 Axle	20,376	22,321	19,433	16,962	18,836	18,807	15,770	15,613
Truck - 3 Axle	59,980	66,706	72,175	56,153	50,150	57,279	49,564	46,391
Two wheeler	82,221	66,418	67,019	52,161	45,264	40,209	31,046	27,766
Others	2,261	2,608	54	55	112	62	34	40

Table 30.Average Monthly Past Traffic Volume

Significant traffic has been reported between 2012 and 2015 due to forcefully diverted traffic from other parallel corridors in view of construction works. Due to that actual traffic growth trends could not be analyzed properly. Due to this reason, only traffic growth trends from year 2014 to 2017 and estimated traffic for 2020 have been taken in to account for estimation of future traffic trends.

3.10.3 PROJECT INFLUENCE AREA

Project influencing area (PIA) has been outlined based on location and traffic patterns observed. The socio-economic indicators of the project influence area affect the traffic growth on the Project Stretch. Although this project is partially located in Gujarat, PIA % consideration is present below:

Year	PIA % Passenger	PIA % Goods
Rajasthan	85%	75%
Gujarat	10%	5%
Otherstates	5%	20%

Table 31.PIA State % contribution

Year	PIA GSDP Passenger	PIA GSDP Goods
2012-2013	62688	62044
2013-2014	65703	65116
2014-2015	69937	69784
2015-2016	74232	74361
2016-2017	79153	79473

Table 32.PIA State GSDP

Source: Central Statistics Office, New Delhi

Note: GSDP constant prices base, 2011-2012

3.10.4 ESTIMATES OF TRANSPORT DEMAND ELASTICITY

Regression analysis has been carried out between GSDP, Vehicles Registration in the PIA and Past Traffic passing through Toll Plaza using the econometric model methodology specified in IRC 108 as detailed below.

$$\text{Loge } P = A_0 + A_i \text{ Loge } \text{GSDP}$$

Where:

P = Traffic Volume

GSDP = Gross State Domestic Product

A₀ = Regression Constant

A_i = Regression (Coefficient)

The value of A_i is known as the Elasticity Coefficient. The Elasticity coefficient is the factor by which the GSDP growth rate has to be multiplied to arrive at the growth rate of traffic. The following table summarizes the results of the regression analysis for transport demand elasticity. The final growth rates have been derived by establishing a relation between the time series data available for India GDP and GSDP of PIA.

First, a regression analysis with India GDP and PIA GSDP has been carried out considering the following values of GDP:

Year	GDP
2014-15	1,24,67,959
2015-16	1,37,71,874
2016-17	1,53,91,669
2017-18	1,70,98,304
2018-19	1,89,71,237
2019-20	2,03,39,849

Table 33. India GDP

Source: IMF & Central Statistics Office, New Delhi

Note: GDP constant prices base, 2011-2012

The regression analysis arrives to an elasticity value of 0.984 for passenger and 1.080 for freight which is used later on this chapter to determine GSDP growth and the traffic growth projections.

Regarding past trends and their correlation with corresponding PIA GSDP, regression analysis of Past Traffic (2014 - 2018) and Vehicles Registration of PIA (2011 - 2017) have been carried out with PIA GSDP arriving to the following elasticity values for each toll plazas:

Vehicle	Elasticity - Past Traffic	Elasticity - VR	Average
Car	0.39	0.58	0.49
Bus	0.20	0.71	0.45
LCV	0.45	0.90	0.67
2 AT	-0.17	0.88	0.36

Vehicle	Elasticity - Past Traffic	Elasticity - VR	Average
3 AT	-0.19	0.88	0.34
MAV	0.12	0.88	0.50

Table 34. Results of Regression Analysis

Three axle and two axle traffic show a negative trend probably due to the replacement of standard trucks by MAVs and also, and in less extent, by LCVs. It can be also observed in above tables above a significant growth of Multi-Axle Vehicles most likely due to the development of Adani port near Bhuj, Gujarat. This should be considered a kind of short term effect which most probably will not sustain for longer periods. Past trends of goods handled by Adani port has been presented in Figures below.

Growth of APSEZ (all Ports)



Figure 13. Yearly MMT (Million Metric Tons) Traffic Handled

Growth Adani Port

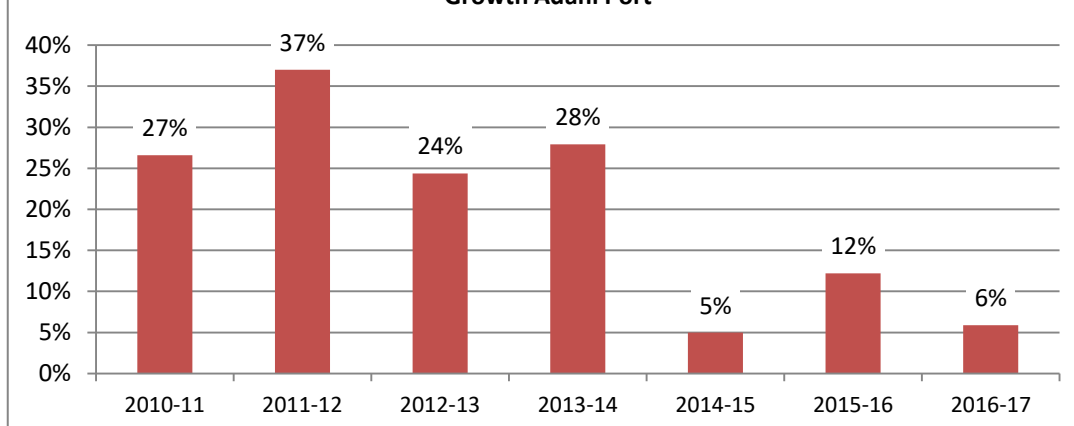


Figure 14. Growth of Adani Port

In view of the reduced growth in last 3 years of MMT handled, it is evident that growth of Multi-Axle

Vehicles will no longer continue as in previous years but in more logical values.

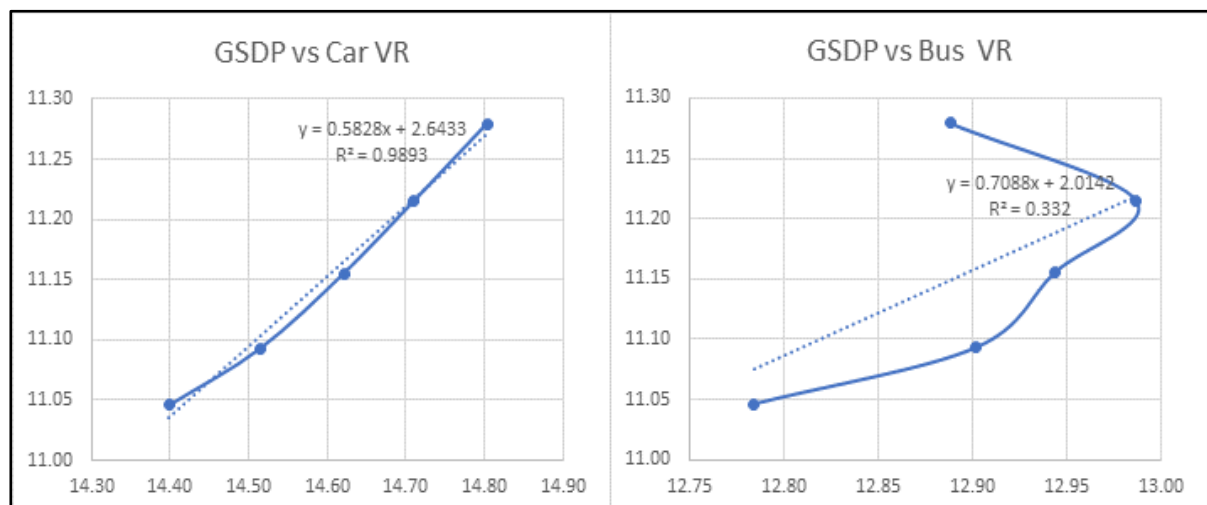
There are many factors that will influence the traffic growth in the project highway in addition to economic changes. The trends on transportation modes are shifting constantly, as an example the below mentioned Delhi-Mumbai Dedicated Railway Freight Corridor, which will absorb a substantial quantity of the freight that currently is transported by heavy vehicles in this corridor; or above effect from a Port development. But also the traffic growth trends are changing between the different types of commercial vehicles based on changes in their efficiency and the own users requirements. Another factor is based on the continuous changes on freight types and packaging (containerization of goods and commodities) and the improvements on transportation logistics. Each year a considerable amount of new kilometres of highways are added to the National and State networks allowing changes in the actual patterns of traffic. With all these factors and considerations, it is important that the elasticity values of traffic obtained from regressions with economic indicators are moderated to contemplate influencing factors and previous projects experience.

The elasticity values recommended in below table, although derived from regression and trend analysis of historical traffic, past registration of vehicles and GSDP for the PIA, have been moderated to stay within realistic and widely accepted limits.

Recommended Elasticity Coefficients						
Vehicle Type	2020 - 2025	2025 - 2030	2030 - 2035	2035 - 2040	2040 - 2045	2045 - 2050
Car	0.58	0.52	0.47	0.42	0.38	0.34
Bus	0.71	0.64	0.57	0.52	0.47	0.42
LCV/LGV	0.67	0.60	0.54	0.49	0.44	0.40
Truck - 2 Axle	-0.17	-0.18	-0.20	-0.22	-0.24	-0.27
Truck - 3 Axle	-0.19	-0.21	-0.23	-0.26	-0.28	-0.31
MAV 6+	0.88	0.79	0.71	0.64	0.58	0.52

Table 35. Recommended Elasticity Values

Following figures give the regression charts of different vehicles vs PIA GSDP.



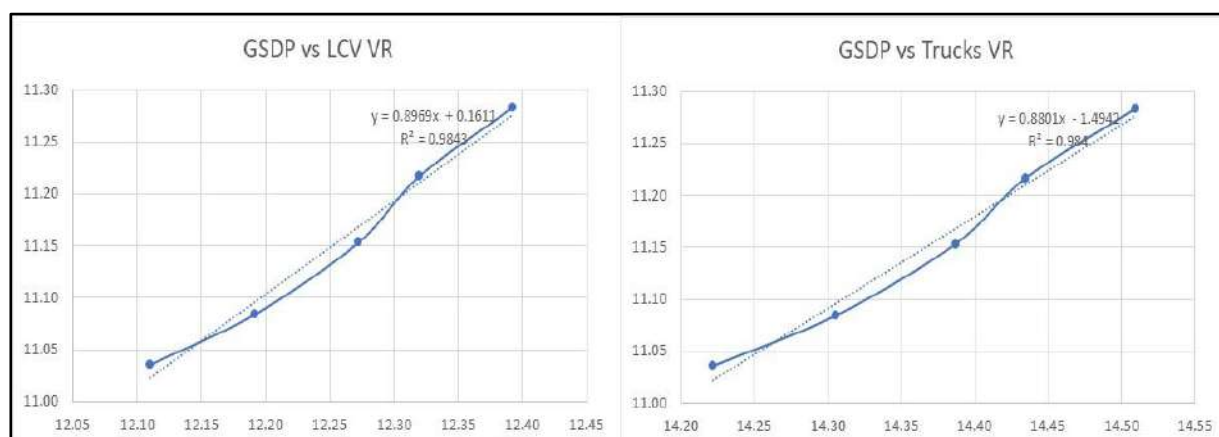


Figure 16. Regression Curves of Vehicle Registration vs GSDP

3.10.5 TRAFFIC GROWTH RATES-RECOMMENDED

According to IMF projections, India GDP for the next years can develop as follows:

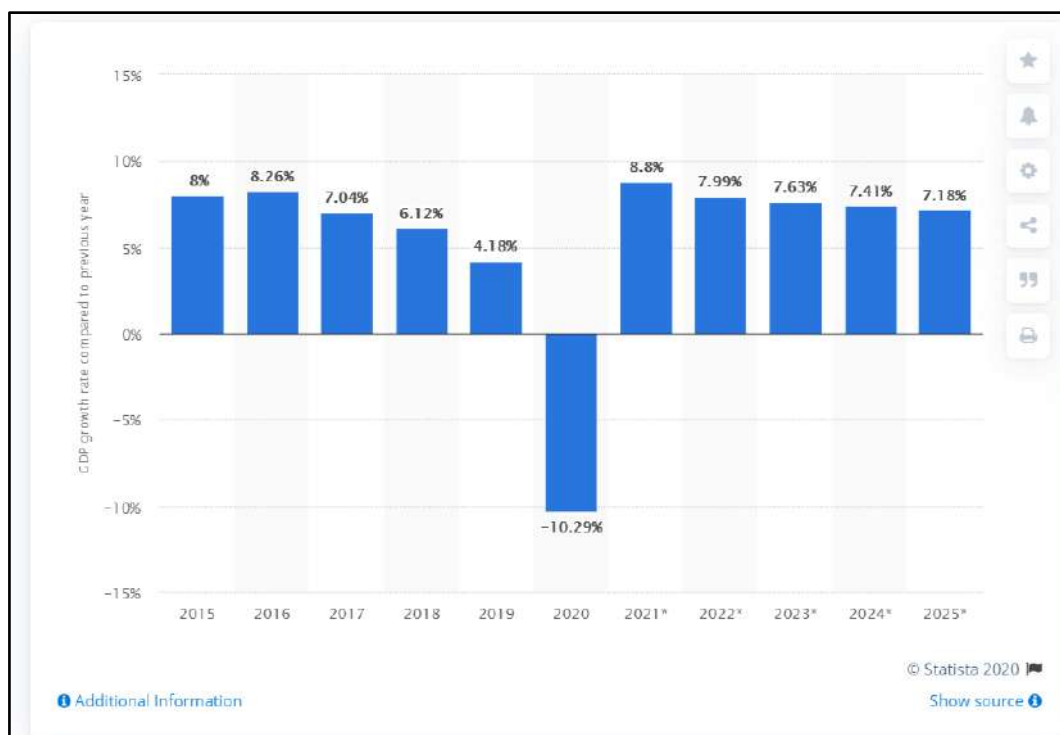


Figure 16. Projection of Indian GDP

(Source: <https://www.statista.com/statistics/263617/gross-domestic-product-gdp-growth-rate-in-india/>)

Considering current social and economic trends, the above scenario for GDP growth can be considered optimistic (see below "Optimistic" scenario) and it is recommendable to assume a more conservative approach with a discount of 0.50% to above GDP growths. Therefore, the estimated average growth of India GDP for the following periods of 5 years and corresponding PIA GSDP has been considered as shown in Table 37

COVID-19 is going to influence our lives for a long time till the vaccines are made available to the masses. COVID-19 is bound to impact our lifestyle as well as travel habits though they are yet to get reflected at ground level.

Social distancing protocols may become the new norm in future, and this will have a major impact on the travel habits. The population in lesser income group will continue to travel in the mass transportation. The population with higher income will use the private transportation more and more.. However, the burden on the roads is bound to increase with the increment in the GDP and purchasing power. In the same vein, COVID-19 has impacted the auto industry and sales are at rock bottom. Thus, all the major auto brands are coming up with promotional schemes such as more discounts and EMI schemes etc., These schemes may lead to more affordability. They may use ridesharing to share the costs and thus reduce their overall cost of transportation. This will result in higher private vehicles on road. Considering these traffic growth rate suggested above will hold good in long run. As a precautionary measure GSDP growth rate is moderated to up to FY 24 to calculate the growth rate.

Period	GDP	PIA GSDP Passenger	PIA GSDP Goods
2020 - 2025	4.29%	4.05%	4.34%
2025 - 2030	7.18%	6.18%	6.61%
2030 - 2035	6.82%	5.87%	6.28%
2035 - 2040	6.48%	5.58%	5.97%
2040 - 2045	6.16%	5.30%	5.67%
2045 - 2050	5.85%	5.04%	5.39%

Table 36.Projections of India GDP and PIA GSDP (Source of India GDP 2019-2023: IMF)

Based on the moderated elasticity values and the projected economic indicators (India GDP), the future average annual compound traffic growth rates by vehicle type have been thus estimated and recommended as follows:

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.64%	2.77%	2.68%	3.71%	3.24%	2.77%	2.37%	2.03%	1.73%
Bus	0.00%	3.22%	3.37%	3.26%	4.52%	3.94%	3.37%	2.88%	2.47%	2.11%
LCV	0.00%	3.26%	3.42%	3.30%	4.58%	4.00%	3.42%	2.92%	2.50%	2.14%
2 AT	0.00%	-0.80%	-0.84%	-0.81%	-1.13%	-1.20%	-1.25%	-1.31%	-1.37%	-1.43%
3 AT	0.00%	-0.93%	-0.98%	-0.94%	-1.31%	-1.40%	-1.46%	-1.53%	-1.59%	-1.67%
MAV	0.00%	4.28%	4.48%	4.33%	6.01%	5.24%	4.48%	3.83%	3.27%	2.80%

Table 37.Recommended Traffic Growth Rates at interval of Five Years

The Optimistic and Pessimistic (assumed GDP-0.5%) traffic growth rates scenarios would be as follows:

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 -35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.77%	2.91%	2.81%	3.90%	3.40%	2.91%	2.49%	2.13%	1.82%
Bus	0.00%	3.38%	3.54%	3.42%	4.75%	4.14%	3.54%	3.03%	2.59%	2.21%
LCV	0.00%	3.43%	3.59%	3.47%	4.81%	4.20%	3.59%	3.07%	2.62%	2.24%
2 AT	0.00%	-0.84%	-0.88%	-0.85%	-1.18%	-1.26%	-1.32%	-1.38%	-1.44%	-1.50%



3 AT	0.00%	-0.98%	-1.03%	-0.99%	-1.38%	-1.47%	-1.53%	-1.60%	-1.67%	-1.75%
MAV	0.00%	4.49%	4.70%	4.54%	6.31%	5.50%	4.70%	4.02%	3.44%	2.94%

Table 38. Optimistic Traffic Growth Rates at interval of Five Years

Vehicle Type	FY 21	FY 22	FY 23	FY 24	FY 25	FY 26-30	FY 31 - 35	FY 36 -40	FY 41-45	FY 46-50
Car	0.00%	2.51%	2.63%	2.54%	3.53%	3.08%	2.63%	2.25%	1.92%	1.65%
Bus	0.00%	3.06%	3.20%	3.10%	4.29%	3.75%	3.20%	2.74%	2.34%	2.00%
LCV	0.00%	3.10%	3.25%	3.14%	4.35%	3.80%	3.25%	2.78%	2.37%	2.03%
2 AT	0.00%	-0.76%	-0.80%	-0.77%	-1.07%	-1.14%	-1.19%	-1.25%	-1.30%	-1.36%
3 AT	0.00%	-0.89%	-0.93%	-0.90%	-1.24%	-1.33%	-1.39%	-1.45%	-1.51%	-1.58%
MAV	0.00%	4.06%	4.26%	4.11%	5.71%	4.98%	4.25%	3.64%	3.11%	2.66%

Table 39. Pessimistic Traffic Growth Rates at interval of Five Years

3.10.6 IMPACT OF DELHI-MUMBAI DEDICATED RAILWAY FREIGHT CORRIDOR

The construction of Mumbai-Delhi Railway Freight Corridor is in progress and expected to be operational by year 2025. Due to this corridor operation, a partial reduction in the traffic of heavy commercial vehicles (trucks and MAVs) is expected. Based on the **Diversion Curve Analysis** This reduction will be applied as follows:

Following figure give the proposed alignment of DFCC Corridor.

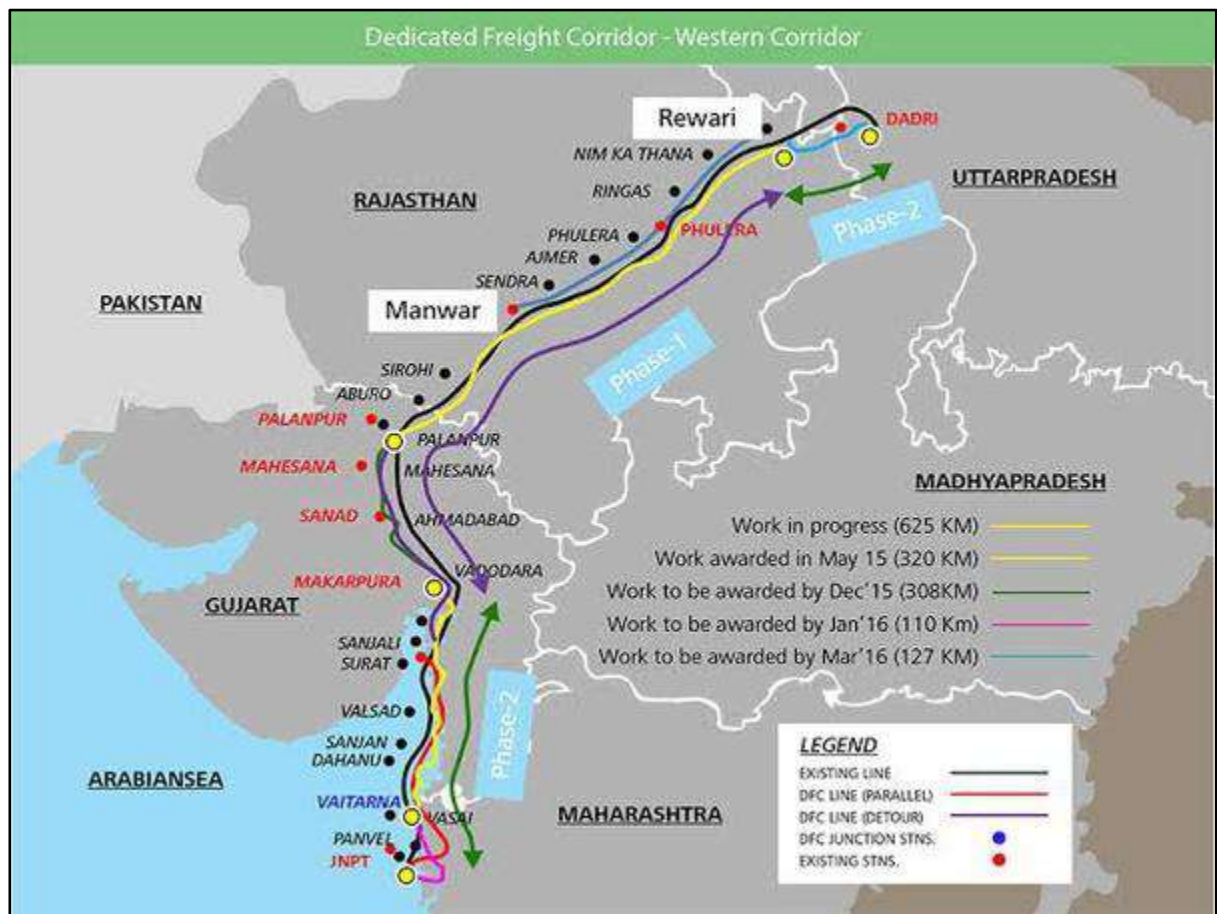


Figure15. Proposed DFCC Alignment

Small distance freight vehicles parallel to project road are less likely to shift to DFCC as from Palanpur to Phulera are the candidate origin destination pair. These trips are almost negligible in this project. Any freight vehicle traveling more than 500 Km is considered as traffic likely to divert to DFCC.

It should be noted that the diversion % percentage has been calculated for the Palanpur-Aburoad section and same has been considered for this section. As distance between toll plaza's (Undawariya and Kheemana) is around 68 kms, so pattern of diversion will hold good at both the sections is same.

Vehicle	Traffic Distribution		Generalized Cost				Diversion		Net Diversion			
	500-1000 Km	>1000 Km	By Rail 500-1000 Km	By Road 500-1000 Km	By Rail > 1000 Km	By Road > 1000 Km	Div % 500 - 1000 Km	Div % > 1000 Km	Div % 500 - 1000 Km	Div % > 1000 Km	Total -2025	Total -2026
2 AT	34%	12%	12473	24999	23964	41665	92%	91%	31%	11%	17%	25%
3 AT	22%	16%	18709	25277	35945	42128	83%	75%	18%	12%	12%	18%
MAV	27%	10%	23633	49111	45405	81851	93%	92%	25%	9%	14%	21%

Table 40. Decrease of Commercial Traffic due to diversion of freight to Railway

Loss of commercial traffic due to Impact of DFCC is presented below:-

Year	2-Axle	3-Axle	MAV
FY-2025	84	129	940
FY-2026	127	194	1410

This road cannot be taken as competing route to DMIC and Delhi Mumbai Expressway because they are far away. Proposed Amritsar – Jamnagar Expressway is about 110 Kms west of this route serving port bound traffic to Jamnagar. As most of heavy vehicle long distance traffic are going to shift to DFCC, almost negligible traffic will shift to this route from project route.

Following map indicates the all the routed running parallel to the project road and indicates that DFCC is the only route which competes for traffic on the project road.



Figure 16.Competing Road and DFCC Alignment

3.11 TRAFFIC PROJECTIONS AND CAPACITY ANALYSIS

The following tables present the estimated traffic based on AADT tollable traffic growth rates for the project stretch for the period of the concession. In the year 2021 means the year from April 2020 to March 2021, i.e., Financial Year 2020-21.

Year	Car/Jee p	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/E ME	Total Vehicles	Total PCUs	% ge Growth
2021	6,515	885	77	568	0	719	1,062	5,354	112	46	15,338	39,367	-
2022	6,515	885	77	568	0	719	1,062	5,354	112	46	15,338	39,367	0.00%
2023	6,687	914	79	586	0	713	1,052	5,583	117	48	15,780	40,640	3.23%
2024	6,866	945	82	606	0	707	1,042	5,833	122	50	16,254	42,024	3.40%
2025	7,050	976	85	626	0	583	908	5,249	127	52	15,656	38,933	-7.36%
2026	7,311	1,021	89	654	0	431	734	4,417	135	55	14,847	34,655	-10.99%
2027	7,548	1,062	92	680	0	425	724	4,649	142	58	15,380	36,055	4.04%
2028	7,793	1,104	96	707	0	420	714	4,892	149	61	15,936	37,525	4.08%
2029	8,045	1,148	100	735	0	415	704	5,148	157	65	16,516	39,069	4.11%
2030	8,305	1,194	104	764	0	410	694	5,418	166	68	17,122	40,689	4.15%
2031	8,574	1,242	108	794	0	405	684	5,702	174	72	17,754	42,390	4.18%
2032	8,812	1,284	111	820	0	400	674	5,957	182	75	18,316	43,909	3.58%
2033	9,056	1,328	115	848	0	395	664	6,224	190	78	18,899	45,494	3.61%
2034	9,306	1,374	119	877	0	390	655	6,503	199	82	19,503	47,146	3.63%
2035	9,564	1,421	123	906	0	385	645	6,794	208	85	20,131	48,869	3.65%
2036	9,829	1,469	127	937	0	381	636	7,098	217	89	20,782	50,665	3.68%
2037	10,062	1,512	131	964	0	376	626	7,370	225	92	21,357	52,260	3.15%
2038	10,300	1,556	134	992	0	371	616	7,652	234	96	21,951	53,913	3.16%
2039	10,544	1,602	138	1,020	0	366	607	7,945	243	100	22,565	55,626	3.18%
2040	10,794	1,649	142	1,050	0	361	598	8,250	252	104	23,198	57,403	3.19%
2041	11,049	1,697	146	1,080	0	356	589	8,565	262	107	23,852	59,245	3.21%
2042	11,273	1,739	150	1,107	0	351	579	8,846	270	111	24,426	60,871	2.74%
2043	11,501	1,783	154	1,134	0	347	570	9,136	279	115	25,017	62,547	2.75%
2044	11,734	1,827	157	1,162	0	342	561	9,435	288	118	25,625	64,277	2.77%
2045	11,972	1,873	161	1,190	0	337	552	9,744	298	122	26,249	66,062	2.78%
2046	12,214	1,920	165	1,220	0	333	543	10,063	307	126	26,891	67,902	2.79%
2047	12,426	1,961	169	1,246	0	328	534	10,345	316	130	27,453	69,519	2.38%

Year	Car/Jee p	Mini LCV	Mini Bus	Bus	LCV	2-axle truck	3-axle truck	MAV	OS (+6)	HCM/E ME	Total Vehicles	Total PCUs	% ge Growth
2048	12,641	2,002	172	1,272	0	323	525	10,634	325	133	28,028	71,179	2.39%
2049	12,860	2,045	176	1,299	0	318	516	10,932	334	137	28,618	72,884	2.40%
2050	13,083	2,089	180	1,326	0	314	508	11,238	343	141	29,221	74,636	2.40%

Table 41. Traffic Volumes (AADT Tollable)

As per the Concession Agreement for InvIT projects, NHAI may undertake or cause to undertake the process for capacity augmentation of the Project Stretch to 6/8-lane configuration in case that the average daily tollable traffic in any accounting year exceeds the designed capacity of 40,000 PCUs for Project Stretch and continues to exceed the designed capacity for three consecutive accounting years, and until the Level of Service C of the highway is reached, 60,000 PCU. According to the estimated traffic projections, the Authority could undertake the process for capacity augmentation of this project stretch at anytime from 2030 to 2042, when the level of service C is reached, and the construction period for capacity augmentation can be assumed to be 2.0 years.

3.12 AXLE LOAD SURVEY ANALYSIS

Axle load survey in both directions has been carried out at all three toll plazas 2 normal days (48hrs) using axle load. Methodology and procedure stipulated in IRC 37 has been followed. Axle loads obtained from the survey have been converted into equivalent standard axles by using equivalency factors recommended by AASTHO. Equation adopted for computation of VDF has been presented below.

$$\text{Single axle with single wheel on either side, } ESA = \left(\frac{\text{axle load in kN}}{65} \right)^4$$

$$\text{Single axle with dual wheels on either side, } ESA = \left(\frac{\text{axle load in kN}}{80} \right)^4$$

$$\text{Tandem axle with dual wheels on either side, } ESA = \left(\frac{\text{axle load in kN}}{148} \right)^4$$

$$\text{Tridem axle with dual wheels on either side, } ESA = \left(\frac{\text{axle load in kN}}{224} \right)^4$$

Using the above equations, VDF has been computed for various categories of commercial vehicles and presented in table below.

Type	Swaroopganj to Abu Road	Abu Road to Swaroopganj
LCV	1.46	0.42
2A	2.39	1.15
3A	3.55	3.14
4A	3.85	3.33
5A	12.80	15.22
6A	13.97	9.54

Table 42. Vehicle Damage Factors (VDF) for Commercial Vehicles

3.13 LANE CHOICE BEHAVIOR

The lane choice behaviour of the carriageway describes the preferred lane by the commercial traffic moving along the Project Stretch. This in turn has effect on the pavement structure in terms of distress caused due to movement of heavy commercial traffic on the same preferred lane. The lane choice behaviour as observed in the Project Stretch is inner lane on both LHS and RHS. However pavement design of road shall be done according to IRC 37 which duly takes in to account the lane choice behaviour for Indian road conditions.

3.14 TRAFFIC SEGMENTATION

For understanding the revenue stream at the toll plaza, based on actual Monthly user fee collection of existing traffic segmentation is collected from the toll plaza as given in the below table.

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commer cial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
No. of Monthly Passes	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
All types of Single Entry	86.3%	94.6%	98.0%	99.0%	98.9%	97.0%
Multiple Entry	0.6%	1.2%	0.3%	0.1%	0.1%	0.0%
Reuse of Multiple Entry Ticket	0.6%	1.1%	0.3%	0.1%	0.1%	0.0%
Reuse of Monthly Passes	4.4%	0.1%	0.3%	0.0%	0.2%	0.0%
Concession Entry/LDV's	0.0%	0.1%	0.0%	0.1%	0.2%	0.0%
Exempted	7.9%	2.8%	1.0%	0.7%	0.6%	3.0%

Table 43. Traffic Segmentation (based on user fee collection)

3.15 POSSIBILITY OF TOLL LEAKAGE

The project site starts from Aburoad and ends at Swaroopganj covering a length of 31Kms. (646+000 to 677+000) and toll plaza at km 670+750 (near Undavariya village) near Swaroopganj. As per current survey one earthen (unpaved) track 3 to 3.5 mtr width and 1.80 kms length is found. Since between exit and entry point on Highway to earthen track is 400 mtr therefore diversion of traffic for toll savings is not significant because of more length and time to travel, less width of track and village problems, there is no leakage of traffic is found at Toll Plaza.

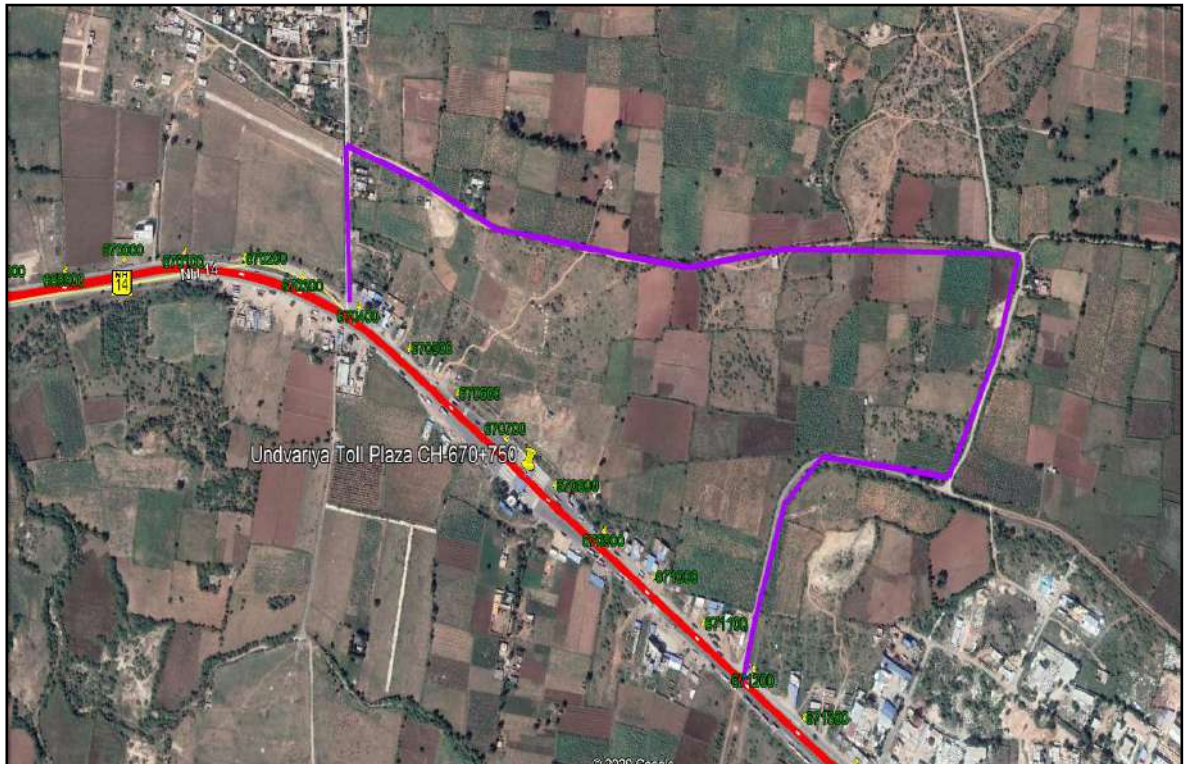


Figure 17. Possible Leakage Route

Existing earthen parallel track at Undavariya Toll LHS side
Length of earthen track - 1.800 Km
Width of earthen road - 3 to 3.5m

4 PAVEMENTS

4.1 GENERAL

The existing pavement along the entire project is flexible except for the rigid pavement in Toll Plaza (Undavariya); and the project road has four lanes (2+2) with paved shoulder.

It should be noticed that this project road is under a BOT (Annuity) Contract with tenure up to 24/03/2024; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road under the InvIT transaction.

Knowing this issue, although this section of the project will be out of the pavement initial scope of works, it was decided to include it in present pavement study.

Pavement evaluation includes the investigation and assessment of its current condition, and the design of the strengthening/improvement of those sections where remaining life is estimated to be of less than 10 years.

The general procedure for the evaluation and strengthening design of in-service pavements follows the guidelines of IRC: 37-2012 – “Guidelines for the Design of Flexible Pavements” and IRC: 115-2014- “Structural Evaluation and Strengthening of Flexible Road Pavements Using Falling Weight Deflectometer (FWD) Technique”.

The kilometric chainage used for the processing of the NSV data, see below point 4.5, has been theoretically assigned from the start to the end points of the stretch by the NSV, including any reference to cracks in the rigid pavement. For the rest of the section within this Chapter, basically the flexible pavement section, it has been used the kilometric chainage as per the existing kilometric stones on site. In Annexure 12 (Strip Plan & Kilometric Reference) it is provided a table of reference between the existing KM stones on site and the kilometric chainage used for NSV data in present report.

The works undertaken by the consultant to evaluate the pavement of this project stretch have mainly consisted in:

1. Field works, which included data collection of the geometry and condition of the pavement, its visual survey, a structural evaluation, pavement materials investigation and traffic surveys of the highway stretch under study. It was developed a systematic survey program of the parameters that define the condition of the pavement using high-performance survey vehicles and equipment (NSV). These vehicles are really efficient and allow collecting large amount of surface pavement condition data accurately and in a short time. This systematic survey is important not only to study the present condition of pavements, but also to be able to forecast their future evolution as accurately as possible. It was programmed and executed a campaign of test pits and core cuttings to investigate the thicknesses of the pavement crust and the characterization of subgrade soils, and granular and bituminous materials. In addition, and in order to evaluate the bearing capacity of the pavement, deflections measures were taken by FWD.
2. Following the field works, all data collected from the various surveys, site testing and investigations was analyzed and processed. The works included the processing and analysis of pavement survey data, the laboratory testing and characterization of materials sampled at site, the analysis of traffic data collected from surveys and the estimations of future traffic demand, the calculation and normalization of deflection values from FWD, back-calculation to obtained the elastic moduli of the pavement layers, the estimation of remaining life based on the number of MSA, the calculation of required overlays, and the establishment of a maintenance plan through

HDM-4.

3. BOQ of the required improvement works

The detail of all these works is described below in this chapter.

4.2 FIELD WORKS AND INVESTIGATIONS

4.2.1 NSV DATA

A network Survey Vehicle is a high-performance survey equipment that allows the collection of roads geometrical data (such as slope, cross slope and radius of curvature), roads surface pavement distresses (such as cracking, IRI, rutting, raveling) road assets inventory data, and roads images (frontal and pavement). NSVs have been developed to obtain all such information in one single pass along each lane of the highway.

It is a basic tool to collect essential data before starting to manage a highway network (main source of data for a Road Assets Management System (RAMS) or at any time to evaluate the condition of road pavements while providing all the necessary measures to help forecasting their evolution as accurately as possible. In parallel it allows to create or maintain an inventory of all highway basic elements and furniture subjected to maintenance. It should be noted that in addition to an efficient NSV it is of major importance the capacity and experience to analyze, process and manage the data collected by NSV to warrant a reliable and high quality final product.

4.2.1.1 COMPONENTS OF THE SYSTEM

Following is a brief description of different components/systems of a NSV.

The GPS Vision system consists of a high grade Differential Global Positioning System (DGPS), Rocket grade Inertial Measurement Unit (IMU), sub centimeter Distance Measuring Instrument (DMI), six 1600 x 1200 optical cameras mounted in stereo pairs viewing forward front, left and right, a house front camera, two optical to infrared downward pavement facing cameras. Two sets of line lasers mounted behind the rear wheels projecting to rear of vehicle and point lasers in the wheel path projecting down and several computers and mass storage devices and user interface system.



Figure 18. GPS vision system

The components of GPS Vision System contribute to the following features:

- The external hardware is interfaced with a central data logger unit which stores the collected location, image and laser data for transfer to processing software.
- Laser profilometer utilizes a class I profiler to collect roughness measurements in the form of the International Roughness Index (IRI).
- Rutting profile of the pavement surface is generated using two line-lasers mounted at each wheel path and two thermal cameras mounted at the roof of the vehicle over each wheel path laser enclosure to capture full lane rutting profile.
- Pavement right of way image logs are captured which are geometrically correct to quickly locate and measure any roadway feature and extract that data for further plotting on maps or to populate databases.
- Road geometry measurement is done using built-in high resolution Inertial Navigation System to calculate the radius of curvature, cross-fall and etc.
- A GPS system Vertical accuracy of the vehicle location is utilized.
- The system has a built-in Distance Measuring Instrument (DMI) with less than 1 mm accuracy.

4.2.1.2 PAVEMENT CONDITION DATA COLLECTION

The images collected by GPS Vision system are used to obtain all the necessary pavement distresses to estimate the Pavement Condition Index (PCI); rutting, raveling, cracking, potholes, and so on. These images organized based on the survey planned will be used in desktop based feature extraction software for extracting road distresses and right of way features and its attributes and storing them in industry standard RDBMS.

The distresses on the roads will be identified and captured in a virtual environment through viewing of stereo-pair high resolution images.

The images of the pavement captured are used to identify sample units. Multiple sample units are marked along the road and each sample unit are recorded with road distresses based on the surface type i.e., Asphalt, PCC and etc.

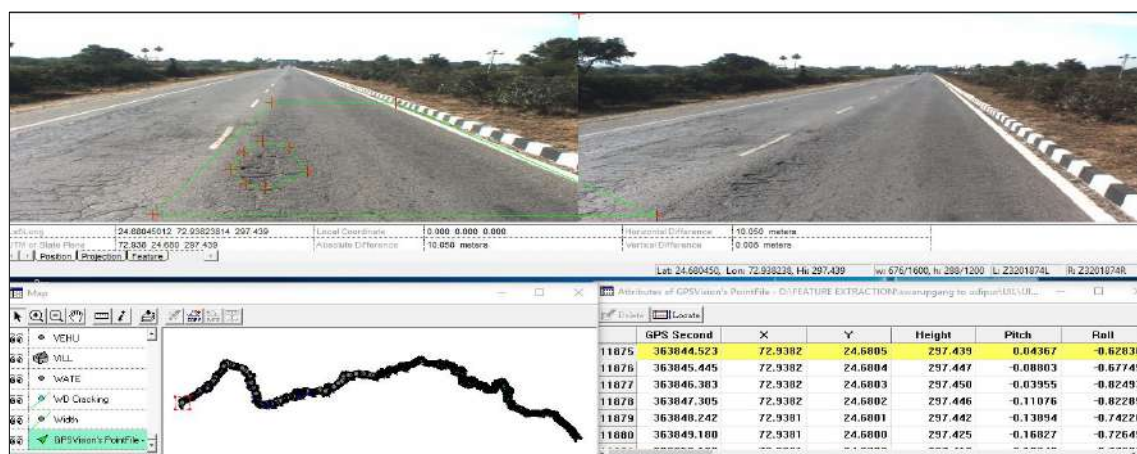


Figure 19. Snapshot of feature extraction software window

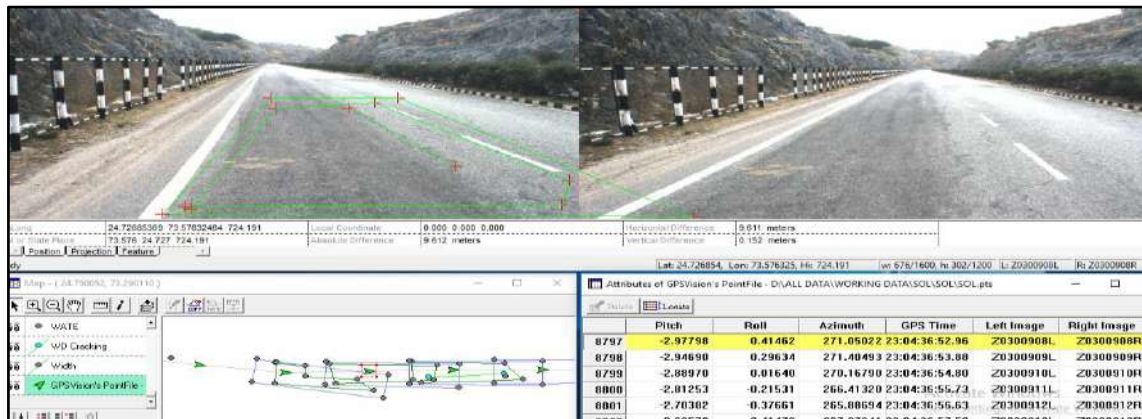


Figure 20. Snapshot of feature extraction of wide cracking

The type and severity of pavement distress is assessed by visualizing the processed digital image in the feature extraction software and then marking the distresses in the sample unit.

The distress data are used to calculate the PCI for each sample unit using ASTM methodology. The PCI of the pavement section is determined based on the PCI of the inspected sample units within the section.

In addition, measurements of the International Roughness Index (IRI) of the highway are collected through a class I laser profilometer. These IRI measurements are later analyzed and process to obtain the final IRI values of the road/lane of the required segments (100 m, 500 m, 1,000 m...). Based on these values, it can be calculated the Roughness of road in BI terms using the corresponding conversion formula.

The PCI and IRI rating for the roads will finally be done based on the required standards about road condition applicable to each particular project.

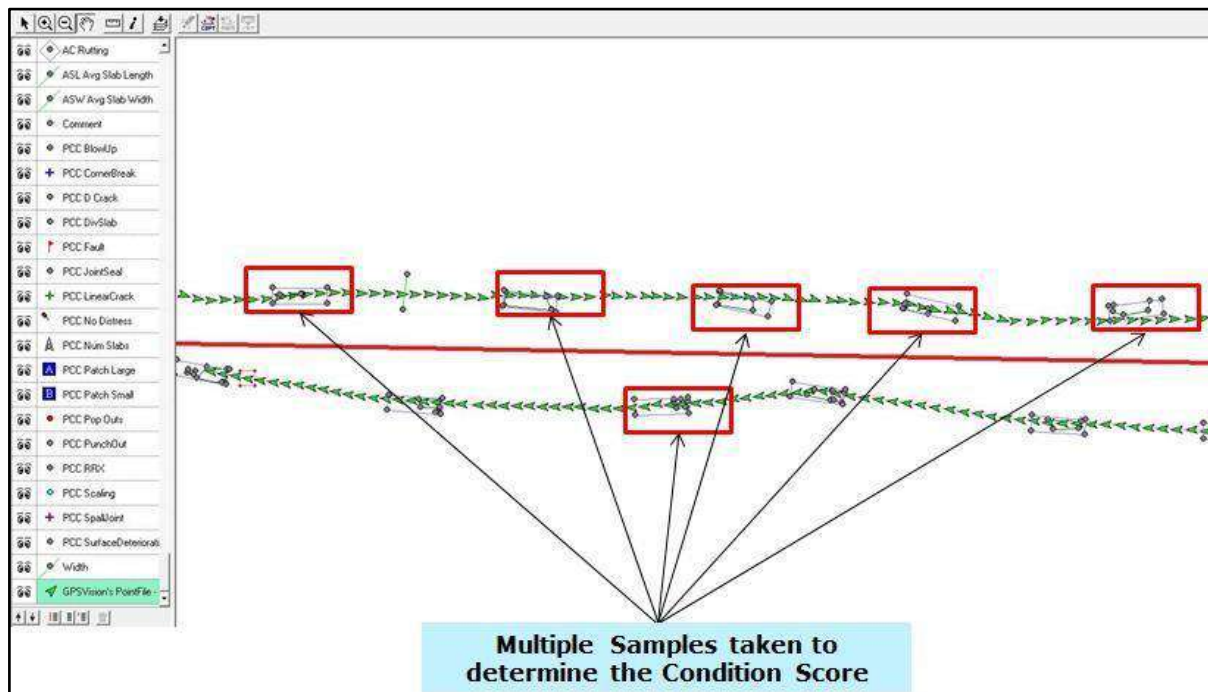


Figure 21. Window showing multiple samples

4.2.1.3 RIGHT OF WAY DATA COLLECTION

As in the road distress feature extraction process stereo pair images is used in feature extraction software to extract right of way inventory.

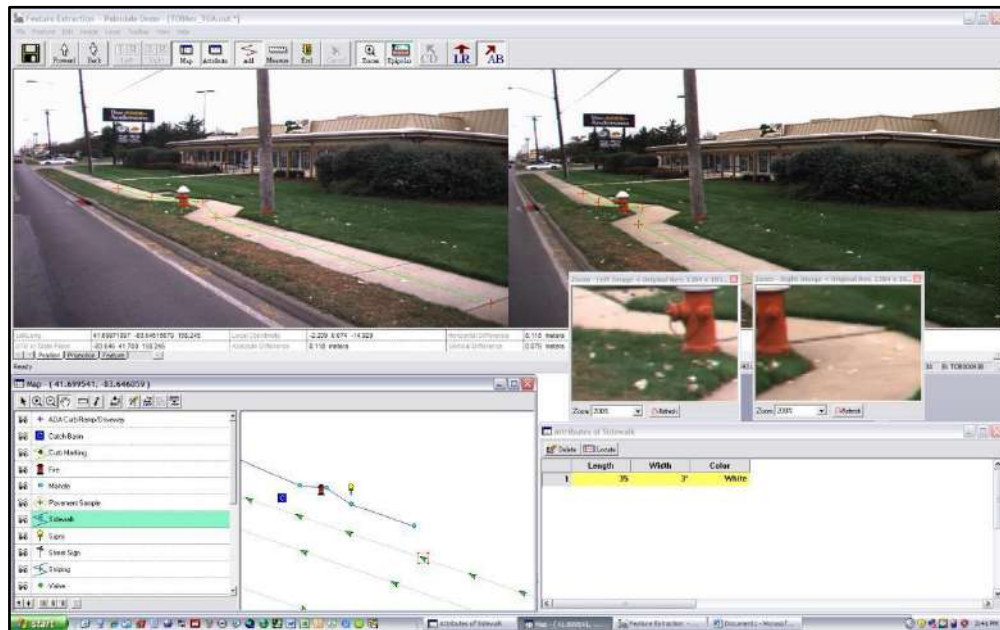


Figure 22. Snapshot showing extraction of Right of Way features

This process of inventory is repeated for all road assets that are required to be part of the final inventory. The minimum aspects to be collected from each asset are as follows, although other special and additional details/attributes of particular assets can be collected. They are described below:

- Road
- Section (LHS/RHS)
- Kilometric Point (initial and final)
- Latitude and Longitude
- Date
- Margin (LEFT/RIGHT/BOTH (LEFT AND RIGHT)),

In addition to the above other special and additional details/attributes of importance for particular assets can be collected.

Typical road assets are:

- Affected service
- Bypass
- Carriageway
- Culvert (asset inventory included in further section)
- Delineator post
- Embankment



- Flyover
- Fuel station
- Guard post
- Guide post
- Hectometre stone
- High mast lights
- Junction
- Kilometre stone
- Land use
- Line drain
- Median opening
- Median
- Pedestrian cattle underpass
- Pedestrian guardrail
- Punctual road marking
- Retaining structure
- Roadside arboriculture
- Safety barrier
- Shoulder
- Sign
- Slip-Service road
- Solar blinker
- Street light
- Toilet block
- Toll plaza
- Truck lay bay
- Urban section
- Village town
- Water body
- Way side amenity

4.2.1.4 TEST PITS AND CORE CUTTINGS

Pavement layer thicknesses are an essential input for processing of back calculation of layer moduli and, in turn, estimation of remaining life and overlay requirements of the in-service pavement. Hence, it is necessary that accurate information is collected about layer thicknesses and characteristics from different sources.

The investigations were carried out along the existing road using trial pits and the following investigation and tests were conducted in those pits:

- Pavement Composition, layer thicknesses
- In-situ Dynamic Cone Penetration Tests to determine the field CBR of expose base and sub-grade.
- In-situ Field Density and Moisture Content test at sub-grade top.
- Collection and preservation of samples of all materials for further testing at the laboratory.

A total of 11 test pits were investigated at the site. As recommended in IRC:115-2014, 0.6 m x 0.6 m test pits were excavated at 2.5 km interval or at suitable larger interval where other records suggest uniformity of pavement composition in such larger sections. The test pits were excavated along the outer lane (LHS/RHS) from the outside edge of the outer lane in the earthen shoulders exposing pavement layers sufficiently to note the condition and thickness of each layer. After collecting necessary data from the test pits it were backfilled with suitable material and manually compacted so that it does not adversely affect the structural condition of the pavement and also do not create any traffic safety hazard.

After the completion of field work, samples of 1.0 kg at each of the location were collected and preserved in poly-bags so as to preserve the field conditions of the samples.

The samples collected were transported to environment controlled laboratory to undergo the laboratory investigations. Their suitability was assessed in accordance to MORT&H provisions.

4.2.1.5 DCP TEST

The aim of the Dynamic Penetration Test (DCP) is to determine the effort required to force a point through the soil and so obtain the resistance value which corresponds to the mechanical properties of the soil. The preliminary use is in cohesion less soils when static penetration test is difficult to perform or dynamic properties of the soil are of special interest.

The DCP values obtained in terms of mm/blow can further be used to determine the elastic modulus of the sub-grade. The penetration and no. of blows observed are plotted in the form of a curve. The bearing ratio (CBR) for Exposed base and Sub-grade base are usually calculated for the maximum penetration values as per Road Note 31.

4.2.1.6 FIELD DENSITY AND MOISTURE CONTENT TEST

The aim of this field test is to determine the in situ density of natural or compacted soils using sand pouring cylinders.

With this test it is possible to determine the field density of the soil. The moisture content is likely to vary from time and hence the field density also. So it is required to report the test result in terms of dry density. The relationship that can be established between the dry density with known moisture content is as follows:

$$\gamma_d = \gamma_b / (1 + \omega)$$

Where:

γ_d : Dry density

γ_b : Bulk density

ω : Water content

4.2.1.7 PAVEMENT COMPOSITION

For each test pit, the following information was recorded:

- Test pit reference (Identification number, location).
- Pavement composition (material type and thickness).
- Sub-grade type (textural classification) and condition (dry, wet).

In order to further investigate the bituminous layers of the pavement at the laboratory level and to determine with more accuracy the thicknesses of the bituminous layers, core cutting samples were extracted at every 5 km of each carriageway at the same road chainages where test pits were located.

4.2.2 FWD

4.2.2.1 GENERAL

The deflection of a pavement is the vertical deviation suffered by this pavement when it supports a standard load. The deflection itself is not a value that can define the structural capacity of a pavement. It depends on:

- Intensity of the applied load
- Surface on which it is applied
- Thickness of every layer
- Elastic module of each of the layers
- Cohesion degree among layers
- Resistance characteristics of support layers
- Discontinuity presence near the load
- Temperature of pavements
- Moisture

The higher the bearing capacity, the lower the deviation (deflection) the pavement will suffer.

Falling Weight Deflectometer (FWD) is the most common and used vehicle for knowing the support capacity of pavements.

It has been carried out a structural strength survey for existing pavements in this stretch of highway using Falling Weight Deflectometer (FWD) technique in accordance with the procedure given in IRC:115 for flexible road pavements.

4.2.2.2 DATA COLLECTION METHODOLOGY

A Falling Weight Deflectometer (FWD) is used for the measurement of deflection along the wheel path and spacing obtained by the condition survey.

The general considerations for FWD data collection are described below:

- Data collection with FWD should be carried out on the whole length of each segment along inner as well as outer wheel paths of all the lanes.
- The spacing between measurement points is defined according to IRC: 115-2014. Thus, spacing has not exceeded 250m.
- All lanes are to be measured. Thus, Inner and Outer lanes have measurement on each kilometer of data collection.
- Three drops are applied on each point of data collection (according to IRC: 115-2014).
- As FWD applies a load as a result of dropping a mass on the pavement, the applied force is not exactly 40 kN. Thus, the results have been standardized to 40 kN (according to IRC: 115-2014).
- Temperature measurement is done every 1hrs in accordance with IRC: 115-2014.
- Six deflections data are obtained from FWD on each point of data collection, one per geophone. For current pavement analysis only maximum deflections (corresponding to Geophone 0) have been used, except for Back-calculation analysis, in which all geophones data is required.

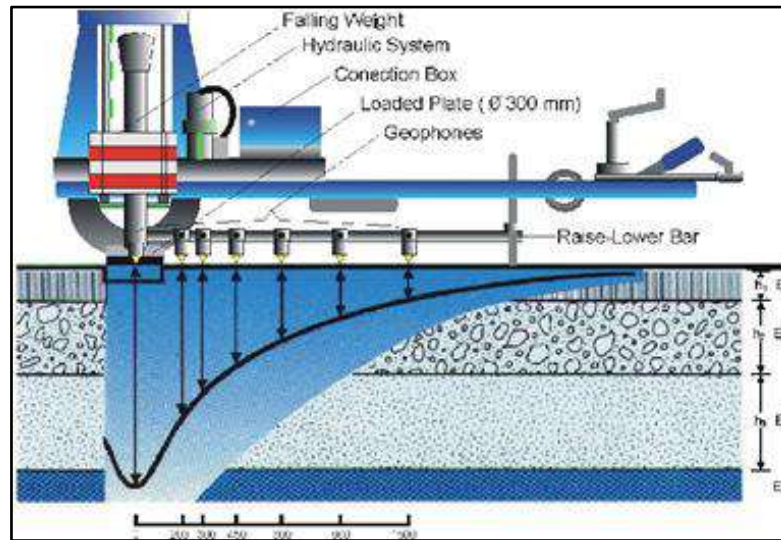


Figure 23 Scheme of results of Geophones of Falling Weight Deflectometer

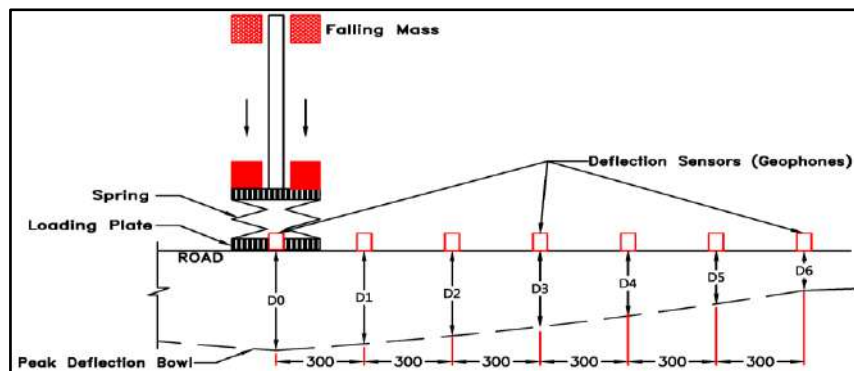


Figure 24. Working principle of a typical FWD



Figure 25. Falling Weight Deflectometer geophones

Pavement condition survey was done based on IRC: 115-2014 guidelines, which recommends a previous visual observation of the pavement for estimation of cracking, rutting and other distresses in the pavement. Based on the data collected from that condition survey, the road length is classified into

sections of uniform performance in accordance with the criteria given in Table 2 of IRC: 115-2014.

Classification	Pavement condition
Good	Isolated cracks of less than 3.0 mm width in less than 5% area of total paved surface AND average rut depth less than 10 mm
Fair	Isolated or interconnected cracks of less than 3.0 mm width in 5 to 20% area of total paved surface AND/OR average rut depth between 10 to 20 mm
Poor	Wide interconnected cracking of more than 3.0 mm width in 5 to 20% area (include area of patching and raveling in this) of paved area OR cracking of any type in more than 20% area of paved surface AND/OR average rut depth of more than 20 mm

Table 44. Pavement Condition Levels

From our visual inspection of this stretch, it was determined that the condition of the pavement was practically good along all the stretch, and consequently, we tested the corresponding number of points per kilometer as per the recommended measurement scheme in IRC: 115-2014.

Typical method of site data collection using FWD is described in below steps.

- Prepare the FWD unit for deflection testing
- Bring the FWD to a stopped position at the beginning of the test section, centered on the outside wheel path (or specific position), and take a measurement by applying load using following sequence: One settling drop to ensure proper contact. Three drops with an applied load of 40 kN \pm 10% (or Specified Load).
- Deflections are recorded from the sensors located at the center of the loading plate for each drop except the settling drop.
- Along with these deflection data, the parameter like chainage, temperature, date and time and position of sensors will also be recorded. The performa used to collect deflections data at site is provided below.
- After each measurement, drive the FWD forward to next measurement point.

Performa for Recording Pavement Deflection Data																
Name of the Road :								Date & Time of Observation								
No. of lanes & Carriageway Type :								Climatic Conditions (hot/humid/cold)								
Homogenous Section :																
S. No.	Lane Position	Location of test point		Temperature °C		Load Drop No	Peak Load Applied (kN)	Peak Deflection (mm) observed at a radial distance (mm) of								Remarks
		Chainage (km)	Distance from carriageway edge (m)	Air	Pavement			0	300	600	900	1200	1500	1800		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

Table 45. Proforma for recording Deflection Data

4.2.2.3 DATA ANALYSIS

Normalization of data obtained from the average of three readings at each location is done taking into account the standardizing of loads to 40 kN, and the temperature and seasonal correction factors.

Analysis of data is done in accordance with IRC: 115-2014 to find the layer moduli of the existing pavement using KGPBACK.

4.3 ESTIMATION OF TRAFFIC (MSA)

The objective of this section is to estimate the Design Traffic (heavy traffic) in terms of Million Standard Axles (MSA) that this stretch of highway will be supporting during the concessional period of 30 years. This Traffic will be later compared with the residual traffic load calculated in terms of MSA that determines the Remaining Life of the pavement. Below calculations are based on the Traffic Surveys and Traffic Demand Report previously contemplated in section 3.

4.3.1 LANE CHOICE BEHAVIOR

For four-lane dual carriageway highways, as the stretch under study, it is important first to determine the preferred lane by the heavy traffic (particularly MAVs and 2/3-Axle Trucks) when moving along this highway; as this behaviour has an effect on that lane pavement structure in terms of distress caused due to movement of heavy commercial traffic.

The lane choice behaviour as observed in the Project Stretch is inner lane on both LHS and RHS as heavy vehicles try to optimize their operating cost. However, and in reference to lanes, we have decided to strictly follow IRC: 37 recommendations for lane distribution factor for our pavement design, which duly takes in to account the lane choice behaviour for Indian road conditions.

4.3.2 ESTIMATION OF AXLE LOAD AND VEHICLE DAMAGE FACTOR (VDF)

The traffic loading on the highway can be determined and standardized by using Equivalent Standard Axle Load (ESAL) factors like the Vehicle Damage Factor (VDF).

The VDF is a multiplier for converting the number of commercial vehicles of different axle loads to the number of standard axle load repetitions. The strengthening of an existing pavement is based upon the cumulative number of 80 kN (8.16 tonne) Equivalent Standard Axles (ESA) that will pass over it during the design period.

The classes of traffic which transmit higher loads and can thus produce substantial damages to the pavement are: LCV/LGV (light cargo vehicles), Buses, 2/3 axle Trucks and Multi Axle Vehicles (MAV); and consequently these are the vehicles to be considered for pavement designing.

VDF are calculated in accordance with the guidelines provided in IRC: 37.

As mentioned earlier in Chapter 3, Axle Load surveys of commercial vehicles were carried out at the toll plaza locations to estimate corresponding VDFs and to check the pattern of overloaded vehicles which can negatively affect the performance of existing pavements.

The spectrum of axle load in terms of axle weights of single, tandem, tridem and multi-axle have been determined and compiled under various classes with class intervals of 10 kN, 20 kN and 30 kN for single, tandem and tridem axles respectively.

The equations for computing equivalency factors for single, tandem and tridem axles given below have been used for converting different axle load repetitions into equivalent standard axle load repetitions.

$$\text{Single axle with single wheel on either side, ESA} = \left(\frac{\text{axle load in kN}}{65} \right)^4$$

$$\text{Single axle with dual wheels on either side, ESA} = \left(\frac{\text{axle load in kN}}{80} \right)^4$$

$$\text{Tandem axle with dual wheels on either side, ESA} = \left(\frac{\text{axle load in kN}}{148} \right)^4$$

$$\text{Tridem axle with dual wheels on either side, ESA} = \left(\frac{\text{axle load in kN}}{224} \right)^4$$

Summation of all ESA gives the total damaging effect for that location. By knowing the number of vehicles weighed and number of axles weighed and total damaging effect, VDF and Axle Equivalency were computed.

$$VDF = \frac{\text{Total ESA}}{\text{No. of vehicles weighed}}$$

$$\text{Axle Equivalency} = \frac{\text{Total ESA}}{\text{No. of axles weighed}}$$

For the purpose of structural design of pavement, only the number of commercial vehicles with laden weight of 30 kN or more and their axle loading pattern has been considered.

Based on the spectrum of axle loads and analysis of axle load data at surveyed location the resulting VDFs are as given in Table 46.

Type of Vehicle	Calculated VDF LHS Carriageway Abu road - Swaroopganj	Calculated VDF RHS Carriageway Swaroopganj - Abu road
LCV	1.455	0.422
Truck - 2 Axle	2.385	1.149
Truck - 3 Axle	3.545	3.137
MAV	10.200	9.360
BUS	1.000	1.000

Table 46. Vehicle Damage Factors (VDF)

The combined VDF for different types of vehicles are given in the following figure:

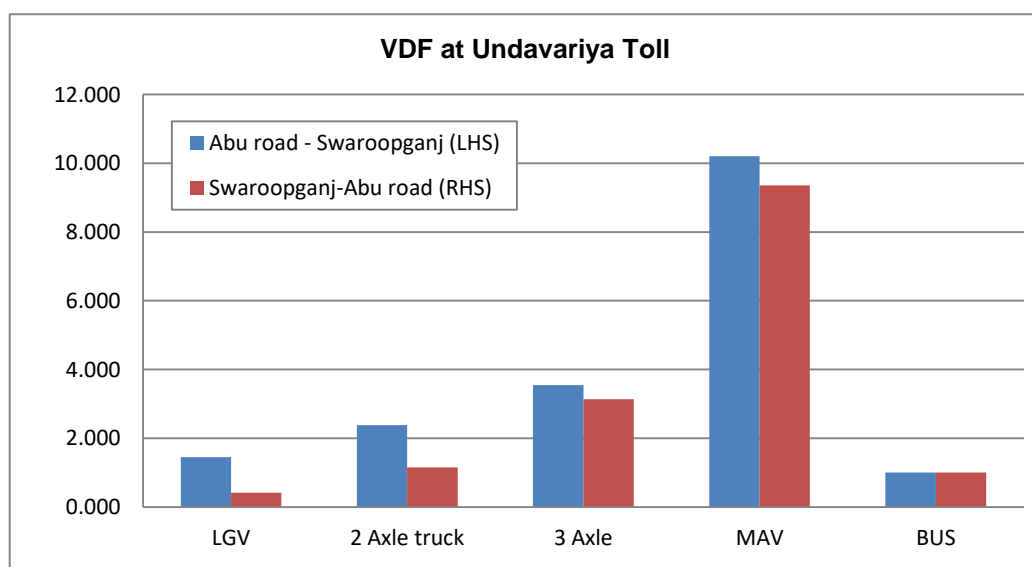


Figure 26. VDF observed for various classes of vehicle

The load distribution pattern (i.e. percentage of empty to loaded vehicles) in both directions is presented below:

- It is observed that vehicle damage factor in RHS is similar to LHS in multi axle vehicles and buses at both locations. But in other categories the VDF of commercial traffic present more differences.

- At Undavariya (Toll) VDF of all commercial vehicles except for LGV/2-Axle are nearly same on both carriageways.
- The VDF values of MAV in LHS are slightly higher as compared to RHS.
- More percentage of Multi axle Vehicles exceed the legal excel load 35.20 tons in LHS as compare to RHS (Section 3. TRAFFIC STUDY).

4.3.3 DESIGN TRAFFIC (MSA)

The design traffic is considered in terms of the cumulative number of standard axles in both directions of the carriageway during the design life of the road. This can be computed using the following equation:

$$N = \frac{365 \times [(1 + r)^n - 1]}{r} \times A \times D \times F$$

where **N** is the cumulative number of standard axles to be catered for the design in terms of Million Standards Axle (MSA), **A** is the initial traffic in terms of the number of commercial vehicles per day, **D** is the lane distribution factors, **F** is the vehicle damage factor, **n** is the design life in years, and **r** is the annual growth rate of commercial vehicles. The traffic in the year of completion is estimated using the following formula: $A = P (1 + r)^x$ where **P** is the number of commercial vehicles as per last count, and **x** is the number of years between the last count and the year of completion between the last count and the year of completion of the project.

Based on the IRC-37-2012 of design the pavement is designed uniformly with the below section. To achieve economy based on the projected MSA pavement section can be varied at different locations.

The entire stretch has been divided into 3 sections based on the traffic load.

Section No	Starting		Ending		Length of Homogeneous Section (km)
	Existing km	Location	Existing km	Location	
I	646+000	Abu Road	677+000	Swaroopganj	31.00

Table 47. Traffic Sections

The estimated total traffic in terms of AADT for this section (from Chapter 3) starting from 2020 is summarized for 10 years of Concession Period (i.e. 2030), 20 years of Concession Period (i.e. 2040) and 30 year of Concession Period (i.e. 2050)as below:

Section	Traffic in year (i.e. 2020)	10 years (i.e. 2030)	20 years (i.e. 2040)	30 years (i.e. 2050)
I : Abu Road - Swaroopganj	15,338	17,122	23,198	29,221

Table 48. Traffic Estimates in AADT

Section wise design traffic in cumulative MSA based on VDF parameters has been worked out and summarized in table below:

Section	Traffic in year (i.e. 2020)	10 years (i.e. 2030)	20 years (i.e. 2040)	30 years (i.e. 2050)
I : Abu Road – Swaroopganj LHS	9.7	83.0	145.5	213.4
I : Abu Road – Swaroopganj RHS	8.7	74.6	130.5	191.2

Table 49. Traffic Estimates in MSAs

From Table 49it may be observed that the traffic is on Section – I Abu road – Swaroopganj is similar on

both carriageways. Section-I a design value of 90 MSA for LHS and 80 MSA for RHS is considered for Structural evaluation for pavement of next 10 years based on 2030 values.

4.3.4 YEARLY ESTIMATED DESIGN TRAFFIC

For the 10 years of the first design period, the estimated design traffic in MSA is calculated with the same lane distribution factor throughout the period.

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No ofYears
	2	3	4	11	1				
2020	258	392	540	2827	312	9652699	9652699	9.65	0
2021	266	389	536	2935	321	9977231	19629930	19.63	1
2022	273	386	531	3047	330	10314434	29944364	29.94	2
2023	281	384	527	3164	340	10664786	40609150	40.61	3
2024	289	381	522	3284	349	11028785	51637935	51.64	4
2025	298	291	389	2470	359	8363670	60001605	60.00	5
2026	310	161	189	1189	374	4192358	64193963	64.19	6
2027	322	159	187	1252	388	4386332	68580296	68.58	7
2028	335	157	184	1317	404	4590629	73170925	73.17	8
2029	348	155	182	1386	420	4805779	77976704	77.98	9
2030	362	153	179	1459	436	5032344	83009048	83.01	10
2031	375	151	176	1524	451	5235513	88244560	88.24	11
2032	388	149	174	1592	466	5447927	93692487	93.69	12
2033	401	147	171	1664	482	5669994	99362482	99.36	13
2034	415	146	169	1738	498	5902138	105264619	105.26	14
2035	429	144	166	1816	515	6144802	111409421	111.41	15
2036	441	142	164	1886	530	6360840	117770261	117.77	16
2037	454	140	161	1958	545	6585280	124355541	124.36	17
2038	467	138	159	2033	560	6818438	131173979	131.17	18
2039	481	136	156	2111	577	7060641	138234620	138.23	19
2040	495	135	154	2192	593	7312230	145546850	145.55	20
2041	507	133	152	2263	608	7534628	153081478	153.08	21
2042	520	131	149	2337	623	7764414	160845892	160.85	22
2043	533	129	147	2414	638	8001826	168847719	168.85	23
2044	546	127	144	2493	654	8247108	177094826	177.09	24
2045	560	126	142	2574	670	5667007	182761833	182.76	25
2046	572	124	140	2646	684	5815942	188577775	188.58	26
2047	584	122	137	2720	699	5969119	194546893	194.55	27

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No of Years
	2	3	4	11	1				
2048	597	120	135	2797	714	6126654	200673548	200.67	28
2049	610	119	133	2875	729	6288667	206962215	206.96	29
2050	623	117	131	2955	744	6455281	213417496	213.42	30

Table 50. Section - LHS (Undavariya) From Abu road - Swaroopganj

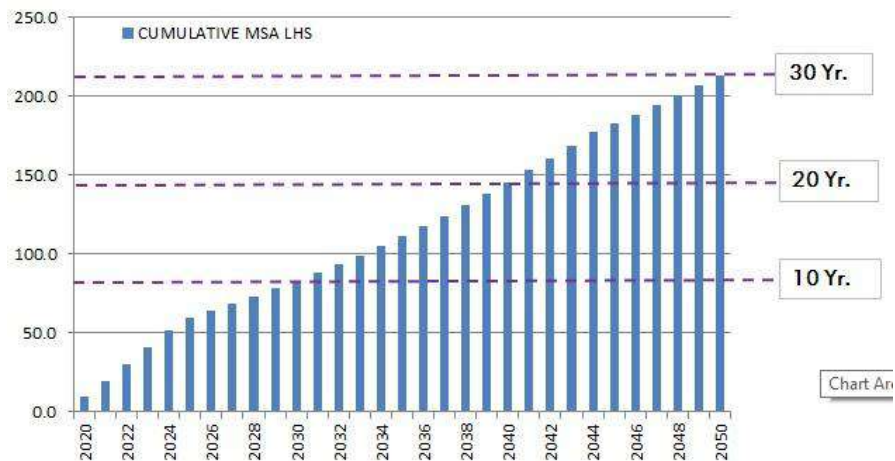


Figure 27. Cumulative MSA: Section - LHS (Undavariya). From Abu road - Swaroopganj

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No of Years
	1	2	4	10	1				
2020	258	392	540	2827	312	8700870	8700870	8.70	0
2021	266	389	536	2935	321	8994552	17695422	17.70	1
2022	273	386	531	3047	330	9299708	26995130	27.00	2
2023	281	384	527	3164	340	9616775	36611905	36.61	3
2024	289	381	522	3284	349	9946203	46558109	46.56	4
2025	298	291	389	2470	359	7526324	54084433	54.08	5
2026	310	161	189	1189	374	3738033	57822466	57.82	6
2027	322	159	187	1252	388	3912084	61734550	61.73	7
2028	335	157	184	1317	404	4095422	65829972	65.83	8
2029	348	155	182	1386	420	4288526	70118498	70.12	9
2030	362	153	179	1459	436	4491901	74610399	74.61	10
2031	375	151	176	1524	451	4674311	79284709	79.28	11
2032	388	149	174	1592	466	4865042	84149752	84.15	12
2033	401	147	171	1664	482	5064462	89214214	89.21	13

VDF	LCV	2 - Axle	3 - Axle	MAV	BUS	Standard Axles in year	Cum Standard Axles	Cum MSA	No ofYears
	1	2	4	10	1				
2034	415	146	169	1738	498	5272954	94487168	94.49	14
2035	429	144	166	1816	515	5490917	99978085	99.98	15
2036	441	142	164	1886	530	5685002	105663086	105.66	16
2037	454	140	161	1958	545	5886653	111549739	111.55	17
2038	467	138	159	2033	560	6096155	117645894	117.65	18
2039	481	136	156	2111	577	6313803	123959697	123.96	19
2040	495	135	154	2192	593	6539905	130499602	130.50	20
2041	507	133	152	2263	608	6739801	137239403	137.24	21
2042	520	131	149	2337	623	6946353	144185756	144.19	22
2043	533	129	147	2414	638	7159773	151345529	151.35	23
2044	546	127	144	2493	654	7380283	158725813	158.73	24
2045	560	126	142	2574	670	5072074	163797886	163.80	25
2046	572	124	140	2646	684	5205995	169003881	169.00	26
2047	584	122	137	2720	699	5343738	174347619	174.35	27
2048	597	120	135	2797	714	5485409	179833028	179.83	28
2049	610	119	133	2875	729	5631115	185464143	185.46	29
2050	623	117	131	2955	744	5780967	191245110	191.25	30

Table 51.Cumulative MSA: Section - RHS (Undavariya) From Swaroopganj – Abu road

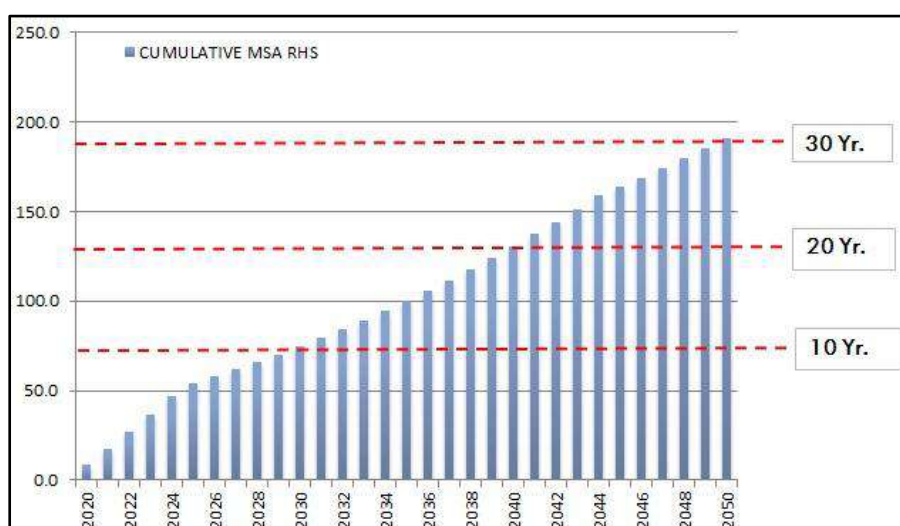


Figure 28. Cumulative MSA: Section - RHS (Undavariya). From Abu road - Swaroopganj

As can be observed from above figure the cumulative estimated design traffic in LHS is slightly higher as compared to RHS.

4.4 SUBGRADE STRENGTH AND PAVEMENT MATERIALS INVESTIGATION

4.4.1 FIELD TEST RESULTS

The locations of test pits investigated for this highway stretch (Abu road - Swaroopganj) with their co-ordinates are provided in the next table.

S. No.	Chainage	Direction	Test Pit No.	Coordinates	
				X	Y
1	647+000	LHS	12	276038	2708077
2	649+500	RHS	11	277601	2710092
3	652+000	LHS	10	279637	2711261
4	654+500	RHS	9	280436	2713493
5	657+000	LHS	8	282095	2715315
6	659+750	RHS	7	281658	2717380
7	662+000	LHS	6	283282	2788510
8	664+500	RHS	5	284767	2720808
9	667+000	LHS	4	286251	2722850
10	669+500	RHS	3	287397	2724978
11	671+050	LHS	2	288418	2726137

Table 52. Test Pit Locations

4.4.1.1 DCPT VALUES

The results obtained in site for DCP test are given in the next table.

CBR values using DCPT						
S. No.	Chainage	Direction	DCPT No.	Test Pit No.	Layer	CBR Value (%)
1	647+000	LHS	12	12	Exposed Base	47
					Subgrade Base	31
2	649+500	RHS	11	11	Exposed Base	28
					Subgrade Base	48
3	652+000	LHS	10	10	Exposed Base	52
					Subgrade Base	8
4	654+500	RHS	9	9	Exposed Base	65
					Subgrade Base	12
5	657+000	LHS	8	8	Exposed Base	29
					Subgrade Base	18
6	659+750	RHS	7	7	Exposed Base	37
					Subgrade Base	18
7	662+000	LHS	6	6	Exposed Base	60
					Subgrade Base	49

CBR values using DCPT						
S. No.	Chainage	Direction	DCPT No.	Test Pit No.	Layer	CBR Value (%)
8	664+500	RHS	5	5	Exposed Base	34
					Subgrade Base	23
9	667+000	LHS	4	4	Exposed Base	52
					Subgrade Base	22
10	669+500	RHS	3	3	Exposed Base	33
					Subgrade Base	9
11	671+050	LHS	2	2	Exposed Base	20
					Subgrade Base	31

Table 53. Test Results. CBR values using DCPT

The graphical representation of field DCPT-CBR % is presented in Figure 29 and Figure 30.

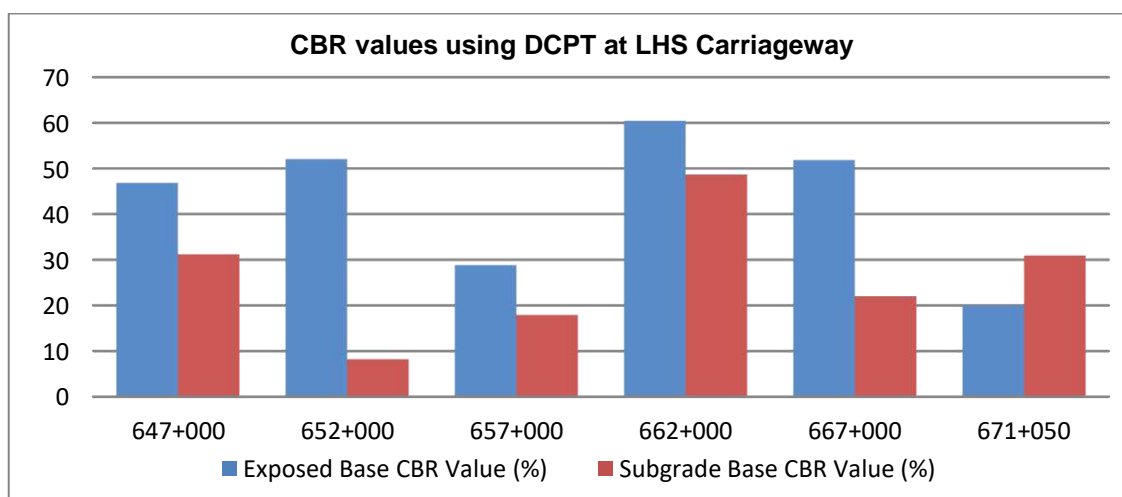


Figure 29. CBR values at LHS

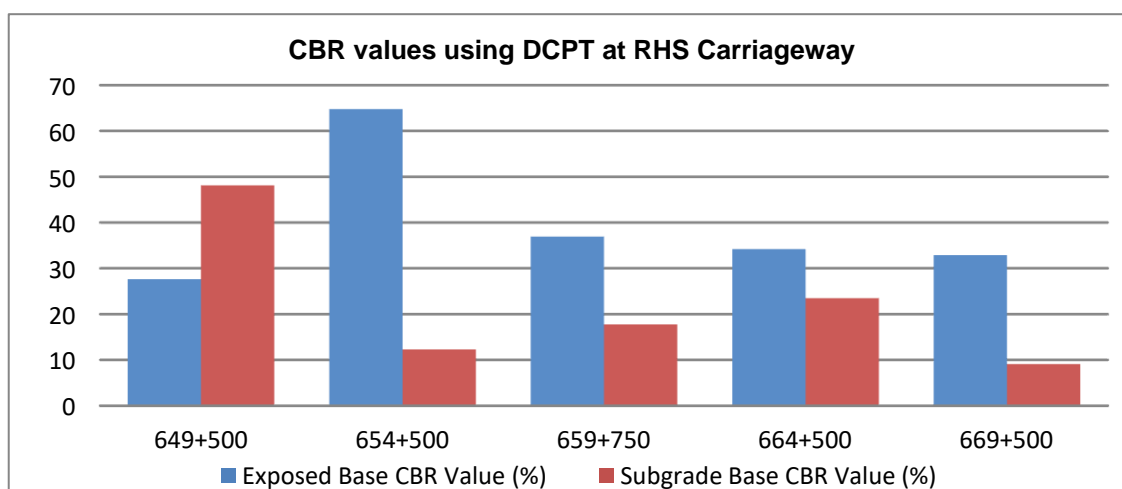


Figure 30. CBR values at RHS

4.4.1.2 FIELD DENSITY AND MOISTURE CONTENT TEST

The following values were obtained:

Value from Chainage 646+000 to 677+000	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)
Maximum	2.18	9.22	2.00
Minimum	1.71	4.75	1.58
Average	1.85	7.55	1.72

Table 54. Test Results. CBR values using DCPT

FIELD DENSITY AND MOISTURE CONTENT					
S.No.	Chainage	Direction	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)
1	647+000	LHS	1.74	8.45	1.60
2	649+500	RHS	2.18	8.74	2.00
3	652+000	LHS	1.71	8.03	1.58
4	654+500	RHS	1.87	7.89	1.73
5	657+000	LHS	1.78	5.84	1.68
6	659+750	RHS	1.82	8.99	1.67
7	662+000	LHS	1.88	7.31	1.75
8	664+500	RHS	1.85	4.75	1.77
9	667+000	LHS	1.85	7.70	1.72
10	669+500	RHS	1.78	6.17	1.68
11	671+050	LHS	1.91	9.22	1.75

Table 55. Test Results. Field Density and Moisture Content

A variation in Bulk Density/Moisture content/Dry Density along the project road was observed. The Bulk Density varies from 1.71 gm/cc to 2.18 g/cc, whereas Dry Density varies from 1.58 gm/cc to 2.00 gm/cc, and Moisture content % varies from 4.75% to 9.22%.

The graphical representation of field Bulk Density/Moisture content/Dry Density is presented in Figures below.

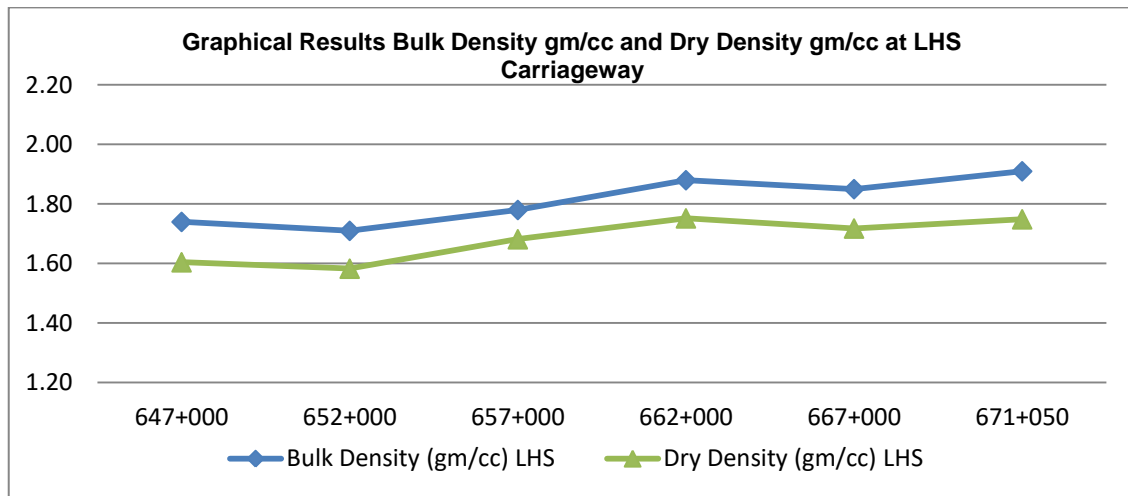


Figure 31. Bulk Density gm/cc and Dry Density gm/cc at LHS

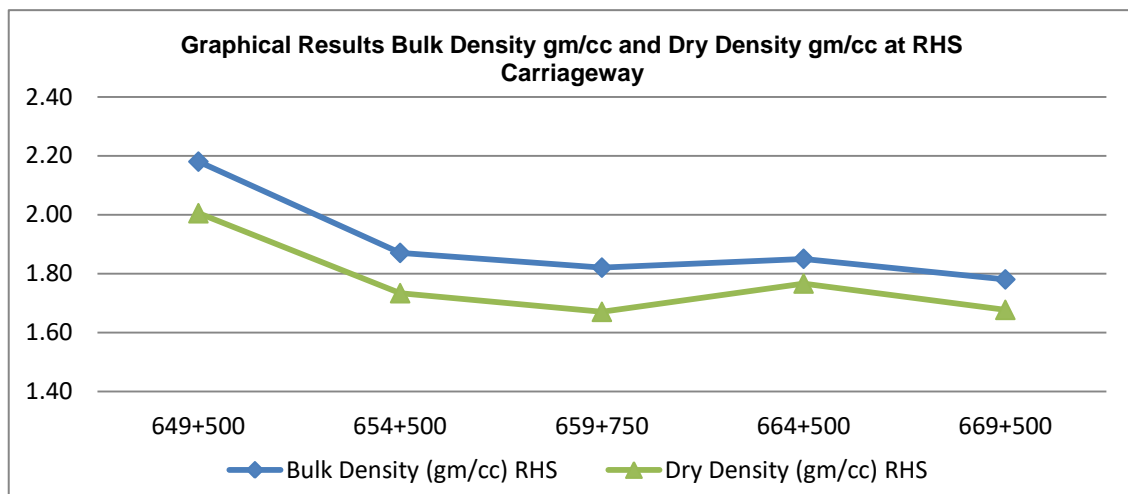


Figure 32. Bulk Density gm/cc and Dry Density gm/cc at RHS

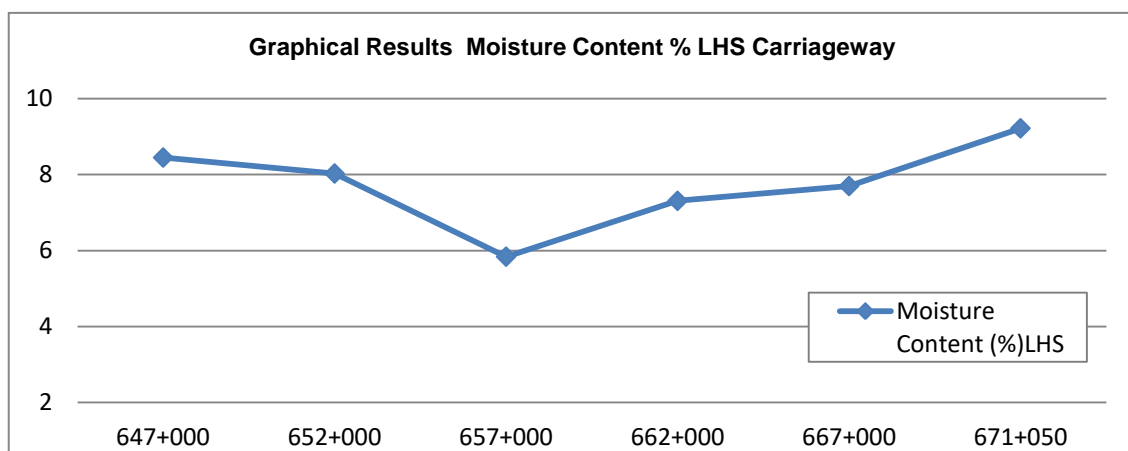


Figure 33. Moisture Content % at LHS

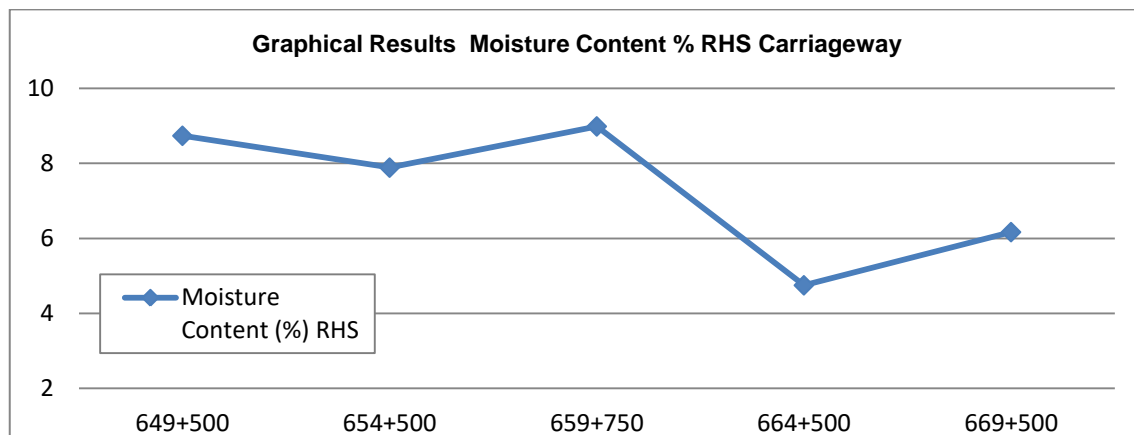


Figure 34. Moisture Content % at RHS

4.4.1.3 PAVEMENT COMPOSITION

The results about pavement crust obtained from each test pit at this stretch are recorded, and a broad variation in pavement thickness along the project road was observed. The Bituminous part at LHS side varies from 100 mm to 235 mm and RHS side varies from 220 mm to 280 mm. While non-bituminous depth at LHS side varies from 405 mm to 645 mm and at RHS side is varies from 370 mm to 460 mm. The details of crust composition chainage wise and the existing Crust composition Maximum, Minimum and Average values (LHS/RHS) carriageway wise are presented below in Table 56 and Table 57.

Value from Chainage 646+000 to 677+000	Bituminous Layer (mm)	WBM/WMM (Base) (mm)	Sub Base (mm)
Maximum	235	335	310
Minimum	100	205	200
Average	173	247	238

Table 56. Crust composition at LHS

Value from Chainage 646+000 to 677+000	Bituminous Layer (mm)	WBM/WMM (Base) (mm)	Sub Base (mm)
Maximum	280	250	210
Minimum	220	180	190
Average	252	216	198

Table 57. Crust composition at RHS

The details of crust composition chainage wise are presented in the following table:

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
1	647+000	LHS	12	Bituminous Layer	185
				WBM/WMM (Base)	270
				GSB (Sub-base)	230
				TOTAL CRUST	685

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
2	649+500	RHS	11	Bituminous Layer	250
				WBM/WMM (Base)	220
				GSB (Sub-base)	200
				TOTAL CRUST	670
3	652+000	LHS	10	Bituminous Layer	235
				WBM/WMM (Base)	230
				GSB (Sub-base)	250
				TOTAL CRUST	715
4	654+500	RHS	9	Bituminous Layer	230
				WBM/WMM (Base)	250
				GSB (Sub-base)	190
				TOTAL CRUST	670
5	657+000	LHS	8	Bituminous Layer	205
				WBM/WMM (Base)	230
				GSB (Sub-base)	220
				TOTAL CRUST	655
6	659+750	RHS	7	Bituminous Layer	280
				WBM/WMM (Base)	180
				GSB (Sub-base)	210
				TOTAL CRUST	670
7	662+000	LHS	6	Bituminous Layer	100
				WBM/WMM (Base)	205
				GSB (Sub-base)	215
				TOTAL CRUST	520
8	664+500	RHS	5	Bituminous Layer	280
				WBM/WMM (Base)	220
				GSB (Sub-base)	190
				TOTAL CRUST	690
9	667+000	LHS	4	Bituminous Layer	110
				WBM/WMM (Base)	210
				GSB (Sub-base)	200
				TOTAL CRUST	520
10	669+500	RHS	3	Bituminous Layer	220
				WBM/WMM (Base)	210
				GSB (Sub-base)	200
				TOTAL CRUST	630

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
11	671+050	LHS	2	Bituminous Layer	205
				WBM/WMM (Base)	335
				GSB (Sub-base)	310
				TOTAL CRUST	850

Table 58. Detailed Crust composition

The graphical representations of these values are presented in Figure 35 and Figure 36.

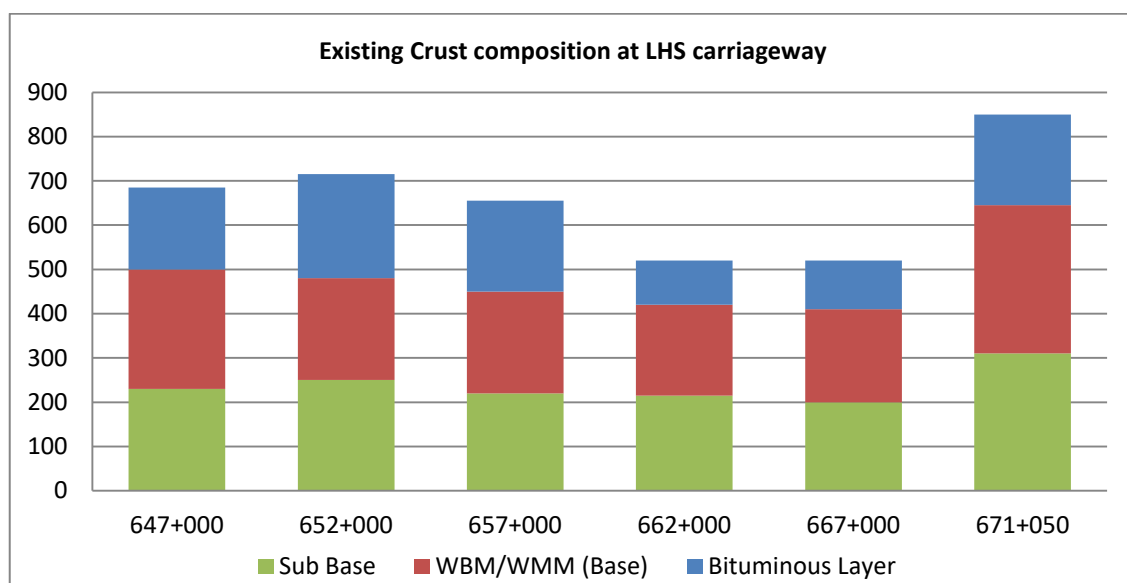


Figure 35. Existing Crust composition at LHS

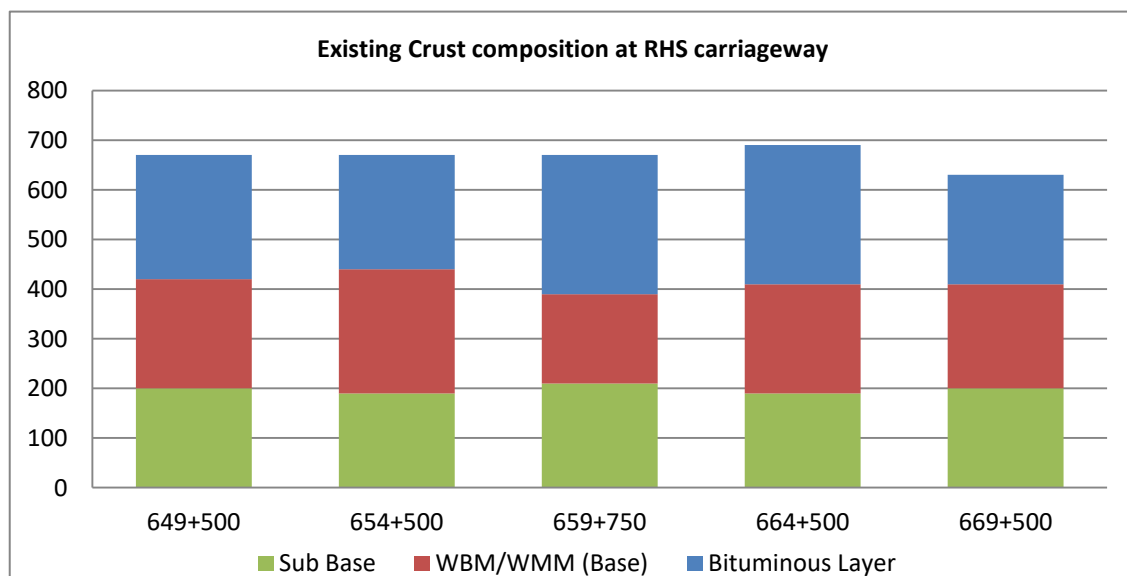


Figure 36.Existing Crust composition at RHS

4.4.2 LABORATORY RESULTS

4.4.2.1 SOIL AND GRANULAR MATERIAL

The laboratory test conducted for the samples of material extracted from tests pits are given in following table.

S.No	Test Parameters	Method Reference
1	Water Content	IS:2720 (Part 2)
2	Grain Size Analysis	IS:2720 (Part 4)
3	Atterberg's Limits	IS:2720 (Part 5)
4	MDD-OMC (Compaction)	IS:2720 (Part 8)
5	CBR	IS:2720 (Part 16)
6	Free Swell Index	IS:2720 (Part 40)

Table 59.Tests carried out on Sub-grade Soil/GSB/WMM

4.4.2.1.1 SUB GRADE SOIL

The laboratory tests carried out for the soil samples of subgrade revealed that soil along the alignment is predominantly silty sand of non-plastic in nature & clayey sand of medium plasticity. At some chainages the sub-grade soil were found to be clayey silt of low to medium plasticity & silty gravels. OMC value varies from 6.00% to 13.00% and those of MDD vary from 1.8 gm/cc to 2.20 gm/cc.

CBR test was conducted by three energy level method as prescribed & the values vary from 10% to 21% for soaked condition and 13% to 31% for un-soaked condition. The summary of laboratory test results is given in Table 60. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 646+000 to 677+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	FSI [IS :2720-Pt- 40]	Max. Dry density (gm/cc)	OMC (%)	Soaked CBR at 3 energy level	Un-soaked CBR at 3 energy level
Maximum	34.00	21.00	14.00	12.00	2.12	11.00	21.00	31.00
Minimum	25.00	20.00	5.00	6.23	2.02	8.00	10.00	13.00
Average	27.64	20.11	8.00	9.81	2.08	9.59	17.82	24.09

Table 60. Test Results of Soil Layer

4.4.2.1.2 GRANULAR SUB BASE

The test results of GSB are generally Sandy Gravels. OMC value is in the range of 6.0% to 7.0% and that of MDD is in the range of 2.16 gm/cc to 2.21 gm/cc. CBR value is in the range of 32.0% to 39.0 %. Specific gravity value is in the range of 2.72% to 2.80 %. The laboratory test results are given in Table 61. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 646+000 to 677+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. Dry density (gm/cc)	OMC (%)	CBR Value at 98 % dry density (Soaked) %	Specific Gravity
Maximum	24.00	Nil	NP	2.21	7.00	39.00	2.80
Minimum	22.00	Nil	NP	2.16	6.00	32.00	2.72
Average	23.09	Nil	NP	2.19	6.64	35.00	2.76

Table 61. Test Results of Granular Sub base Material

4.4.2.1.3 WET MIX MACADAM

The WMM sample is generally Silty Gravels of low plasticity. Plasticity Value is not found. The laboratory test results are given in Table 62. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 646+000 to 677+000	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. Dry density (gm/cc)	OMC (%)	Specific Gravity	Impact (%)
Maximum	25.00	Nil	NP	2.29	6.50	2.81	26.00
Minimum	22.00	Nil	NP	2.25	5.00	2.75	20.00
Average	23.91	Nil	NP	2.27	6.00	2.78	23.36

Table 62. Test Results of Wet Mix Macadam

4.4.2.2 BITUMINOUS MIXES

Two types of mixes compose basically the bituminous layers of the highway:

- **BITUMINOUS CONCRETE (BC):** BC is a Dense Graded Bituminous Mix used as Wearing Course for roads with intense traffic. BC Mix consists of Coarse Aggregates, Fine Aggregates, Filler and Binder blended as per Marshall Mix Design.
- **DENSE BITUMINOUS MACADAM (DBM):** DBM is a close Graded Bituminous mix of lower bitumen content and used as a binder course for all flexible pavements.

4.4.3 LABORATORY INVESTIGATION

Laboratory investigations were conducted to the core cutting samples collected in accordance to the provisions mentioned in various standard codes as follows:-

- Gradation (as per MORTH // Table 500-10).
- Binder Content (as per MORTH // Clause 507.2.5).
- Bulk Density (as per AASHTO T 166).

Summary of core cutting samples, and test results of Bitumen Core (BC) are provided in table and figures shown below. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 646+000 to 677+000	Density (gm/cc)	Binder Content (%)	Thickness (mm)
Maximum	2.61	4.80	80.00

Minimum	2.38	3.29	27.00
Average	2.49	4.27	47.00

Table 63. Test Results of Bituminous Concrete

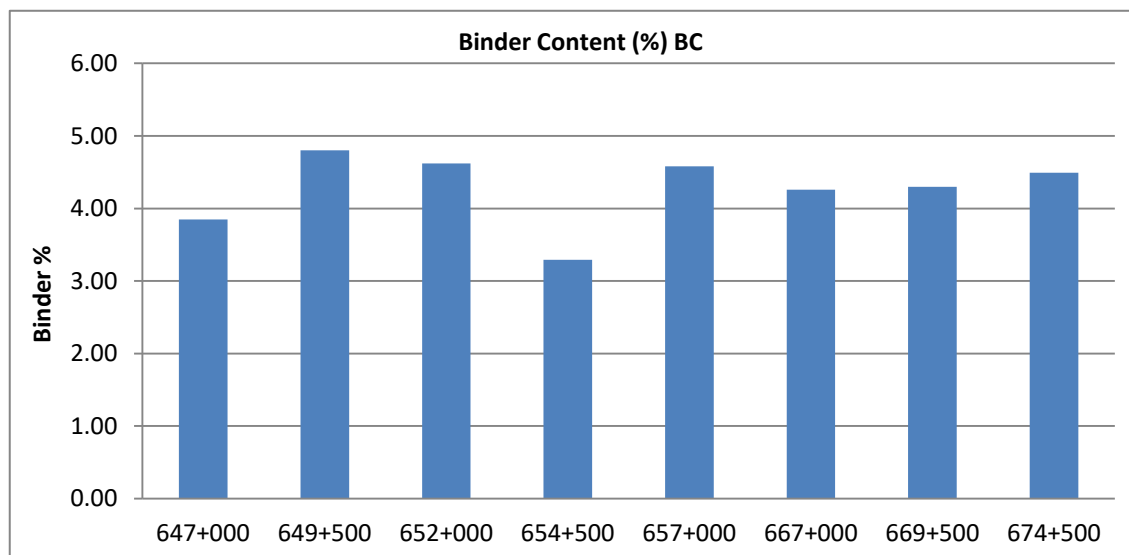


Figure 37. Binder Content (%) BC

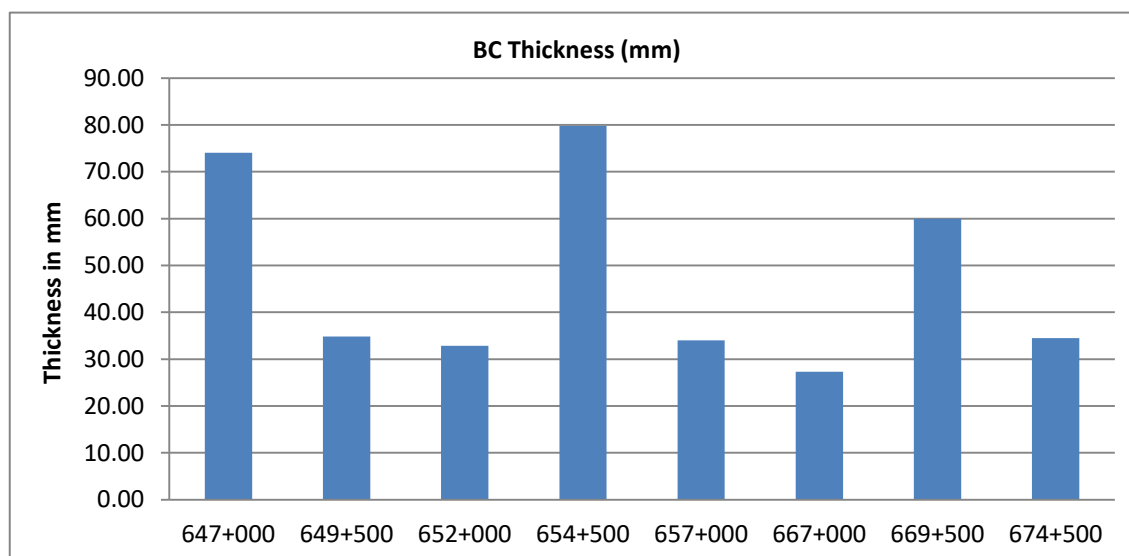


Figure 38. BC Thickness (mm)

Summary of core cutting samples, and test results of Bitumen Core (DBM) are provided in table and figures shown below. The detailed laboratory test results are given in tabular form in Annexure Labs Investigation.

Chainage 646+000 to 677+000	Density (gm/cc)	Binder Content (%)	Thickness (mm)
Maximum	2.61	4.49	192

Minimum	2.48	3.22	30
Average	2.57	3.91	110

Table 64. Test Results of Dense Bituminous Macadam

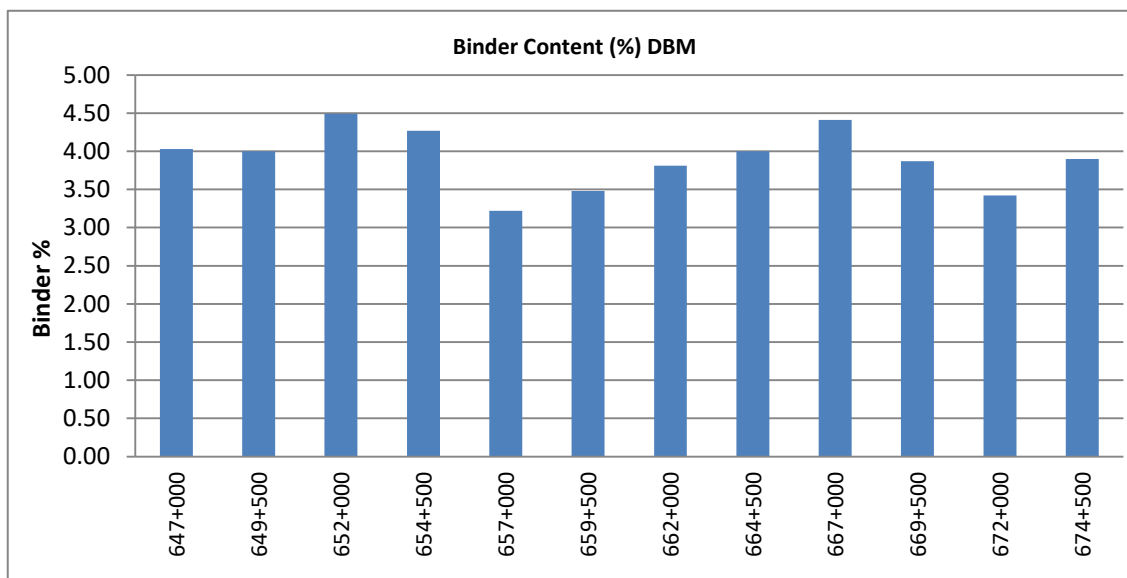


Figure 39. Binder Content (%) DBM

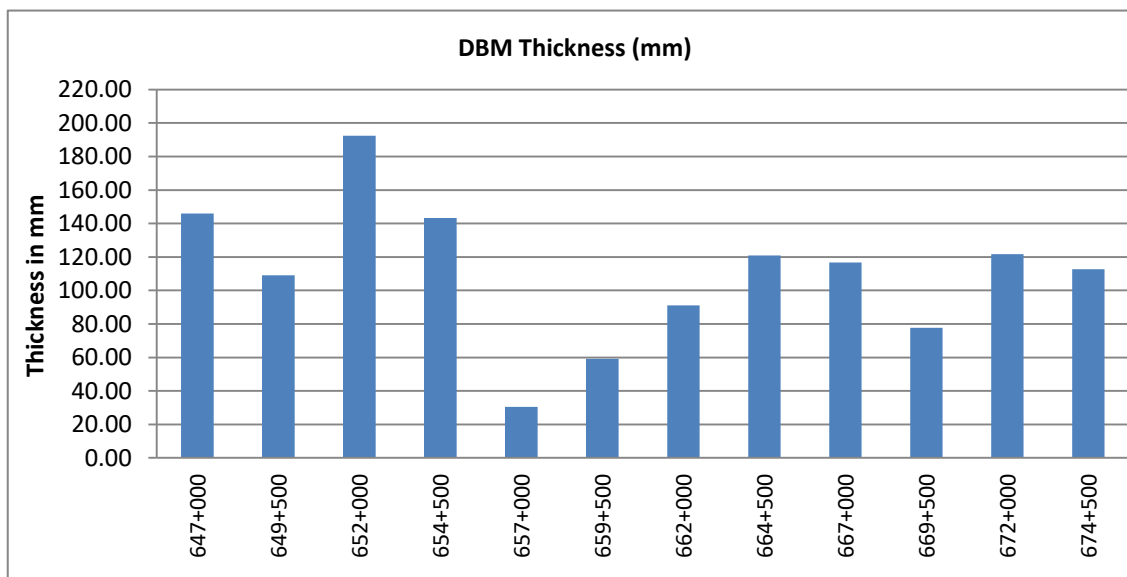


Figure 40. DBM Thickness (mm)

4.5 PAVEMENT CONDITION (NSV DATA)

The analysis of various performance parameter data as collected during NSV survey is presented in this section.

Graphs and tables are represented in average kilometric values. Detail of average hectometre values are collected in Annexure IRI and Rut Depth results.

4.5.1 PAVEMENT CONDITION INDEX (PCI)

Analysis of (cracks, potholes, patching, etc.) is undertaken to determine PCI of the Stretch. The Pavement Condition Index rates the condition of the surface of a road and provides a numerical rating for the condition of pavement segments within the project stretch, where 0 is the worst possible condition and 100 is the best.

The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities.

Regular monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI can also provide feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.

In this project, the PCI is calculated as per the international guidelines provided in ASTM-D6433. For different pavement condition, according to ASTM-D6433, PCI values are presented in the following table.

PCI	Rating
85 - 100	Good
70 - 85	Satisfactory
55 - 70	Fair
40 - 55	Poor
25 - 40	Very poor
10 - 25	Serious
0 - 10	Failed

Table 65. PCI Values

For each pavement distress type/severity combination identified by the pavement inspectors in a sample unit, a deduct value is calculated from the appropriate deduct curve, based on the quantity of distress present. The deduct curves are significantly different from distress to distress, reflecting the implications for present and future road conditions of the particular distress type. Load-related distresses, such as alligator cracking and rutting, have much steeper deduct curves (i.e. a given quantity of a load-related distress will result in a higher deduct value than the same quantity of a non-load related distress such as bleeding).

The individual deduct values are totaled, adjusted to account for the interaction of multiple distresses, and subtracted from the "perfect" PCI of 100 to give the actual PCI of the sample unit inspected. The deduct value computation and correction is performed by computer software; the pavement distress data are entered (distress type, severity and quantity for each distress type/severity combination) and the software performs all of the remaining calculations. As the estimation of quantity of the distress defects is based totally on visual assessment from the video, it was found that it was most consistent and reproducible to give the pavement inspector ranges of magnitude (<1, 1-5, 5-10 etc.), of the estimated percent area of the distress to choose from. The value of the ranges varies by distress. Use of the ranges has worked out well in practice, with good levels of repeatability in surveying sections with different teams of inspectors.

The PCI for a section of pavement is calculated in five steps:

- Step 1: The first step is the determination of distress types and severity levels of each distress type in the inspection units. This data is obtained after processing the field survey data. Firstly, the total

quantity of each distress type at each severity level is added. Then the total quantity of each distress type at each severity level is divided by the total area of the sample unit (10 m section) and multiplies by 100 to obtain the percent density of each distress.

- Step 2: Determination of deduct values for each of the distresses and under each severity level from the distress deduct value curves as shown in the fig.
- Step 3: Computation of total deducts value by adding the deduct values of all distress types under each severity levels.
- Step 4: Determination of the maximum corrected deduct value (CDV) from the graph as shown in the following figure.
- Step 5: Compute $PCI = 100 - CDV$ for each sample unit inspected.

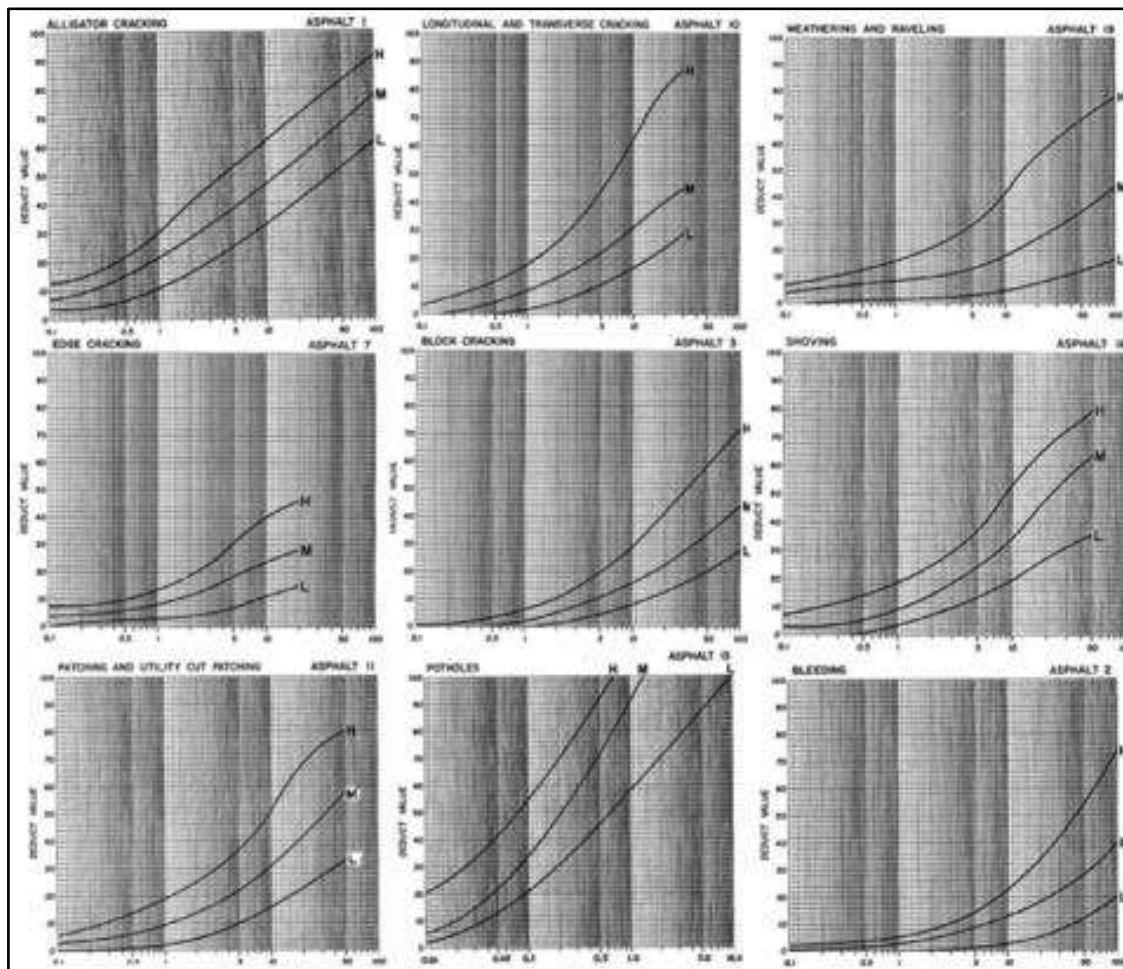


Figure 41. Deduct values curve

The maps of PCI along the whole stretch are shown in the following figures:

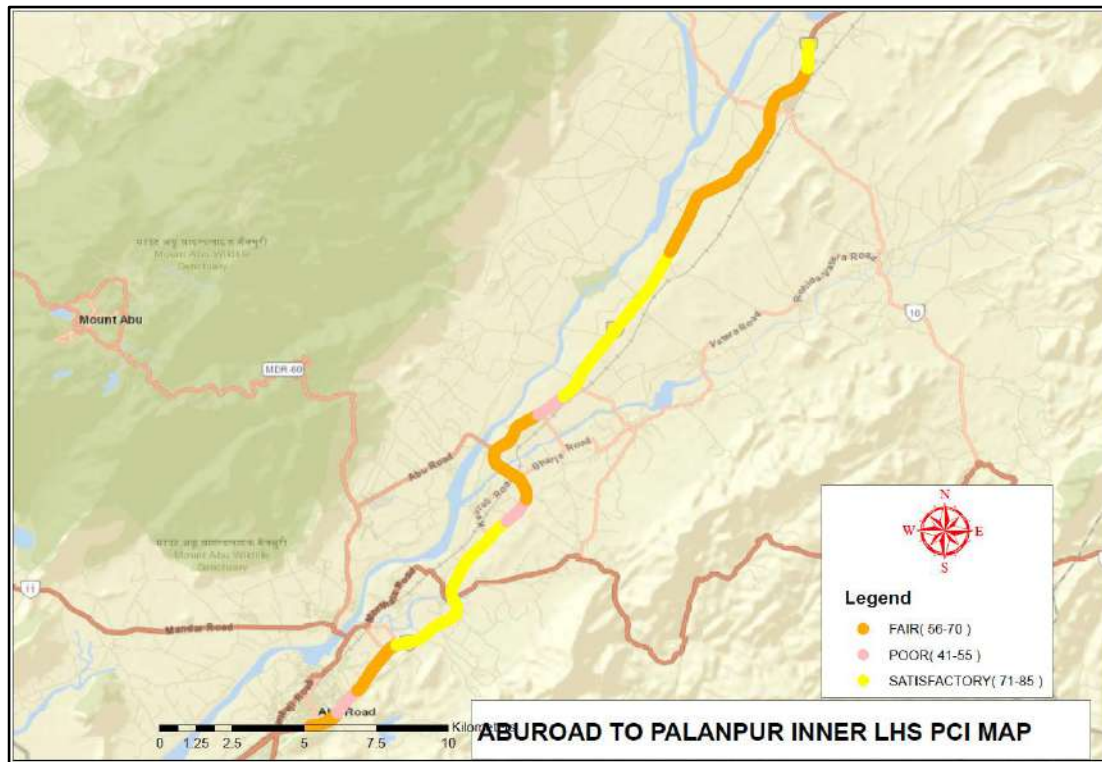


Figure 42. PCI along the stretch (LHS, Inner Lane)

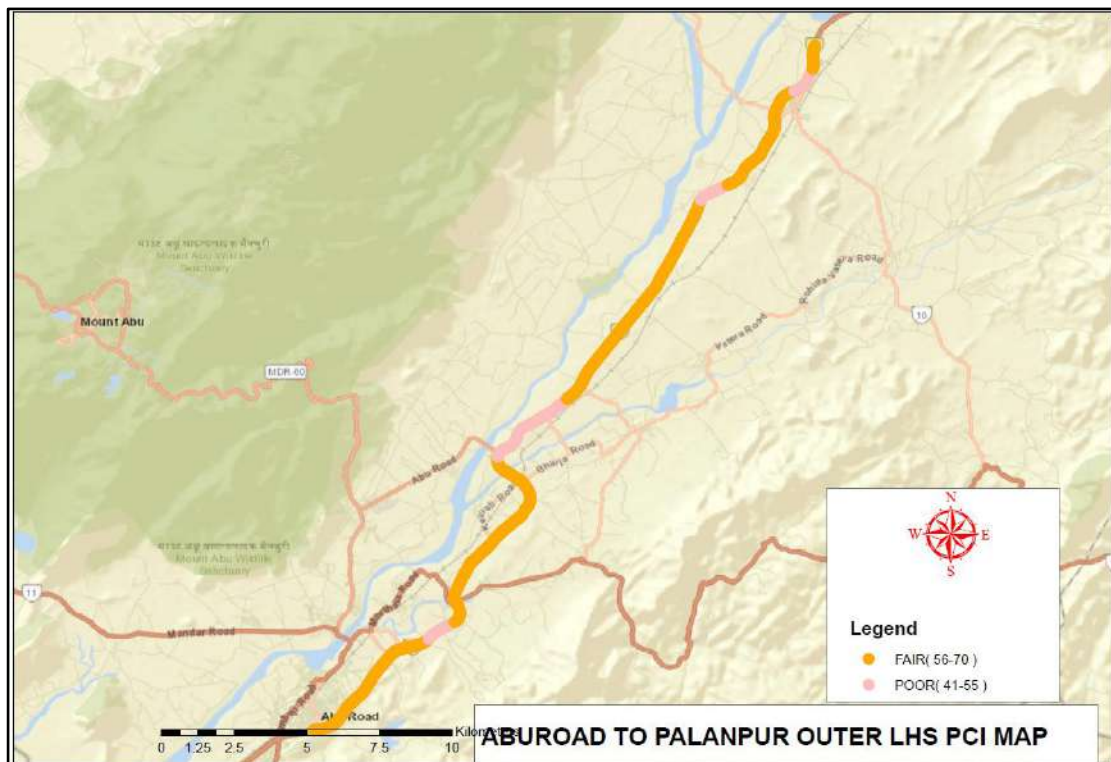


Figure 43. PCI along the stretch (LHS, Outer Lane)

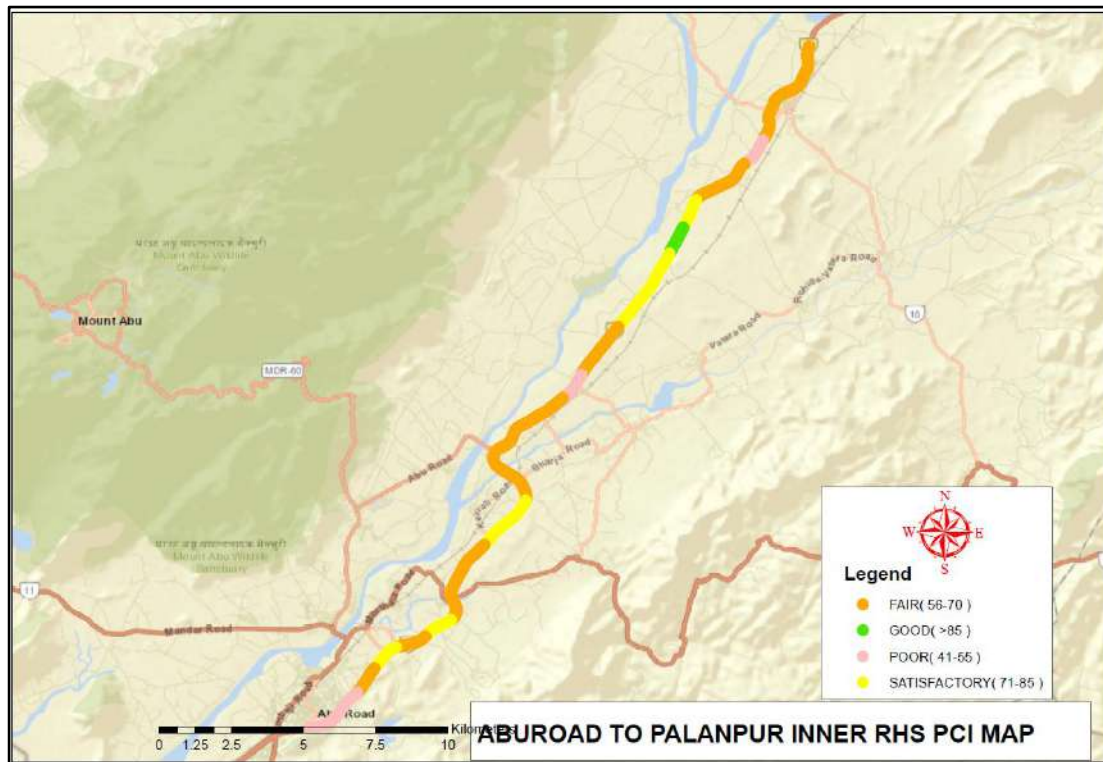


Figure 44. PCI along the stretch (RHS, Inner Lane)

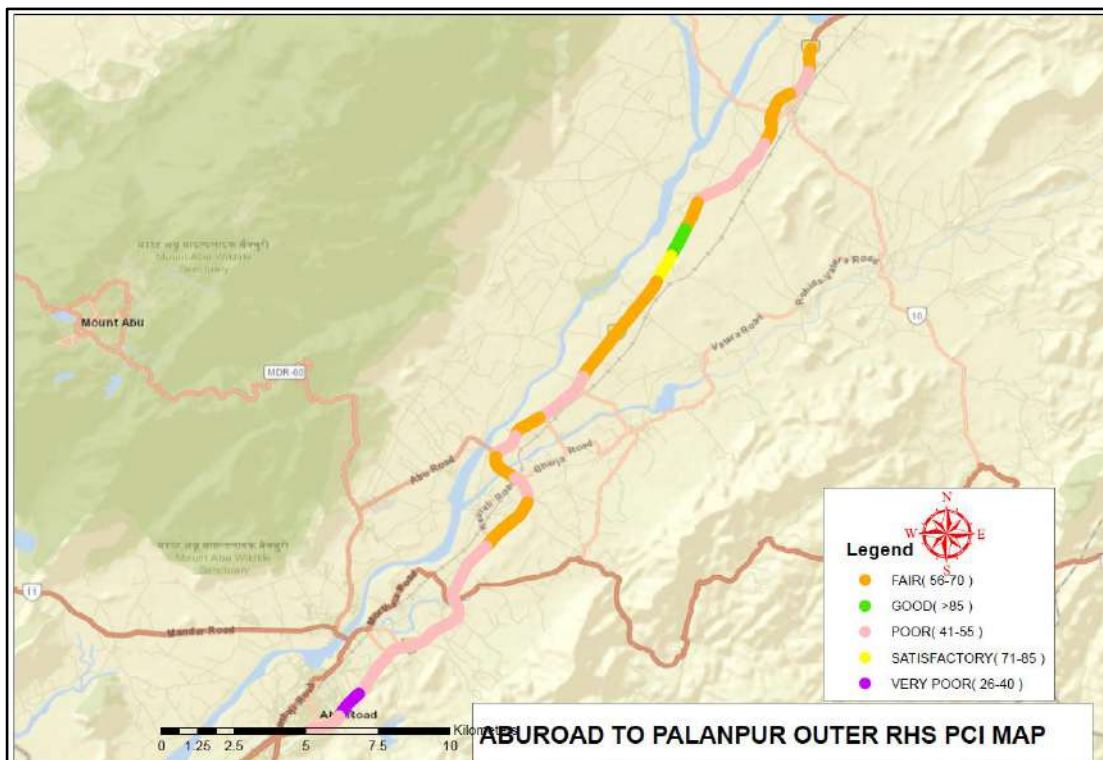


Figure 45. PCI along the stretch (RHS, Outer Lane)

4.5.1.1 OUTER/INNER LANE PCI

Length wise PCI condition details for both directions are given in Table 66 and Table 67.

It can be observed that PCI values are lower in outer lane as compared to inner lane in both directions.

Condition	PCI Range	Length LHS Outer (km)	PCI %	Length LHS Inner (km)	PCI %
Good	85 - 100	0	0	0	0
Satisfactory	70 - 85	0	0	13	42
Fair	55 - 70	25	81	15	48
Poor	40 - 55	6	19	3	10
Very Poor	25 - 40	0	0	0	0
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Table 66.LHS outer lane and inner lane PCI results

Condition	PCI Range	Length RHS Outer (km)	PCI %	Length RHS Inner (km)	PCI %
Good	85 - 100	1	3	2	6
Satisfactory	70 - 85	1	3	8	26
Fair	55 - 70	12	39	17	55
Poor	40 - 55	16	52	4	13
Very Poor	25 - 40	1	3	0	0
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Table 67.RHS outer lane and inner lane IRI results

4.5.1.2 LHS/RHS LANE PCI

Length wise summarized PCI condition details for both the directions are given in the next table:

Condition	PCI Range	LHS (km)	LHS (%)	RHS (km)	RHS (%)
Good	85 - 100	0	0	3	5
Satisfactory	70 - 85	13	21	9	15
Fair	55 - 70	40	65	29	47
Poor	40 - 55	9	15	20	32
Very Poor	25 - 40	0	0	1	2
Serious	10 - 25	0	0	0	0
Failed	0 - 10	0	0	0	0

Table 68.Direction wise Roughness distribution

It is observed that PCI value was slightly higher in RHS as compare to LHS.

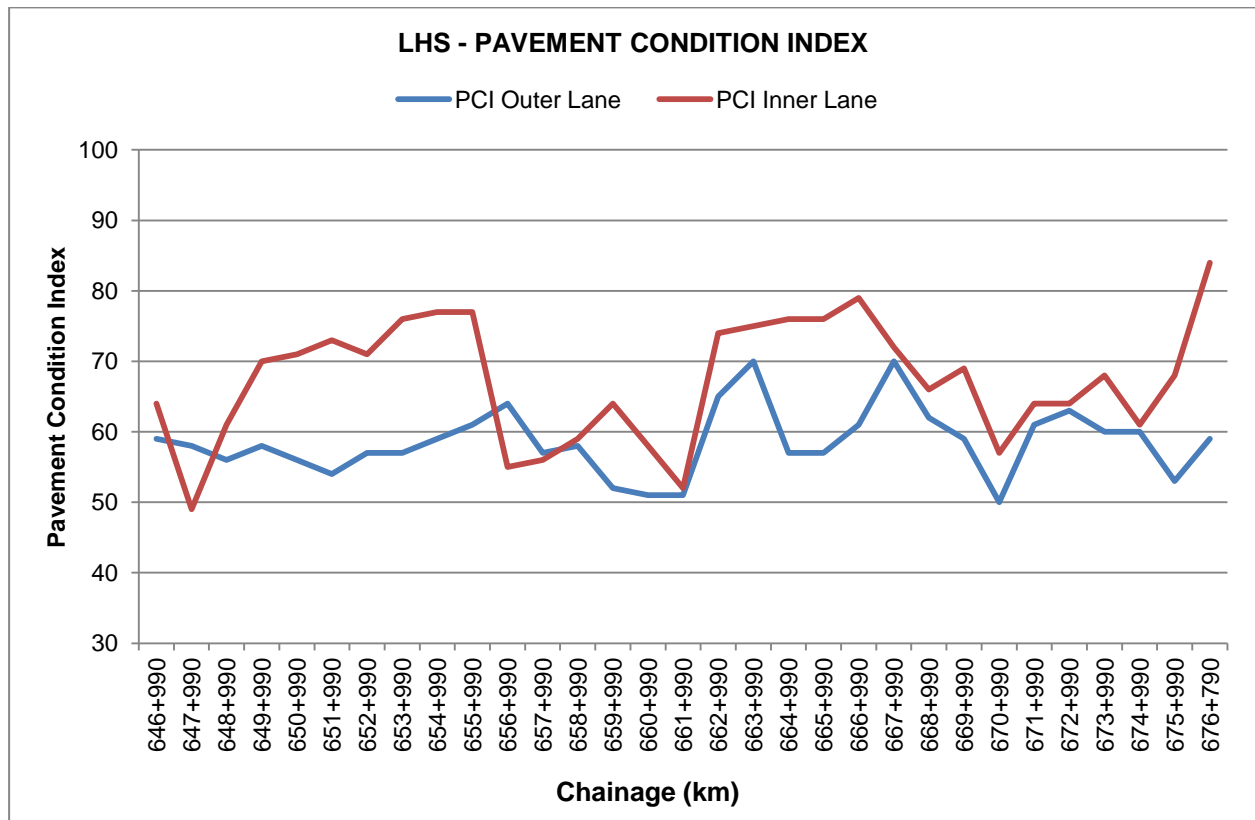


Figure 46. PCI for LHS carriageway

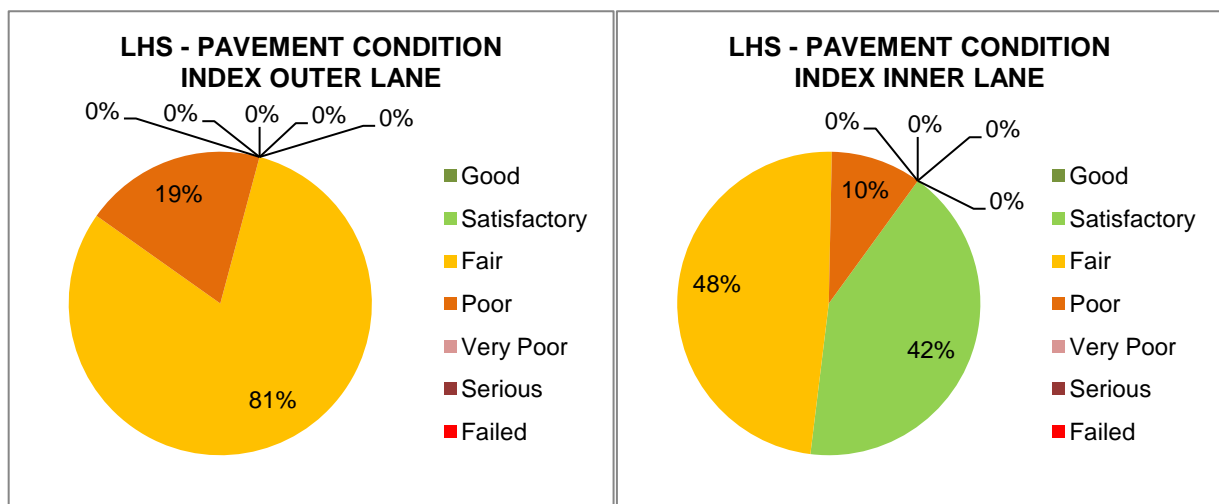


Figure 47. LHS Pavement Condition Index. Figures

It is observed from the Figure 47 that 0% of values in LHS, both for Outer and Inner lanes have PCI values in Good condition, whereas Satisfactory was in range between 0% - 42% in outer/inner lane and Fair condition is in range of 81% in outer lane and 48% in inner lane. The rest of all (Poor/Very poor/serious/failed) section is in 19% in outer lane and 10% in inner lane.

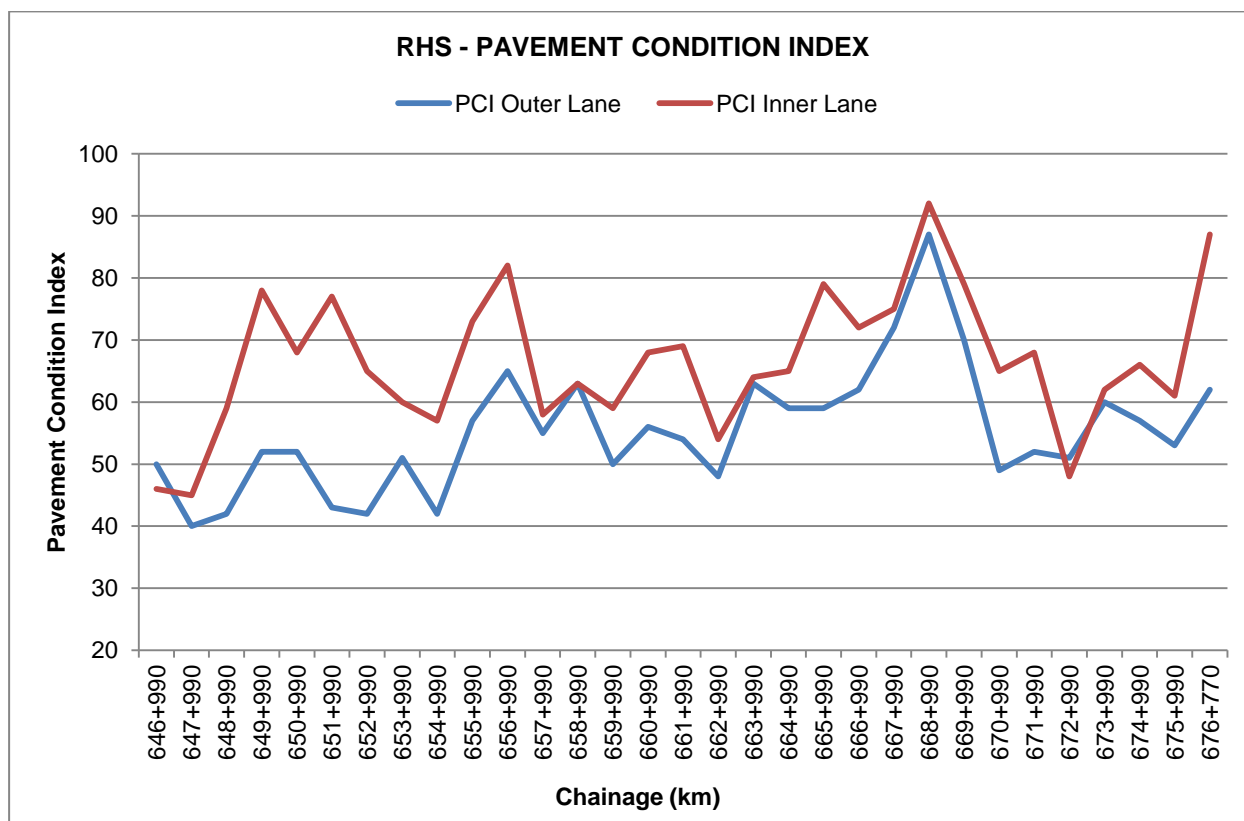


Figure 48.RHS Pavement Condition Index

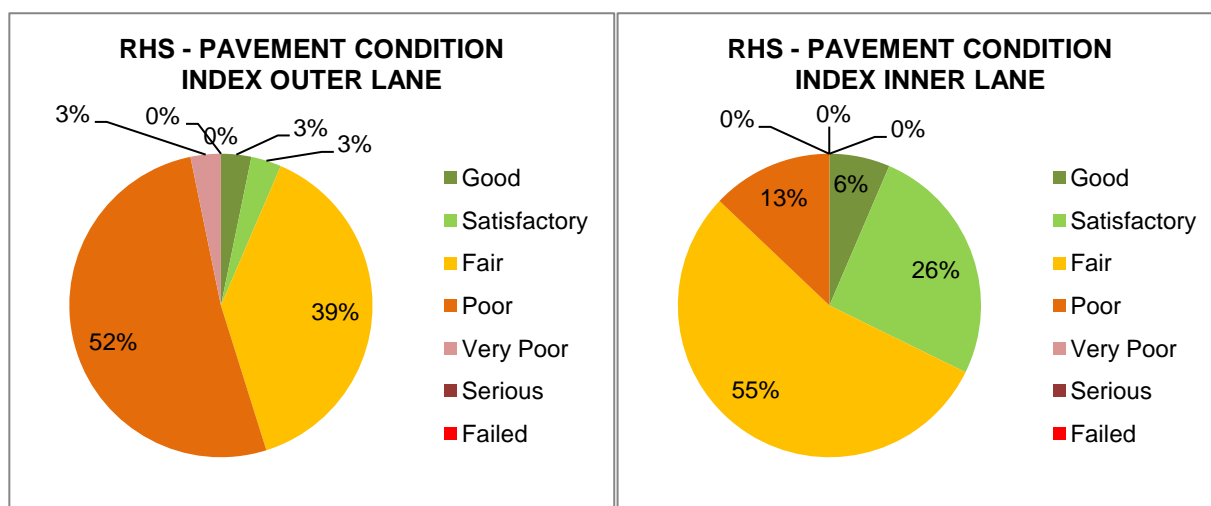


Figure 49.RHS Pavement Condition Index. Figures

It is observed from the Figure 49 that 3%-6% on outer/inner lane of Project Stretch RHS has a PCI value in Good condition, whereas Satisfactory was in range between 3%-26% in outer/inner lane and Fair condition is in range of 39% in outer lane and 55% in inner lane. The rest of all (Poor/Very poor/serious/failed) section is in 55% in outer lane & 13% in inner lane.

KP	LHS OuterLane	LHS InnerLane	RHS OuterLane	RHS InnerLane
646+990	59	64	50	46
647+990	58	49	40	45
648+990	56	61	42	59
649+990	58	70	52	78
650+990	56	71	52	68
651+990	54	73	43	77
652+990	57	71	42	65
653+990	57	76	51	60
654+990	59	77	42	57
655+990	61	77	57	73
656+990	64	55	65	82
657+990	57	56	55	58
658+990	58	59	63	63
659+990	52	64	50	59
660+990	51	58	56	68
661+990	51	52	54	69
662+990	65	74	48	54
663+990	70	75	63	64
664+990	57	76	59	65
665+990	57	76	59	79
666+990	61	79	62	72
667+990	70	72	72	75
668+990	62	66	87	92
669+990	59	69	70	79
670+990	50	57	49	65
671+990	61	64	52	68
672+990	63	64	51	48
673+990	60	68	60	62
674+990	60	61	57	66
675+990	53	68	53	61
676+790	59	84	62	87

Table 69. PCI Results

Graphs and tables are represented in average kilometric values. Detail of average hectometre values are shown in Annexure IRI and Rut Depth results.

4.5.2 INTERNATIONAL ROUGHNESS INDEX (IRI)

Road roughness has been defined as the variation in surface elevation that induces vibration in moving vehicles. In particular, the International Roughness Index (IRI) is a scale for roughness based on the response of a standardized motor vehicle to the road surface. It is considered that the road user's view of satisfactory or unsatisfactory road condition is primarily influenced by roughness or ride quality. IRI has become the most accepted world standard for Roughness.

The IRI can be measured by an extensive range of equipment from rod and level through response-type meters up to very accurate laser-based profile meters. The IRI is expressed in units of meters per kilometer, with low values indicating smooth roads, and high values indicating rough roads with poor ride quality.

Roughness is one of the important parameters for determining the functional characteristics of pavements. In India, the roughness has been traditionally measured using the fifth wheel bump integrator (developed by CRRRI). Bump Integrator Roughness (BI) has been traditionally the standardize measurement of the longitudinal road profile in India, either in m/km or mm/m.

The National Highway Authority of India (NHAI), via letter no. 11041/218/2007 –Admn. dated 03/11/2009 on POLICY MATTERS –TECHNICAL (37/2009) has approved the use of Laser Profiling devices for NHAI works. Consequently, IRI measurement has been progressively introduced in India. IRI correlation with BI values can be calculated by the following formula:

$$BI = 630 \cdot (IRI)^{1.12}$$

Where:

BI: Bump Integrator Roughness or Unevenness Index (mm/km).

IRI: International Roughness Index.

The following table shows the applicable and equivalent values that can define the roughness condition of highway pavements in India:

Condition	Roughness (BI)	IRI (m/km)
Good	BI < 2000	IRI < 2.8
Fair	2000 < BI < 3000	2.8 < IRI < 4.0
Poor	BI > 3000	IRI > 4.0

Table 70. IRI Condition Scale

The maps of International Roughness Index along the whole stretch are shown in the following figures:

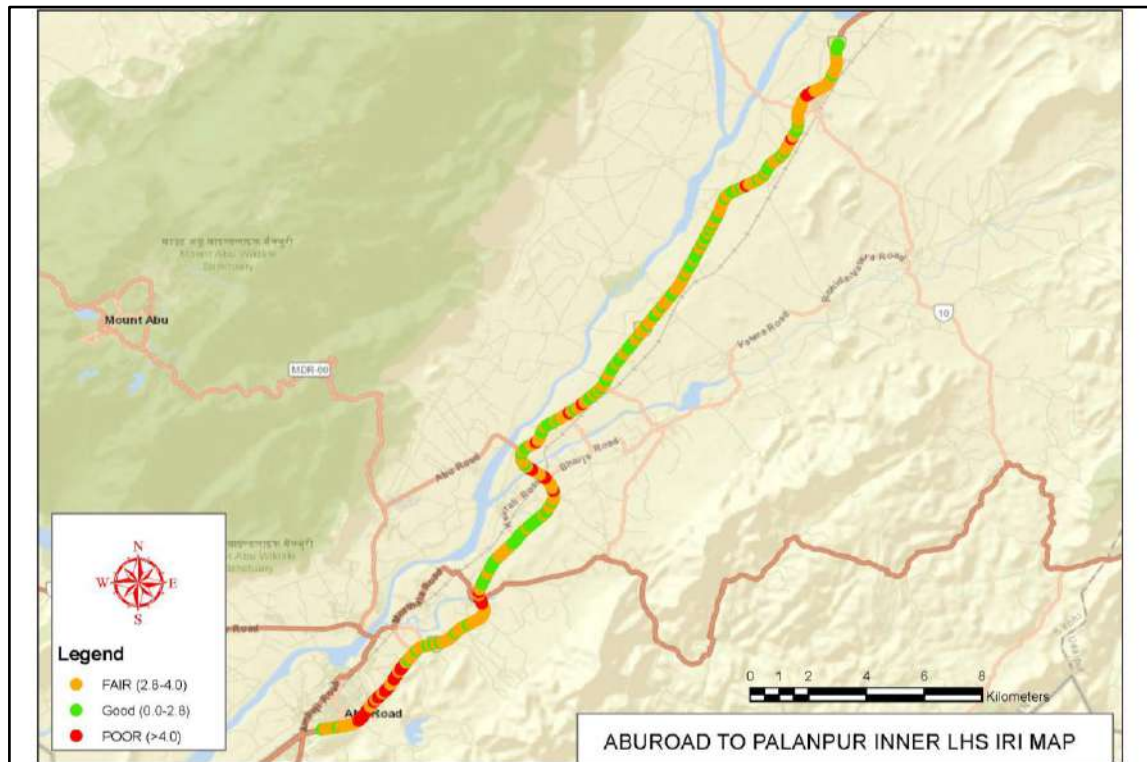


Figure 50. Roughness Index along the stretch (LHS, Inner lane)

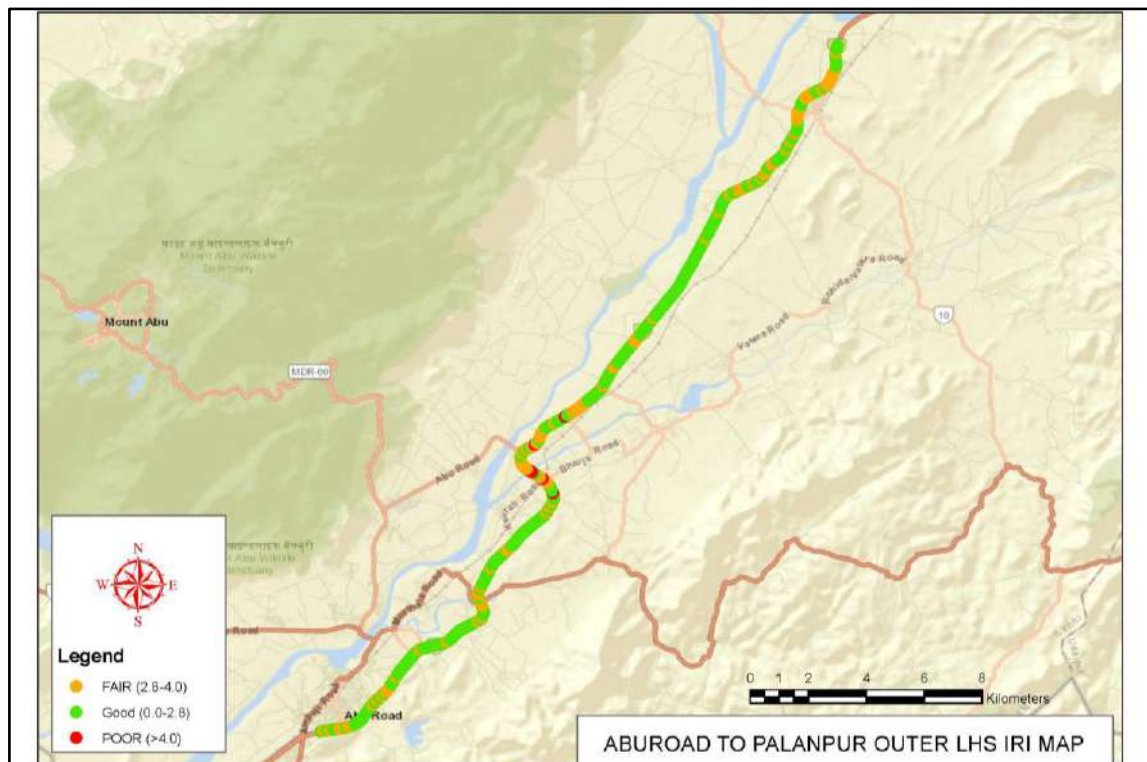


Figure 51. Roughness Index along the stretch (LHS, Outer lane)

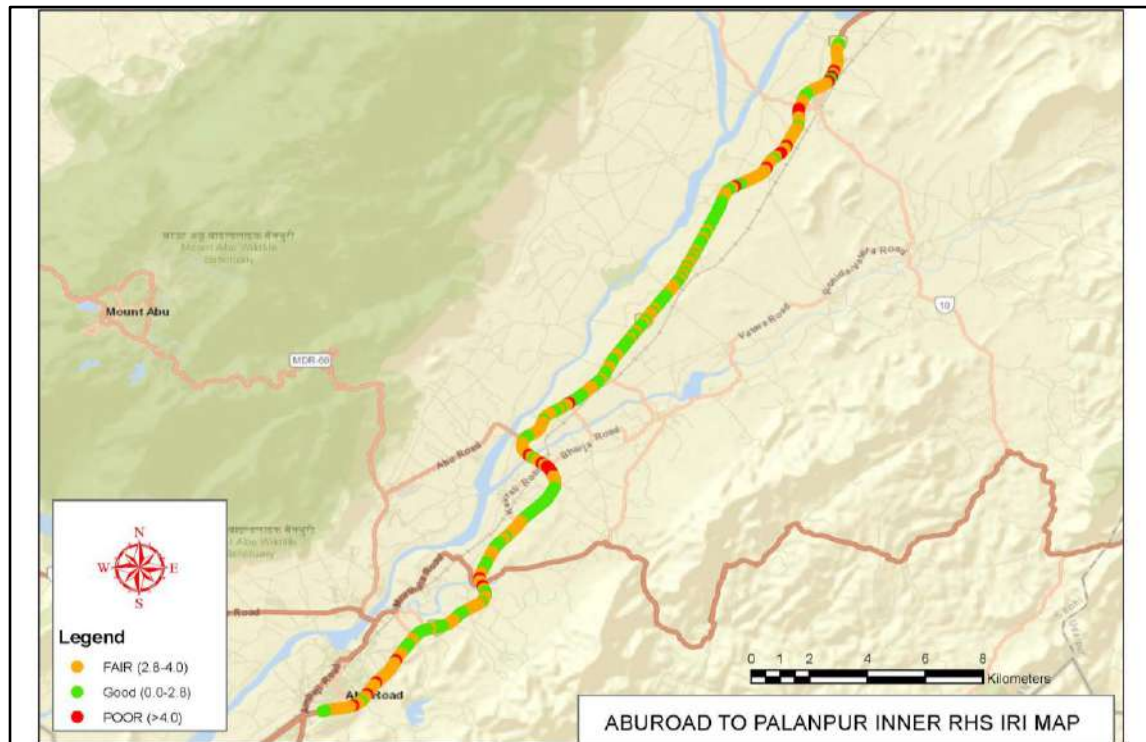


Figure 52. Roughness Index along the stretch (RHS, Inner lane)

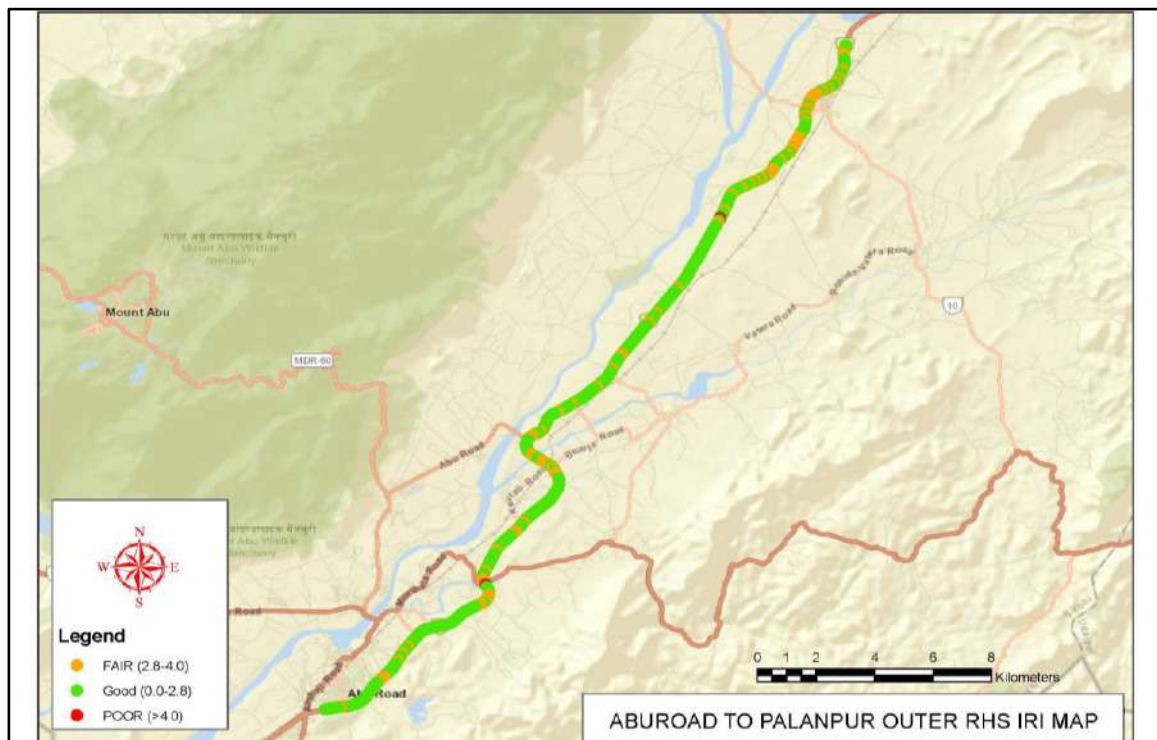


Figure 53. Roughness Index along the stretch (RHS, Outer lane)

4.5.2.1 OUTER/INNER LANE ROUGHNESS INDEX

It is observed that roughness index was similar in inner lane as compared to outer lane for both the direction. The International Roughness Index of the both lanes at some sections was beyond the desirable limit of 4.0 mm/km.

It is observed that roughness index is lower in outer lane as compared to inner lane in both directions.

Condition	Range	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	IRI < 2.8	24	77	6	19
Fair	2.8 < IRI < 4.0	7	23	24	77
Poor	IRI > 4.0	0	0	1	3

Table 71.LHS carriageway outer lane and inner lane IRI results

Condition	Range	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	IRI < 2.8	26	87	9	29
Fair	2.8 < IRI < 4.0	4	13	21	68
Poor	IRI > 4.0	0	0	1	3

Table 72.RHS carriageway outer lane and inner lane IRI results

4.5.2.2 LHS/RHS ROUGHNESS INDEX

Length wise summarized IRI condition details for both the directions are given in the next table:

Condition	IRI (m/km)	LHS (km)	LHS (%)	RHS (km)	RHS (%)
Good	IRI < 2.8	30	48	35	57
Fair	2.8 < IRI < 4.0	31	50	25	41
Poor	IRI > 4.0	1	2	1	2

Table 73. Direction wise Roughness distribution

It is observed that roughness index was similar in LHS as compared to RHS.

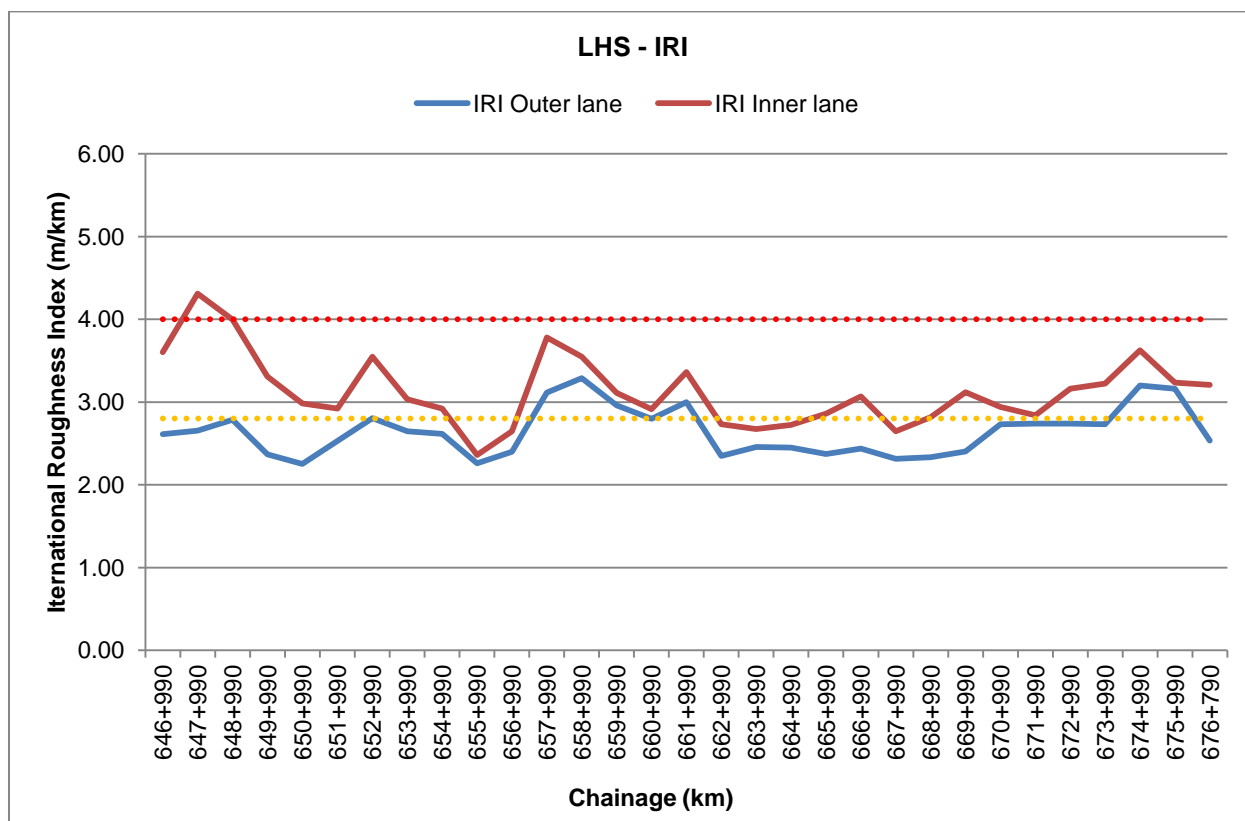


Figure 54. LHS International Roughness Index

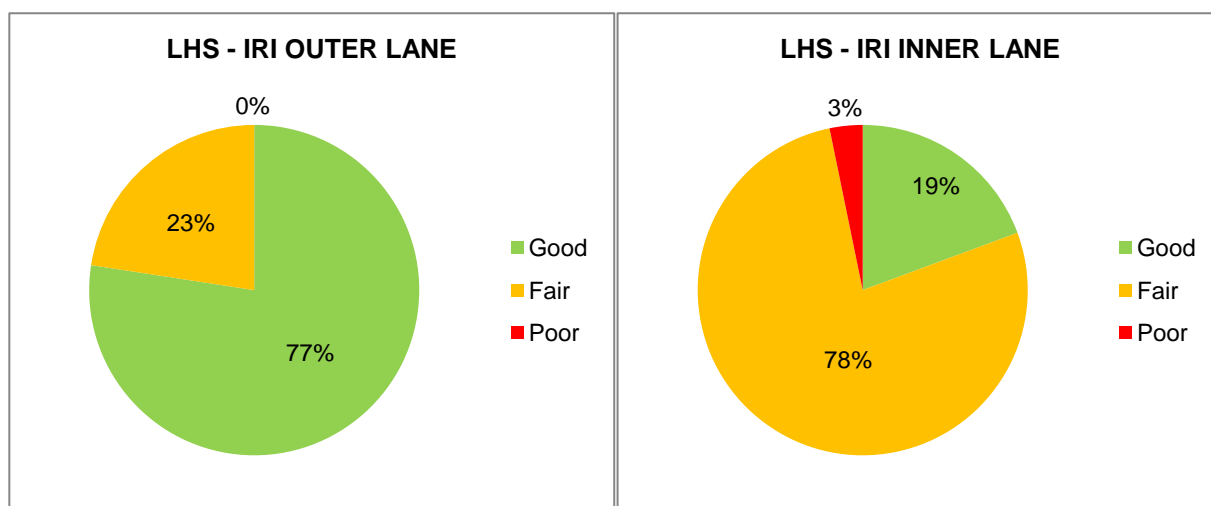


Figure 55.LHS International Roughness Index. Figures

It is observed from Figure 55 that 77%-19% of Project Stretch LHS on outer/inner has IRI value in Good range, whereas Fair was in range between 23% in outer lane and 78% in inner lane and, Poor condition, is in range of 0% in outer lane and 3% in inner lane.

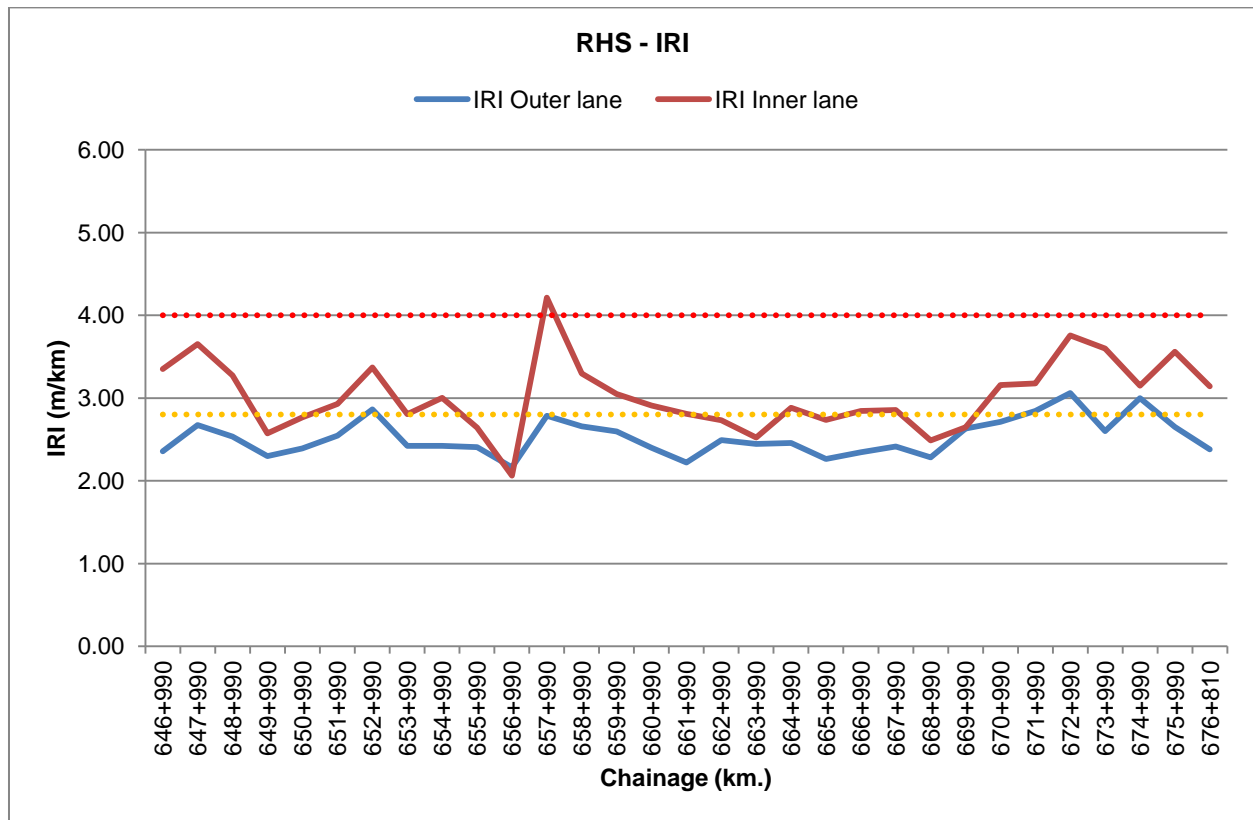


Figure 56. RHS International Roughness Index

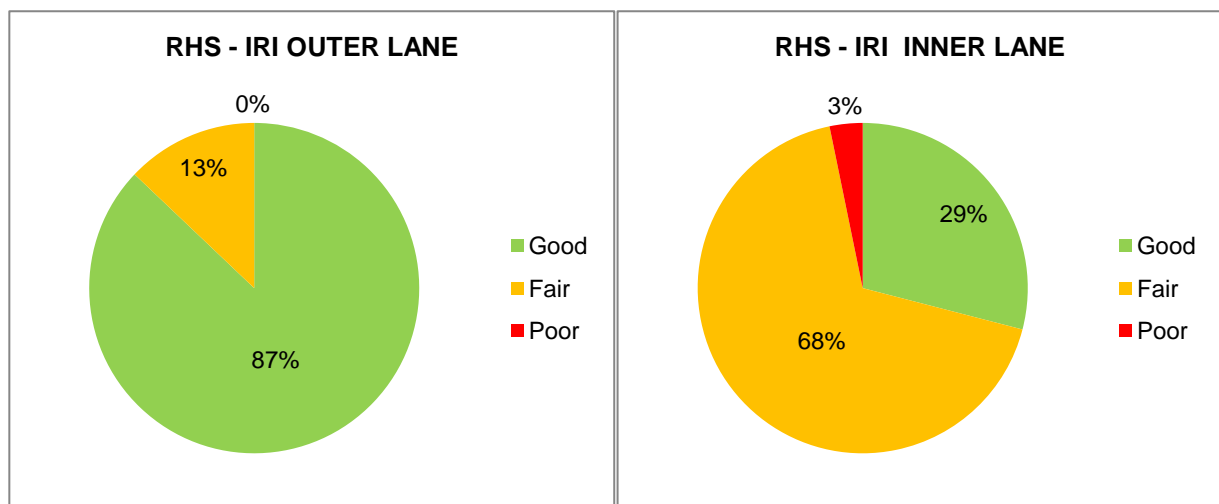


Figure 57. RHS International Roughness Index. Figures

It is observed from Figure 57 that 87%-29% of Project Stretch RHS on outer/inner has IRI value in Good range, whereas Fair was in range between 13% in outer lane and 68% in inner lane and, Poor condition, is in range of 0% in outer lane and 3% in inner lane.

KP	LHS OuterLane	LHS InnerLane	RHS OuterLane	RHS InnerLane
646+990	2.6	3.6	2.4	3.4
647+990	2.7	4.3	2.7	3.7
648+990	2.8	4.0	2.5	3.3
649+990	2.4	3.3	2.3	2.6
650+990	2.3	3.0	2.4	2.8
651+990	2.5	2.9	2.6	2.9
652+990	2.8	3.6	2.9	3.4
653+990	2.7	3.0	2.4	2.8
654+990	2.6	2.9	2.4	3.0
655+990	2.3	2.4	2.4	2.6
656+990	2.4	2.7	2.2	2.1
657+990	3.1	3.8	2.8	4.2
658+990	3.3	3.6	2.7	3.3
659+990	3.0	3.1	2.6	3.1
660+990	2.8	2.9	2.4	2.9
661+990	3.0	3.4	2.2	2.8
662+990	2.4	2.7	2.5	2.7
663+990	2.5	2.7	2.4	2.5
664+990	2.5	2.7	2.5	2.9
665+990	2.4	2.9	2.3	2.7
666+990	2.4	3.1	2.4	2.9
667+990	2.3	2.7	2.4	2.9
668+990	2.3	2.8	2.3	2.5
669+990	2.4	3.1	2.6	2.7
670+990	2.7	2.9	2.7	3.2
671+990	2.7	2.8	2.8	3.2
672+990	2.7	3.2	3.1	3.8
673+990	2.7	3.2	2.6	3.6
674+990	3.2	3.6	3.0	3.2
675+990	3.2	3.2	2.7	3.6
676+790	2.5	3.2		3.1

Table 74. IRI Results (m/km)

4.5.3 RUTTING

Rutting is one of the important factors which determine the functional performance of pavement. Rutting is characterized by permanent deformation of the pavement in wheel path due to heavy load vehicles. It is one of the main modes of failure in asphalt mixes.

Condition	Rut Depth Range (mm)
Good	< 5
Fair	5 - 10
Poor	> 10

Table 75. Rut Condition scale

The maps of Rut Depth along the whole stretch are shown in the following figures:

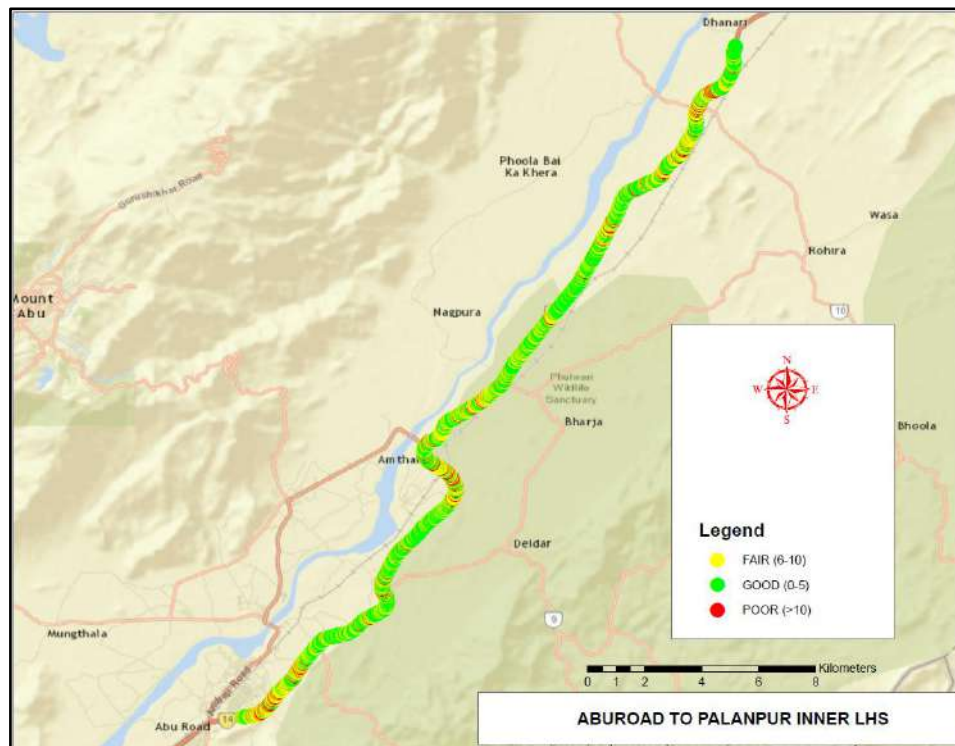


Figure 58. Rutting along the stretch (LHS, inner lane)

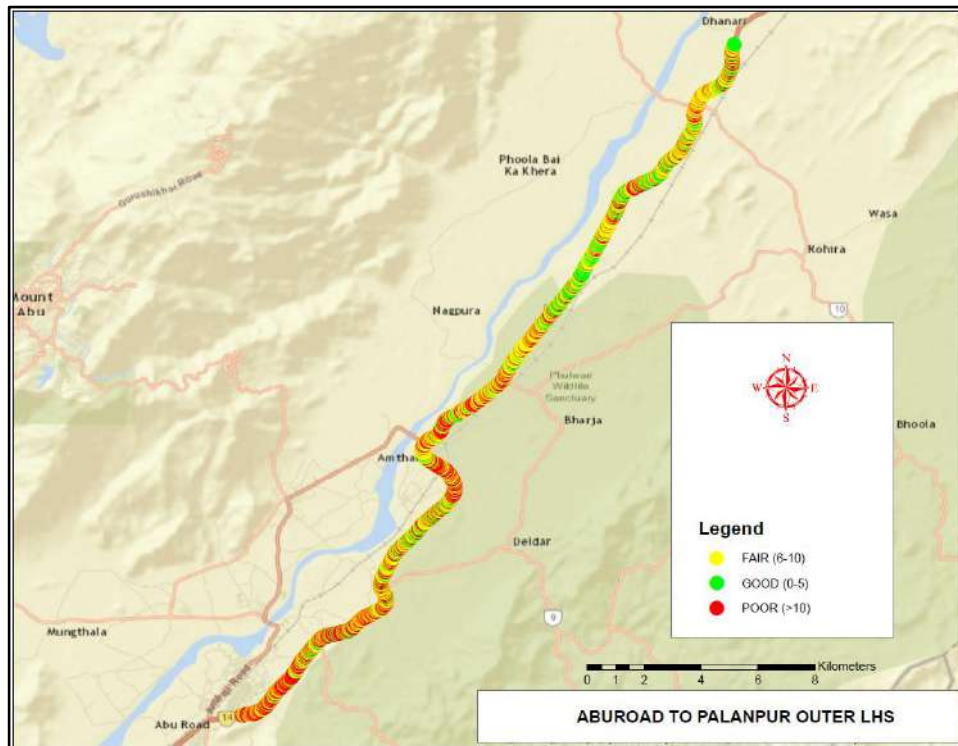


Figure 59. Rutting along the stretch (LHS, outer lane)

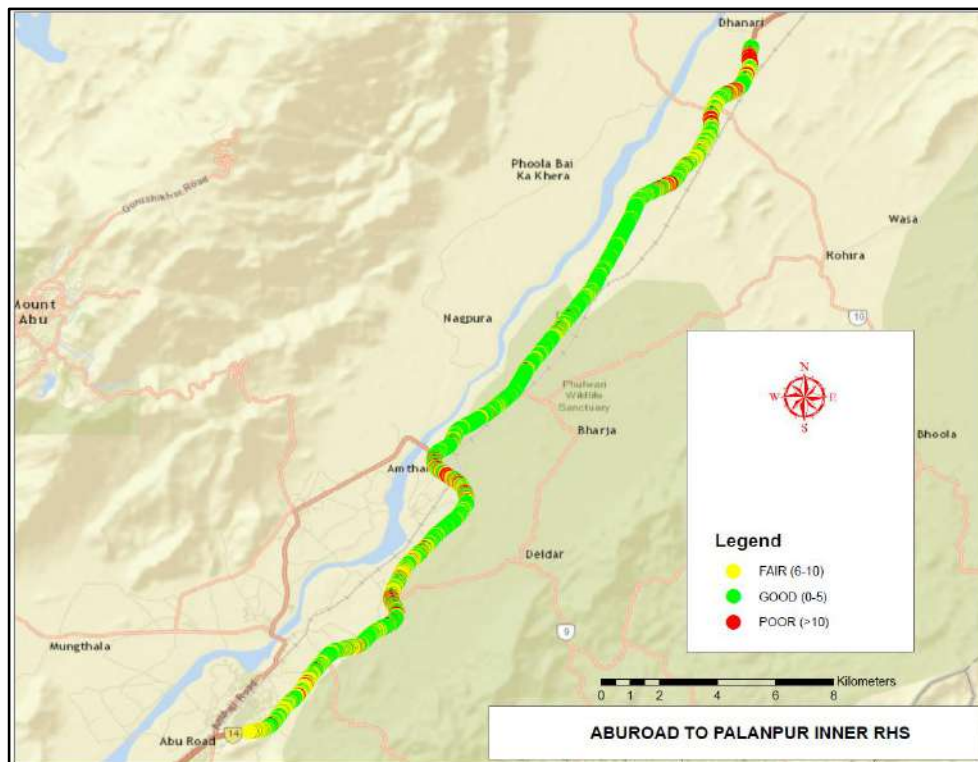


Figure 60. Rutting along the stretch (RHS, inner lane)

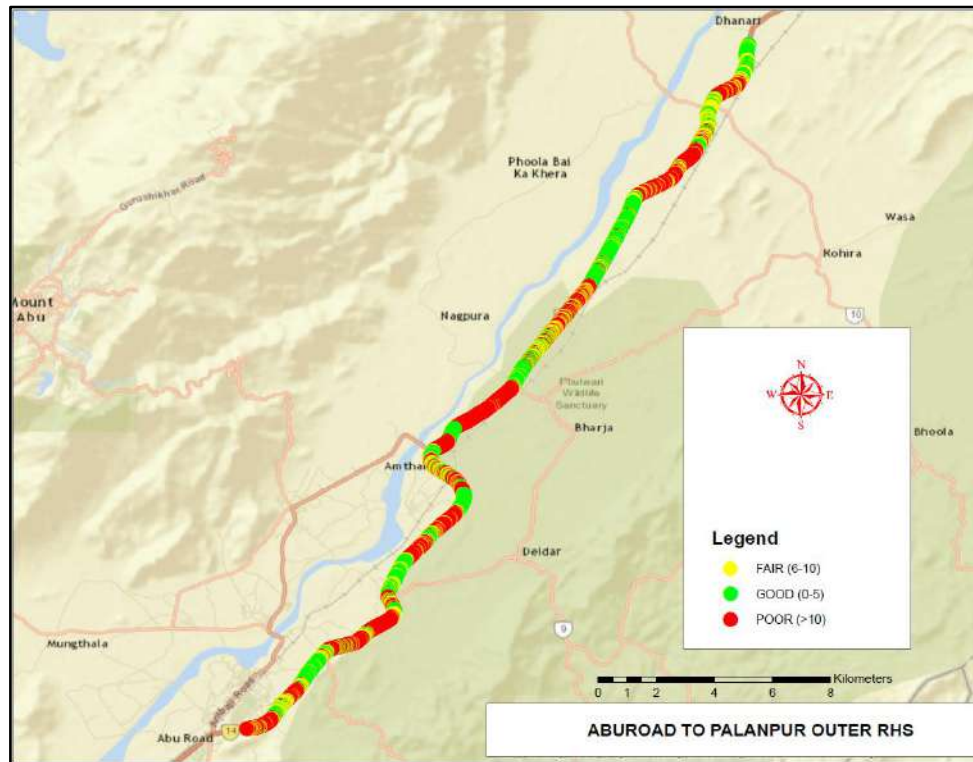


Figure 61. Rutting along the stretch (RHS, outer lane)

4.5.3.1 OUTER/INNER LANE RUT DEPTH

The rut depths observed for all 4 lanes (2-LHS and 2- RHS) are presented in the figures shown below.

It can be observed that Rutting values are considerably lower in inner lane as compared to outer lane both for LHS and RHS.

Condition	Rut Depth Range (mm)	Length LHS Outer (km)	Percentage LHS Outer (%)	Length LHS Inner (km)	Percentage LHS Inner (%)
Good	< 5	1	3	20	65
Fair	5 - 10	19	61	11	35
Poor	> 10	11	35	0	0

Table 76.LHS carriageway outer lane and inner lane Rut Depth results

Condition	Rut Depth Range (mm)	Length RHS Outer (km)	Percentage RHS Outer (%)	Length RHS Inner (km)	Percentage RHS Inner (%)
Good	< 5	4	13	19	63
Fair	5 - 10	6	20	11	37
Poor	> 10	20	67	0	0

Table 77.RHS carriageway outer lane and inner lane Rut Depth results

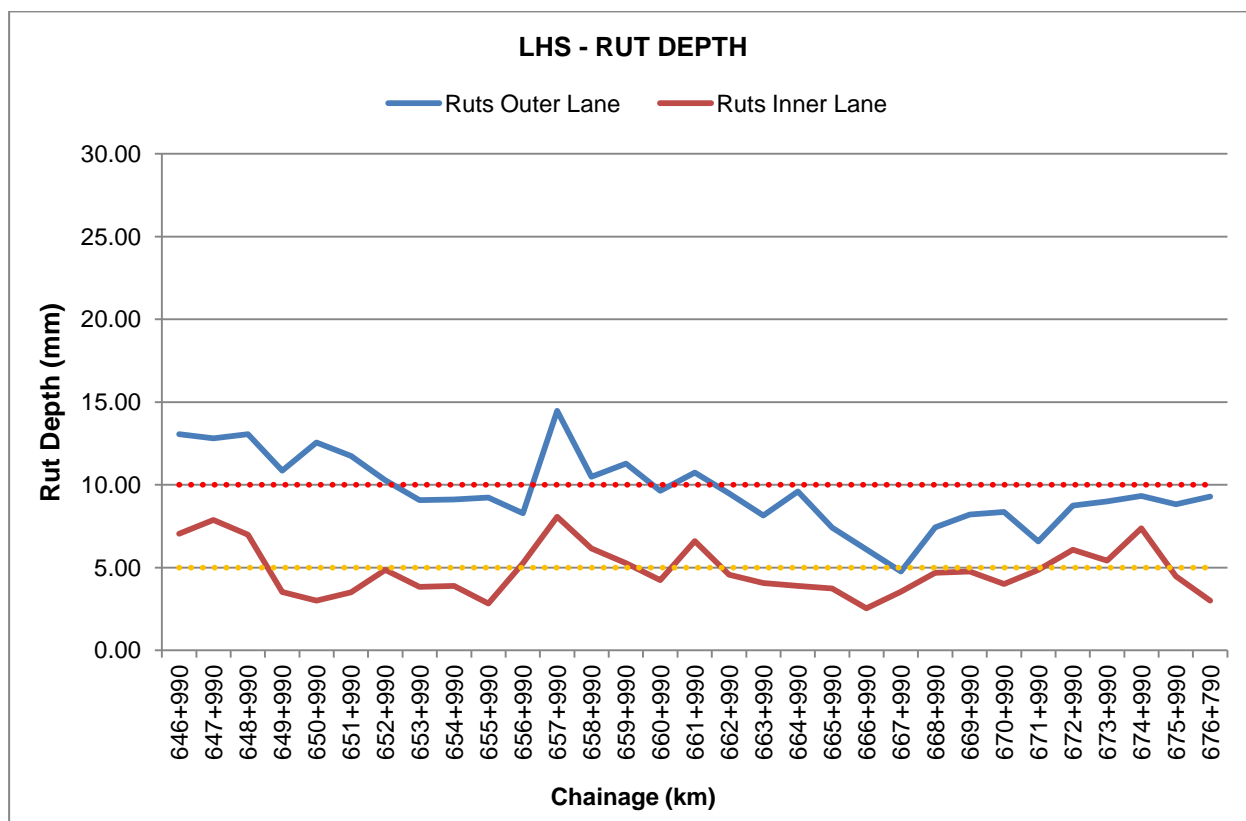


Figure 62. Rut Depth observed for Inner and Outer Lane of LHS carriageway

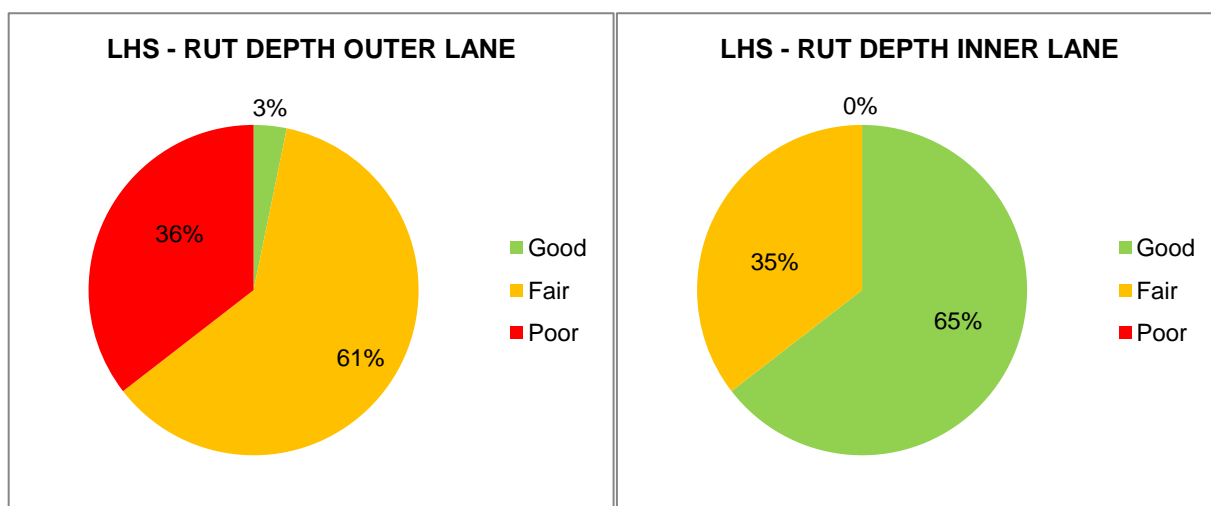


Figure 63. LHS Rut Depth Outer/Inner Lane

It is observed from the Figure 63 that 3% - 65% on outer/inner lane of Project Stretch has a Rutting value in Good condition, whereas Fair was in range between 61% - 35% in outer/inner lane and Poor condition is in range of 36% in outer lane and 0% in inner lane.

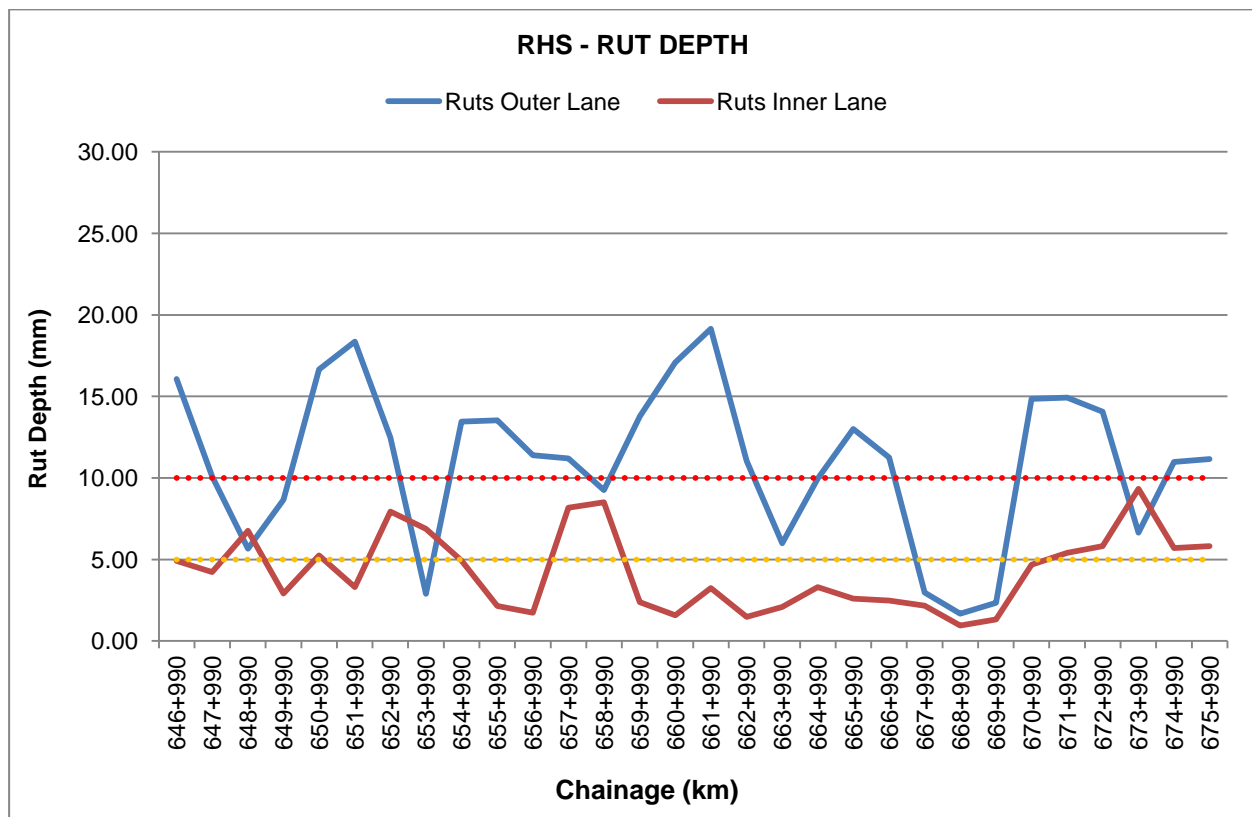


Figure 64. Rut Depth observed for Inner and Outer Lane of RHS carriageway

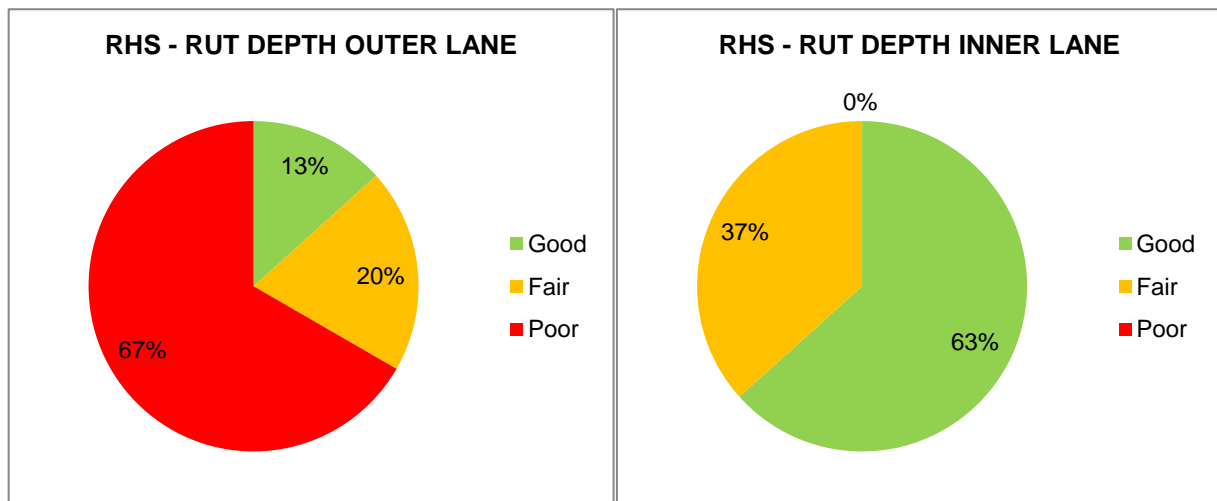


Figure 65. RHS Rut Depth Outer/Inner Lane

It is observed from the Figure 65 that 13%-63% on outer/inner lane of Project Stretch has a Rutting value in Good condition, whereas Fair was in range between 20%-37% in outer/inner lane and Poor condition is in range of 67% in outer lane and 0% in inner lane.

4.5.3.2 LHS/RHS RUT DEPTH

Length wise summary of Rut depth condition details for both the directions is given in Table 78:

Condition	Rut Depth (mm)	LHS (km)	LHS (%)	RHS (km)	RHS (%)
Good	RD < 5	21	34	23	38
Fair	5 < RD < 10	30	48	17	28
Poor	RD < 10	11	18	20	33

Table 78. Direction wise Rut depth distribution

KP	LHS Outer Lane	LHS Inner Lane	RHS Outer Lane	RHS Inner Lane
646+990	13	7	16	5
647+990	13	8	10	4
648+990	13	7	6	7
649+990	11	4	9	3
650+990	13	3	17	5
651+990	12	4	18	3
652+990	10	5	12	8
653+990	9	4	3	7
654+990	9	4	13	5
655+990	9	3	14	2
656+990	8	5	11	2
657+990	14	8	11	8
658+990	10	6	9	9
659+990	11	5	14	2
660+990	10	4	17	2
661+990	11	7	19	3
662+990	9	5	11	1
663+990	8	4	6	2
664+990	10	4	10	3
665+990	7	4	13	3
666+990	6	3	11	2
667+990	5	4	3	2
668+990	7	5	2	1
669+990	8	5	2	1
670+990	8	4	15	5
671+990	7	5	15	5
672+990	9	6	14	6

KP	LHS Outer Lane	LHS Inner Lane	RHS Outer Lane	RHS Inner Lane
673+990	9	5	7	9
674+990	9	7	11	6
675+990	9	4	11	6
676+790	9	3		

Table 79. Rut depth results (mm)

Graphs and tables are represented in average kilometeric values. Detail of average hectometre values are shown in Annexure IRI and Rut Depth results.

4.6 FWD RESULTS

Structural Condition of pavement has been evaluated using Falling Weight Deflectometer (FWD) and subsequent analysis was carried out to ascertain the relative performance of the pavement for entire Project Stretch, in the context of evaluating its residual life, overlay and other maintenance requirements.

Normalization of data obtained from the average of three readings at each location is done taking into account the temperature and seasonal correction factors. The results are provided at below table.

Side	Initial Kilometeric Point (km)	Final Kilometeric Point (km)	Average Deflection (mm/100)	Characteristic Deflection (mm/100)
LHS	646+000	650+000	22	35
LHS	650+000	655+000	20	32
LHS	655+000	660+000	22	33
LHS	660+000	665+000	25	36
LHS	665+000	670+000	23	32
LHS	670+000	675+000	24	34
LHS	675+000	677+000	25	35
RHS	677+000	675+000	21	35
RHS	675+000	670+000	23	36
RHS	670+000	665+000	14	27
RHS	665+000	660+000	19	32
RHS	660+000	655+000	19	32
RHS	655+000	650+000	20	34
RHS	650+000	646+000	20	33

Table 80. FWD results

The graphical representations of these values are presented.

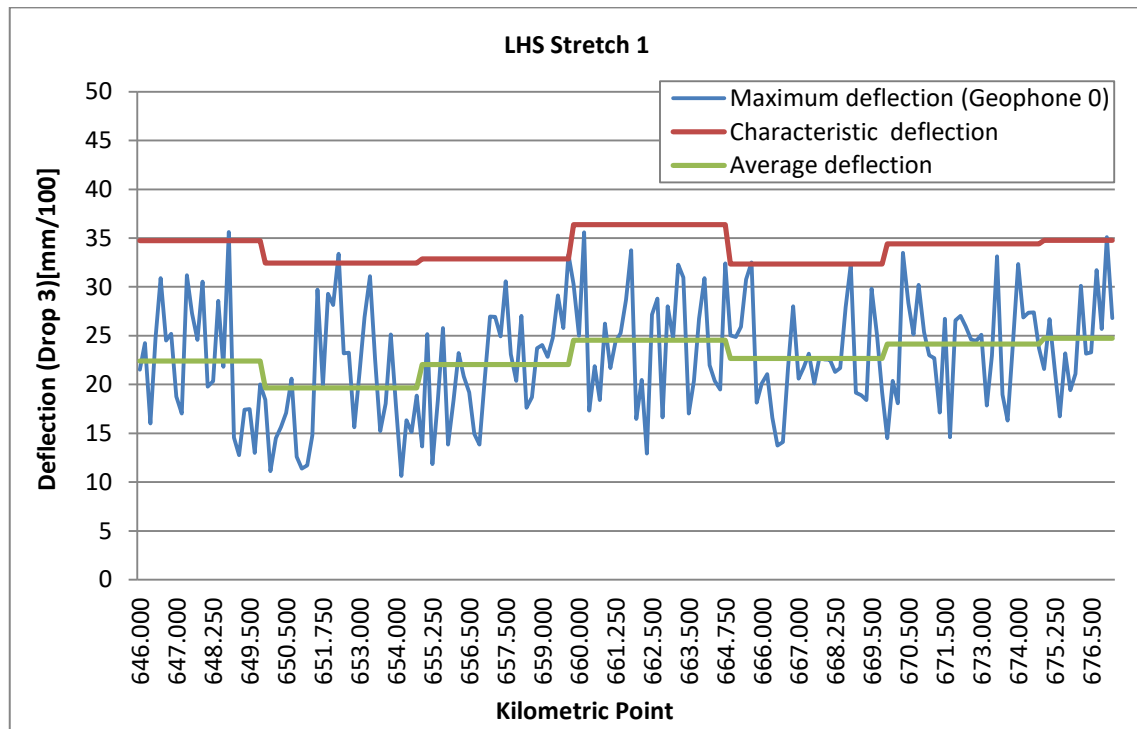


Figure 66.FWD results. LHS

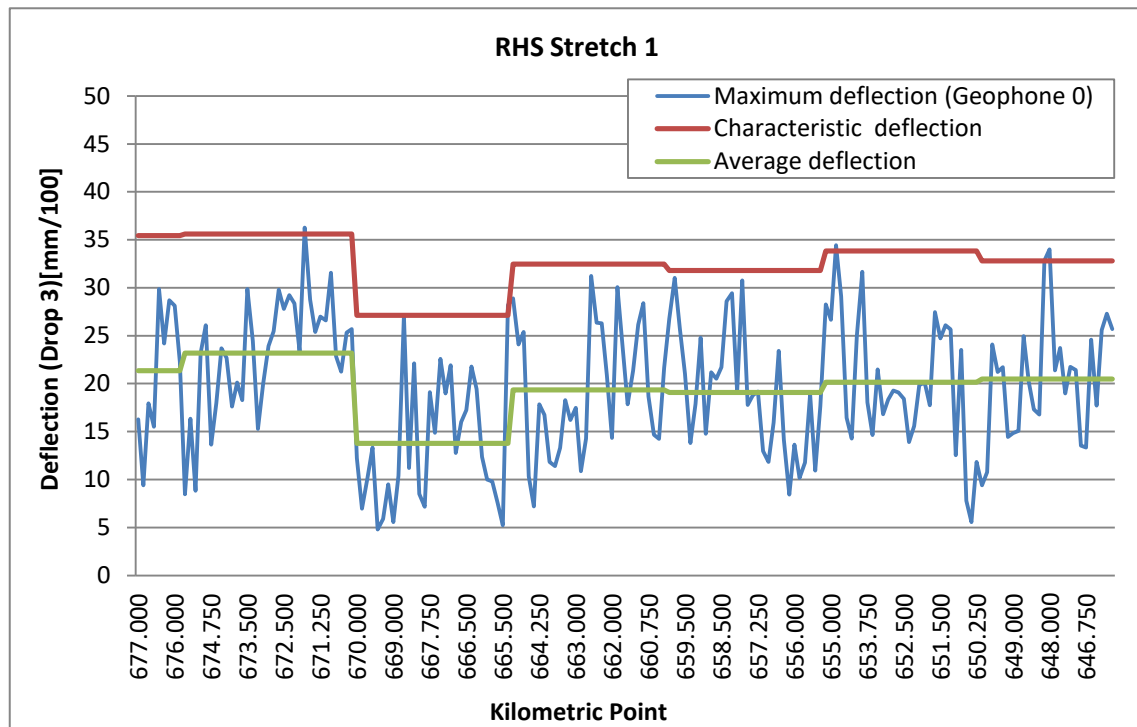


Figure 67. FWD results. RHS

4.7 PAVEMENT STRUCTURAL EVALUATION AND OVERLAYS REQUIREMENT

The evaluation of the structural condition of an in-service pavement is made by following the guidelines detailed by IRC: 115-2014 and using deflection (FWD) data as well as other pavement data as inputs to a back calculation model for determining the elastic moduli of pavement layers, and, thereafter, using these moduli as inputs to a pavement design model for estimating the overlay requirement.

4.7.1 BACKCALCULATION OF LAYERS ELASTIC MODULI

Measured surface deflections are normalized to a standard load of 40 kN. Based on these normalized surface deflections, and the thicknesses and physical characteristics of the different pavement layers of this highway stretch, we did the back calculation of the elastic moduli for existing pavement layers and then applied the subsequent corrections based on temperature and seasonal variations.

Correction factors have been applied after back calculated by KGPBACK with deflection point's carriageway wise.

- Correction for Temperature
- Correction for Seasonal Variation

Based on these correction factors corrected values of Bituminous/Granular/Subgrade values were used for final calculation of elastic moduli.

4.7.1.1 DATA ANALYSIS

Moduli of each layer have been calculated using KGPBACK for each test point. The calculated modulus values for each layer are presented in the form of graph, for LHS and RHS of the Project Stretch. The Elastic Modulus of Bituminous Layers is shown in the following figures:

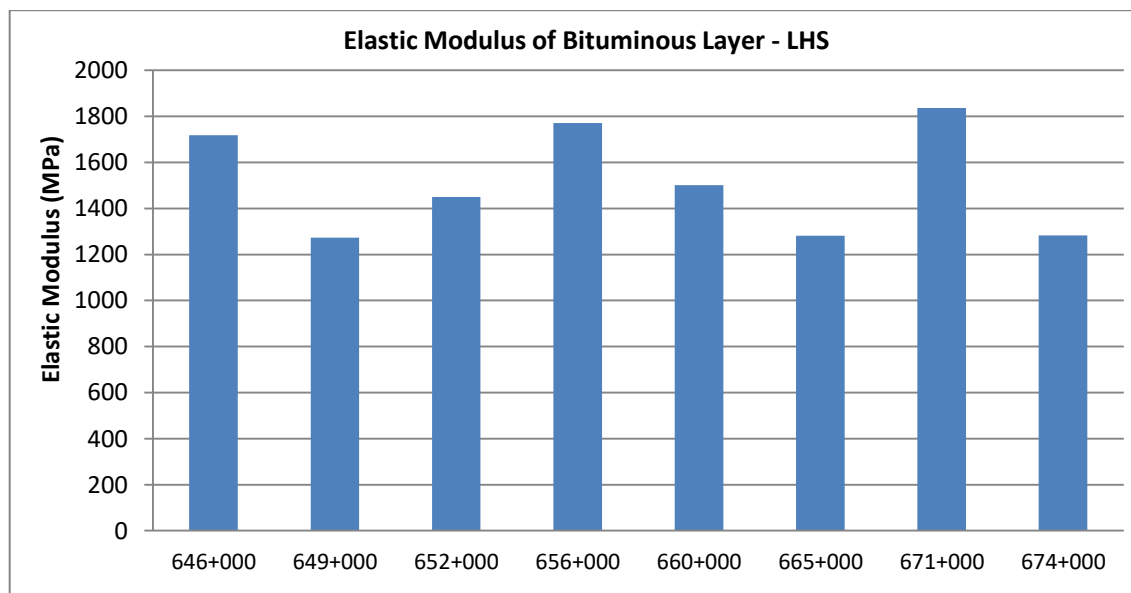


Figure 68. Elastic Moduli for Bituminous layer on LHS Carriageway

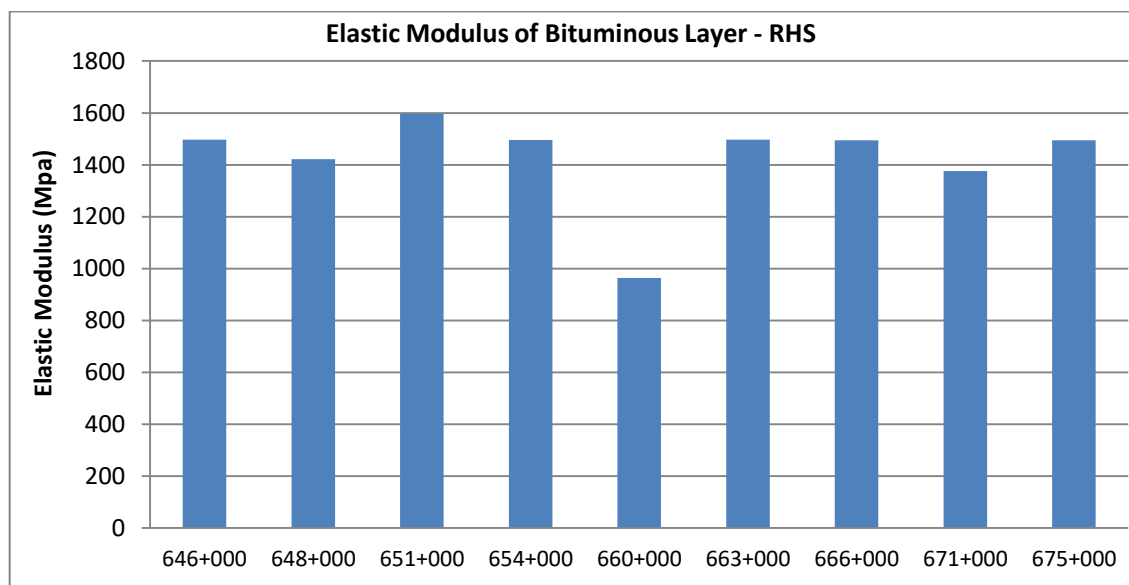


Figure 69. Elastic Moduli for Bituminous layer on RHS Carriageway

It is observed from the above graph the elastic moduli of the bituminous layer for LHS and RHS were found to be varying between 964 MPa to 1836 MPa. The elastic modulus values are slightly lower at some location at the start of the stretch. The similar trend was observed at the time of core cutting because of de-bonding of bituminous layers at multiple locations, from Chainage 600+000 of the Project Stretch is having more than around 1200 (MPa) elastic modulus value were observed. The same trend is observed in other performance parameters wherein a comparison was made for the LHS and RHS elastic modulus values of the bituminous layer of the carriageway and is shown in the next figure.

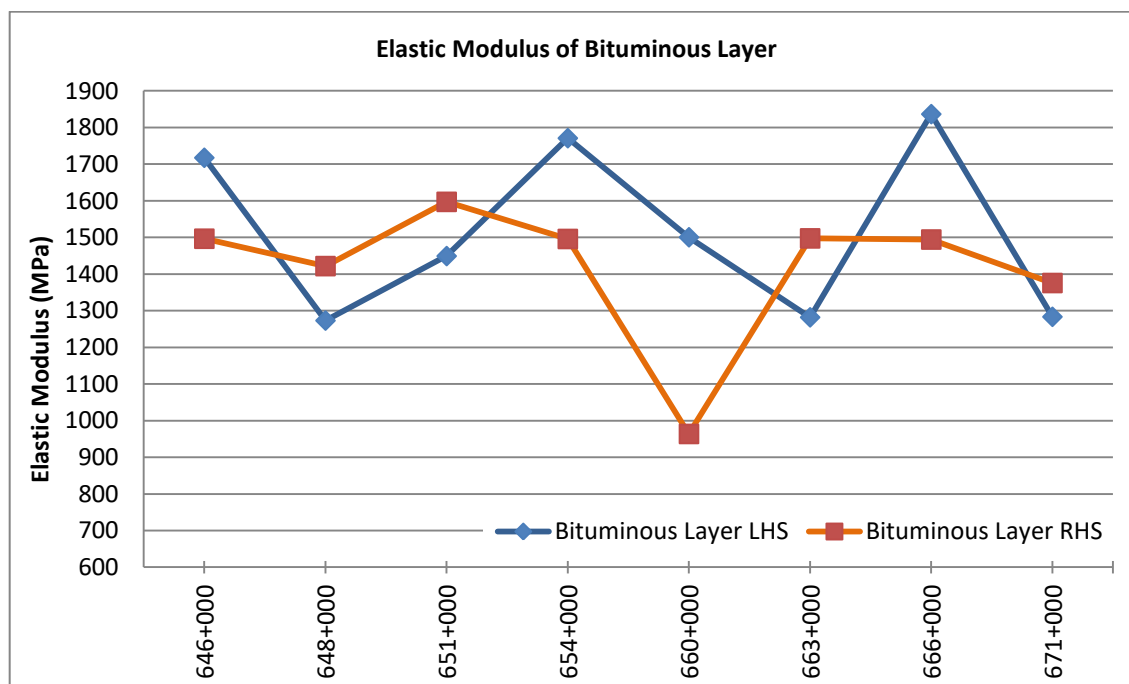


Figure 70. Elastic Modulus values of Bituminous layer for LHS and RHS carriageway

The Elastic Modulus of Granular Layers for LHS and RHS is shown in the following figures:

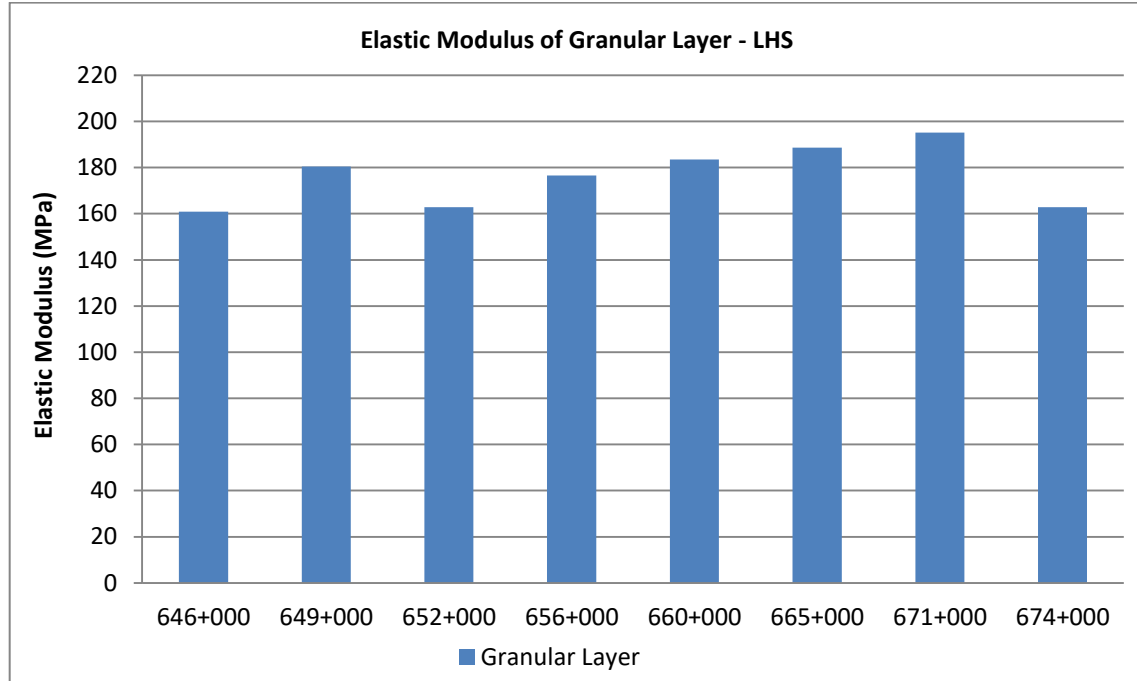


Figure 71. Elastic Moduli for Granular layer on LHS Carriageway

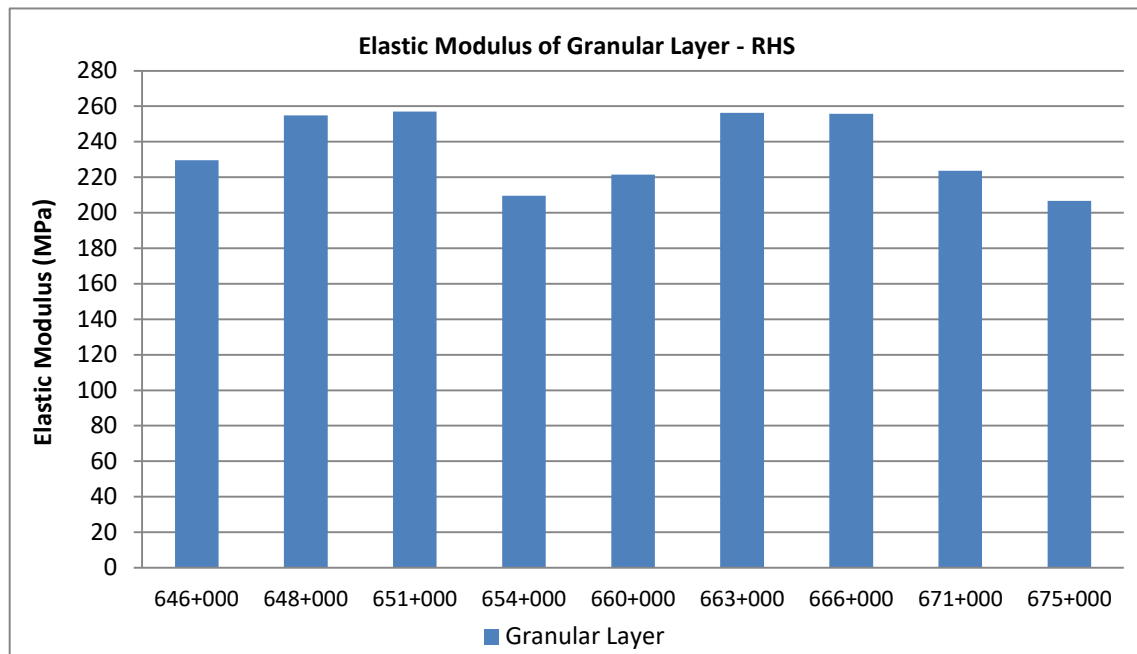


Figure 72. Elastic Moduli for Granular layer on RHS Carriageway

The elastic moduli of granular layer were found to be varying from 55 MPa to 143 MPa as shown in the figures above. The trend of the elastic modulus values seems to be similar to that of the trend shown by the elastic modulus values of the bituminous layer.

A comparison has been made for the LHS and RHS elastic modulus values of the granular layer of the carriageway and is shown in the next figure:

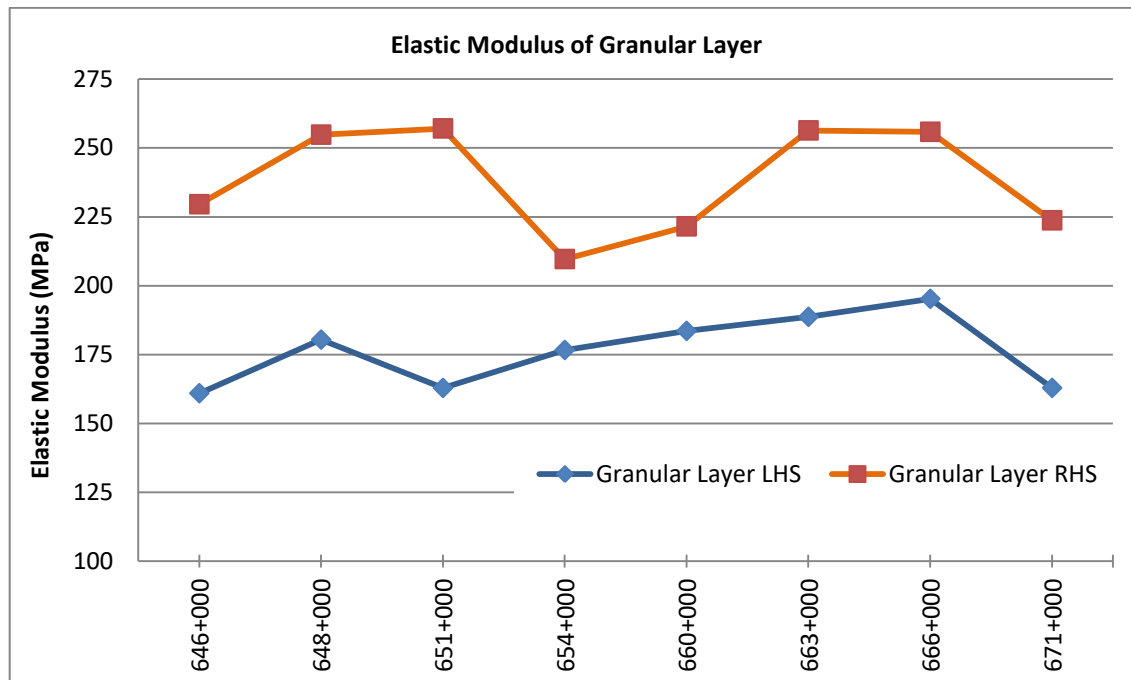


Figure 73. Elastic Modulus values of Granular layer for LHS and RHS carriageway

The Elastic Modulus of Subgrade Layers for LHS and RHS is shown in the following figures:

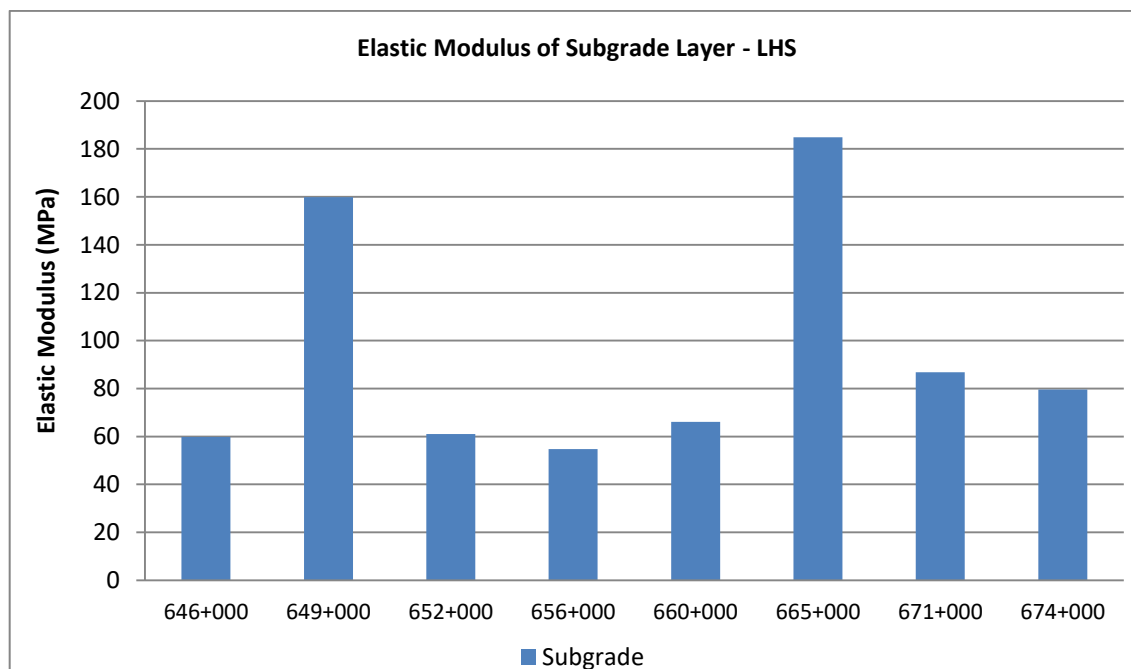


Figure 74. Elastic Moduli for Subgrade layer on LHS Carriageway

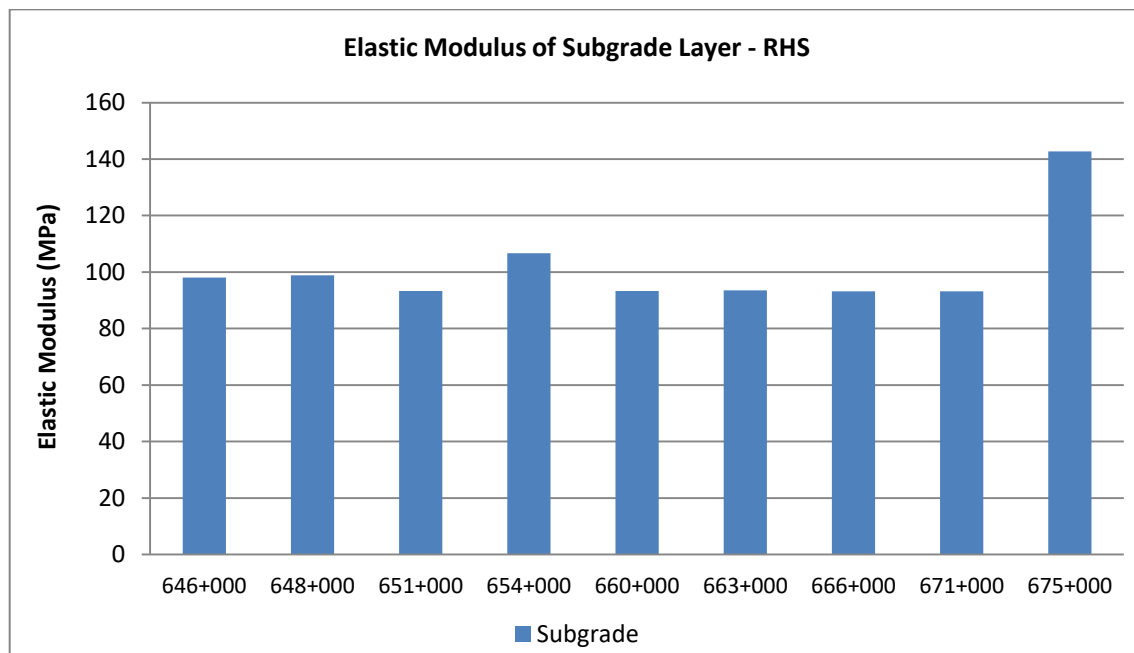


Figure 75. Elastic Moduli for Subgrade layer on RHS Carriageway

The elastic moduli of subgrade layer were found to be varying from 161 MPa to 257 MPa as shown in the figures above. The elastic modulus of the subgrade layer is greatly dependent on the CBR of subgrade soil. The pattern of the moduli seems to be similar with the CBR.

A comparison has been made for the LHS and RHS elastic modulus values of the subgrade of the carriageway and is shown in the figure below:

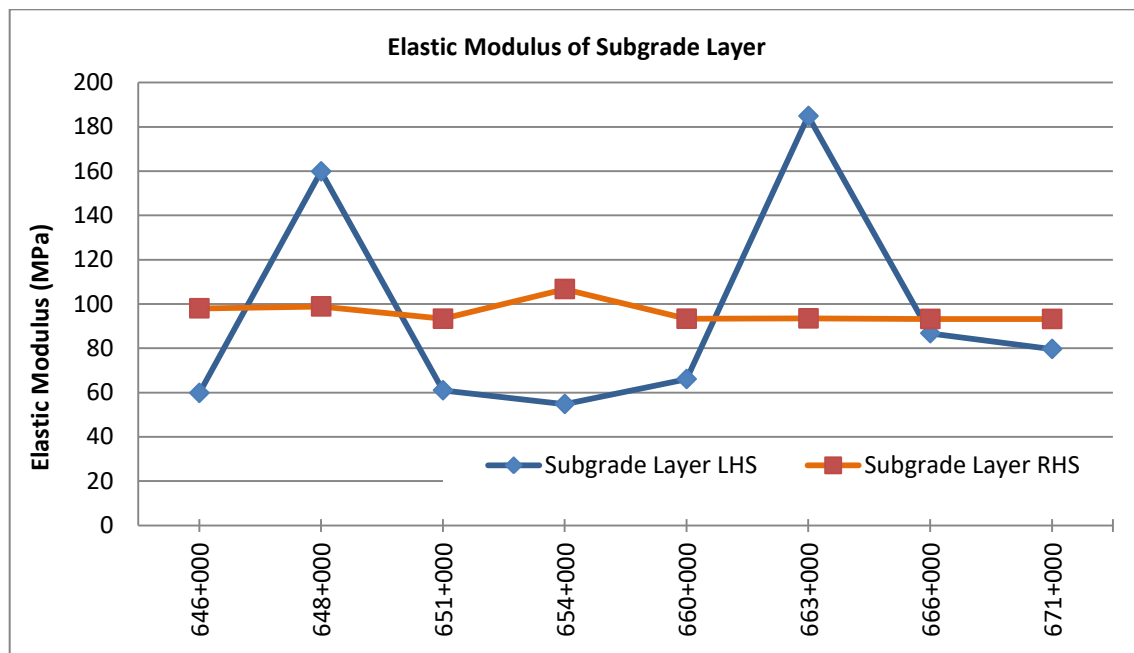


Figure 76. Elastic Modulus values of subgrade layer for LHS and RHS carriageway

The subgrade modulus of LHS and RHS of the carriageway is similar from the above graph.

The elastic moduli for each layer have been categorized as Poor, Fair and Good based on the range obtained from FWD analysis for each layer. Moduli condition ranges of different layers for both directions have been summarized in the next table:

Layer	Condition	Modulus Range	Length in km	
			LHS	RHS
Bituminous	Good	More than 3000	-	-
	Fair	3000 - 750	31.00	31.00
	Poor	Less than 750	-	-
Granular	Good	More than 500	-	-
	Fair	500 - 100	31.00	31.00
	Poor	Less than 100	-	-
Subgrade	Good	More than 298	-	-
	Fair	75 - 298	15.00	31.00
	Poor	Less than 75	16.00	-

Table 81. Moduli condition ranges

As per above table the range of Elastic Modulus values of Bituminous/Granular and Subgrade layer (Good/Fair/Poor) for LHS and RHS carriageway are presented below in pie charts.

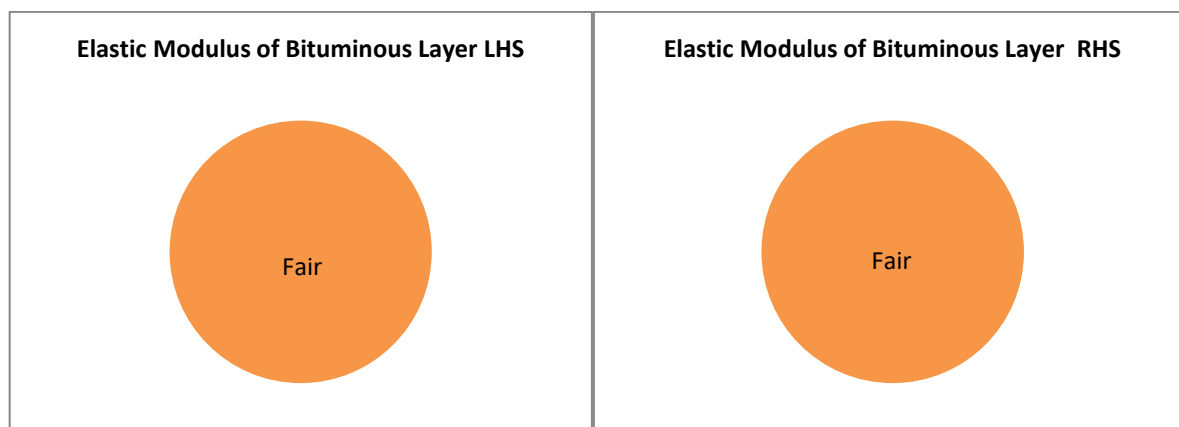


Figure 77. Variation of Elastic moduli of bituminous layer for LHS and RHS carriageway

As shown in Figure 77, the bituminous layer moduli are in fair conditions on both sides in around 100%.

According to values collected in Table 81, the granular layer modulus for the whole stretch has found to be in fair condition. The pie chart figure is shown below.

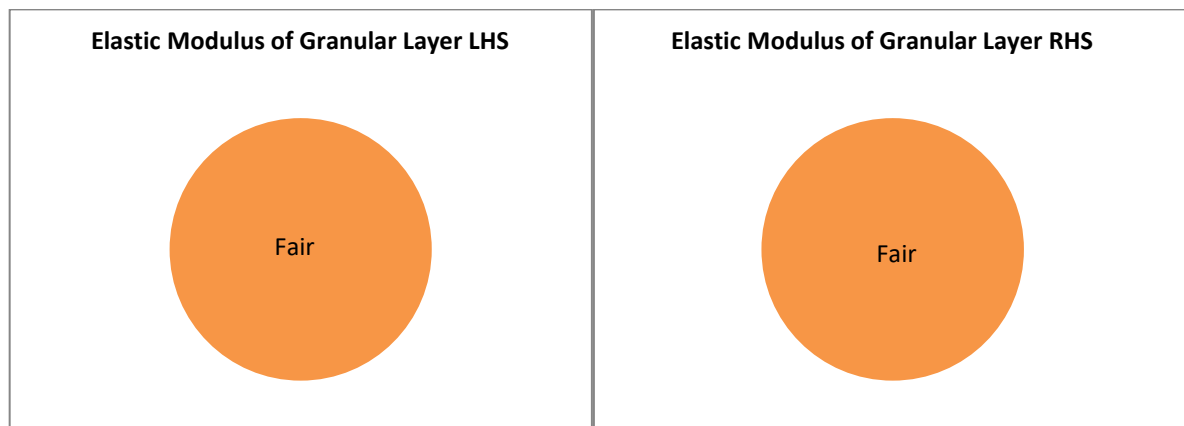


Figure 78. Variation of Elastic moduli of bituminous layer for LHS and RHS carriageway

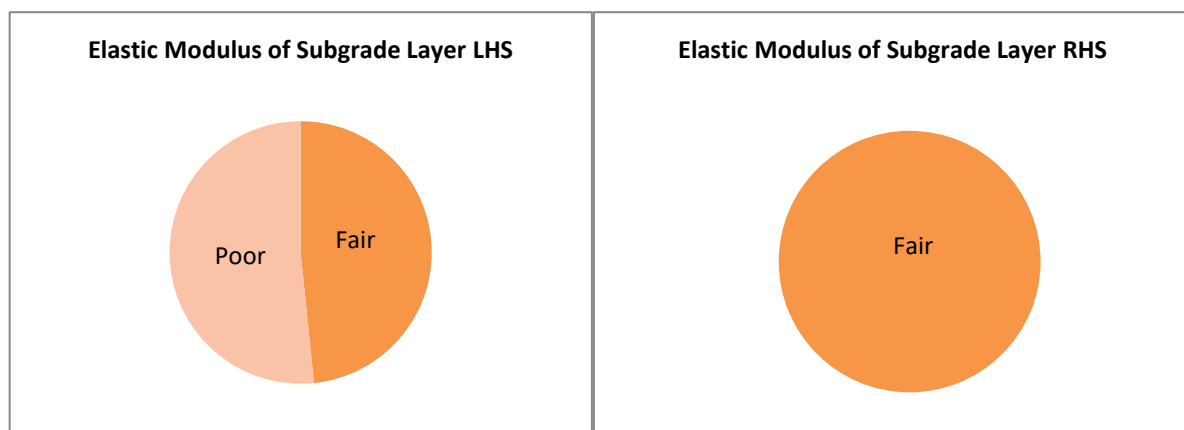


Figure 79. Variation of Elastic moduli range of subgrade for LHS and RHS carriageway

It can be observed from the above charts, the subgrade moduli for the whole stretch in RHS side are in fair condition, while LHS side are in Fair/Poor condition of Project Stretch.

4.7.2 SEGMENTATION (HOMOGENEOUS SECTIONS)

The Identification of homogeneous sections is done on the basis of the peak deflections or peak deflection bowl parameters, subgrade strength, design traffic, layer thicknesses and extent and severity of distress.

Here in this section Surface Curvature Index (SCI) are used for identification of homogeneous sections. The statistical technique used for identification is the "Cumulative Difference" approach. The series of cumulative differences (z_j) for the measured sequence of a given variable 'x' (SCI) is used to determine homogeneous sections.

Homogeneous section based on (SCI) index for LHS carriageway is as follows:

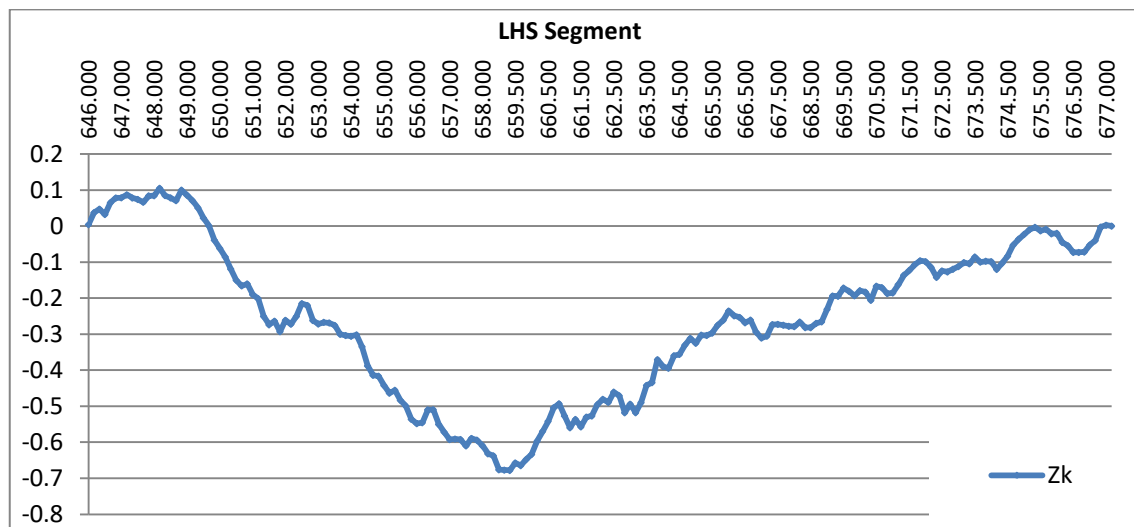


Figure 80. Variation of deflection point range of FWD for LHS carriageway for homogeneous section

Homogeneous section based on (SCI) index for RHS carriageway is as follows:

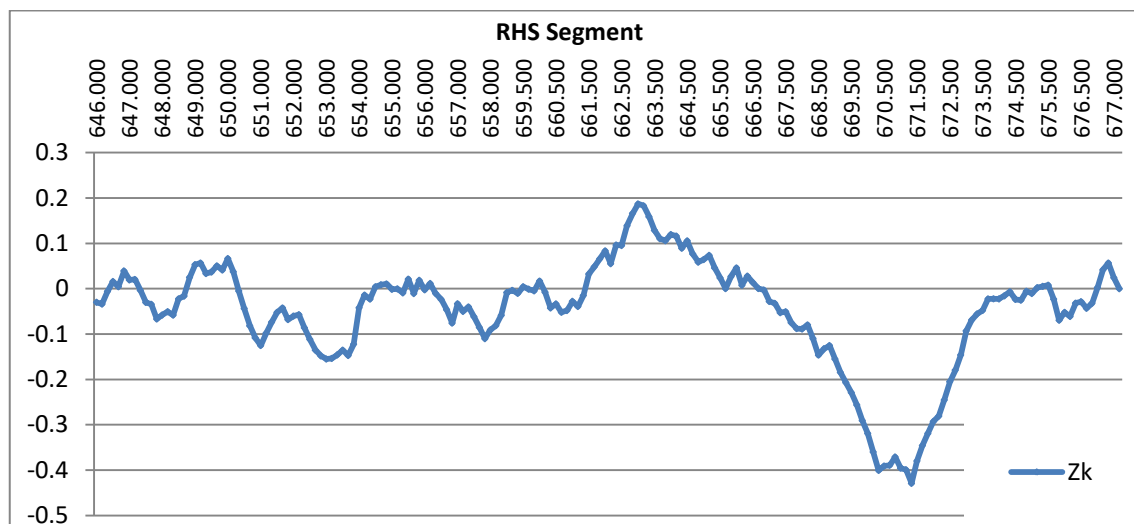


Figure 81. Variation of deflection point range of FWD for RHS carriageway for homogeneous section

Based on above graphs of homogeneous section of LHS and RHS carriageway it is clear that the sections are not the same for both carriageways, based on these homogeneous sections the overlay calculation was done.

4.7.3 REMAINING LIFE ANALYSIS

The structural condition of the pavement has been assessed by its Remaining Life which in this case is estimated from the critical strains computed for the present condition of the pavement.

Any method used to estimate the remaining life of a pavement will have its limitations and the results cannot automatically be accepted. It is, hence, very important that the estimations be compared with other indicators of the structural condition such as surface distress data, test pit inspection, coring data, etc., to check whether all these data give similar indications.

The layer moduli of in-service pavement backcalculated from FWD deflection data are used to analyze the pavement for critical strains which are indicators of pavement performance in terms of rutting and fatigue cracking failure. This criterion follows IRC: 115-2014 and IRC: 37-2012 and facilitates the estimation of the remaining life of the pavement and the subsequent design of overlays.

■ **FATIGUE IN BITUMINOUS LAYER:**

Following IRC: 115-2014, it is used the fatigue model for 90% reliability as below:

$$N_f = 0.711 \times 10^{-4} \times \left(\frac{1}{\epsilon_t}\right)^{3.89} \times \left(\frac{1}{M_r}\right)^{0.854}, \text{ For 90\% Reliability}$$

Where:

N_f = fatigue life in number of standard axles.

ϵ_t = Maximum Tensile strain at the bottom of the bituminous layer.

M_r = Resilient Modulus of the bituminous layer.

■ **RUTTING IN PAVEMENT:**

Following IRC: 115-2014, it is used the rutting model for 90% reliability as below:

$$N = 1.41 \times 10^{-8} \times \left[\frac{1}{\epsilon_v}\right]^{4.5337}$$

Where:

N = Number of cumulative standard axles.

ϵ_v = Vertical strain in the subgrade.

Using the moduli values previously calculated, the remaining life of the pavement is estimated by using IIT PAVE.

Remaining Life in (Fatigue and Rutting) of Pavement section wise LHS Carriageway are presented below in Table 82.

Section	Length km	Chainage		Pavement		15th Percentile			Before overlay	
		From	To	BT	GR	BT Layer	GR Layer	SB Layer	Fatigue Life	Rutting Life
Sec - 01	3.0	646+000	649+000	185	500	1,717	161	60	24.74	171.81
Sec - 02	3.0	649+000	652+000	185	500	1,273	180	160	20.54	2,349.34
Sec - 03	4.0	652+000	656+000	235	480	1,449	163	61	54.13	328.43
Sec - 04	4.0	656+000	660+000	205	450	1,771	177	55	42.02	151.42
Sec - 05	5.0	660+000	665+000	100	420	1,500	184	66	3.93	15.35
Sec - 06	6.0	665+000	671+000	100	410	1,282	189	185	3.80	272.09
Sec - 07	3.0	671+000	674+000	162	539	1,836	195	87	21.83	523.71
Sec - 08	3.0	674+000	677+000	205	645	1,283	163	80	26.53	1,376.45

Table 82. Remaining Life (Fatigue and Rutting) of Pavement(LHS)

Remaining Life in (Fatigue and Rutting) of Pavement section wise RHS Carriageway are presented below, in Table 83.

Section	Length km	Chainage		Pavement		15th Percentile			Before overlay	
		From	To	BT	GR	BT Layer	GR Layer	SB Layer	Fatigue Life	Rutting Life
Sec - 01	2.0	646+000	648+000	250	420	1,496	230	98	132.16	1,131.56
Sec - 02	3.0	648+000	651+000	250	420	1,422	255	99	146.78	1,173.69
Sec - 03	3.0	651+000	654+000	250	420	1,597	257	93	172.02	1,362.58
Sec - 04	6.0	654+000	660+000	230	440	1,496	210	107	79.66	1,145.39
Sec - 05	3.0	660+000	663+000	280	390	964	222	93	123.26	677.16
Sec - 06	3.0	663+000	666+000	280	390	1,497	256	93	240.38	1,083.42
Sec - 07	5.0	666+000	671+000	220	410	1,494	256	93	87.08	573.60
Sec - 08	4.0	671+000	675+000	220	410	1,376	224	93	62.92	466.70
Sec - 09	2.0	675+000	677+000	220	410	1,495	207	143	65.50	1,653.84

Table 83. Remaining Life (Fatigue and Rutting) of Pavement(RHS)

Both tables presented above show back calculation of each layer system with corrected values and remaining life of pavement.

4.7.4 OVERLAY REQUIREMENTS

The flexible pavements are designed as a three layered system consisting of typical component layers, namely sub-grade, sub-base & base course (granular) and binder & surface course (bituminous).

The Proposed overlay requirements are obtained from the calculated Remaining Rutting life and Fatigue Life of the pavement, based on elastic modulus of bituminous layer as determine by back calculations. IITPAVE is used to calculate the strain values (vertical/horizontal) based on elastic modulus of all pavement layers, and assists to evaluate the remaining life of pavement in accordance to the thickness of overlay design in structural and functional requirement.

Falling Weight Deflectometer (FWD) Overlay Design Summary for Stretch 1 (LHS)										
Ch.	Length km	Section Details		Design Traffic (MSA)	After overlay		Overlay Thickness (mm)	Overlay Thickness Adopted (mm)		Remarks
		From	To		Fatigue Life	Rutting Life		BC	DBM	
Sec - 01	3.0	646+000	649+000	90	102.0	696.6	70	30	40	Structural Overlay
Sec - 02	3.0	649+000	652+000	90	102.9	9,474.8	70	30	40	Structural Overlay
Sec - 03	4.0	652+000	656+000	90	98.8	568.8	30	30	0	Structural Overlay
Sec - 04	4.0	656+000	660+000	90	93.8	326.0	40	40	0	Structural Overlay
Sec - 05	5.0	660+000	665+000	90	93.8	448.5	150	40	110	Structural Overlay
Sec - 06	6.0	665+000	671+000	90	91.3	6,062.3	140	40	100	Structural Overlay

Falling Weight Deflectometer (FWD) Overlay Design Summary for Stretch 1 (LHS)										
Ch.	Length km	Section Details		Design Traffic (MSA)	After overlay		Overlay Thickness (mm)	Overlay Thickness Adopted (mm)		Remarks
		From	To		Fatigue Life	Rutting Life		BC	DBM	
Sec - 07	3.0	671+000	674+000	90	99.0	1,975.3	70	30	40	Structural Overlay
Sec - 08	3.0	674+000	677+000	90	100.7	4,037.5	60	30	30	Structural Overlay

Table 84. Proposed Overlay thickness of LHS

Remaining life of pavement in fatigue before overlay and after overlay of pavement in LHS:

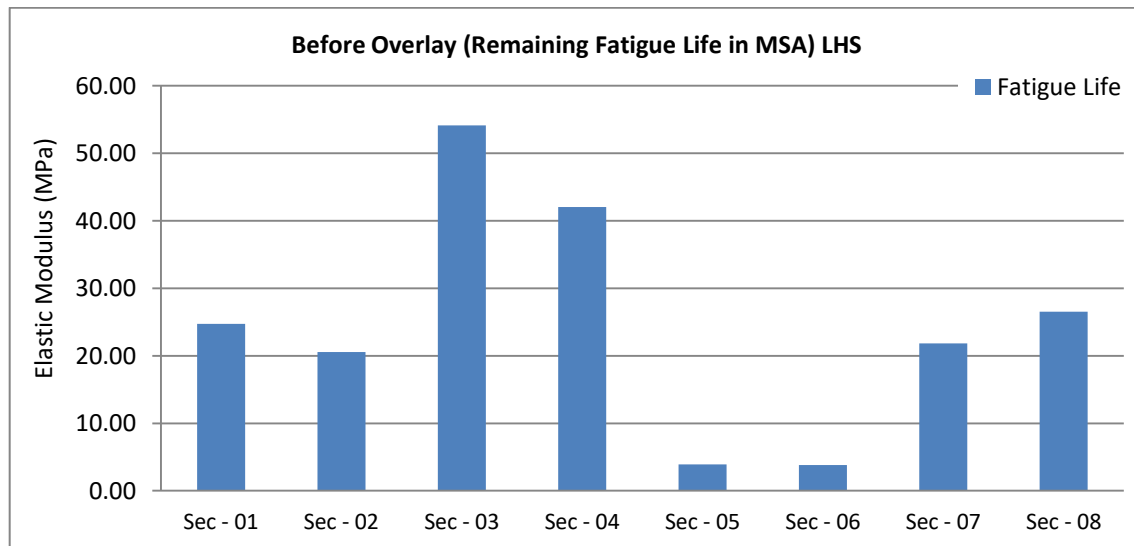


Figure 82. Remaining life before overlay (in MSA) LHS

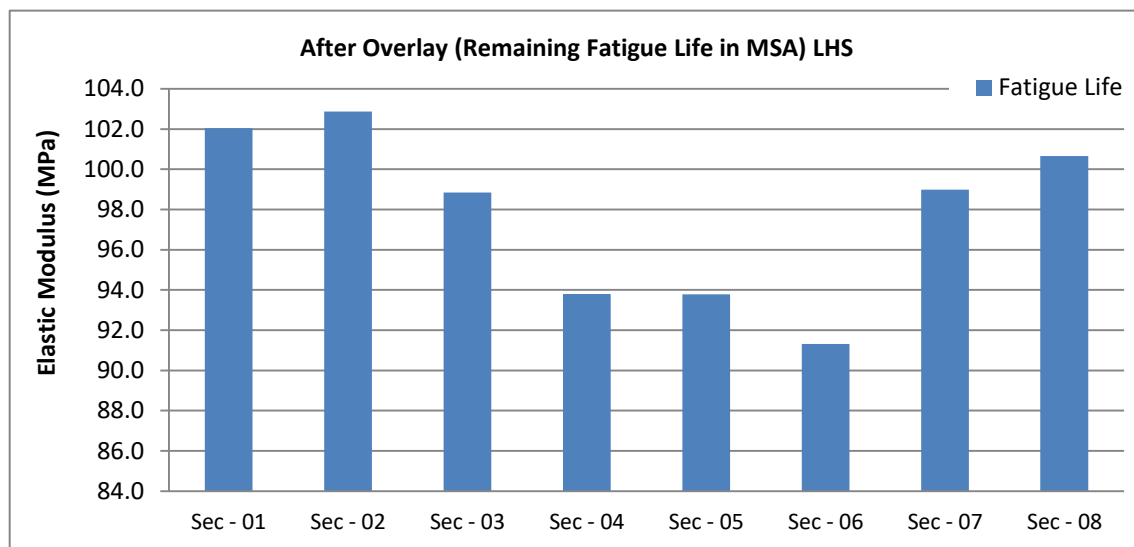


Figure 83.Remaining life after overlay (in MSA). LHS

Falling Weight Deflectometer (FWD) Overlay Design Summary for Stretch 1 (RHS)										
Ch.	Length km	Section Details		Design Traffic (MSA)	After overlay		Overlay Thickness (mm)	Overlay Thickness Adopted (mm)		Remarks
		From	To		Fatigue Life	Rutting Life		BC	DBM	
Sec - 01	2.0	646+000	648+000	85	248.4	1,875.5	30	30	0	Functional Overlay
Sec - 02	3.0	648+000	651+000	85	285.5	1,953.7	30	30	0	Functional Overlay
Sec - 03	3.0	651+000	654+000	85	317.3	1,890.8	30	30	0	Functional Overlay
Sec - 04	6.0	654+000	660+000	85	152.2	1,948.4	30	30	0	Structural Overlay
Sec - 05	3.0	660+000	663+000	85	255.5	1,220.8	30	30	0	Functional Overlay
Sec - 06	3.0	663+000	666+000	85	484.2	2,158.4	30	30	0	Functional Overlay
Sec - 07	5.0	666+000	671+000	85	171.6	989.7	30	30	0	Functional Overlay
Sec - 08	4.0	671+000	675+000	85	124.7	832.2	30	30	0	Structural Overlay
Sec - 09	2.0	675+000	677+000	85	127.6	2,881.3	30	30	0	Structural Overlay

Table 85.Proposed Overlay thickness of RHS

***Note:-**The survey investigations were conducted in the year 2018. Accordingly as per analysis requirement of overlay was as per mentioned in the table above. As per current status an overlay of 40 mm BC have been executed by present concessionaire in the year 2019.

Further, based on the findings in year 2018 pavement structural strengthening was recommended in certain stretches. Since present annuity concessionaire executed an overlay of 40 mm BC on entire stretch in year 2019, based on the findings including current overlay satisfies the MSA requirement till year 2024 (end of current concession period) except for the stretch from km 660+000 to 671+000 (LHS) which requires immediate attention, as this section doesn't satisfies current calculated MSA requirements.

Authority may take a note that this section requires an additional overlay of 80mm based on 2018 FWD results for pavement structural strengthening to sustain upto end of concession period (2024).

Remaining life of pavement in fatigue before overlay and after overlay of pavement in RHS:

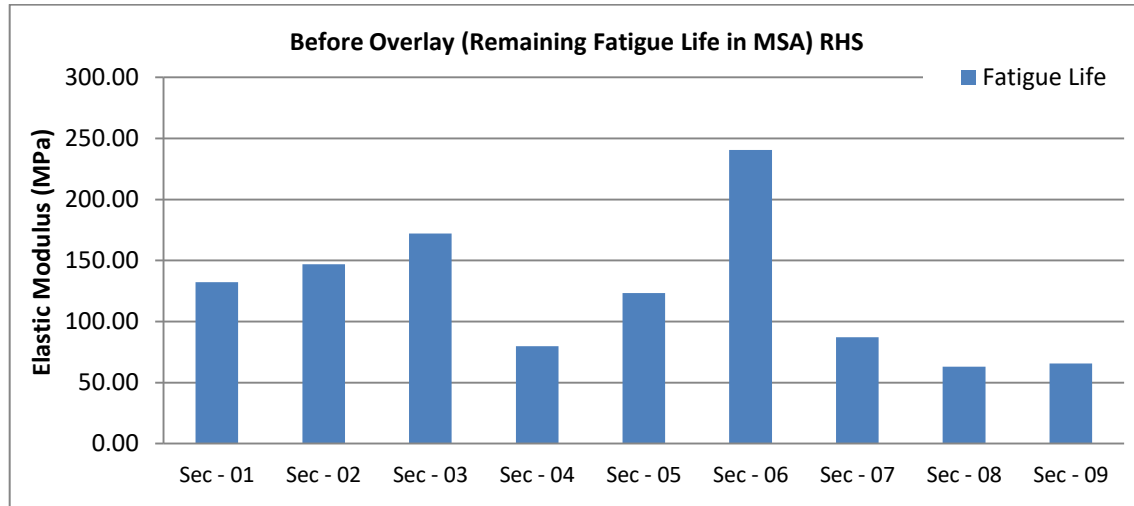


Figure 84. Remaining life before overlay (in MSA) RHS

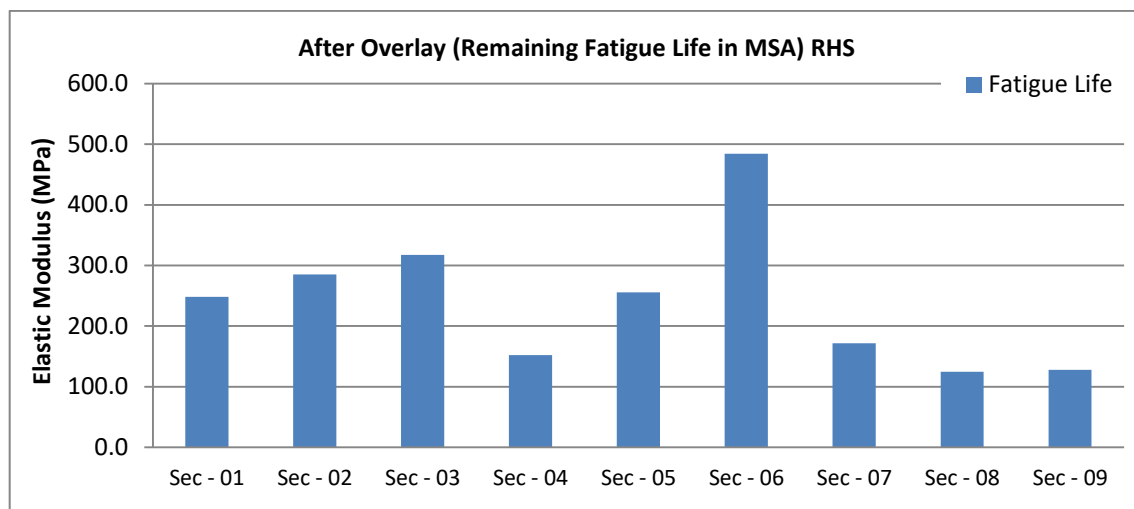


Figure 85. Remaining life before overlay (in MSA) RHS

4.7.5 SUMMARY OF INITIAL PAVEMENT WORKS

The following table summarizes all the pavement works that are recommended for the initial stage of the project in accordance to the current condition of the road. Works are including Milling & Overlays due to functional/surface distresses such as Rutting and Cracking, and the above calculated Structural Overlays. The distribution of the works is shown by carriageway and by lane to provide more detail with quantities (thicknesses) in mm.

- **Routine Maintenance:** it is done with a preventive and permanent approach, whose purpose is to preserve the elements of the road, preserving the conditions that they had after the construction or rehabilitation. Among the usual activities of Routine Maintenance there are drainage cleaning, crack sealing, as well as patching works of wide cracking and potholes.
- **Periodic Maintenance:** it is done with a corrective approach, that is to say, in response to a problem that has already occurred. However, with the in-depth study of the pavement, the application of mathematical models and specialized technical staff, it is possible to foresee the problems that will arise, anticipate to them and so minimizing the risk of severe deterioration of the road. The goal of the periodic maintenance is to recover the physical conditions of the deteriorated pavement, prevent the evolution of defects on it and preserve the surface characteristics. Among the usual activities are milling and replace of asphalt layer, reinforcement and overlays, as well as slurry seals.
- **Extraordinary Maintenance:** commonly referred to as rehabilitation, it is performed when the structural condition of the infrastructure suffers a deterioration that exceeds the admissible one, according to the designed life. The rehabilitation is to restore the structural and functional characteristics that the pavement had at the beginning.

The pavement is responsible for bearing the entire superstructure and external agents (traffic, weather conditions...) on the road, so that one of the most important features of the roads is their bearing capacity.

However, another important factor such as comfort or road safety depends on the surface conditions of the pavement. To establish an optimal Maintenance Strategy through Rehabilitation and Periodic and Routine Maintenance and to preserve both functional and structural characteristics, it is necessary to know the behaviour of the pavement. In this way it will be possible to predict more accurately what will happen in the long term, which will allow road managers to anticipate to the problems and define a successful Maintenance Strategy.

To know and to simulate the behaviour of road pavement technical tools based on the so-called Pavement Deterioration Models are often used. Pavement Deterioration Models are created with an architectural structure based on mathematical equations that allow forecasting the behaviour of pavement on the basis of certain data inputs, collected directly from the real roads with high performance equipment (IRI, deflections, layers' thickness, etc.), or making reasonable assumptions in cases where data is not available.

One of the most well-known tools for the modelling of the deterioration of the pavement is the HDM-4 (Highway Development and Management System), a software application developed by the World Bank - PIARC. Their models are widely recognized by the international scientific community in the field of roads and are used in more than 100 countries and are also endorsed as a reference system at the global level.

4.8.1 PRINCIPLES OF HDM-4

HDM-4 (Highway Development and Management) is a software package with associated documentation, which can serve as the main tool for the analysis, planning, management and evaluation of maintenance and improvements, and the decision-making related to the investment in roads. [Source PIARC].

More in-depth, HDM-4 is a simulation model of the life-cycle behaviour of the pavement roads, which considers the relationship between road pavement, the environment and traffic within a national or regional economy that determines the composition and the cost structure of the variables. The model performs a detailed analysis based on the data provided by the user.

HDM-4 is not an optimization tool, since it is not able to find the absolute "optimum solution" of the problem, but it performs the calculations corresponding to each raised alternative and provides technical

and economic (if desired) indicators for the user to sort the alternatives, and then select the optimal in accordance with considered objectives.

The general structure of HDM-4 is shown in Figure 86. HDM-4 operates under three different tools of analysis: Strategy, Programme and Project, depending on the level of detail and goals wished. It is composed of a series of databases that will be used or not, depending on the chosen analysis tool.

The three analysis tools operate on data defined in one four data managers [Source HDM-4 Manual]:

- Vehicle Fleet: defines the characteristics of the vehicle fleet that operate on the road network to be analyzed.
- Road Network: defines the physical characteristics of road sections in a network or sub-network to be analyzed.
- Road Works: defines maintenance and improvements standards which will be applied to the different road sections to be analyzed.
- HDM Configuration: defines the other data to be used in the applications, like environmental parameters or calibration factors.

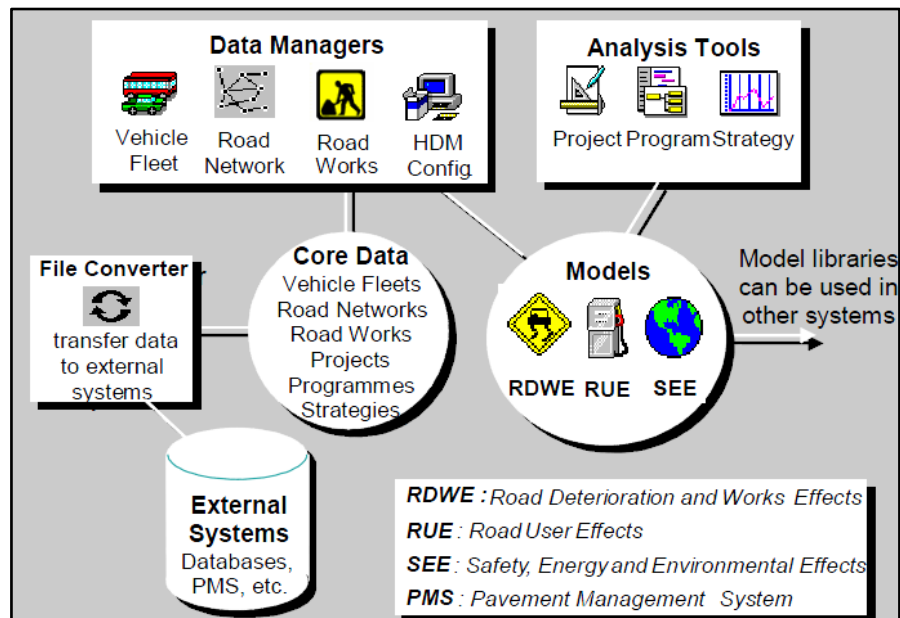


Figure 86. HDM-4 System Architecture (Source HDM-4 Manual)

In addition to the data managers, once the user has entered all the necessary data, there are three key concepts in the approach of HDM-4 for the simulation of the deterioration of roads which are:

- Road Deterioration Models (RD)
- Adjusted Structural Number (SPN)
- External agents

First, there is the so-called Road Deterioration Models (RD). In HDM-4 there are a total of 8 types of RD models for flexible pavements. Each one of them simulates the evolution of deterioration through a Surface Condition Index. The Table 89 shows the 8 models and indicators together with their units of measure:

MODELS	INDEX	UNITS
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MODELS	INDEX	UNITS
Cracking	Wide cracking	% of total carriageway area
	Thermal cracking	% of total carriageway area
	Total cracking	% of total carriageway area
Ravelling	Ravelled area	% of total carriageway area
Potholing	Potholes	No/km
Edge-break	Edge-break area	% of total carriageway area
Rutting	Rut Depth	mm
Roughness	IRI	m/km
Texture Depth	Texture Depth	mm
Skid Resistance	SFC	%

Table 89. HDM-4 Models and indicators

In addition to all of them, there is another key component: bearing capacity of the pavement. This is represented through the Adjusted Structural Number (SNP), which is linked to the pavement design, that is to say, thickness and materials of the layers, and pavement deflectometric condition in operation phase.

MODELS	INDEX	UNITS
Pavement strength	SNP	-

Table 90. HDM-4 Bearing Capacity Index

The deterioration of the structural capacity of the pavement (SNP), as well as all the previous models, is influenced by the following external agents, which in HDM-4 are as following:

- Traffic Loads
- Environmental factors
- Effects of inadequate drainage

The previous three items explained (RD models, SNP and exogenous agents) have a dependency relationship between them. This implies, at the operational level, that initially it is necessary to enter a value for each one of them, regardless of the user wishes to take them into account for the analysis, or not.

The HDM-4 internal software programming of these three components, together with the initial data entered, HDM-4 makes possible to get as a result a full simulation of the behaviour of the pavement throughout his operation life. In this way, the Surface Condition Indexes will take values over the years that will represent the deterioration of the pavement.

Forecasting the pavement future deterioration, it will be possible to raise a number of Maintenance alternatives in order to maintain the desired Performance thresholds. In this way, depending on how it evolves the pavement deterioration and how the values reach the performance thresholds, the user gets the Pavement Maintenance Plan, which determines which works must be done and when.

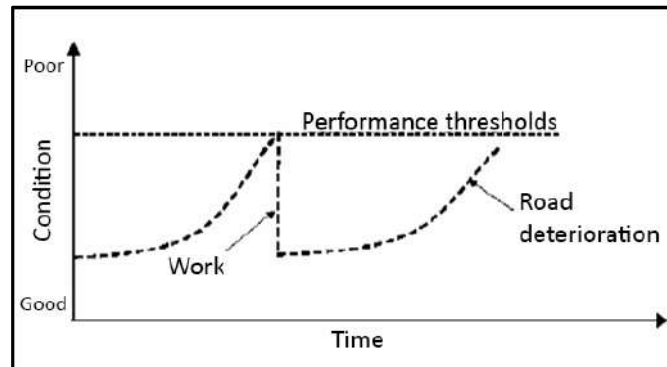


Figure 87. Road deterioration evolution model sketch

4.8.2 HDM-4 INPUT DATA

HDM-4 model performs a detailed analysis based on the data provided by the user. The following paragraphs show the system input data that has been considered.

First of all, it is necessary to introduce climatic data of the study area. The figure below shows the climatic distribution used by HDM-4: Köppen climate classification. Stretch 1 belongs to Warm semi-arid climate (BSH).

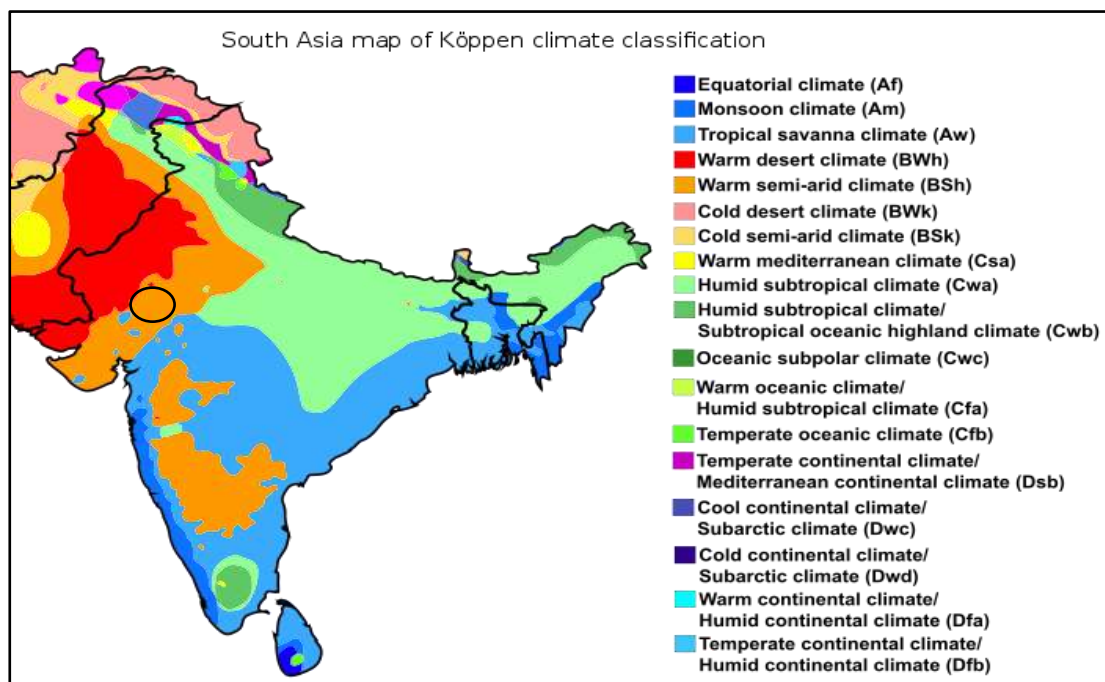


Figure 88. Stretch 3 Köppen climate classifications

It is also necessary to configure traffic of the stretch 1. The following tables show the traffic data used to run HDM and AASHTO calculations.

Year	MSA cumulated	SA Cumulated /day	MSA Increment	% TrafficGrowth
------	---------------	-------------------	---------------	-----------------

Year	MSA cumulated	SA Cumulated /day	MSA Increment	% TrafficGrowth
2020	9.7	9652699	-	-
2021	19.6	9977231	9.98	-
2022	29.9	10314434	10.31	0%
2023	40.6	10664786	10.66	3%
2024	51.6	11028785	11.03	3%
2025	60.0	8363670	8.36	-7%
2026	64.2	4192358	4.19	-11%
2027	68.6	4386332	4.39	4%
2028	73.2	4590629	4.59	4%
2029	78.0	4805779	4.81	4%
2030	83.0	5032344	5.03	4%
2031	88.2	5235513	5.24	4%
2032	93.7	5447927	5.45	4%
2033	99.4	5669994	5.67	4%
2034	105.3	5902138	5.90	4%
2035	111.4	6144802	6.14	4%
2036	117.8	6360840	6.36	4%
2037	124.4	6585280	6.59	3%
2038	131.2	6818438	6.82	3%
2039	138.2	7060641	7.06	3%
2040	145.5	7312230	7.31	3%
2041	153.1	7534628	7.53	3%
2042	160.8	7764414	7.76	3%
2043	168.8	8001826	8.00	3%
2044	177.1	8247108	8.25	3%
2045	182.8	5667007	5.67	3%
2046	188.6	5815942	5.82	3%
2047	194.5	5969119	5.97	2%
2048	200.7	6126654	6.13	2%
2049	207.0	6288667	6.29	2%
2050	213.4	6455281	6.46	2%

Table91.LHS averageannualtrafficgrowthrate

Year	MSA cumulated	SA cumulated /day	MSA Increment	% TrafficGrowth
2020	8.7	8700870	-	-
2021	17.7	8994552	8.99	-

Year	MSA cumulated	SA cumulated /day	MSA Increment	% TrafficGrowth
2022	27.0	9299708	9.30	0%
2023	36.6	9616775	9.62	3%
2024	46.6	9946203	9.95	3%
2025	54.1	7526324	7.53	-7%
2026	57.8	3738033	3.74	-11%
2027	61.7	3912084	3.91	4%
2028	65.8	4095422	4.10	4%
2029	70.1	4288526	4.29	4%
2030	74.6	4491901	4.49	4%
2031	79.3	4674311	4.67	4%
2032	84.1	4865042	4.87	4%
2033	89.2	5064462	5.06	4%
2034	94.5	5272954	5.27	4%
2035	100.0	5490917	5.49	4%
2036	105.7	5685002	5.69	4%
2037	111.5	5886653	5.89	3%
2038	117.6	6096155	6.10	3%
2039	124.0	6313803	6.31	3%
2040	130.5	6539905	6.54	3%
2041	137.2	6739801	6.74	3%
2042	144.2	6946353	6.95	3%
2043	151.3	7159773	7.16	3%
2044	158.7	7380283	7.38	3%
2045	163.8	5072074	5.07	3%
2046	169.0	5205995	5.21	3%
2047	174.3	5343738	5.34	2%
2048	179.8	5485409	5.49	2%
2049	185.5	5631115	5.63	2%
2050	191.2	5780967	5.78	2%

Table 92.RHS average annual traffic growth rate

As can be seen, in 2035 it has been considered a decrease (-25%) of traffic due to the expected widening of the road with 2 extra lanes (one per carriageway).

The following tables show the bearing capacity data required by HDM-4.

STRETCH 1. LHS # HDM-4 ID	Current structural condition (2018)			
	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 1-01 - LHS	24	29	6.66	185
Str 1-02 - LHS	19	23	7.65	185
Str 1-03 - LHS	20	25	7.3	235
Str 1-04 - LHS	24	29	6.62	205
Str 1-05 - LHS	24	30	6.5	100
Str 1-06 - LHS	23	28	6.76	100
Str 1-07 - LHS	23	28	6.72	162
Str 1-08 - LHS	25	30	6.46	205

Table 93. Bearing capacity input data in HDM-4 software of LHS

STRETCH 1. RHS # HDM-4 ID	Current structural condition (2018)			
	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 1-01 - RHS	21	26	7.19	250
Str 1-02 - RHS	18	22	7.82	250
Str 1-03 - RHS	21	25	7.23	250
Str 1-04 - RHS	20	24	7.39	230
Str 1-05 - RHS	23	28	6.81	280
Str 1-06 - RHS	16	20	8.43	280
Str 1-07 - RHS	15	19	8.68	220
Str 1-08 - RHS	25	31	6.42	220
Str 1-09 - RHS	20	24	7.47	220

Table 94. Bearing capacity input data in HDM-4 software of RHS Stretch 3

The deflections values expressed in 40 kN load, have been normalized to values of 700 kPa, which is the form that HDM-4.

The current SN (SNP_{def}) has been calculated in each homogeneous section with the equation below:

$$SNP_{def} = 3.2(DEF)^{-0.63}$$

Subsequently, from the values of SNP_{def} has added the contribution of bearing capacity of the overlay, work described in previous sections. To do that, structural coefficients of $a_1=0.42$ and $a_2=0.41$ have been established, as can be seen in the previous tables.

Finally, the final SNP of the pavement design is obtained. It can be seen that some of SNP values are greater than 7. HDM-4 only accepts maximum SNP values of 7. For this reason, those SNP values greater than 7 have been introduced as $SNP = 7$.

Regarding the surface condition of the homogeneous sections, since the HDM-4 study analysis starting

from an overlay work, condition surface is hypothesized like a new pavement. The following tables show the surface condition data required by HDM-4.

4.8.3 MAINTENANCE STRATEGY (WORK STANDARD)

As indicated in paragraphs above, pavement bearing capacity, comfort and safety, are three key aspects in the operation and management of roads. Bearing capacity defines the capabilities of the pavement to absorb traffic loads in terms of strength. That is, pavement design will have the capacity to support a determined volume of traffic. In addition, pavement bearing capacity will decrease due to external agents (traffic loads, environmental factors and inadequate drainage effects), so that bearing capacity lasts a certain lifecycle which ends with the destruction of the pavement. Therefore, it is necessary to study how much traffic each homogeneous section is able to withstand, in order to know when it will be necessary to propose structural improvement works. As indicated above, the fundamental parameter that represents pavement bearing capacity in the established methodology is the Structural Number.

In the other hand, user comfort and safety are related to the so-called functional capacity. Regarding to safety, in addition to pavement functional capacity, other aspects are relevant too, such as the highway layout (curves, slopes, camber, etc.), or user driving culture. Both aspects are not controllable by a pavement maintenance strategy. However, aspects such as skid resistance and potholes are also very important for safety, and these are controllable with a proper pavement maintenance strategy.

As for user comfort when driving through road, it is closely related to pavement functional capacity, which is directly related to roughness, rutting, potholes, macro-texture (noise) and wide cracking. All these aspects are directly controllable with a suitable pavement maintenance strategy.

To correctly evaluation of both the previous concepts, structural and functional capacity, it is necessary to establish an adequate pavement maintenance strategy. For this, it is recommendable to use the AASHTO - HDM-4 methodology. On the one hand, with HDM-4 it is possible to foresee the deterioration of the road due to external agents and propose works to maintain the required functional capacity. And in the other hand, with AASHTO it is possible to calculate pavement designs according to the traffic that must be supported to maintain the structural capacity.

The followed methodology has coordinated HDM-4 and AASHTO rules, so that every 7 years required Structural Number (SN) has been checked according to AASHTO methodology.

This methodology is described below:

1. HDM calculation according to initial overlays calculation, in order to obtain expected SN on year 7 (2028) (*).
2. AASHTO calculation of required SN on year 7 to support the traffic of 10 following years, and in case of this SN is higher than previously calculated (expected SN on year 7), establish the required overlay (**).
3. HDM calculation according to previous overlays calculation, in order to obtain expected SN on year 14 (2035).
4. AASHTO calculation of required SN on year 14 to support the traffic of 10 following years, and in case of this SN is higher than previously calculated (expected SN on year 14), establish the required overlay (**).
5. HDM calculation according to previous overlays calculation, in order to obtain expected SN on year 21 (2042).
6. AASHTO calculation of required SN on year 21 to support the traffic of 10 following years, and in case of this SN is higher than previously calculated (expected SN on year 21), establish the required overlay (**).
7. HDM calculation according to previous overlays calculations, in order to establish the required surface works to be done in the whole period.

(**) In the case of present Stretch (Stretch 1), initial overlays have been considered in 2020-21 as this stretch is currently under Annuity (BOT) by NHAI terminating on 2024.

(*) In case of structural overlay is not required, it has been established a milling and overlay work of 3cm in order to restore surface conditions.

It should be emphasized that all solutions have been checked in order to assure that, according to AAHSTO, they support the expected traffic (for 10 years).

The final overlay results have been recorded in HDM-4 so final evolution of surface characteristics and required works have been as well established. The strategy followed in HDM is described below:

- Mill and replace
 - Surface material: bituminous concrete
 - Depth of milling: 5 cm
 - Thickness of new surfacing (replacement): 5 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when Rut depth \geq 15 mm
 - Road condition effects after works:
 - IRI = as per HDM-4 Work Effect Models
 - Rutting = as per HDM-4 Work Effect Models
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%
- Mill and replace
 - Surface material: bituminous concrete
 - Depth of milling: 3 cm
 - Thickness of new surfacing (replacement): 3 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when no work is required as per AASHTO calculation
 - Road condition effects after works:
 - IRI = as per HDM-4 Work Effect Models
 - Rutting = as per HDM-4 Work Effect Models
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%
- Overlay 5 cm
 - Surface material: bituminous concrete
 - Thickness of new surfacing (overlay): 5 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when IRI \geq 4 m/km
 - Road condition effects after works:
 - IRI = as per HDM-4 Work Effect Models
 - Rutting = as per HDM-4 Work Effect Models
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%

- Overlay 3 cm
 - Surface material: asphaltic concrete
 - Thickness of new surfacing (overlay): 3 cm
 - Strength coefficient: 0.42
 - Intervention criteria: when $SFC \leq 0.40$
 - Road condition effects after works:
 - Skid Resistance= as per HDM-4 Work Effect Models
 - Surface Texture = as per HDM-4 Work Effect Models
 - Cracking = 0%
- Patching
 - Intervention criteria: when Wide Structural Cracking ≥ 2 % OR potholing ≥ 1
 - Road condition effects after works:
 - Wide Structural Cracking = 0%
 - Potholing = 0
 - This work eliminates only Wide Structural Cracking (ACW), reducing total cracking (ACRA) in an amount identical to the removed ACW.

The strategy followed in AASHTO is described below:

- Reliability: 90%
- Standard Deviation: 0.43
- $P_0=4.20$
- $P_t=3.0$
- $a_i(BC)=0.42$
- $a_i(DBM)=0.40$

4.8.4 HDM-4 ANALYSIS CONCLUSIONS(2021)

HDM-4 analysis is revised & reviewed based on the renewal work taken up by the present concessionaire and The results of HDM-4 analysis can be seen in the tables shown below.

HDM-4 ANALYSIS CONCLUSIONS STRETCH 1.LHS

X	Milling X and Replace X mm (functional)
X	Milling X and Replace X mm (structural)
X	Overlay X mm (functional)
X	Overlay X mm (structural)
X	Patching (X% area to patch)

STRETCH 1.LHS #HDM-4 ID	Section	From	To	Length (m)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
STR 1-01 - LHS	1	646+000	649+000	3000	40				4%	3%	4%	80						4%	80						4%	40					4%	3%	40	
STR 1-02 - LHS	2	649+000	652+000	3000	40				4%	3%	4%	80						4%	80						4%	40					4%	3%	40	
STR 1-03 - LHS	3	652+000	656+000	4000	40				4%	3%	4%	70						3%	30					3%	4%	30					3%	4%	30	
STR 1-04 - LHS	4	656+000	660+000	4000	40				4%	3%	4%	70						3%	30					3%	4%	30					3%	4%	30	
STR 1-05 - LHS	5	660+000	665+000	5000	40				4%	3%	4%	140							50						4%	50					4%	50		
STR 1-06 - LHS	6	665+000	671+000	6000	40				4%	3%	4%	130							50						4%	50						4%	50	
STR 1-07 - LHS	7	671+000	674+000	3000	40				4%	3%	4%	80						4%	80						4%	40					4%	3%	40	
STR 1-08 - LHS	8	674+000	677+000	3000	40				4%	3%	4%	80						4%	80						4%	40					4%	3%	40	

LHS maintenance schedule by HDM-4 analysis

Table 95.LHS maintenance schedule by HDM-4 analysis

HDM-4 ANALYSIS CONCLUSIONS STRETCH 1.RHS

X	Milling X and Replace X mm (functional)
X	Milling X and Replace X mm (structural)
X	Overlay X mm (functional)
X	Overlay X mm (structural)
X	Patching (X% area to patch)

STRETCH 1.RHS #HDM-4 ID	Section	From	To	Length (m)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
STR 1-01 - RHS	1	646+000	648+000	2000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-02 - RHS	2	648+000	651+000	3000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-03 - RHS	3	651+000	654+000	3000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-04 - RHS	4	654+000	660+000	6000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-05 - RHS	5	660+000	663+000	3000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-06 - RHS	6	663+000	666+000	3000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-07 - RHS	7	666+000	671+000	5000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		
STR 1-08 - RHS	8	671+000	675+000	4000	40				4%	3%	4%	70						3%	30					3%	4%	30				3%	4%	30		
STR 1-09 - RHS	9	675+000	677+000	2000	40				4%	3%	4%	60						3%	30					3%	4%	30				3%	4%	30		

RHS maintenance schedule by HDM-4 analysis

Table 96.RHS maintenance schedule by HDM-4 analysis

In Annexure HDM-4 Results are collected the graphs obtained with HDM-4 software.

The AAHSTO-HDM results of Stretch 1 show that:

- During the whole period high traffic is expected in the Stretch.
- Both for LHS and RHS structural and functional overlays have been established to be attended according to NHAI BOT annuity contract (their Operation and Maintenance to be completed by 2024).
- Some patching works are required due to expected cracking in 2023, 2024, 2025, 2032, 2038, 2039, 2045 and 2046.

Note:-

Both for LHS and RHS, periodic renewal at every 6th years on 2030, 2036 and 2042, 40mm BC overlay in the whole stretch have been established, except the thickness for service/slip roads overlay of 30mm have been established due to functional reasons.

Detailed investigations have been conducted in year 2018. From 2018 to 2020 Authority has taken up below mentioned major maintenance works. However, considering these major maintenance works, improvement proposals i.e. Initial Maintenance Cost has been taken accordingly and final estimate/BOQ is prepared.

S No	Description	Remark
1	Renewal of BC overlay with 40 mm thickness without milling in entire stretch full carriageway width.	Executed in August 2019

*It should be noticed that this project road is under a BOT (Annuity) **Contract with tenure up to 24/03/2024**; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement improvement works of this section would be out of the initial scope of works of the concessionaire who could be awarded this project road.*

5 STRUCTURES

The present section refers to the inventory and condition survey of all the highway structures following the guidelines from IRC: SP-35.

5.1 FIELD WORKS AND INVESTIGATIONS

Field works included the collection of data to produce an inventory of all the structures and the inspection to evaluate their condition.

Data and photos of all the cross drainage and grade separated structures, such as culverts and minor/major bridges, were taken in order to complete the inventory.

In addition to minor (< 60 m length) and major bridges (>60m length) other categories of structures have been considered depending on their function, such as Vehicle Underpass (VUP), Pedestrian/Cattle Underpass, ROB/RUB, Flyovers. In case of their existence, Tunnels have also been considered.

All minor and major bridges were inspected by a bridge expert and the methodology adopted for that inspection was as follows.

- Collection of data from authority regarding details of the structure and study of previous inspection reports so that condition of the defects which were noticed earlier could be checked.
- Visual inspection of foundations, abutments, wing-walls/returns, piers, columns and bearings, soffits of the deck including beams, details under the deck, condition of road surface, drainage, parapets, expansion joints, condition of approaches, condition of protective works.
- Inspection of bridges using MBIU and taking photograph.
- In general and particularly in case of any important or major short coming/distress is noticed leading to doubt about structural adequacy, a detailed investigations using Nondestructive Test is carried out.
- Preparation of report and proposals for repair/rehabilitations/reconstruction of the structure as per site conditions.

5.1.1 COLLECTION OF INVENTORY DATA

Past records of this highway were collected from PIU Gandhidham and we were provided with Detailed Project Report, As Built Drawings and Inspection Reports.

After doing a scrutiny of the aforementioned provided data regarding locations, structural details and condition of the structures, a team of Engineers visited the site and an inventory of all the structures and visual condition survey was carried out as per IRC:SP:35.

Inventory records for the grade separated structures and major bridges were collected in the 22 column format given below:

S.No	Location (km)	Type of structure	Span arrangement (nos. and length)		Length of structure (m)	Carriageway width with P.S. (m)		Width of structure (m)	Protection			
									Type	Condition		
1	2	3	4		5	6		7	8	9		
Pier foundation material	Abutment material	Present Condition of various features of bridge								Presence of scour	Adequacy waterway	Remark
		Abutment	Piers	Slab	Bearing	Parapet	Slab Pipe Box Arch	Return wall	Parapet handrail			
10	11	12	13	14	15	16	17	18	19	20	21	22

Table 97.Inventory format

5.1.2 INSPECTIONS

Based on the visual condition survey all the distresses were noted for each element of each and every structure and wherever required detailed investigations were carried out including NDT.

A Bridge Expert inspected minor and major bridges, and when required, and particularly for major bridges, the inspection was supported by an MBIU. In this stretch MBIU was required. Photographs of all major bridges were taken and present health condition of all the structures was recorded for all the elements of the bridges or culverts except foundations which are buried underground.

Photographs of Mobile Bridge Inspection Unit (MBIU) used for inspection are given below.



Figure 89. Mobile Bridge Inspection Unit used in inspections



Figure 90. Mobile Bridge Inspection Unit used in inspections

5.1.3 NDT

To evaluate the strength of the components of bridges/structures, the following Non Destructive Tests (NDT) was conducted.

5.1.3.1 REBOUND HAMMER

The Rebound Hammer Method was used for:

- Assessing the likely compressive strength of concrete with the help of suitable co-relations between rebound index and compressive strength.
- Assessing the uniformity of concrete.
- Assessing the quality of the concrete in relation to standard requirements.
- Assessing the quality of one element of concrete in relation to another.



Figure 91. Operators conducting rebound hammer test

5.1.3.2 ULTRASONIC PULSE VELOCITY

The ultrasonic pulse velocity method was used to establish:

- The homogeneity of the concrete.
- The presence of cracks voids and other imperfections.
- Changes in the structure of the concrete which may occur with time.
- The quality of the concrete in relation to standard requirement.
- The quality of one element of concrete in relation to another.
- The values of dynamic elastic modulus of the concrete.



Figure 92. Operators conducting ultrasonic pulse velocity test

5.2 INVENTORY

There are total of 75 structures on this Project Highway and a summary type of structure wise is given in Table 98 below:

S No.	Type of Structure	Nos.
1	Box Culvert	49
2	Slab Culvert	02
3	Pipe Culvert	07
4	Minor bridge	08
5	Vehicular Underpass	06
6	Major Bridge	02
7	Road Over Bridge	01
8	Flyover	00
9	Tunnel	00
Total		75

Table 98.Inventory of Structures

5.2.1 CULVERTS

There are 58 culverts on this project road from which 49 are box type, 02 slabs and 07 pipes.

A summary of the inventory of all culverts is provided in below tables, for a more detailed inventory you can refer to Annexure Structures.

Details of Box Culverts

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)
1	647/1	646+320	1 x 2.00
2	648/1	646+980	1 x 2.00
3	648/2	647+070	1 x 2.00
4	649/1	648+165	1 x 2.00
5	649/2	648+880	1 x 2.90
6	650/2	649+680	1 x 2.40
7	650/3	649+785	1 x 2.50
8	650/4	649+900	1 x 2.00
9	651/1	649+995	1 x 5.70
10	652/2	651+685	1 x 4.00
11	652/3	651+797	1 x 2.00
12	654/1	653+125	1 x 1.20
13	655/1	654+105	1 x 2.90
14	655/2	654+890	1 x 2.90
15	656/2	657+690	1 x 2.50
16	657/1	656+185	1 x 4.00
17	658/2	657+700	1 x 2.00
18	660/1	659+015	1 x 3.00
19	660/4	659+705	1 x 2.90
20	661/1	660+460	1 x 2.00
21	661/2	660+960	1 x 2.00
22	662/2	661+490	1 x 1.50
23	662/4	661+800	1 x 1.00
24	663/1	662+255	1 x 2.90
25	665/1	664+002	1 x 3.40
26	665/2	664+805	1 x 2.50
27	666/1	665+470	1 x 2.00
28	667/1	666+166	1 x 2.00
29	667/2	666+380	1 x 2.00

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)
30	668/1	667+035	1 x 2.30
31	669/2	668+503	1 x 2.30
32	669/3	668+761	1 x 4.20
33	670/1	669+210	1 x 2.00
34	671/1	670+697	1 x 2.70
35	671/2	670+900	1 x 2.20
36	672/1	671+195	1 x 2.00
37	672/2	671+545	1 x 2.90
38	672/3	971+940	1 x 2.00
39	673/1	672+340	1 x 3.00
40	673/3	672+810	1 x 4.10
41	674/1	673+255	1 x 2.00
42	674/3	678+945	1 x 2.00
43	675/4	674+520	1 x 2.20
44	675/5	674+935	1 x 3.00
45	676/1	675+300	1 x 3.00
46	676/2	676+580	1 x 4.00
47	676/3	675+800	1 x 2.20
48	677/1	676+020	1 x 2.40
49	677/3	676+275	1 x 3.00

Table 99. Details of Culvert (Box Culverts)



Figure 93. Photographs of box culverts 649/2 and 650/2 respect.

Sr. No.	Structure No.	Chainage	Span Arrangement
---------	---------------	----------	------------------

1	656/1	655+255	1 x 1.85
2	675/2	674+155	1 x 2.00

Table 100. Details of Culvert (Slab Culverts)



Figure 94. Photograph of slab culverts 656/1

S.No	Structure No	Chainage	Span Arrangement
1	651/2	650+130	1 x 1.00
2	653/1	652+050	1 x 1.00
3	662/3	661+750	1 x 1.00
4	663/2	662+640	1 x 1.00
5	669/1	668+060	3 x 0.60
6	675/1	674+005	2 x 1.20
7	677/2	676+200	1 x 1.00

Table 101. Details of Culvert (Pipe Culverts)



Figure 95. Photographs of pipe culverts 651/2 and 663/2 respect.



Figure 96. Photograph of pipe culvert 669/1

5.2.2 MINOR BRIDGES AND VUP

There are 08 minor bridges and 06 underpasses on this project road.

A summary of their inventory is provided in below table, for a detailed inventory please refers to Annexure Structures.

S.N o.	Chainage (km)	Side	Span Arrangement (m)	Total Length (m)	Carriageway Width (m)	Deck Width (m)	Footpath (Present/ Not Present)(m)	Type of Superstructure	Type of Substructure
1	647+935	Both	2 x 5.00	10	8.5	35.25	No	Box	-
2	647+765	LHS	2 x 6.20	12.4	8.5	10.25	Present	T- Beam Slab	RCC
		RHS	6 x 5.40	32.4	8.5	14	Present	RCC	RCC
3	649+492	Both	2 x 5.74	11.48	8.5	26.25	No	Box	-
4	651+318	Both	4 x 3.4	13.6	8.5	25.5	No	Box	-

S.N o.	Chainage (km)	Side	Span Arrangement (m)	Total Length (m)	Carriageway Width (m)	Deck Width (m)	Footpath (Present/ Not Present)(m)	Type of Superstructure	Type of Substructure
5	657+100	Both	2 x 6.6	13.2	8.5	24.25	No	Box	-
6	669+470	Both	3 x 4.8	14.4	8.5	26.25	No	Box	-
7	673+530	Both	2 x 5.3	10.6	8.5	40	No	Box	-
8	676+935	Both	2 x 4.40	8.8	8.5	35.25	No	Box	-

Table 102. Structure Details of Minor Bridges



Figure 97. Photograph of Minor Bridge 652/1



Figure 98. Photograph of Minor Bridge 670/2

S.No	Location (km)	Chainage	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Ventway (No x Length) (m)	Clear Height (m)	Horizontal Clearance (m)	Carriage way width (m)	Width of structure (m)	Remark
1	653/2	652+328	Box (VUP)	1 X 11.00	5.5	11	2 X 8.50	24.5	-
2	660/2	659+240	Box (VUP)	1 X 11.00	5.5	11	2 X 8.50	24.5	-
3	673/2	672+402	Box (LVUP)	1 X 4.50	3	4.5	2 X 8.50	24.5	-
4	675/3	674+418	Box (VUP)	1 X 11.00	5.5	11	2 X 8.50	24.5	-
5	659/2	658+060	Box (LVUP)	1 X 11.00	3	11	2 X 8.50	24.5	-
6	662/1	661+100	Box (LVUP)	1 X 4.50	3	4.5	2 X 8.50	24.5	-

Table 103. Structure Details of VUP & LVUP



Figure 99. Photograph of VUP 653/2



Figure 100. Photograph of LVUP 673/2

5.2.3 MAJOR BRIDGES AND ROB

There are 02 major bridges, no Flyovers and 1 ROB on this Project Highway. A summary of their inventory is given in table below. For detailed inventory please refer to Annexure Structures.

S.No.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width of carriageway
1	652+745	653/3	LHS	T-Beam slab	(3*24.00)	72	10.2	2*8.50
			RHS		(3*24.00)			
2	658+475	659/	LHS	T-Beam slab	(5*21.00)	105	10.2	2*8.50

S.No.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width of carriageway
		3	RHS		(5*21.00)			

Table 104. Structure Details of Major Bridges and ROB



Figure 101. Photographs of Major Bridge 653/3



Figure 102. Photographs of Major Bridge 659/3

S.No.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width of carriageway
1	658+031	659/1	LHS	T-Beam girder	1 x 40.950	40.95	10.5	2 x 7.5
			RHS		1 x 40.950	40.95	10.75	2 x 7.5

Table 105. Structure Details of ROB



Figure 103. Photograph of ROB 659/1

5.3 CONDITION

Condition of all structures was evaluated by visual inspection and NDT tests and is being reported below.

5.3.1 CULVERTS

Culverts whose condition at the time of inspection is given below .Details of the culvert have been given in Annexure Structures.

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
1	647/1	646+320	1 x 2.00	Good	Fair	Cleaning of vent way
2	648/1	646+980	1 x 2.00	Good	Good	Over all condition is good
3	648/2	647+070	1 x 2.00	Good	Good	Cleaning of vegetation
4	649/1	648+165	1 x 2.00	Good	Good	Cleaning of vegetation
5	649/2	648+880	1 x 2.90	Good	Good	Stone pitching and cleaning required
6	650/2	649+680	1 x 2.40	Good	Good	Over all condition is good
7	650/3	649+785	1 x 2.50	Good	Good	Over all condition is good
8	650/4	649+900	1 x 2.00	Good	Good	Over all condition is good
9	651/1	649+995	1 x 5.70	Good	Good	Over all condition is good
10	652/2	651+685	1 x 4.00	Good	Good	Over all condition is good
11	652/3	651+797	1 x 2.00	Good	Good	Cleaning of vegetation
12	654/1	653+125	1 x 1.20	Good	Good	Over all condition is good

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
13	655/1	654+105	1 x 2.90	Good	Good	Over all condition is good
14	655/2	654+890	1 x 2.90	Good	Good	Stone pitching required
15	656/2	657+690	1 x 2.50	Fair	Fair	Not Reachable
16	657/1	656+185	1 x 4.00	Fair	Fair	Not Reachable
17	658/2	657+700	1 x 2.00	Fair	Fair	Not Reachable
18	660/1	659+015	1 x 3.00	Good	Good	Cleaning of vent way, Stone pitching and cleaning of vegetation required
19	660/4	659+705	1 x 2.90	Good	Good	Over all condition is good
20	661/1	660+460	1 x 2.00	Good	Good	Cleaning of vegetation
21	661/2	660+960	1 x 2.00	Good	Good	Over all condition is good
22	662/2	661+490	1 x 1.50	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
23	662/4	661+800	1 x 1.00	Good	Good	Over all condition is good
24	663/1	662+255	1 x 2.90	Good	Fair	Cleaning of vegetation and waterway surface
25	665/1	664+002	1 x 3.40	Good	Good	Cleaning of vegetation
26	665/2	664+805	1 x 2.50	Good	Good	Stone pitching improvement and cleaning of vegetation
27	666/1	665+470	1 x 2.00	Good	Good	Cleaning of vegetation
28	667/1	666+166	1 x 2.00	Good	Good	Improvement of stone pitching and cleaning of vegetation
29	667/2	666+380	1 x 2.00	Good	Good	Cleaning of waterway surface and vegetation
30	668/1	667+035	1 x 2.30	Good	Good	Over all condition is good
31	669/2	668+503	1 x 2.30	Good	Good	Cleaning of waterway surface and vegetation
32	669/3	668+761	1 x 4.20	Good	Good	Cleaning of waterway surface and vegetation

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
33	670/1	669+210	1 x 2.00	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
34	671/1	670+697	1 x 2.70	Good	Good	Cleaning of vegetation
35	672/2	671+545	1 x 2.90	Good	Good	Cleaning of vegetation
36	672/1	671+195	1 x 2.00	Good	Good	Over all condition is good
37	672/2	671+545	1 x 2.90	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
38	672/3	971+940	1 x 2.00	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
39	673/1	672+340	1 x 3.00	Good	Good	Cleaning of vent way and vegetation
40	673/3	672+810	1 x 4.10	Good	Good	Improvement stone pitching required
41	674/1	673+255	1 x 2.00	Good	Good	Improvement stone pitching required
42	674/3	678+945	1 x 2.00	Good	Good	Cleaning of waterway improvement of stone pitching and cleaning vegetation
43	675/4	674+520	1 x 2.20	Good	Good	Cleaning of waterway surface and vegetation
44	675/5	674+935	1 x 3.00	Good	Good	Cleaning of vegetation
45	676/1	675+300	1 x 3.00	Good	Fair	Str. choked with silt, need cleaning
46	676/2	676+580	1 x 4.00	Good	Good	Over all condition is good
47	676/3	675+800	1 x 2.20	Good	Good	cleaning of vegetation
48	677/1	676+020	1 x 2.40	Good	Good	Improvement of stone pitching
49	677/3	676+275	1 x 3.00	Good	Fair	Improvement of stone pitching, veg.

Table 106. Condition of Box culverts



Figure 104. Photographs of the condition of box culverts 649/1 and 675/4 respect.



Figure 105. Photographs of the condition of box culverts 675/5 and 677/3

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protection Work	Condition of Structure	Remark
1	656/1	655+255	1 x 1.85	Good	Poor	Over all condition is good
2	675/2	674+155	1 x 2.00	Fair	Fair	Cleaning of water way

Table 107. Condition of Slab culverts



Figure 106. Photograph of the condition of slab culverts 656/1

S.No	Structure No	Chainage	Span Arrangement	Condition of Protection Work	Condition of Structure	Remark
1	651/2	650+130	1 x 1.00	Good	Good	Cleaning of water way, cleaning of vegetation and improvement of stone pitching
2	653/1	652+050	1 x 1.00	Good	Good	Fully choked by water need cleaning of water way
3	662/3	661+750	1 x 1.00	Fair	Fair	-
4	663/2	662+640	1 x 1.00	Good	Good	Cleaning of water way, cleaning of vegetation and improvement of stone pitching
5	669/1	668+060	3 x 0.60	Fair	Fair	Cleaning of vegetation
6	675/1	674+005	2 x 1.20	Good	Good	Over all condition is good
7	677/2	676+200	1 x 1.00	Fair	Fair	Cleaning of water way and vegetation

Table 108. Condition of Pipe culverts



Figure 107. Photographs of the condition of pipe culverts 663/2 and 669/1

5.3.2 MINOR BRIDGES AND VUP

Minor Bridges and Underpasses were inspected by a Bridge Engineer and findings of them are presented below:

S.No.	Chainage (km)	Side	Span Arrangement (m)	Condition of Protection Work	Condition of Structure	Remark
1	647+935	Both	2 x 5.00	Good	Good	Cleaning of water way
2	647+765	LHS	2 x 6.20	Good	Good	Improvement of stone pitching and cleaning of vegetation
		RHS	6 x 5.40			
3	649+492	Both	2 x 5.74	Good	Good	Improvement of stone
4	651+318	Both	4 x 3.4	Fair	Fair	-
5	657+100	Both	2 x 6.6	Good	Good	Cleaning of vegetation
6	669+470	Both	3 x 4.8	Good	Good	Over all condition is good
7	673+530	Both	2 x 5.3	Good	Good	Cleaning of vegetation, stone pitching improvement
8	676+935	Both	2 x 4.40	Fair	Fair	-

Table 109. Structure Details of Minor Bridges



Figure 108. Photographs of the condition of Minor Bridge at 647+935



Figure 109. Photographs of the condition of Minor Bridge at 651+318

S.No	Location	Chainage	Type of	Span Arrangement and Total Ventway (No x Length) (m)	Condition of Protection Work	Condition of Structure	Remark
1	653/2	652+328	Box (VUP)	1 X 11.00	Good	Good	Over all condition is good
2	660/2	659+240	Box (VUP)	1 X 11.00	Good	Good	Over all condition is good
3	673/2	672+402	Box (LVUP)	1 X 4.50	Good	Good	Over all condition is good
4	675/3	674+418	Box (VUP)	1 X 11.00	Good	Good	Over all condition is good
5	659/2	658+060	Box (LVUP)	1 X 11.00	Good	Good	Over all condition is good
6	662/1	661+100	Box (LVUP)	1 X 4.50	Good	Good	Over all condition is good

Table 110. Structure Details of VUP & LVUP



Figure 110. Photographs of the condition of Underpasses 653/2 and 673/2.

5.3.3 MAJOR BRIDGES AND ROB

There are 2 Major Bridges and 1 ROB on this project highway which were inspected by the Senior Bridge Engineer using MBIU. Findings of the Bridge Engineer are given below and detailed report with NDT results is appended at Annexure Structures.

S.No	Str. No.	Chainage	Type of Structure	Side	Pier	No. of samples			Remarks
						UPV	RHT	Carbonation	
1	653/3	652+745	Major Bridge	LHS	II	2	2	-	Overall structure is in good condition.
2	659/3	658+475	Major Bridge	LHS	III Central	2	1	3	UPV reading is doubtful. Rebound hammer gives strength of 26 MPa and below. The strength of the span appears to be low. Pressure Grouting is recommended to achieve proper strength.
					III	1	2	1	UPV reading is doubtful. Rebound hammer gives strength of 21 MPa and below. The strength of the span appears to be low. Pressure Grouting is recommended to achieve proper strength.

Table 111. Summary of Condition and NDT details of Major Bridges

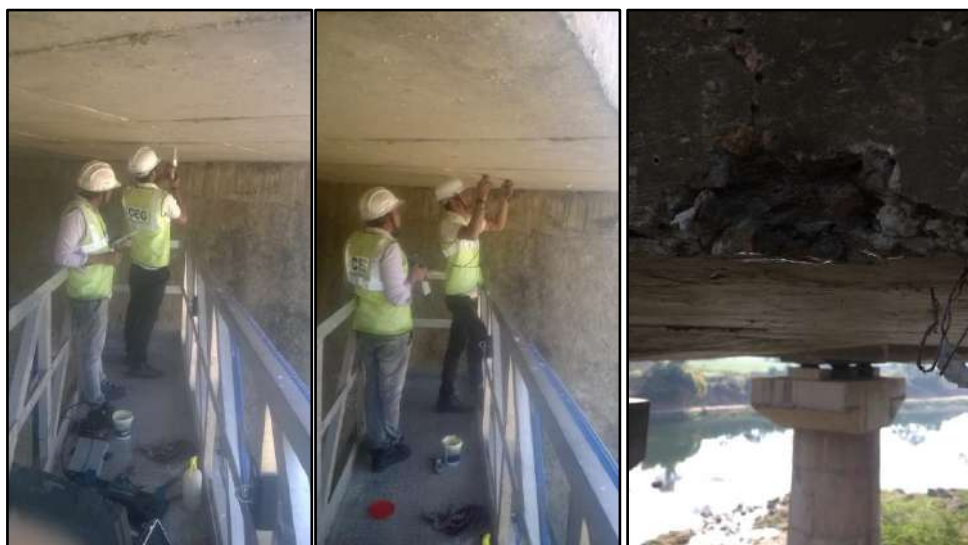


Figure 111. NDT carried out RHT, UPVT and Carbonation Test, respectively

S. No.		1
Structure No.		659/1
Chainage		658+031
Type of Structures		T-Beam
Span Arrangements		1 X 40.950
Details of Protection Work	Type	Crash Barrier
	Condition	Good
Present Condition of the Bridge	Abutment	Good
	Piers	Good
	Slab	Good
	Bearings	Good
	Parapet	Good
Condition of various features of bridge	Carriageway surface	Good
	Drainage Spout	Good
	Return wall / Wing wall	-
	Head wall	Good
Remarks		Reinforcement exposed in deck slab.cover to be provided. Removal of debris from expansion joints & removal of vegetation from side slopes required

Table 112. Condition details of ROB



Figure 112. Photographs of the condition of ROB 659/1

5.4 REPAIR / IMPROVEMENT WORKS

5.4.1 GENERAL

As per condition survey findings it is evident that most of the structures are in good condition except one major bridge at km 658+475 where Pressure Grouting is recommended to achieve proper strength . Protection works and expansion joints, etc. are minimally distressed. All type of distresses and their solutions for repair and rehabilitation measures are given in Annexure Structure.

BOQ has been prepared for routine maintenance viz. greasing of bearings, cleaning of drainage ducts, repair of Parapet walls and crash barriers and repair of pitching and accidental damages.

Note:-

Detailed investigations have been conducted in year 2018. However, latest inspection reports of structures carried out by authority between 2019 to 2020 is annexed at Annexure-B.

*It should be noticed that this project road is under a BOT (Annuity) **Contract with tenure up to 24/03/2024**; consequently, operation and maintenance of this stretch will remain under BOT contractor until the termination of their contract, and periodic maintenance of pavement will also remain under their scope. Therefore, any up-gradation (reinforcement) of the pavement until 24/03/2024 should be directly under the responsibility of BOT and O&M current contractor; and consequently, the pavement*

*improvement works of this section would be out of the initial scope of works of the concessionaire who
could be awarded this project road*

6 ROAD SAFETY AUDIT

6.1 ROAD SAFETY AUDIT

Road Safety Audit (RSA) of the Project Stretch Abu Road-Swaroopganj (Chainagekm 646.000 to km 677.000) of total length 31 km was carried out along the project stretch in order to assess the current situation and to suggest improvement measure.

This chapter covers the following issues:

- Identifying issues related to Road Safety along the Project Stretch
- Improvement Proposals for these identified issues/locations along the Project Stretch.

The first task of the team was to collect and review the available historical data for the accidents that have occurred in the highway stretch since the commencement of its operation. The analysis of accident data can help to identify patterns that could be linked to safety deficiencies on the road. The accident data for the Project Stretch is summarized in the next table.

Accident Summary for April 2018- March 2020 Undavariya Toll						
Month	Total Accidents Nos	Fatal Accident Nos	Major Nos	Minor Nos	Severity Index	No. of Persons Injured per 100 accidents
April	3	0	2	1	0.00	100
May	11	0	4	7	0.00	100
June	3	0	1	2	0.00	100
July	4	0	2	2	0.00	100
August	5	1	2	2	20.00	80
September	6	0	3	3	0.00	100
October	2	1	0	1	50.00	50
November	6	1	1	4	16.67	83.33
December	1	0	1	0	0.00	100
January	1	0	0	1	0.00	100
February	3	0	2	1	0.00	100
March	2	0	2	0	0.00	100
Total	47	3	20	24	7.22	93

Table 113. Accident Data along Project Stretch (Data Source: NHAI)

Notes: - Severity Index: Number of Persons Killed per 100 accidents.

Total numbers of Accidents from **April 2018- February 2020** were studied, and it was observed from the accident data provided that there is no evidence of any particular black spot due to particular conditions of the highway.

Considering the Severity Index of this stretch the average of the period under study was 7.22, and the nationwide Severity Index for 2015 amounted to 29.1 (road accident death per 100 accidents, source :- road accident in India-2018 published by morth). Consequently, this stretch of highway from Abu road–Swaroopganj seems to present a relatively very low Severity Index when compared with the whole country.

As a result of the Road Safety Audit the following safety concerns were identified:

- Safety Issues on Junctions along the Project Stretch
- Deficiencies In Safety Barriers
- U-Turn – Median opening
- Unauthorized Ramps along the Project Stretch
- Improper Pedestrian Crossing along the Project Stretch
- Current Situation of Truck lay-byes, Bus bays and Bus Stops along the Project Stretch
- Provision of Service Roads
- Provision of ATMS along the Project Stretch

6.2 MAJOR SAFETY ISSUES FOR IMPROVEMENT

6.2.1 SAFETY ISSUES ON JUNCTIONS ALONG PROJECT STRETCH

There are total 33 junctions on this highway project (Abu Road-Swaroopganj) which require an improvement, they can be classified as T- junctions, Y- junctions and Cross junctions.

Majority of minor junctions along the Project Stretch are meeting abruptly with the main carriageway. The main issues observed at minor junctions are as below:

- Minor junctions meeting main carriageway at steep gradient leaving no leveled space for vehicles waiting at junction, resulting in improper visibility at junction.
- Improper acceleration and deceleration lanes for traffic merging from minor road and traffic diverging to minor road respectively.
- Improper visibility of approaching minor junction for main carriageway traffic and vice a versa. As per the junction visibility requirement, visibility triangle at the junctions should be kept free from any obstructions blocking visibility.
- Road studs are absent making difficult to follow the path at night.
- Rumble strips on side road are not provided before the junction so as to slow down the speed of vehicles approaching the junction.
- Inadequate space and radius at the junctions for traffic movements.
- Inadequate lighting condition at crossings which makes the visibility at night very difficult.
- Maintenance of road marking and signage.
- Channelizing islands are absent to separate different traffic directions.

Some of the photographs showing the present condition of minor junctions along the Project Stretch are shown below.



Chainage : 647+400

Rumble strips, Marking and Stop Signage, Channelizing island



Chainage : 648+100

Figure 113. Photographs of Minor Junctions for improvements



Chainage : 650+500

Rumble strips, Stop Line Marking and Stop Signage, Channelizing island



Chainage : 651+400



Chainage : 654+300

Chainage : 656+100

Rumble strips, Stop Line Marking and Stop Signage, Channelizing island



Chainage : 659+300

Chainage : 661+350

Rumble strips, Stop Line Marking and Stop Signage, Channelizing island- Geometric Design, steep slope inapproaching road

Table 114. Photographs of improper minor junctions

The following are the major/minor junctions which require improvement for safe movement of traffic:

S. No	Chainage (Km)	Side	Type	Improvement Strategies
1	652+815	-	+	Stop line and stop sign Provide
2	659+240	-	T	Stop line and stop sign Provide
3	673+780	-	Y	Stop line and stop sign Provide
4	674+410	-	+	Rumble strips, stop line marking and Stop Signage and Channelizing island. Acceleration and decelerationlanerequired
5	675+500	-	+	Stop line and stop sign Provide
6	647+040	LHS	T	Stop line and stop sign Provide
7	647+290	LHS	T	Stop Line and Stop Sign required
8	649+020	LHS	Y	Rumble strips, stop line marking and Stop Signage and Channelizing island. Acceleration and Decelerationlanerequired
9	649+600	BHS	+	Stop line and stop sign Provide
10	650+100	LHS	Y	Stop line and stop sign Provide
11	650+500	LHS	T	Stop line and stop sign Provide
12	650+800	RHS	T	Stop line and stop sign Provide
13	650+900	BHS	+	Stop Line and Stop Sign required
14	651+400	LHS	T	Rumble strips, stop line marking and Stop Signage and Channelizing island.

S. No	Chainage (Km)	Side	Type	Improvement Strategies
				Acceleration and deceleration lane required
15	651+625	RHS	Y	Stop Line and Stop Sign required
16	652+100	LHS	T	Acceleration and deceleration lane required
17	652+200	RHS	T	Stop Line and Stop Sign required
18	652+610	LHS	Y	Stop Line and Stop Sign required
19	652+820	BHS	+	Acceleration and deceleration lane required
20	655+350	LHS	T	Rumble strips, stop line marking and Stop Signage and Channelizing island. Acceleration and deceleration lane required
21	657+300	RHS	Y	Acceleration and deceleration lane required
22	659+300	LHS	T	Acceleration and deceleration lane required
23	660+100	LHS	T	Acceleration and deceleration lane required
24	660+565	LHS	T	Acceleration and deceleration lane required
25	661+250	RHS	Y	Acceleration and deceleration lane required
26	662+800	LHS	T	Stop Line and Stop Sign required
27	665+900	RHS	T	Rumble strips, stop line marking and Stop Signage and Channelizing island. Acceleration and deceleration lane required
28	666+300	LHS	T	Rumble strips, stop line marking and Stop Signage and Channelizing island. Acceleration and deceleration lane required
29	667+900	RHS	T	Stop Line and Stop Sign required
30	668+800	BHS	+	Rumble strips, stop line marking and Stop Signage and Channelizing island. Acceleration and deceleration lane required
31	669+600	LHS	T	Stop Line and Stop Sign required
32	671+200	LHS	T	Stop Line and Stop Sign required
33	676+700	LHS	T	Stop Line and Stop Sign required

Table 115. Identified Minor Junctions for improvements

Note:- For Major and Minor junctions improvement works (Lighting, rumble strips, signage, road studs, Stop line and stop sign) has been taken up by Authority and will be completed prior to handing over of the stretch to InvIT.

It is suggested that apart from desired geometric improvements, following provisions shall be provided at minor junctions for safety of road users:

- Stop and Give Way signs, as per IRC 67: 2012 as per Figure 114.
- Cautionary sign boards for identification of access roads, as per IRC 67: 2012 as per Figure 115.
- Speed Breakers on side roads as per IRC84: 2014 as per Figure 116.
- Proper Road Markings for turning Traffic, as per IRC 35: 1997 as per Figure 117.
- Provision of acceleration and deceleration lane.
- Availability of visibility tunnel as per Figure 118.

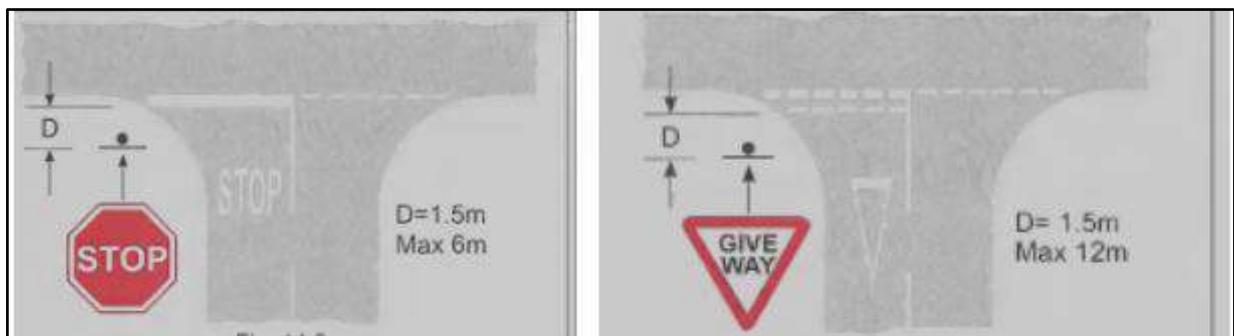


Figure 114. Stop and Give Way Sign boards as per IRC 67-201



Figure 115. Cautionary sign boards as per IRC

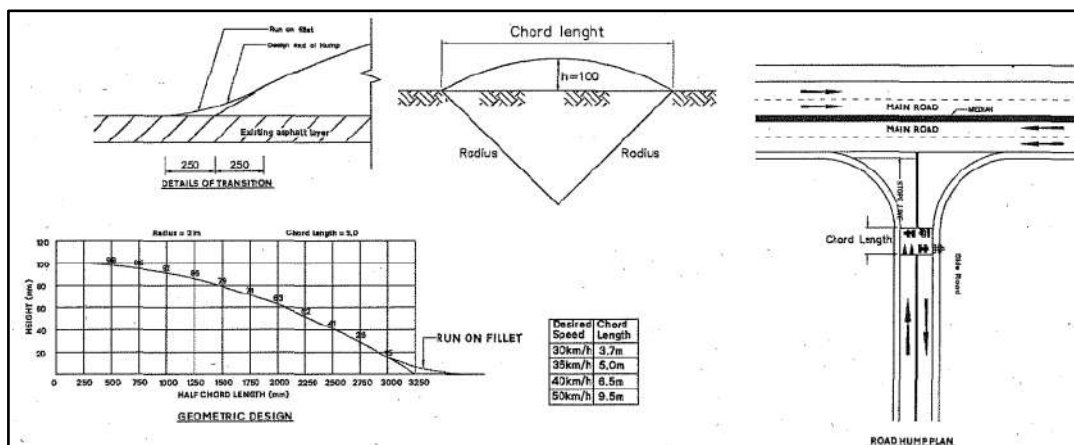


Figure 116. Design Details of Speed Breakers as per IRC

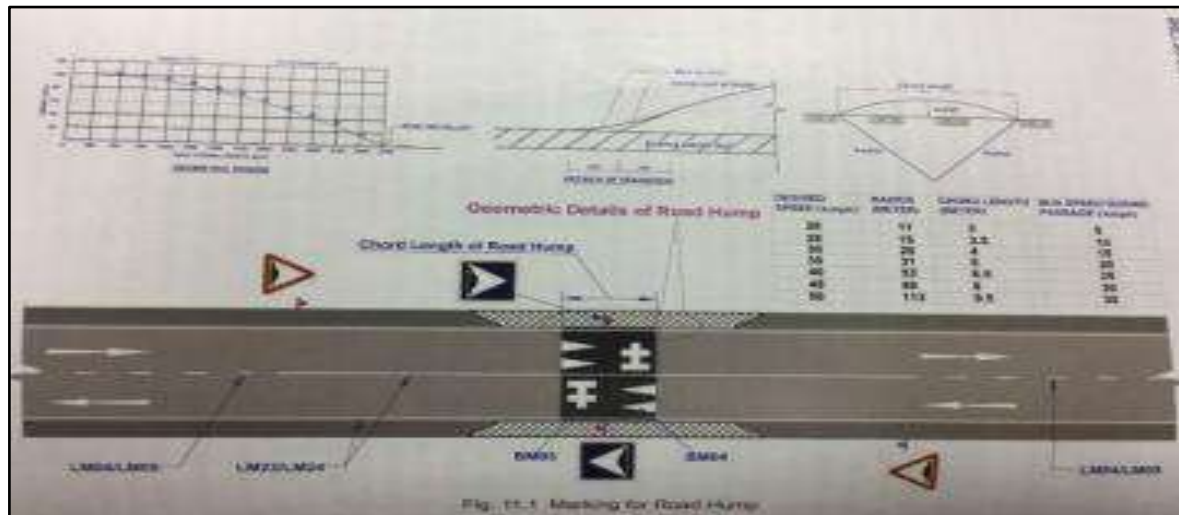


Figure 117. Proper Road Markings for turning Traffic, as per IRC 35: 1997

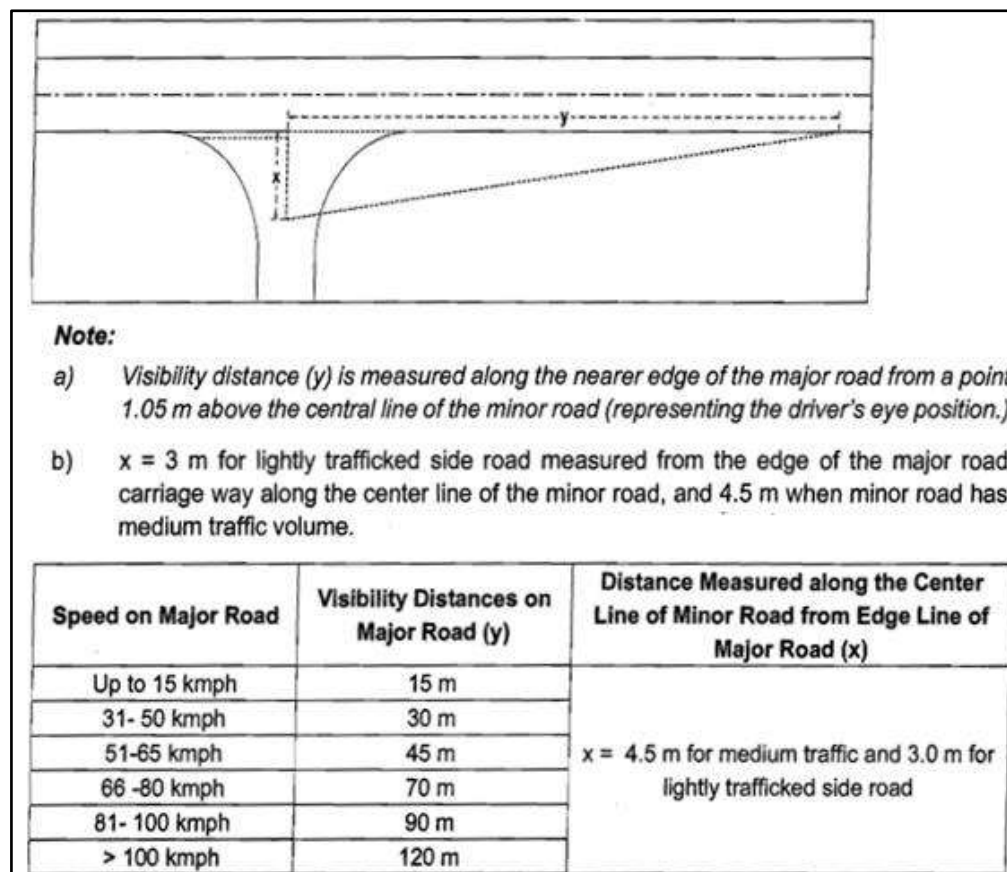


Figure 118. Present the visibility funnel

Note: - All shortcomings related to signages, Markings etc observed in year 2018 are under implementation at the level of authority and will be completed prior to handover to InvIT.

6.2.2 DEFICIENCIES IN SAFETY BARRIERS

The following are the various type of deficiencies found along the project stretch.

- Safety Barriers along sharp curves: Safety barriers along sharp curves have been found missing. Such sections have been listed in
- Safety Barriers along high embankment sections: As per the site visit, high embankments on stretch are present with no protection work done. So it is recommended that safety barrier as per IRC: 119-2015 shall be provided at these locations. Such locations are tabulated in
- Safety Barrier along hilly/land sliding area: As per IRC: 119-2015 suitable safety barriers shall be provided for non-traversable hazards like hilly area/land sliding zone with steep vertical cuts very close to the carriageway. In this area major problem of land sliding or fallen of large rock can create a problem for the moving vehicles on highway. It is recommended to provide a safety barrier or construction of a protection wall along these sections. Such location is tabulated in
- Some of the Photographs related to deficiencies in safety barriers as observed presently are as follows:



Figure 119. Photographs of deficiencies in safety barriers 659+800 and 659+600. Curve and elevated embankment



Figure 120. Photographs of deficiencies in safety barriers 648+200 and 655+300. High embankment



Figure 121. Photograph of deficiencies in safety barriers 647+800. Land/stone slide risk and impact

The details related to additional safety barriers are given in the next table.

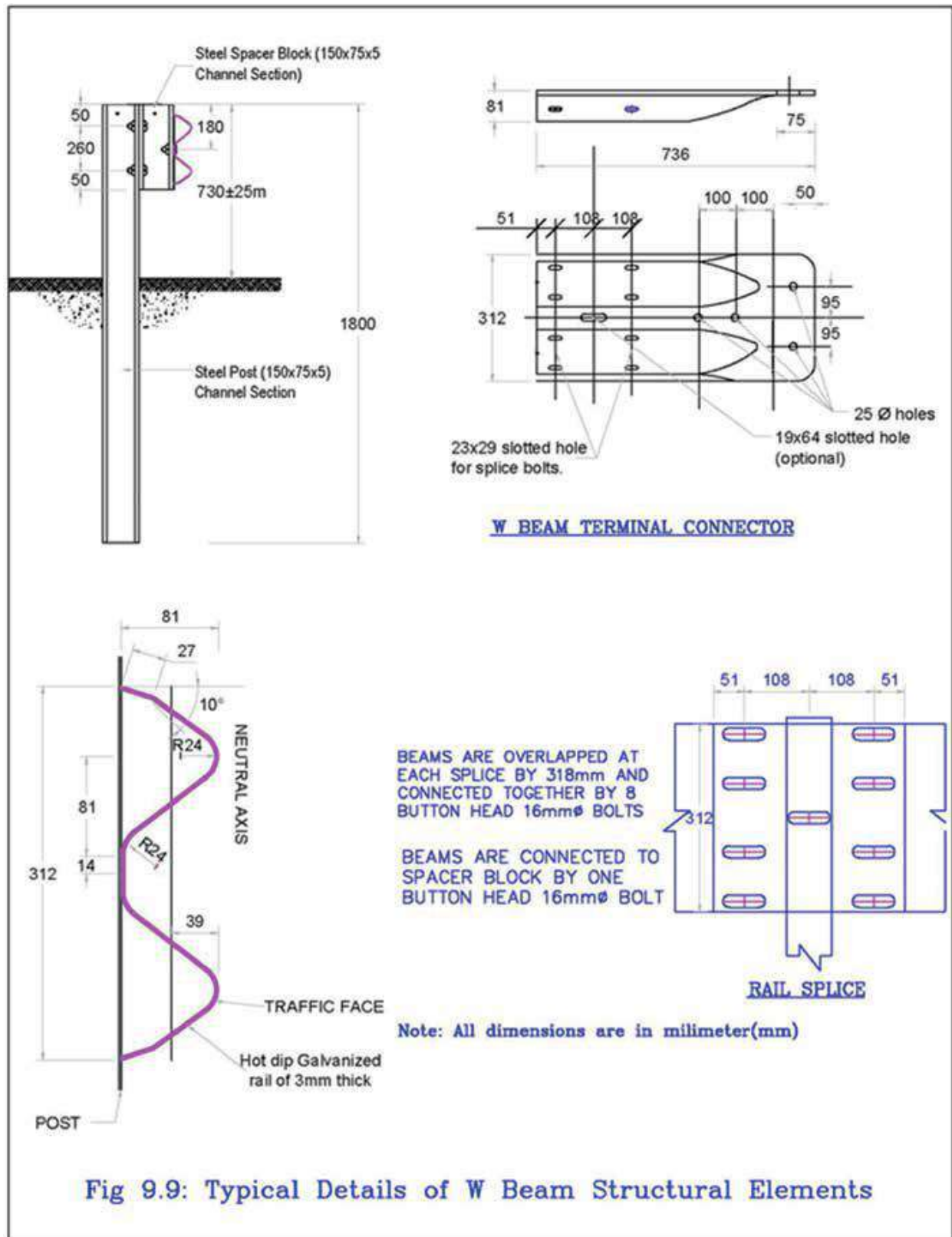
Sl. No.	Chainage (km)		Length (m)	Location	Actual Length	Type of Barrier
	From	To				
1	647.8	648.6	0.8	Median	800	W-Beam Barrier
2	649	649.55	0.55	Median	550	W-Beam Barrier
3	653	653.85	0.85	Median	850	W-Beam Barrier
4	660.3	660.7	0.4	Median	400	W-Beam Barrier
5	664.3	664.7	0.4	Median	400	W-Beam Barrier
6	665.3	665.65	0.35	Median	350	W-Beam Barrier
7	666.85	667.45	0.6	Median	600	W-Beam Barrier
8	667.71	668.47	0.76	Median	760	W-Beam Barrier
9	668.61	670	1.39	Median	1390	W-Beam Barrier
10	647.8	648.6	0.8	RHS Shoulder	800	W-Beam Barrier
11	649.3	650.3	1	RHS Shoulder	1000	W-Beam Barrier
12	650.6	650.8	0.2	LHS Shoulder	200	W-Beam Barrier
13	651.2	651.5	0.3	BHS Shoulder	600	W-Beam Barrier
14	654.1	654.4	0.3	RHS Shoulder	300	W-Beam Barrier
15	655.3	655.4	0.1	LHS Shoulder	100	W-Beam Barrier
16	658.05	658.2	0.15	LHS Shoulder	150	W-Beam Barrier

Sl. No.	Chainage (km)		Length (m)	Location	Actual Length	Type of Barrier
	From	To				
17	659.6	660.1	0.5	BHS Shoulder	1000	W-Beam Barrier
18	661	661.1	0.1	LHS Shoulder	100	W-Beam Barrier
19	664.2	664.4	0.2	LHS Shoulder	200	W-Beam Barrier
20	665.2	665.4	0.2	BHS Shoulder	400	W-Beam Barrier
21	667.2	667.3	0.1	LHS Shoulder	100	W-Beam Barrier
22	669.1	669.3	0.2	BHS Shoulder	400	W-Beam Barrier
23	671	671.2	0.2	LHS Shoulder	200	W-Beam Barrier
Total Length (m)			10.45		11650	

Table 116. Identified Locations along the Project Stretch for Safety Barriers

Note:- All requisites safety barriers observed in year 2018 are under implementation at the level of authority and will be completed prior to handing over to InvIT.

The next figure given below, shows configuration/layout of crash barrier as per IRC- SP: 84 -2019.



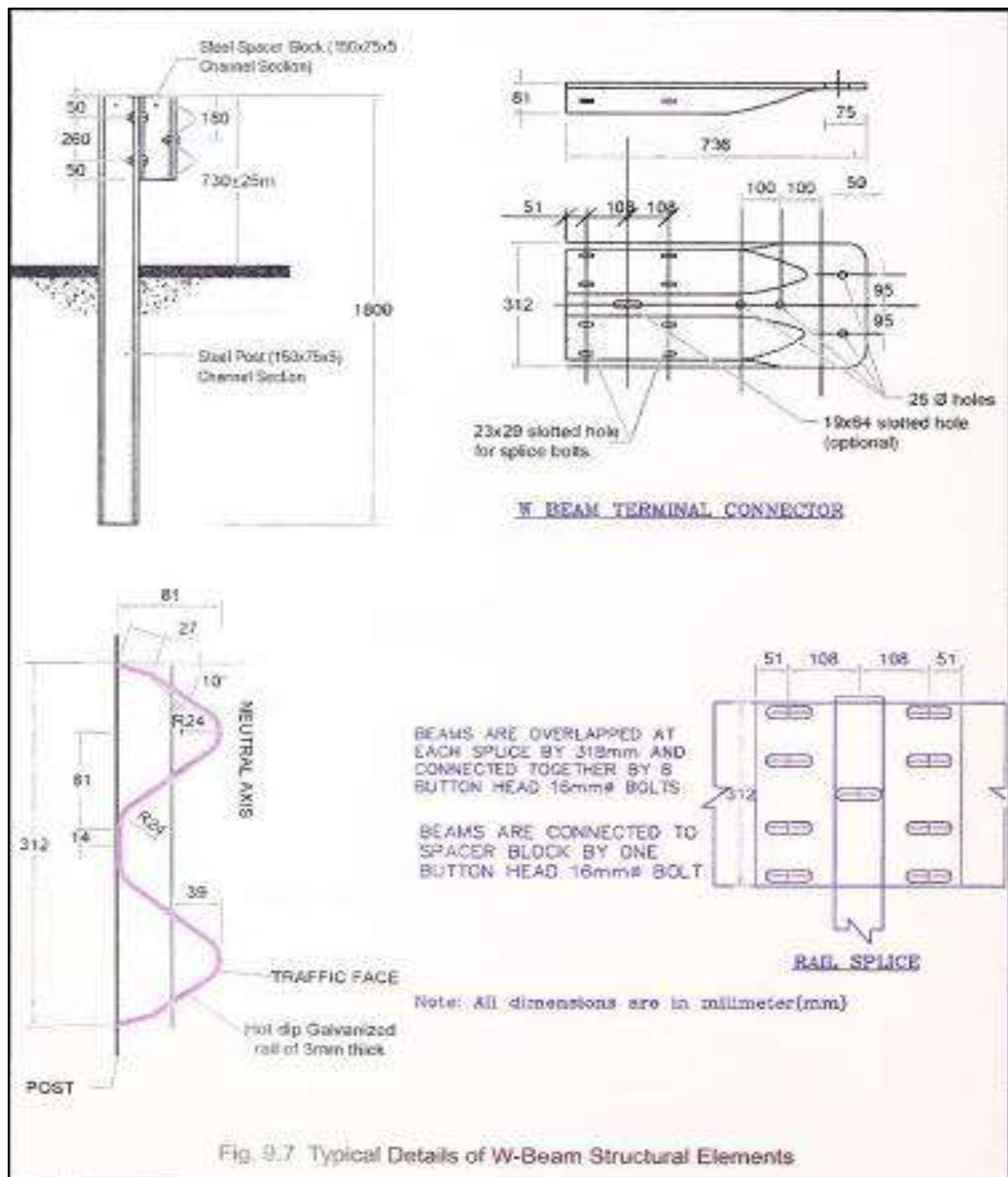


Figure 122. Typical Details of W-Beam as per IRC 84-2019

6.2.3 U-TURN AND MEDIAN OPENING

Median Opening should generally be limited to intersections with public streets or major generators of traffic and should not be accepted for individual business needs. Their number should be kept to the minimum. During road safety audit improper u-turn and median opening have been observed.

Some of the Photographs showing Improper/Unauthorized Median Cuts along the Project Stretch are shown below.



Figure 123. Pictures of improper medians cuts. 652+800 and 657+300



Figure 124. Pictures of improper medians cuts. 649+100 and 649+600

The details related to the locations of such cuts are given in the next table.

S.No.	Chainage(km)	Problems and Improvement Strategies
1	652+800	Improper median needs improvement
2	657+300	Median cut is on curve and should be closed
3	649+100	Bus Stand /Built up area. Median opening should be provided
4	649+600	Improper median needs improvement

Table 117. U-Turn – Median opening

Note:- All requisites U turn median opening observed in year 2018 are under implementation at the level of authority and will be completed prior to handing over to InvIT.

These type of Improper Median Cuts along the Project Stretch should be reconstructed as per IRC:84 by reconstructing the median to ensure the safety of road users. If necessary then proper median cuts should be provided as per IRC SP 84: 2019.

6.2.4 UNAUTHORIZED RAMPS AND ACCESSES

Number of unauthorized ramps was observed along the project stretch at places where the majority of farmers access to their fields and un-paved road have been developed. Most of the unauthorized ramps are leading towards agricultural fields, local residences, roadside restaurants, etc.

Some of the Photographs showing Unauthorized Ramps along the Project Stretch are shown below.



Figure 125. Photographs of unauthorized ramps



Figure 126. Photographs of unauthorized ramps

The details related to the locations of such ramps are given in the next table below in group of 5 km length of highway.

S. No	From(km)	To(km)	No. of Ramps	
			LHS	RHS
1	646+000	651+000	4	6
2	651+000	656+000	3	2
3	656+000	661+000	4	2
4	661+000	666+000	2	3
5	666+000	671+000	3	5
6	671+000	677+000	2	2

Table 118. Number of Unauthorized Ramps

Note :-All requisites Unauthorized Ramps observed in year 2018 are under implementation at the level of authority and will be completed prior to handing over to InvIT.

A properly designed T or Y-Junction might be recommended for those ramps which lead to small habitations and groups of agriculture fields where the number and type of vehicles can justify their cost. Also, some of those ramps should be closed if alternatives are identified to access to and from the highway. In any case, no particular works related to this issue will be recommended in this study.

6.2.5 IMPROPER PEDESTRIAN CROSSING ALONG THE HIGHWAY

It is observed that required pedestrian crossing facilities have not been provided and in the absence of these, the local population devise their own unauthorized ways to cross the highway affecting the safety of road users and their own safety.

Some of the Photographs showing lack of Pedestrian Crossing along the Project Stretch are shown below.



Figure 127. Photographs of Improper Pedestrian Crossing (647+050 and 657+300 respect.)

According to IRC SP 88-2010 controlled form of crossing in populated areas nearby and along the highway shall be achieved through provision of Zebra Crossings, whether at signalized intersection or pedestrian actuated signal. When located appropriately and used correctly, these crossings can be effective in reducing pedestrian-vehicular traffic conflicts. The following are the locations where signage is to be installed.

Sr. No.	Chainage	Reason
1	647+050	Pedestrian crossing to be provided because of Median opening /T-junction and Built-up area
2	652+800	Pedestrian crossing to be provided because of Cross junction / median cut
3	657+300	Pedestrian crossing to be provided because of Median cut / T-junction
4	660+700	Pedestrian crossing to be provided because of Median cut (Madhav university)

Table 119. Location of Improper Pedestrian Crossing

6.3 CURRENT SITUATION OF TRUCK LAY-BAYS ALONG PROJECT STRETCH

Truck Lay-bays: The Concessionaire shall construct and maintain adequate number and size of truck lay-bays for parking of trucks by the side of the Project Highway as indicated by the Government. These shall be provided as clause 12.4.2.2 IRC SP 84:2019.

The following location is purposed for truck lay bay:



Figure 128. Picture of location purposed for truck lay bay

S.No	Chainage (km)	Side	Improvements Required
1	656+800	LHS	Truck lay Bys
2	657+050	RHS	Truck lay Bys

Table 120. Proposed location of Truck lay-bays

A typical configuration/layout of Truck Lay bay have been shown in Figure 129 below which is as per provision in IRC SP 84:2019

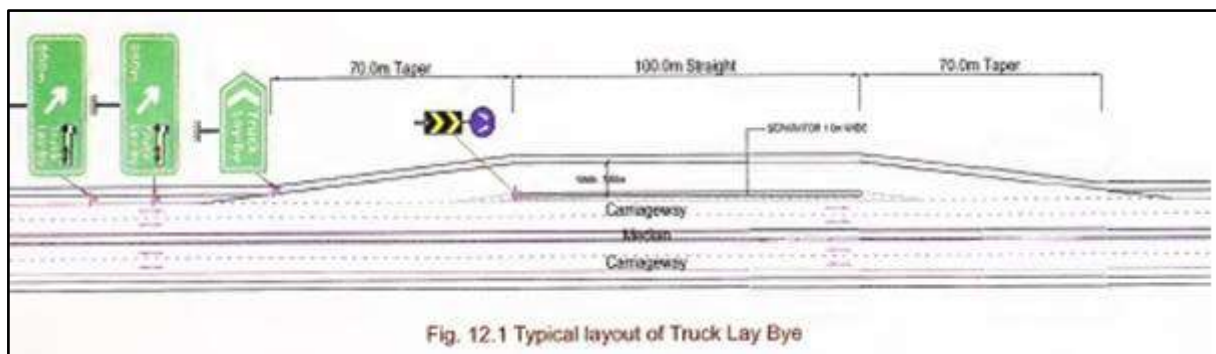


Figure 129. Typical layout of Truck Lay Bay

Bus Bays and Bus Shelters: Bus bays are required at various locations along project road, mainly where cross roads are meeting with the project road and new habitations have been developed. In four lanes project road there should be Bus Bays on both sides of median as per fig 12.2 of IRC SP 84:2019.

Following photographs presents some current situation of bus bays / bus stops along the Project Stretch. At this site bus bay/bus stop on LHS is missing. It is recommended to provide and same pedestrian marking on both carriageway.



Figure 130. Picture of location purposed for Bus-Bay required on LHS (649+115)

The requirement Bus Bay has been listed in Table 121.

S. No.	Chainage (km)		Side	Reason	Requirement
	From	To			
1	649+000	649+230	LHS	Built Up area	Bus Bay

Table 121. Proposed location of Bus-Bay required

A typical configuration/layout of Bus Bay is shown below, which follows the provision as per IRC SP 84:2019.

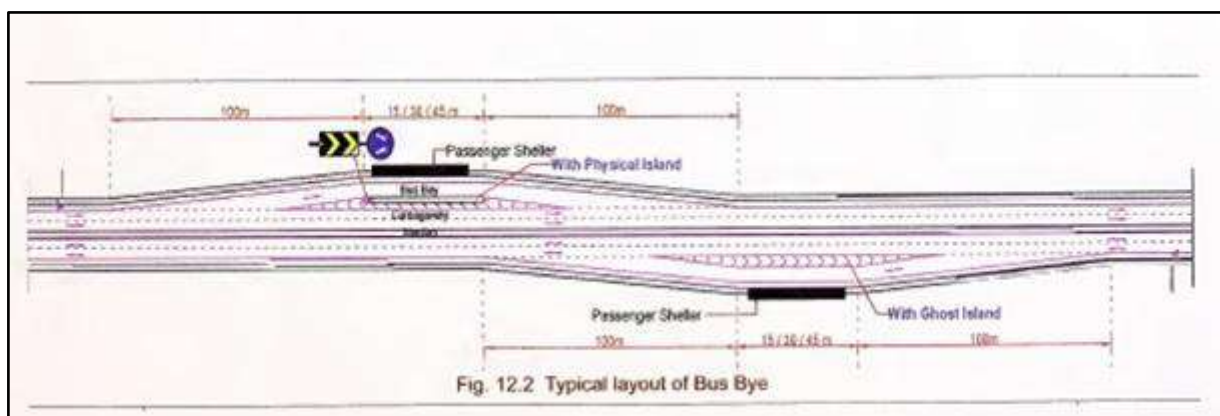


Figure 131. Typical layout of Bus Bay

6.4 PROVISION OF SERVICE ROADS AND SLIP ROADS

Service road is necessary in built up area to segregate slow moving & fast moving vehicle. It is also required to achieve the access to the highway. A service road with properly designed entry and exit ramp from service road and from highway avoid direct conflict of merging of traffic.

- Slow /local moving traffic creating hindrance to the free movement of vehicles.
- Substantial wrong side movement which can be dangerous on a highway stretch with the vehicles coming at high speed.
- Substantial pedestrian movements.
- Unavailability of street lights creating these portions highly dangerous at night.



Figure 132. Picture showing requirement of improvement in Service Road (647+040 and 648+550 respect.)

Considering the above safety hazards, the construction of a service road is recommended for the following chainages as per Table 122.

S. No.	Chainage (km)		Side	Reason	Requirement
	From	To			
1	647+040	647+700	LHS	660m	Built up
2	648+550	649+150	Both	600m	Built up
3	659+700	660+800	RHS	1100m	Built up
4	666+600	667+000	LHS	400m	Built up
5	676+400	677+000	Both	600m	Built up

Table 122. Service Road Requirement

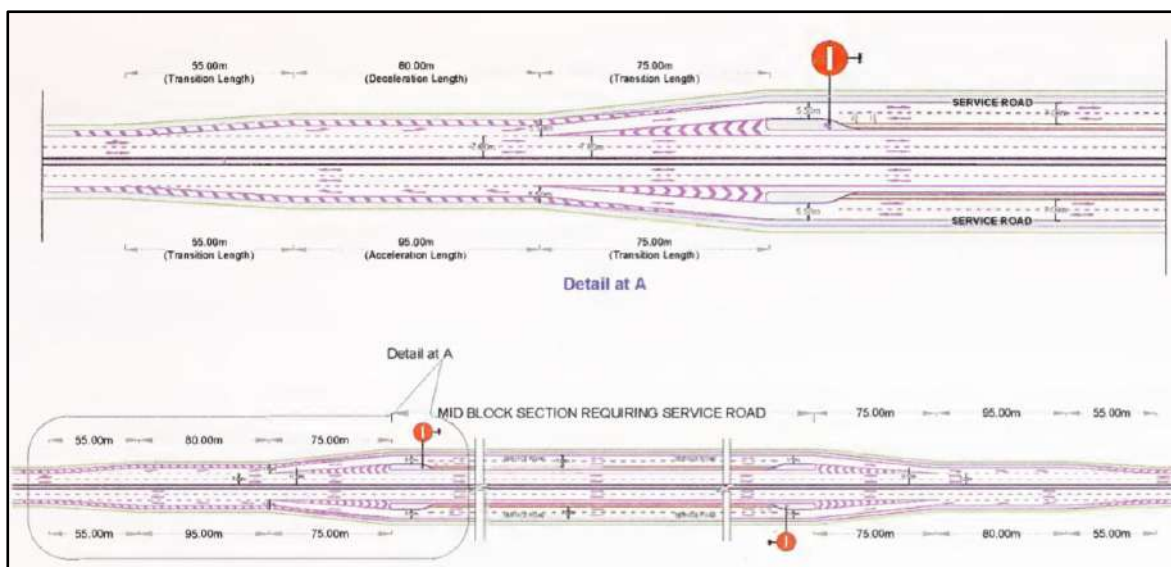


Figure 133. Typical cross section of service road as per IRC 84

6.5 PROVISION OF ATMS

The following Specifications and Standards shall be applied in addition to 'Manual on Specifications and Standards for Highways' published as IRC: SP: 99-2013 with all amendments and additions till date. Provision of ATMS in latest NHAI policy in vogue (currently, NHAI Policy Circular-Technical (214/2016) dt.15.09.2016 is being practiced which may be amended in due course of time) will govern the implementation. Latest Policy / Circular at the time of execution shall prevail.

The ATMS implementation shall cover design, supply, installation, commissioning and operation and maintenance of Advanced Traffic Management Systems.

The system would include out-door equipment including emergency call boxes, variable message sign systems, vehicle actuated speed system, meteorological data system, close circuit TV camera (CCTV) system, traffic counting and classification system, mobile radio communication system and transmission system. The indoor equipment would comprise a large display board, central computer (with Network Management System – NMS), CCTV monitor system, call centre system or management of emergency call boxes housed in a control centre with uninterrupted power supply. The systems shall meet following objectives:

- Smooth and uninterrupted traffic flow
- Enhance road safety
- Real time information and guidance to users
- Emergency assistance round the clock
- Alerts for abnormal road and weather conditions
- Reduced journey time and inconvenience

The system configuration shall have the following sub-system:

- Variable Message Sign system
- Video Surveillance system
- Video Incident Detection System (VIDS)
- Network /Communication Infrastructure

ATMS shall provide the following facilities to Highway users:

- Make emergency calls to Control Centre in case of accidents, breakdown, fire and ambulance.
- Pre-warn the Highway users about unusual condition on the road.

ATMS shall provide the following information/data to traffic managers for efficient and effective handling of traffic:

- Information regarding location of any incident, incoming calls, help required and messages to be passed to third parties.
- Information regarding traffic congestion, speed and weather conditions.

ATMS shall provide the following controls to traffic managers:

- Change the variable message signs from the Control Centre.
- Mobilize the movement of ambulances, cranes & patrolling vehicles.

ATMS shall provide online recording and reviewing of the voice & visual information for record and analysis.

Value Added Systems in information dissemination to users of the Project may be taken up in future. These shall include the following:

- Value Added Systems in the form of real time information on traffic conditions, unusual events, congestion levels, weather conditions etc.; to facilitate project users as also the operator.
- Through relevant websites including that for the Project SPV/Concessionaire.
- Subscription based alert systems.
- Dedicated TV channels pertaining to traffic movement.
- Tie ups with FM radio channels or creation of dedicated AM radio channel.
- Dedicated Toll Free Telephone Systems.

6.5.1 VARIABLE MESSAGE SIGNS (VMS)

6.5.1.1 PURPOSE AND GENERAL INFORMATION

Variable Message Signs (VMSs) are to be installed for conveying the traffic conditions ahead to the drivers on real time basis as well as to display messages to support national road safety campaigns. It may also include the variable traffic speed limit depending upon the requirements.

Variable message signs (VMSs) shall provide traveller information for warning, regulating, routing, and managing the traffic in order to improve the overall traffic flow. The philosophy is to inform the driver of impending conditions with up-to-date information. The overall goal of VMS application is to provide permanently located signs that can be programmed remotely to communicate with the drivers the necessary information such that the driver can choose or be directed to the most appropriate route. The

VMSs shall be controlled from the main CCR. Based on requirement, the VMS may be fixed or portable in nature.



Figure 134. VMS System

6.5.1.2 LOCATION

VMS shall be provided as per locations determined later. A general policy adopted for locating VMSs is to provide VMS at an average interval of 10 km in each direction (not necessarily on the same gantry) to guide and forewarn the users about the traffic and weather conditions on the Highway.

The most critical locations for installing permanent VMSs are in advance of interchanges or Highways where drivers can have the opportunity to take some action in response to messages displayed on VMSs. A VMS should not compete with existing roadway signs.

Drivers generally do not anticipate using a different route until they see and read a VMS message. Drivers who are travelling in the inside lanes need ample time to read the message and change lanes to exit.

In general, a VMS should be permanently installed at the following locations:

- Upstream from major decision points (e.g., exit ramps, freeway-to-freeway interchanges, or intersection of major routes that will allow drivers to take an alternate route).
- Upstream of bottlenecks, if any
- Where regional information concerning weather conditions such as fog, wind, or dust is essential.

The portable VMS can be mounted at the back of the truck or similar vehicle. The VMS sign mounted on truck could be powered by solar energy or battery.

The exact location shall be adjusted for the maximum utility to the users based on the site conditions, however, only with the consent of the NHAI.

6.5.2 VIDEO SURVEILLANCE SYSTEM (CCTV)

6.5.2.1 PURPOSE AND GENERAL INFORMATION

The purpose of the Video surveillance system is to monitor specific areas of the Highway remotely from the CCR by use of cameras installed at such critical junctions. This shall help in managing incidents.

The system shall also record and store video for analysis and future reference.

The functional and technical requirement of the Closed Circuit Television (CCTV) System to be used as a sub-system of ATMS Implementation shall include fixed cameras and PTZ cameras.

6.5.2.2 LOCATION

The system monitors vehicular and other road related activity along the highway stretch. CCTV system is required to ensure effective surveillance of the target road section and related surrounding areas and generate a tamperproof record for post event analysis.

The software supplied and installed at the ATMS Control Centre to operate the CCTV systems shall be able to integrate with/Export data to and import data from the ATMS unified database located in ATMS Control Centre.

6.5.3 VIDEO INCIDENT DETECTION SYSTEM (VIDS)

6.5.3.1 PURPOSE AND GENERAL INFORMATION

The purpose of the VIDS is to sense, detect and record the incident. The system shall be an intelligent image detection using camera. The VIDS shall have inbuilt intelligence to ascertain when the image has meaningfully deviated from the standard image originally recorded. A pilot run for VIDS is suggested before implementation.

The specification, functional and technical requirement of the CCTV based VIDS to be used as a sub-system of ATMS implementation, for automatic detection of incidents and generation of local visual alerts. It also includes the associated visual alerts in the form of flashing lights which are connected to and activated by the VIDS. The system offered shall have the capability to also operate in low light conditions normally experienced during night. In very poor visibility conditions such as during winter fog/smog, the system shall detect the condition of poor visibility and generate visual alerts. Further it shall raise an alarm if signal/image quality is too poor to reliably process.

6.5.3.2 LOCATION

VIDS is established at strategic locations. The software supplied and installed at the ATMS Control Centre to operate the CCTV-based VIDS shall be able to integrate with/Export data to and import data from the ATMS unified database located in ATMS Control Centre.

6.5.4 OFC BACKBONE

6.5.4.1 PURPOSE AND GENERAL INFORMATION

The purpose of the OFC backbone is to transport voice, data, LAN and video services between the field equipment and CCR.

As the transmission system would be used as a backbone network, the system shall have following characteristics:

- High Availability

- High Reliability
- Dual ring configuration
- Easy to install and operate
- Scalability
- High degree of flexibility with respect to the types of interfaces

6.5.4.2 LOCATION

OFC shall be laid all through the Highway. It may be laid on RHS or LHS of the main carriageway or in the median. Lateral elements shall be connected on OFC or copper.

6.5.5 NETWORK MANAGEMENT SYSTEM (NMS)

6.5.5.1 PURPOSE AND GENERAL INFORMATION

This system provides connectivity between ATMS Control Centre and outdoor equipment such as Emergency Roadside Phones, Variable Message Signs, Mobile and fixed CCTV cameras, Speed Displays, ATCC, Mobile Weigh in motion Stations, etc.

It also provides the external data connectivity required between the ATMS control centre and the NHAI ATMS Cloud as well as between the ATMS control centre and the NHAI ATMS Master & relevant Regional Control Centres.

The Fibre Optic Transmission System shall be equipped with a user friendly, Microsoft, Windows-based Network Management System (NMS). The NMS shall allow the operator to manage and monitor multiple sub-networks in an efficient way.

The NMS shall have the following functionality: network configuration, configuration of services, monitoring, diagnostics, activation-deactivation of interface modules, bandwidth allocation, alarms and event logging and graphical network representation.

The network management hardware shall consist of a Personal Computer, which at the time of installation is the current industry standard. The NMS architecture shall be based on Employer-server technology. It shall be possible to connect multiple active Employers to the NMS server allowing network management from multiple and/or remote locations or by multiple users.

6.5.5.2 LOCATION

Software at Central Control Room.

6.5.6 CENTRAL CONTROL ROOM (CCR)

6.5.6.1 PURPOSE AND GENERAL INFORMATION

The purpose of the CCR is to monitor the Highway and to provide information to the road user. The CCR also houses the central servers and data processing equipment.

The CCR shall provide the real-time information and assistance to the Highway users, collect data for the use of Highway authorities and to monitor and control the Traffic on the Highway as per the requirements.

The CCR shall be designed for round the clock operations of monitoring, on-line information acquisition and processing the same for decision making. The CCR shall be the repository of all the data acquired from the field and their processing, storing, and archiving. All the information for real time monitoring of Highway shall be generated at the CCR and the relevant information shall be disseminated to the users through VMS, and to O&M teams through mobile radio.

ATMS Control Centre would be the facility from where all the activities of the ATMS would be controlled. ATMS Control Centre would primarily comprise of the in-door portion of CCTV, VMS, and other support systems. All the aforementioned subsystems shall preferably reside in a dedicated permanent structure with adequate floor area to house the required man power and equipment. Where ever such a permanent floor/building/structure cannot be made available, the ATMS Control Centre shall be housed in temporary portable cabins.

6.5.6.2 LOCATION

There shall be one CCR located in any toll plaza.

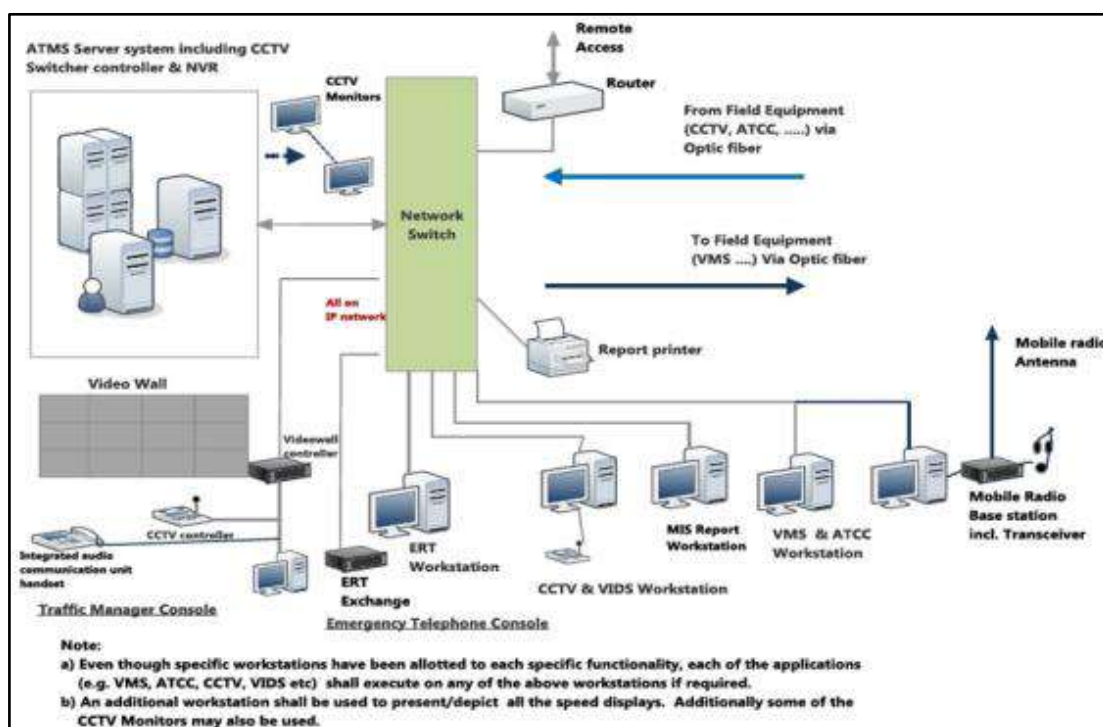


Figure 135. CCR System Schema

6.5.7 CONCLUSIONS AND RECOMMENDATIONS

ATMS system should be provided as per its requirement is shown below in the following table:

S.No	Item Description	Unit	Req. Qty	Requirement
1	Video Surveillance system	Nos.	31	<p>Requirement:-To monitor traffic conditions (Day & Night) on the highway including junctions with considerable traffic, populated village town sections / road junctions and vulnerable sections of the highway. Range of 1 km on the highway (i.e. 1 km on either side).</p> <p>Location:-Closed Circuit Television (CCTV) System to be used as a sub-system of ATMS Location of CCTV Cameras shall be within the stretch as verified byNHAI.</p> <p>1. Built up sections 2. Major Junction 3. Toll Plaza</p> <p>1 nos. of camera for everytwo kms interval</p>

S.No	Item Description	Unit	Req. Qty	Requirement
2	Video Incident Detection System (VIDS)	Nos.	20	Requirement: -Detection range from Camera location: 200 m (Day and night) Provision of warning with flashing lights: a) 100 m before the area of detection b) 200 m before the area of detection to warn arriving vehicles To be located such that detection range is 200 m or less Location:- Blind corner of highways, highway locations such as vulnerable merger points of Service road with the main carriageway and Junctions. (Location can be finalized in consultation with IE and NHAI at the time of execution).
3	Network /Communication Infrastructure	Nos.	01	Requirement: -Communications System utilizing Optic fiber, point-to-point wireless links, GSM/GPRS and Wi-Fi Communications linked to ATMS Control Centre shall be provided depending on equipment communication criteria. Location:- At plaza location
4	ATMS Control Centre	Nos.	01	Requirement: -One ATMS Control Centre including the equipment (hardware, software, and local networking) shall be developed on Project Stretch Location:- At plaza location
5	Vehicle Speed Detection System Equipment (VSDES)	Nos.	18	Requirement: -Detection range from Camera location: 200 m (Day and night) Provision of warning with flashing lights: a) 100 m before the area of detection b) 200 m before the area of detection to warn arriving vehicles To be located such that detection range is 200 m or less Location:- At entry and exit of highway (with VMS) (Location can be finalized in consultation with IE and NHAI at the time of execution).
6	Power supplies for field equipment	Nos.	01	Requirement: -Working on Mains power supported with back-up (largely on renewable energy) to facilitate 24 X 7 operation and for the ATMS Control Centre working on Mains power supported by UPS and Diesel generator set of adequate capacities, to facilitate 24 x 7 operation. Location:- Toll plaza and Stretch portion

Table 123.ATM requirements(minimum as per ATMS policy)

7 TOLL PLAZAS

7.1 TOLL SURVEY

Toll on this Project stretch of NH 27 is currently being collected at one location – km 670+750, Undavariya Toll Plaza. This stretch has been constructed under BOT (Annuity) with tenure up to 24/03/24, and toll is being collected by NHAI through open competitive bidding.

The project stretch starts from km 646+000 and ends at km 677+000 with a total length of 31.000 km.

TMS and ETC System

Toll Management System (TMS) is installed and operational.

Toll Lanes

There are total 8 operational lanes with six dedicated ETC lanes and two Hybrid lanes.

TMS application is used to generate toll slip for the customers and weekly & monthly reports.

Equipment like OHLS, UFD and Barrier are present in the lanes and lanes are in working condition.

The booth condition is okay.

Exemption log is maintained by the TC.

Toll lane controller (TLC) is situated in the tunnel below each toll booth.

Paper smart cards are used and monthly passes are verified by vehicle number.

ETC Lanes

There are six ETC lanes at toll plaza RFID readers are used to detect ETC tags.

AVC - There is AVC at the toll plaza; hence, transactions are validated.

FASTAG

FasTag is a device that employs Radio Frequency Identification (RFID) technology for making toll payments directly from the prepaid account linked to it. It is affixed on the windscreen of your vehicle and enables you to drive through toll plazas. FasTag has a validity of 5 years and after purchasing it, it needs to be recharged/ topped up the FasTag as per requirement.

FasTag offers near non-stop movement of vehicles through toll plazas and the convenience of cashless payment of toll fee with nation-wide interoperable Electronic Toll Collection Services.

Presently existing toll plaza having 06 ETC dedicated lanes (with RFID) and 2 lane (for cash and RFID transitions)

7.2 CURRENT CONDITION

7.11.1 UNDAVARIYA TOLL PLAZA

Existing toll plaza including infrastructure, toll management system and operational activities were reviewed during site visit. Photographs of toll plaza are given below:



Figure 136.Undavariya Toll Plaza



Figure 137.Photograph of UndavariyaToll Plaza

- It is situated at km 670+750 on NH27. There are 8 (4+4) tolling lanes, two of them with extra wide at the sides. Two lanes are hybrid lanes (semi-automatic + ETC) and Six are ETC-dedicated lanes one in each direction with RFID readers and electronically operated boom barriers with synchronized traffic lights.
- Traffic islands exist as per specifications. Width of toll lanes are adequate and traffic islands accommodate toll booth with protective barrier as per codal provisions i.e. IRC SP-84.
- There are eight single toll booths with adequate space for computer operator seating, computer, printer, cash box, etc., and CCTV cameras are installed.
- Canopy has been provided covering toll booths with adequate vertical clearance.
- Weigh in motion facilities have been provided in all lanes. Statics weigh bridges have been installed in each direction.
- Traffic signs, road markings, lighting, water supply, firefighting system have been provided as per relevant codes.
- There is an Administrative Toll Office with an adequate control room.
- TMS (Toll Management System) has been installed and is working well.
- There is tunnel under the lane system for movement between Administrative building and toll booths and all electric connection, cabling etc. have been done appropriately.

7.11.2 TOLL COLLECTION AND MANAGEMENT SYSTEM

The toll collection is manual and ETC. The system shall include:

- Dedicated ETC lanes with RFID based system
- Manual Collection/Cash collection in Hybrid lanes and Through RFID in ETC lanes
- Cash Reconciliation module
- Transaction Validation and Audit
- Management Information System (MIS) and Reports
- CCTV Surveillance System on Lanes, Booths, Plaza area
- Real Time connectivity with the Toll plaza office through dedicated and secured internet connection
- Real Time video monitoring display facilities along with network connectivity
- RFID Lane with Automated Vehicle Classification System
- Lane software integrated with all equipment
- Lane system having allowing Toll collectors to Log In and process transactions
- Lane system record and track all transactions shift wise / collector wise
- Lane system store all transactions in Lane controller, independent AVC (iAVC) with inbuilt memory and battery and send all transactions to Plaza server

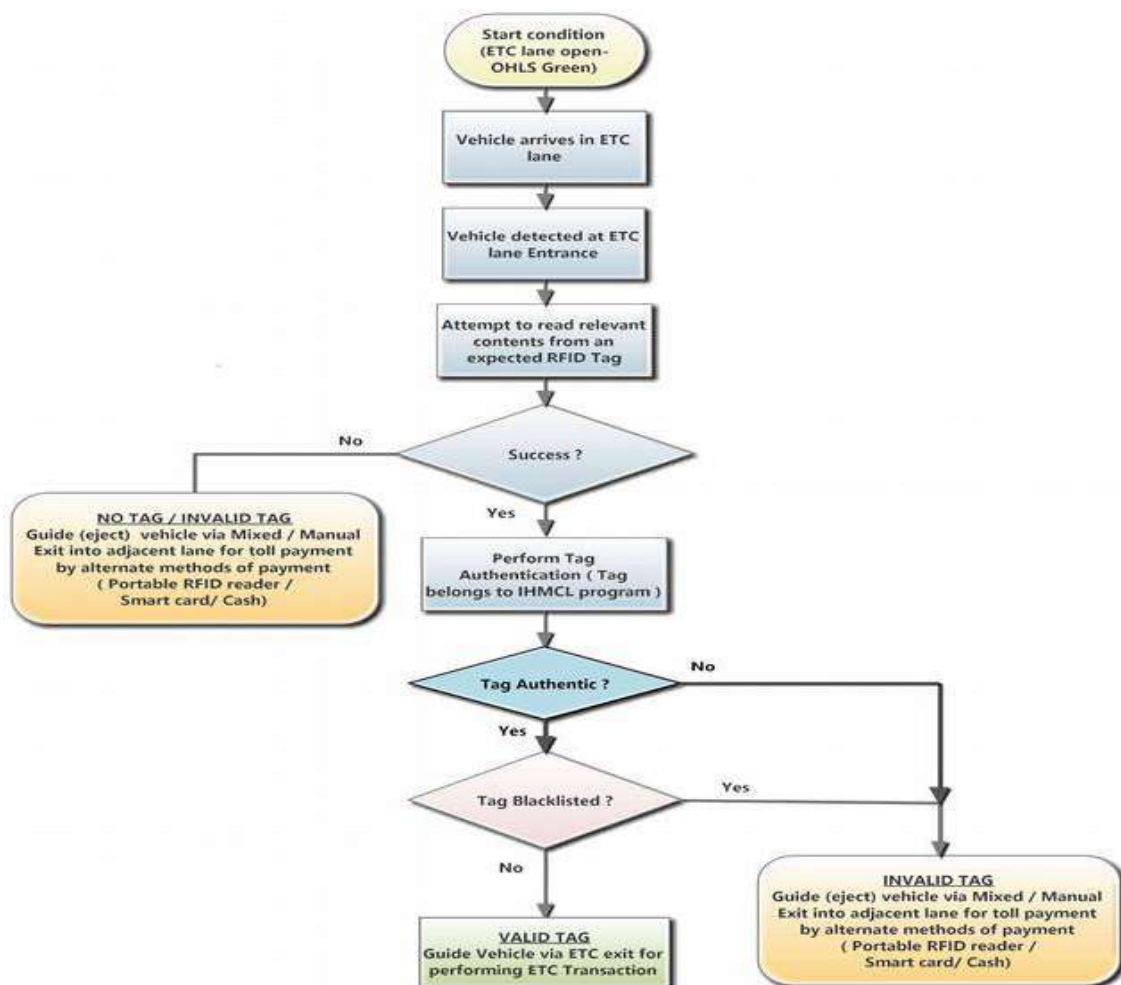


Figure 138. A. Toll Collection System through ETC lane with RFID system

Indicative List of Equipment / Software / Licenses

a) Plaza and Lane level are Specific Equipment (Common)

- Plaza Server
- Adequate Server Rack, with fans and adequate power points and cable management
- Admin / Audit Workstation – 6 Nos.
- Network Laser Printer (Black & White) - 2
- Network Switches for Lane & Plaza system(s)
- Intercom Slave units
- UPS for plaza system
- Provision of Dedicated Internet connection (minimum 2Mbps link) with Data Center.
- Firewall, IPS etc as per requirement for data security
- PTZ and Dome Cameras

b) Software/ Licenses

- Toll Management System with all features fully integrated with all other systems / peripherals.
- Server Operating Systems – Preferably Open Source (Linux / Unix)
- Lane / Admin Workstations Operating System Licenses
- MS-Office on Admin Workstations.
- Relational Data Base Management System (RDBMS)
- Antivirus and Anti-Spam
- Integration with Control Center for Real Time Data & Video Feed Transfer

c) Toll Lane Equipment for Hybrid Lane

- Toll Lane Controller with required software/ licenses.
- Readers for prescreening and Tag identification
- Readers for transaction processing
- Independent Automatic Vehicle Classification System (iAVC)
- Lane Software and Licenses
- Transaction Signal / Traffic Light
- Overhead Lane Signal (OHLS)
- Toll Fare Indicator / User Fare Display ix. Automatic Boom Barrier
- Incident Capture Camera xi. Lane and Booth Camera
- License Plate / Automatic Number Plate Reader Camera
- Toll Lane PC / Workstation
- Fog Light
- Violation Light & Violation Alarm
- UPS for Toll Lane Equipment
- Toll Lane Monitor
- Customized Key Board
- Thermal Receipt Printer
- Intercom Slave Unit
- Cash Tray
- Networking & Cabling for data and power
- Data storage, backup and retrieval of entire data being created on the plaza

7.12 PROBLEMS

- ETC-dedicated lanes are installed side by side at the center of the Plaza (inner lanes), consequently it would make more difficult to provide reversible lanes to this Plaza.
- Toll plazas have been provided with WIM system for checking and preventing overloading of vehicles but separate space for holding off loaded goods from overloaded vehicles is not available.

7.13 SEGMENTATION OF VEHICLES ACCORDING TO TYPE OF RATES

Average Traffic Segment Passing through toll plaza for Year-2020 (From Month January to October)	Car, Jeep, VAN OR LMV	LCV, LGV OR Mini Bus	Truck/ Bus (Two Axles)	Three Axle Commer cial Vehicle	Hcm Or EME Or MAV (Four To Six Axles)	Oversized Vehicles (Seven Or More Axles)
No. of Monthly Passes	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
All types of Single Entry	86.3%	94.6%	98.0%	99.0%	98.9%	97.0%
Multiple Entry	0.6%	1.2%	0.3%	0.1%	0.1%	0.0%
Reuse of Multiple Entry Ticket	0.6%	1.1%	0.3%	0.1%	0.1%	0.0%
Reuse of Monthly Passes	4.4%	0.1%	0.3%	0.0%	0.2%	0.0%
Concession Entry/LDV's	0.0%	0.1%	0.0%	0.1%	0.2%	0.0%
Exempted	7.9%	2.8%	1.0%	0.7%	0.6%	3.0%

Table 124. Segmentation of vehicles according to Type of Rates

Source: Past toll collection data from PIU

7.14 CONSIDERATIONS ABOUT TOLL PLAZA CAPACITY

The number of existing lanes in the toll plaza together with their level of automation allows estimating the service time and thus the capacity of the plaza to manage present and future traffic.

An important parameter to determine traffic capacity of toll plazas is the actual number of vehicles that can be serviced by a particular lane in one hour. According to IRC: SP:84-2019 and for the purpose of guidance, the following capacities are suggested:

- Semi-Automatic lane: 240 vehicles/hour
- ETC dedicated lane: 1200 vehicles/hour

But the experience indicates that above figures are difficult to meet even when the systems are working at perfection. In fact, drivers and tolling staff behaviour and the level of efficiency of the systems at every moment will substantially reduce those figures.

Considering a complete manual process of tolling (that still can be seen at certain plazas and at certain times) up to the most efficient ETC system the following range of capacities could be considered for different scenarios:

- Manual/Semi-automatic lanes: 80 – 130 – 180 – 240 vehicles/hour

- ETC dedicated lanes: 600 – 750 – 900 – 1200 vehicles/hour

In the present study, it was observed that tolling systems in general are operating at normal level, but to be on conservative side, the estimations will not consider the maximum number of vehicles from above ranges.

Consideration is also given to current usage of ETC lanes/system at toll plazas as there is no clear statistic about the number of vehicles that are currently using ETC at each and every toll plaza; however, nationwide estimations arrive to maximum range of ETC usage of 70-85% with FASTAG. NHAI has recently instructed to convert all normal lanes to ETC mode through Radio Frequency Identification Device (RFID). In any case, it is important that the percentages of ETC users increase rapidly with time as it will permit to the existing toll plazas to manage growing traffic more efficiently and without continuous increases of the number of lanes.

In the present as per data provide by PIU and toll agency, it is considered that current usage of ETC is 90% and it will be growing at an additional 0.25% for the following years to reach 90 to 95% usage of ETC in 20 years. It should be noted that it is not considered any change/improvement of efficiency due to the conversion of lanes to ETC mode, which will make the following estimations to be conservative.

Final consideration refers to another recommendation from IRC: SP:84-2019 which states that toll plazas shall be designed for a projected peak hour traffic of 20 years

UNDAVARIYA TOLL PLAZA		2020	2050
AADT (tollablen ^o vehicles)		15,338	29,221
Estimated Peak Hour Traffic (n ^o vehicles)		609	1,465
Percentageof ETC users		85%	95%
Number of vehicles passing normal lanes		91	73
Number of Vehicles using ETC dedicated lane		518	1392
N ^o of ETC lanes required based on capacity (vehicles/hour)	600	1	2
	900	1	2
N ^o of normal lanes required based on capacity (vehicles/hour)	80	2	1
	130	1	1
	180	1	0

Table 125.Undavariya Toll Plaza lanes capacity estimation

According to above table, current number of lanes (6 ETC dedicated lanes + 2 Normal lanes) is practical to cope up with the potential peak hour traffic, estimated for 2020 and it may face a short term capacity problem if tolling systems do not work at an adequate level. In case we consider the directional split of the peak hour traffic, 53% and 47%, one of the directions could compromise to meet appropriate service times with current lanes configuration. For year 2024, and considering traffic estimations and a 100% usage of ETC lanes by drivers. Currently as per NHAI policies having in force from dated 14th February 2021 all toll lanes at plaza having dedicated ETC lanes.

7.15 RECOMMENDATIONS

- Today, this toll plaza is closed to its capacity to manage peak hour traffic at a reasonable service level. Consequently, an expansion of the number of lanes is recommendable; moreover, as per NHAI guidelines, the minimum number of toll lanes must be six in each direction (total 12), therefore at least two lanes in each direction are required to be added. But considering a design period of 20 years (till 2040),

- It is recommended to have maximum number of ETC lanes. It can be noted that the location of the toll plaza is not suitable to accommodate extra lanes and all other required facilities and structures for its expansion. Consequently, to anticipate its expansion requirements, it is also recommendable to start as soon as possible the acquisition of land (Minimum area of land to be acquired is 6,000 sqm).
- It is recommendable that for 12 lanes of the plaza, 2 (5+5) will be ETC dedicated, and the 2 center lanes (1+1) to be reversible, which will force to shift the ETC dedicated lanes from their current position. Installation and/or upgrading of ETC systems in all lanes are recommended.
- Since overloading of vehicles has been identified as a major problem of road failures it is recommended that separate space for unloading of goods from overloaded vehicles at plaza
- It is recommended that there should be provided the weighing in motion (slow and medium type) in all toll lanes.
- Since the existing TMS is old and its liability period is to over at the time of handover of toll plaza to the new concessionaire in year 2024 therefore, fully new system for operation of toll plaza TMS is recommended.

7.16 SUMMARY OF IMPROVEMENT PROPOSALS

Immediate investment requirements have been identified for the toll plaza as follows:

- Provision of two extra toll lane and toll booth in each direction (total 4), and modification of the two central lanes (1+1) to be reversible, shifting the position of currently existing ETC dedicated lanes.
- Up - gradation of Toll Information Systems including the installation and/or upgrading of ETC system in 12 lanes (6+6).

Bill of Quantities for the above works has been prepared and incorporated in cost estimates. And cost estimate for TMS for the year 2020 is as following:-

Sr No	Equipment for (12 Lane Plaza)	No. of Lanes as per proposal
1	RFID Lane Reader for Pre-screening and Tag Identification	12
2	Automatic Vehicle Classification (AVC) incl Sensors, loop and detector	12
3	Traffic Light/Transaction Signal	12
4	Overhead Lane Sign	12
5	User Fare Display	12
6	Automatic Boom Barrier	12
7	Barrier IR Sensor	12
8	Fog Light	12
9	Violation Light & Violation Alarm	12
10	Lane Incident Capture Camera	12
11	License Plate Capture Camera	12
12	Loop with Detector	24
13	Light curtain	12
14	Hand held RFID Reader	4
15	Toll Lane Monitor	12
16	Customized Key Board	12
17	Toll Fee Receipt Printer	12

Sr No	Equipment for (12 Lane Plaza)	No. of Lanes as per proposal
18	UPS for Toll Lane Equipment	12
19	Intercom Slave	12
20	Electronic Enclosure	12
21	Toll Lane Controller	12
22	AVC Controller	12
23	Booth Camera	12
24	Plaza Server	1
25	SAN	1
26	Video Server	1
27	Server Rack	1
28	POS Rfid Reader/Writer	1
29	Admin/Audit Workstation	4
30	Network Laser Printer (B&W)	2
31	Network Switch (Layer 2) for Lane and Plaza	2
32	Intercom Master	1
33	UPS for Plaza System	1
34	BarCode Reader	1
35	Internet Connectivity	2
36	Plaza Control Room Display Monitor	1
37	PTZ Camera	2
38	POS/Cashup high resolution Dome camera	4
39	MPLS Connectivity	2
40	Firewall with IPS	1
41	USB Camera for Workstation	6
42	Copier and Scanner	1
43	Wireless Router (2nos. On each side)	2
44	Set of maintenance tools including Laptop computer and other tools	1
45	Oracle database	1
46	MS-Office @ 5000 for 6 Workstations at each site (Reporting Terminal, POS, Validation and Cashup	6
47	Windows Server	2
48	Windows for Workstation	6
49	Anti-Virus and Anti-Spam @ 5000 for 6 Workstations	6
50	Lane Software	12
51	Plaza Software	1
52	IPS - Gateway	1
53	Video Management Software	16

8 MATERIAL INVESTIGATIONS

The material investigation has been carried out to identify the potential of construction materials and to assess their general availability and properties. For improvement works, the list of materials includes the following materials.

- Granular materials for lower sub-base works
- Crushed stone aggregates for upper sub-base base surfacing and cement concrete works
- Sand for filter materials and cement concrete works, sub-base and filling material
- Borrow materials for embankment, sub-grade and filling.

The information on material sources was carried out with the following basic objectives.

- Location of sources indicating chain age and location (place)
- Access to source, indicating the direction i.e. left/right of Project Stretch, approximate lead distance from the Project Stretch and type of access road.
- The quality of material along with its results and classification

During the process of investigation, due consideration has been given to the locally available materials for reducing the cost of construction. The samples from various identified sources have been collected for laboratory testing as per IRC/MORTH Specifications.

8.1 BORROW AREA SOILS

The potentials borrow area location for sub-grade and embankment construction has been identified. Tests were performed on the samples collected from these Borrow areas for their suitability to be used in the construction of sub-grade.

The required laboratory testing was conducted as in Table 126.

S.No	Type of sample	Sampling criteria	Testing Criteria	
			Description of Test	Std code Applicable
1	Borrow Area Soil	Representative samples of various borrow area soils were collected within the reasonable lead distance	Soil Classification	IS 1498
			Sieve Analysis	IS 2720 (Part-IV)
			Atterberg Limits	IS 2720 (Part-V)
			Laboratory Compaction test	IS 2720 (Part –VIII)
			4-days soaked CBR test	IS 2720 (Part-XVI)
2	Coarse aggregate	Representative samples of various sizes of stone	Specific Gravity and Water Absorption	IS 2386 (Part-III)
3	Crushers / Quarries	Including stone dust were collected from quarries	Description of Test	Std code Application
			Aggregate impact values (AIV) Test	IS 2386 (Part-IV)
			Stripping and coating value Test	IS 6241
			Los Angeles Abrasion Value (LAV) Test	IS 2386 (Part-IV)
			Combined Flakiness and Elongation index Test	IS 2386 (Part-I)

Table 126. Site Sampling and Testing Criteria

Borrow areas soils available near the project stretch fulfil the requirement to be used for construction and all the values are within the acceptable limits as per MoRTH 5th Revision Specifications.

8.2 COARSE AGGREGATE (STONE)

Coarse aggregate samples were collected from the nearby available quarries and the required laboratory tests were carried out on the collected samples. The summary of the test results are tabulated below. The physical requirement of coarse aggregates to be adopted in road construction is also tabulated below for all pavement layers as per MoRTH 5th Revision Specifications.

S.No	Name of Stone Quarry Area	Lead Distance up to Project road	Location Direction of Crusher
1	Ambaji - Abu road	5 km at junction Ambaji - Abu road crossing	Right side of Abu road - Swaroopganj
2	Shiava mines	9 km at junction Ambaji - Abu road crossing	Right side of Ambaji – Abu road crossing
3	Near Morthala on SH-11	It is located on 6.9 km away from Abu road	6.9 km left side of Abu road - Swaroopganj
4	Near Akrahbhatta SH-11	It is located on 6.6 km away from Abu road to Swaroopganj	6.6 km right side of Abu road to Swaroopganj NH-27

Table 127.Details showing stone source and lead

AQ. No.	Source/Location	Specific Gravity	Water Absorption (%)	AIV(%)	Coating values (%)	Soundness Test (%)
1	Ambaji - Abu road	2.74	0.30	25.6	> 95%	1.95
2	Shiava mines	2.72	0.32	26.5	> 95%	2.10
3	Near Morthala	2.71	0.29	27.0	> 95%	1.96
4	Near Akrahbhatta	2.72	0.30	25.5	> 95%	2.00

Table 128. Test Results summary of Course Aggregate (stone)

S.No	Test	GSB	WMM	Pavement Layer		
				BM	DBM	BC
1	Water Absorption	2% (max)*	2% (max)	2% (max)	2% (max)	2% (max)
2	Los Angeles Abrasion Value	-	40% (max)	40% (max)	35% (max)	30% (max)
3	Aggregate Impact Value	40% (max)	30% (max)	30% (max)	27% (max)	24% (max)
4	Combined Flakiness and Elongation Index	-	35% (max)	35% (max)	35% (max)	35% (max)
5	Striping/ Coating	-	-	95% (min)	95% (min)	95% (min)

*If Water absorption value is more than 2, the aggregate is to be tested for soundness test

Table 129.MoRTH 5th Revision Specifications for Coarse Aggregate in road construction

- Aggregate Impact Value (AIV), Los Angeles Abrasion Value (LAV) and Combined Flakiness and Elongations Index Value are within the limit as per MoRTH 5th Revision Specifications to be used in granular layers and in surface layers of BC/DBM for both the sources AQ-1 and AQ-2.

- Water absorption is within the specified limit.

8.3 LOCATION MAPS

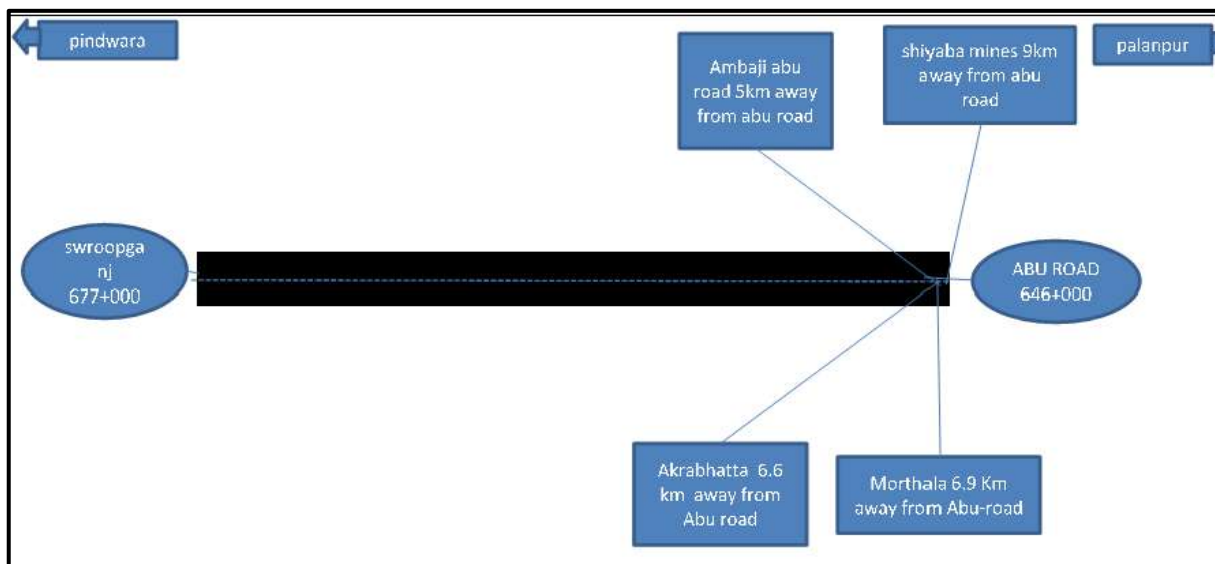


Figure 139. Lead Chart

9 COST ESTIMATE

9.1 GENERAL

The Project cost estimates have been prepared based on various items of works required such as:

- Toll Plaza Widening
- Intersections improvements
- Traffic Signs & Markings
- Service Roads/Service Lane
- Bus bays & Truck Lay Bays
- New Installation of ATMS& TMS

Provision of granular sub base and WMM base courses has been considered for the service roads, Truck lay bays, Bus bays, Toll plaza. Provision of 'bituminous courses', has been considered of DBM and Bituminous Concrete for service roads, Overlaying in carriageway, pavement for Truck Terminals, Bus bays and provision of Cement Concrete pavement for Toll plaza lanes. Repair and Rehabilitations of existing culverts, bridges & other structures is also proposed base on the NDT Tests and Inventory of the structures.

9.2 ESTIMATION OF QUANTITIES

The quantities of major items of works have been worked out based on following:

- Site Clearance: The area considered for Site Clearance is the area within the proposed Right of Way.
- Earth Works: This item provides for roadway excavation, earthwork in embankment, sub-grade and shoulders, medians, islands including disposal of surplus earth and unsuitable material. In this stage, the construction of embankment height has been taken as per site condition. Sub-grade soil having a CBR \geq 10% will be taken from borrows area.
- The pavement quantities like GSB, WMM & Bituminous items etc. have been worked out based on Typical Cross Sections, pavement design is done based on traffic and with 10% CBR.
- The estimation of quantities for Repair & Rehabilitation is based on NDT Tests and site conditions of structures and have been worked out as per site requirement in order to maintain durability of structures and natural drainage system of project area.
- Traffic Signs and Markings: Proposed as per site requirement and the quantities have been calculated as per Design Plan and IRC standard.
- The quantities for junctions, bus bays, traffic appurtenances and other miscellaneous items have been calculated from the standard drawings.
- Based on typical cross section estimates of new construction for service road/slip roads has been prepared.
- A study of the existing structures has been carried out to ascertain the structure to be retained or reconstructed. Cost of the Repairs, Rehabilitation, and up-gradation of stretches are worked out by experienced bridge engineers.

9.3 PROJECT COST

Cost estimate was made for the following proposal suggested.

1. The pavement quantities like GSB, WMM & Bituminous items etc. have been worked out based on Typical Cross Sections, pavement design for Service roads/slip roads, Truck lay bays/bus bays done based on minimum requirement of traffic MSA.
2. Proposed Base and Sub-Base and surface Courses for Service road/service lanes.

Sub-grade	GSB	WMM	DBM	BC
500 mm	200 mm	250 mm	60 mm	40 mm

Table 130. Proposed Base and Sub-Base and surface Courses for Service road/service lanes

3. Proposed Base and Sub-Base and surface Courses for Bus bays & Truck lay bays.

Sub-grade	GSB	WMM	DBM	BC
500 mm	200 mm	250 mm	80 mm	40 mm

Table 131. Proposed Base and Sub-Base and surface Courses for Bus bays & Truck lay bays

4. Proposed Bituminous Layers overlay calculation is based on MSA and FWD analysis (2018).

Description	From km	To Km	DBM 80 mm	Remarks
Total Length of overlay in both sides	660+000	671+000	5,000 m	As per FWD Analysis & MSA, the structural overlay requirement is 80 mm DBM, is recommended for overlay proposed to sustained the pavement till period of 2024.

Table 132. Proposed Overlay Thicknesses on existing lane

9.4 IMPROVEMENTS PROPOSALS

Following improvement proposals have been considered based on site requirement and Road Safety Chapter.

9.4.1 EXISTING DISTRESSED BITUMINOUS SURFACE MILLING

ProposedMillingSections				
CHAINAGE		Side	Length (m)	Thickness (mm)
FROM	TO			
646+000	677+000	LHS	31,000	Nil
646+000	677+000	RHS	31,000	Nil

Table 133. Distressed Bituminous Surface Milling

9.4.2 BITUMINOUS COURSES OVERLAY

STRETCH -1 (LHS)						
Chainage	Outer			Inner		
	Structural		M&O	Structural		M&O
	DBM	BC		DBM	BC	
646 - 660	-	-	-	-	-	-
660 - 671	80	-	-	80	-	-
671 - 677	-	-	-	-	-	-

*Additional structural requirement of DBM layer with Bituminous concrete

Table 134.Bituminous Courses Overlay in LHS

- Total Length of DBM 80 mm in LHS: 5,000 m

STRETCH -1(RHS)						
Chainages	Outer			Inner		
	Structural		M&O	Structural		M&O
	DBM	BC		DBM	BC	
646 - 677	-	-	-	-	-	-

Table 135. Bituminous Courses Overlay in RHS

- Total Length of BC30 mm in RHS: Nil

9.4.3 NEW PROPOSED TRUCK LAY BAY

S.No	Chainage (km)	Side	Improvements Required
1	656+800	LHS	Truck lay Bay
2	657+050	RHS	Truck lay Bay

Table 136. Location of proposed truck lay bay

9.4.4 NEW PROPOSED BUS BAYS

Sr. No	Chainage	Side
1	649+115	RHS

Table 137. Location of proposed Buslay bay

9.4.5 NEW PROPOSED SERVICE ROAD/SLIP LANES

S.No	Chainage (km)		Length (m)	Side	Proposed Width (m)
	From	To			
1	647+040	647+700	660	LHS	7
2	648+550	649+150	600	LHS	7
3	648+550	649+150	600	RHS	7
4	659+700	660+800	1100	RHS	7
5	666+600	667+000	400	LHS	7
6	676+400	677+000	600	LHS	7
7	676+400	677+000	600	RHS	7
Total Length (m)			4560		

Table 138. Location of proposed road/slip lane

9.4.6 SAFETY BARRIERS

- Total length of safety barrier: 11650 m.

9.4.7 SOLAR BLINKER (NEW)

- Solar blinkers are provided in accordance with RSA at Un-Authorized ramps, Junctions, Toll plaza, Bus bays/Truck lay bays.
- Total of solar blinkers provided: 116 Nos.

9.4.8 SIGNAGE (NEW) STOP / GIVE WAY, ROUTE MARKER AND JUNCTION SIGN

- Signage are provided in accordance with RSA at Junctions, Toll plaza, Bus bays/Truck lay bays, Exit & entry of service roads/service lane.

9.4.9 JUNCTION IMPROVEMENTS

Quantities of Junction improvements such as Acceleration & De-Acceleration lane and junction flaring are determined from standard drawings and in accordance with RSA.

- No. of Acceleration lanes: 14 Nos.
- No. of Deceleration lanes: 14 Nos.

9.5 METHODOLOGY

In this report estimation of preliminary cost, a primary pre-requisite for Financial evaluation, has been carried out. The process involved in the preliminary cost estimation has been described under the following sections.

9.5.1 RATE ANALYSIS

To develop a thorough understanding of the prevailing construction rates the Consultant reviewed the following:

Basic Schedule Rates 2019 as per NH Circle Udaipur (Rajasthan) has been considered for cost estimates. Following the review, some items not available in SOR, have been considered as per prevailing industry /Market rates. Cost Estimates have been escalated @5% for every year for the consecutive year 2020-21.

9.5.2 COST ABSTRACT

Initial Cost for Engineering and Safety Improvements for Base year 2020-21:

Abu road - Swaroopganj Section (from km 646+000 to km 677+000) of NH-27 in the State of Rajasthan (Based on BSR 2019-20 Udaipur Circle)			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	BT Works	53264145	5.33
2	Toll Plaza	52830702	5.28
3	Intersections Improvements	30730107	3.07
4	Miscellaneous Items	124939563	12.49
5	Service Roads/Service Lanes	81502562	8.15

6	Bus/ Truck Lay Bays	8035550	0.80
7	Culvert	8245442	0.82
9	ATMS & TMS	149577258	14.96
	Total	509125330	50.91
	Escalation @ 5% per Annum for 1 year	25456266	
	Total Amount with Escalation =	534581596	
	Contingency Charges @ 5.0 %	26729080	
	Total Amount	561310676	56.13

Table 139. Abstract of Estimated Initial costs

Operation and Maintenance Cost for Base year 2020-2021:

The Project Operation and Maintenance cost estimates have been prepared based on various circulars and analysis:

FOR ROUTINE MAINTENANCE WORKS:

- Routine Maintenance for BT works at MCW consider as @ 7lacs/km/year for 2010-2011 (add escalation @5% per year from 2010-2011 to 2020-2021 $7 \times 1.05^{10} = 11.40$ lacs/km/year) circular NHAI/11033/CGM(Fin)/2011
- Routine Maintenance for BT works at Service/Slip roads consider as 60% of @ 7lacs/km/year for 2010-2011
- Equipment Based Survey Works (Annual/Periodic as per Maintenance Schedule) based on market rate
- Contingency @ 3 %
- Toll Plaza operation and maintenance charges @ 32.5 lacs/lane/year
- System Integrator maintenance charges @ 5.04 lacs/lane/year
- Electricity & Patrolling expenses @ 2.03 lacs/km/year
- Additional RPV(Route patrolling vehicle) for state police department and Ambulance services for state government health authority to be provided
- The ATMS systems shall cover design, supply, installation, commissioning and operation and maintenance including charges for electricity to be provided
- SPV charges or Other Office expenses @ 407 lacs/year
- Insurance cost
- And GST @ 12% on all above item has been added in total Operation and Maintenance cost

FOR PERIODIC MAINTENANCE WORKS:

- Periodic maintenance works for main carriageway and service road is proposed as per MoRTH circular (RW/NH-33044/10/2022-S&R dated 21-August-2018)
- Periodic renewal is proposed at every 6th year after completion of existing annuity period i.e 2024. For Main carriageway 40mm BC and for Service/Slip roads/bus bays/ truck lay bay/junction etc. 30mm BC is proposed for every successive renewal period.

Total Operation and Maintenance cost for (30 Years)	
Particular	Str-1
Routine Maintenance	108.09
Toll Plaza Operation and Maintenance	151.37
Electricity & Patrolling expenses	43.18
Other office expenses	132.35
Insurance	24.38
GST @ 12%	55.12
Total Routine Maintenance cost	514.48
Major Maintenance :- (Cycles)	
2029-2030	29.51
2035-2036	29.51
2041-2042	32.34
Construction Period (2044-2046) DLP Period 5 years (2046-2051)	-

Table 139. Abstract of Operation and Maintenance costs

All cost are mentioned in this report are based on year 2020. And the cost for Major Maintenance Work/Routine maintenance and Operational maintenance works would be escalated for their consecutive appearance years on the basis of Price index.

Capacity Augmentation Cost: Based on Year 2020-21:

Abu road - Swaroopganj Section (from km 646.000 to km 677.00) of NH-27 in the State of Rajasthan)			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
1	Bituminous Courses Overlay	391019244.00	39.10
2	Clearing and Grubbing	26445.53	0.003
3	Road Widening 4 Lane to 6 Lane	1097068992.40	109.71
4	Widening of Structure	291130620.00	29.11
5	Repair & Rehabilitation of Existing Structure	12802665.07	1.28
6	Toll Plaza	36126275.08	3.61
7	Intersections Improvements	147885716.59	14.79
8	Miscellaneous Items	401825005.10	40.18
9	Service Roads	74712537.44	7.47
10	Structure Approaches	377598921.27	37.76

Abu road - Swaroopganj Section (from km 646.000 to km 677.00) of NH-27 in the State of Rajasthan)			
ABSTRACT			
Sr no.	Particulars	Amount in Rs.	Amount in Crores
11	Bus/ Truck Lay Bays	39096321.83	3.91
12	Drain	118061579.86	11.81
13	Landscaping and Tree Plantation	4609589.00	0.46
14	ATMS & TMS	275827853.91	27.58
	Total	3267791767.08	326.78
	Escalation @ 5% per Annum for 1 year	163389588.35	
	Total Amount	3431181355.43	343.12
	Cost for Capacity Augmentation	3431181355	343.12

Table 140. Abstract of costs Capacity Augmentation

Base year is considered as 2020, all rate and estimates for improvement proposal are escalated @5% for every year. All cost are mentioned in this report are based on year 2020 which is escalated @5% for every year from 2019-2020. Also the cost for Capacity Augmentation and Major Maintenance Work would be escalated for their consecutive appearance years on the basis of Price index.

10 COMPLEMENTARY DATA

10.1 TOPOGRAPHIC SURVEY

10.1.1 MOBILE LIDAR TECHNOLOGY

10.1.1.1 INTRODUCTION

The basic objective of the topographic survey would be to capture the essential ground features along the alignment in order to consider improvements and for working out improvements and rehabilitation costs. The detailed topographic surveys should normally be taken up after the completion of reconnaissance surveys.

The following are the set of deliverables which should be submitted after completion of survey:

- Raw DGPS data for the entire highway length and adjoining areas of interest
- Point cloud data/Data of points captured for the entire highway length and adjoining areas of interest
- Topographic map of scale 1:1000 of the entire highway length and adjoining areas of interest
- Contour map of 50 cm of entire highway length and adjoining areas of interest
- Cross section of the highway at every 100 m in *.dwg format.

For land based surveys, Network Survey Vehicle/ Mobile LiDAR (Light Detection and Ranging) shall be adopted.

The detailed field surveys would essentially include the following activities:

- Topographic Surveys along the Existing Right of Way (ROW): Carrying out topographic survey using LiDAR or equivalent technology along the existing road, wherever required and properly referencing the same with reference pillars fixed on either side of the centre-line at safe places within the ROW.
- Collection/ Extraction of details for all features such as structures (bridges, culverts etc.) utilities, existing roads, electric and telephone installations (both O/H as well as underground), huts, buildings, fencing and trees (with girth greater than 0.3metre) oil and gas lines etc. falling within the extent of survey.

The width of the survey corridor should take into account the layout of the existing alignment including the extent of embankment and cut slopes and the general ground profile. While carrying out the field surveys, the topographic surveys should cover sufficient width beyond the centre line of the carriageway. Normally the surveys should extend a minimum of 30 m beyond either side of the centre line of the carriageway or land boundary whichever is more.

10.1.1.2 LIDAR TECHNOLOGY OVERVIEW

LiDAR (Light Detection and Ranging) is a new survey technique which has the advantage of collecting the survey data at very high rate and getting a 3D point cloud of the area being mapped. It has wide ranging applications in 3D mapping, robotics, autonomous vehicles, infrastructure planning and monitoring, mining etc. This document briefly reviews the methodology and steps to be conducted for LiDAR Survey.

10.1.1.3 WORKS METHODOLOGY

In addition to LiDAR data, most highway projects in India also require establishing Primary Ground Control Points. GPS is used to establish primary control points at an interval of approximately 5 km.

The data collected using these is processed and checked for errors if they are within acceptable limits. The error is adjusted so that it does not propagate in the long route. These control points also serve as check points to assess the accuracy of LiDAR data.

The data collected on the site have to be processed in order to get the accurate georeferenced coordinates by combining various data obtained through LiDAR, IMU and GPS sensors. There no standard software for this. Every LiDAR manufacturer creates its own software for creating the point cloud. The result is a dense point cloud. This point cloud is adjusted with TBMs to get best accuracy levels.

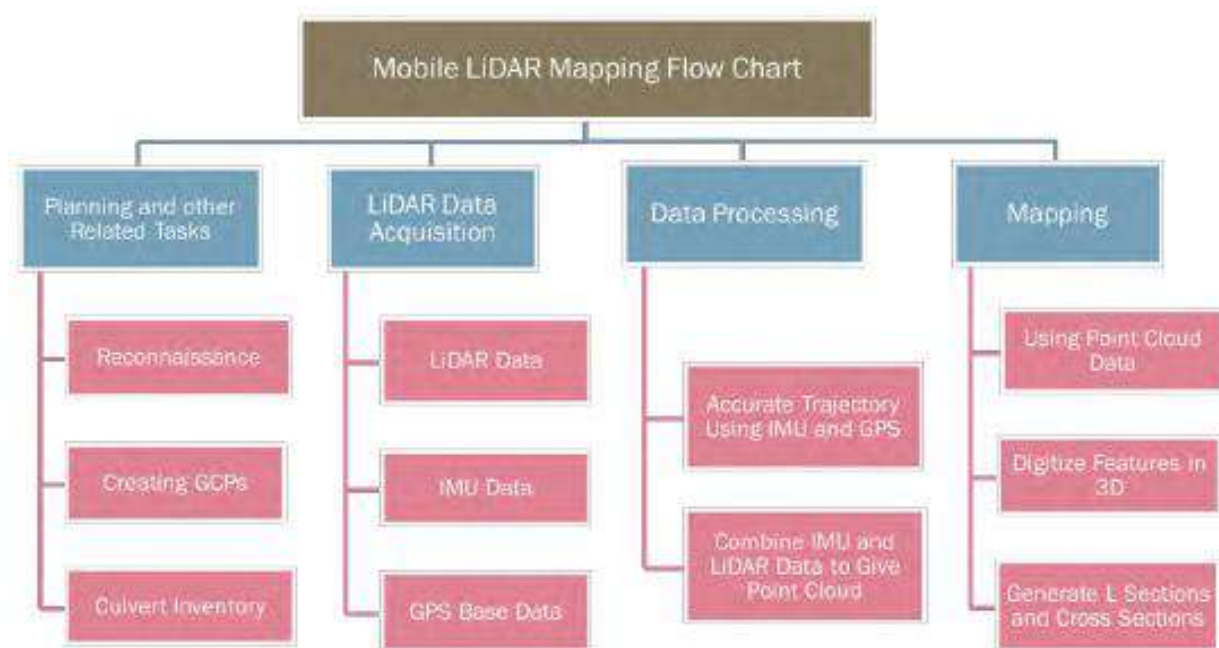


Figure 140. Mobile LiDAR mapping Flow Chart

10.1.1.4 EQUIPMENT

In this kind of survey, the LiDAR equipment is mounted on top of a vehicle along with Inertial Measurement Unit (IMU) and GPS. The data is collected on the go and generally about 100 KM of data can be collected in a day depending upon the terrain conditions.

There are two major components of a mobile LiDAR scanner: LiDAR and Inertial Measurement Unit (IMU). A standard picture of the mobile scanner is given in Fig 1; IMU further consist of Inertial Navigation System (INS) and GNSS receivers. GNSS provides location of the sensor on the surface of the earth using signals from satellites.



Figure 141. Equipment

Depending upon the quality of the GNSS receiver (single or dual frequency), the location accuracy can vary from 2 cm to a few meter even under visible sky.

More than often, road survey projects involve surveying through dense canopy of trees. Here a standalone GNSS systems performs poorly due to limited visibility of the satellites. Here, Inertial Navigation System, consisting of Gyroscopes and accelerometers, enables users to get quality location data. Standard software like Inertial Explorer from Novatel is used to fuse GNSS data with inertial data.

In addition to these equipment, a static GPS is also placed on a fixed control point within suitable range of the survey area to provide more accuracy when processed with vehicle mounted GPS data. This technique is called differential-GNSS. To ensure better accuracy, GNSS data is collected in good sky visibility during the LiDAR survey work. This data is then used to correct the error in the positioning.

Laser scanner used in the LiDAR system also varies quite a lot. Major differentiating factors are range and measurements per second. Industry standards are Z+F, Riegl, Velodyne, Quanergy etc. All of these have a line of sight range of 100m or more. Scanning speeds range from 500,000 points per second to 10,00,000 per second. All of these sensors are better than 1 cm at 100 m range.

10.1.1.5 DATA COLLECTION AND ANALYSIS OF DATA

Mobile mapping is the process of collecting geospatial data from a mobile vehicle. Typically fitted with a LiDAR remote sensing systems, such systems are composed of an integrated array of time synchronized navigation sensors (survey grade DGPS) and imaging sensors mounted on a mobile platform. Primary output after pre-processing of data includes geo-referenced 3D point cloud data, digital maps, images and videos. Further, after postprocessing, output in desired format like AutoCAD*.dwg or Arc GIS*.shp files are obtained.

After the LiDAR data is processed, it is used to classify features. All the desired features are identified and classified using standard software such as Bentley Microstation. A topographic map alongwith contours can be provided in CAD format. L section and cross sections can also be generated using LiDAR data as required by the client.

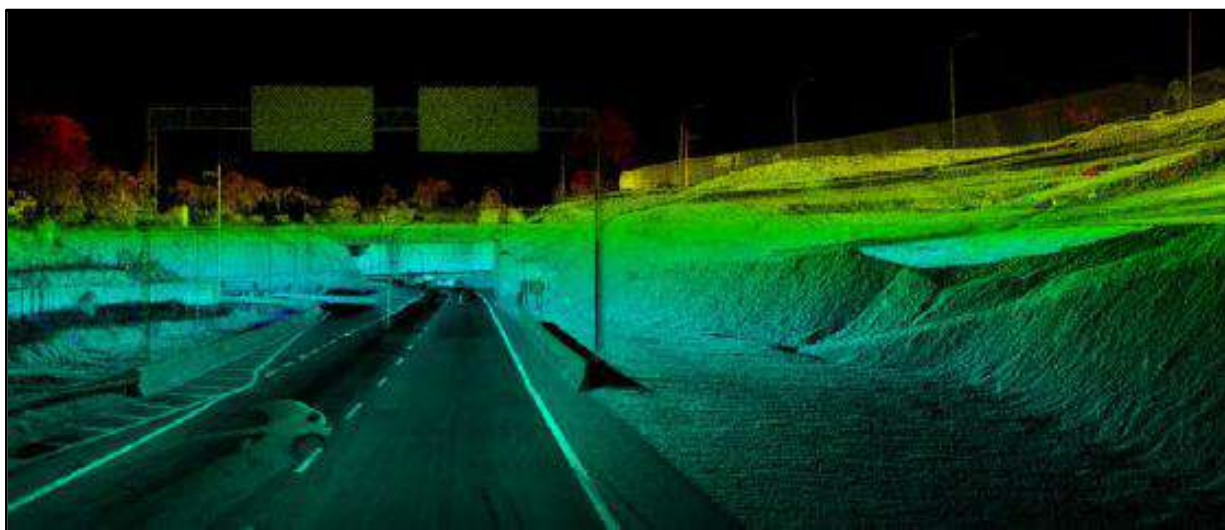


Figure 142. LiDAR point cloud sample – colors by height

10.1.1.6 GENERAL DELIVERIES

- Detailed Topographical Map of total ROW minimum 60m, i.e. 30 m on either side of the road centerline with standard feature mapping
- Cross Section at every 10 m along the centerline and L-section every 10 m in AutoCAD format.
- Contour map at 50 cm contour interval.
360 degree panoramic images of the entire highway length and adjoining areas of interest shall be submitted.
- 3D drawings in CAD format with lines features as 3D polyline.

10.1.2 AERIAL DRONE VIDEOGRAPHY

It has been carried out a High Definition video captured by drone as per ToR requirements. The work flow to be followed has been:

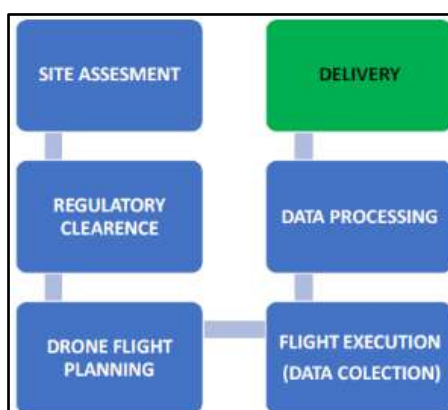


Figure 143. Flow chart drone

10.1.2.1 SITE ASSESSMENT

The Drone Agency will undertake a preliminary site assessment in each stretch to understand the environment where have to operate its drone. The objectives of the site-visit are to:

- Understand the topography, weather conditions, and general environment in which the land-survey needs to be undertaken.
- Know obstructions and hazards posed by natural or man-made structures for drones to fly in the survey area.
- Plan for contingency measures to deal with the hazards.
- Gather inputs for detailed flight planning of the drone taking into consideration the topography, weather conditions, general environment, obstructions, and hazards.
- Determine the logistical needs, and time-frame required for conducting the video recording in the roads.
- Plan the project execution from start to finish accurately so as to meet the customer's timeframe without delays
- Collect the X-Y/Lat-Long co-ordinates of start and end points, ascertain whether additional inputs or work is required to be done.



Figure 144. Sample of Software of Flight Planification

10.1.2.2 DRONE FLIGHT PLANNING

Drone Agency will make use of the detailed requirements defined by ToR, along with the information gathered from the site assessment to create the drone flight plan. The flight plan defines how, when and where the drone will fly and what data will be gathered by the drone in the process of surveying the land.

10.1.2.3 DATA COLLECTION AND TRANSFER

On site operations will involve data collection on board the drone. Transfer of data for presentation and analysis will be done as and when data connectivity is available to the onsite team.

10.1.2.4 DATA PROCESSING AND DELIVERY

The data collected by the drone will be processed to generate the HD Video as per ToR. Each road will be delivered in a separated file and a sheet of data of the flight and road recorded. This sheet will includes: drone characteristics (controlling unit, processing unit ...), camera used (Lents ...), GPS (if any), planning software, processing software and height of flight.

ANNEXURES– A (SURVEY YEAR 2018)

- ▣ ANNEXURE 1 NSV EQUIPMENT
- ▣ ANNEXURE 2 PAVEMENT MATERIAL INVESTIGATION
- ▣ ANNEXURE 3 LABORATORY INVESTIGATION
- ▣ ANNEXURE 4 DEFLECTIONS
- ▣ ANNEXURE 5 IRI AND RUT RESULTS
- ▣ ANNEXURE 6 HDM-4 RESULTS
- ▣ ANNEXURE 7 AAHSTO-HDM CALCULATIONS RESULTS
- ▣ ANNEXURE 8 STRUCTURES
- ▣ ANNEXURE 9 NDT RESULTS
- ▣ ANNEXURE 10 TRAFFIC PROJECTIONS
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ANNEXURES – B (DATA PROVIDED BY AUTHORITY)

ANNEXURES – C TRAFFIC DATA & COST ESTIMATES (YEAR 2020)

- ▣ ANNEXURE 1 TRAFFIC PROJECTIONS
- ▣ ANNEXURE 2 OPERATION AND MAINTANANCE COST
- ▣ ANNEXURE 3 INITIAL IMPROVEMENT COST



■ QUALITY CONTROLSHEET

DOCUMENT	Technical Due Diligence Report of NH27 (NH14) Abu road - Swaroopganj (Stretch1).				
PROJECT	Preparation of report on physical condition of the National Highways on Roads Asset Under (InvIT) model				
CODE	IM4663-FR-STRETCH_1-Ed1 (Annexures-A)				
AUTHOR	INITIALS	RFS			
	DATE	2/07/2018			
VERIFIED	INITIALS	GAA			
	DATE	2/07/2018			
RECIPIENT	National Highways Authority of India				
NOTES					

ANNEXURES

- ▣ ANNEXURE 1 NSV EQUIPMENT
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- ▣ ANNEXURE 12 STRIP PLAN & KILOMETRIC REFERENCE



ANNEXURE 1 NSV EQUIPMENT

1. NSV DATA

1.1. COMPONENTS OF THE SYSTEM

1.1.1. EXTERIOR GPS VISION SYSTEM

The GPS Vision system consists of a high grade Differential Global Positioning System (DGPS), Rocket grade Inertial Measurement Unit (IMU), sub centimeter Distance Measuring Instrument (DMI), six 1600 x 1200 optical cameras mounted in stereo pairs viewing forward front, left and right, a house front camera, two optical to infrared downward pavement facing cameras. Two sets of line lasers mounted behind the rear wheels projecting to rear of vehicle and point lasers in the wheel path projecting down and several computers and mass storage devices and user interface system.



Figure 1 GPS visionsystem



Figure 2 GPS vision system components

The high resolution stereo cameras are mounted within their in secure, climate controlled and waterproof pods and the pods are affixed to the roof rack. Wider camera positions are possible outside the width of the interior of the survey vehicle providing a longer base distance between the stereo pairs which adds to the exceptional accuracy of the GPS Vision system. The roof rack is permanently marked for consistent alignment without the risk of bumping or interference that can occur with cameras mounted inside the vehicle. Positioning the cameras on top of the vehicle also creates an excellent viewing height to see both the roadway in front of the vehicle and see over adjacent vehicles. In addition the same perspective is maintained throughout the project without the image and accuracy degradation that can occur from viewing through curved, tempered and possibly tinted auto windshield glass. As stated previously the standard GPS Vision system consists of 1600x1200 optical cameras mounted in a stereo pair forward front, two optical infrared downward pavement facing cameras.

Images will be collected at a camera (CCD) resolution of 1600x 1200 pixels (approximately 2 megapixels) as captured and in 3D point of view essentially doubles those megapixel resolutions as an overlapped or interlaced view.

1.1.2. INTERIOR GPS VISIONSYSTEM

The GPS Vision Systems TM is integrated with GPS/INS solutions for accurate positioning of mobile mapping data. The integrated GPS/INS solution produces continuous, smooth position and orientation of the GPS Vision™ data. The system has the capability to provide accurate positional data for several minutes even when the GPS signals are lost due to obstructions such as bridges, trees, tunnels or high-rise buildings.

The GPS Vision Distance Measure Instrument (DMI) is integrated with the GPS/INS system and used to provide distance pulses and velocity to the various data collection modules. Information from the DMI is used in one of two methods; the first is for distanced based data where data is collected at a set distance intervals and the second for time based systems that require the distance or speed information associatedwiththedatacapturedatthedefinedtimeinterval.TheDMIconsistsofanencodertracking

revolution of the vehicle tire. The DMI is very accurate meeting the requirements of ASTM E-950, 0.02% of the distance traveled, and California Test Method 1001-S, 1 foot in 528 feet. The images below represent examples of typical vehicle equipment configurations.



Figure 3 NSV Control Systems and DataStorage

1.1.3. GPS VISIONLASERSCAN™

The GPS Vision Laser Scan™ system consists of:

- Downward facing Point lasers - for a wheel path IRI assessment of the road surface.
- Downward facing infrared cameras - for a hi-resolution view of the road lane surface profile. The images area combined to give a 4m wide continuous pavement view. This is used both for crack detection and cross lane profiling.
- Line projecting lasers –Through the Laser Scan™ software, pavement rutting and cross profiles are automatically measured to sub-centimeter accuracy.
- Laser gauges – these are mounted in the wheel path and take >1kHz measurements of the road surface to <0.05mm resolution. This allows us to exceed ASTM E950 recommendations for a class 1 longitudinal profiler for a wheel path at up to highway speeds.
- 4-axis accelerometers – these are mounted directly above each laser gauge. They provide an inertial basis for the Laser Scan™ system.

GPS Vision™ Imaging system integration – the Laser Scan™ system incorporates measurements from the wheel counters, GPS, and INS and imaging systems on the vehicle to provide precise distance and location readings for developing a complete 3D model of the roadway.

1.1.4. DISTANCE MEASUREMENT INDICATOR (DM)

A Distance Measurement Indicator (DMI) is used to aid in the GPS/INS positioning solution and used to measure the distance (log mile) and trigger image sets at a predetermined image distance. GPS Vision system uses a proprietary Kalman algorithm that calibrates the DMI automatically in post processing. Our DMI is typically configured for 4000 counts per wheel revolution or less than 1 mm accuracy. The DMI needs to be checked and calibrated prior to each project and the system checks that the spacing is meeting the required length automatically with each image to keep the image distance correct. In a similar

procedure the GPS satellites and inertial measurements are automatically checked and validated and any out of bounds readings turn red to the operator.

Camera lens calibration includes and internal software adjustment to account for lens distortions. The initial calibration of the lens to the camera and the cameras to one another is part of the overall system design and quality control and is performed when a system is commissioned. The camera settings are generated by the program parameters at the end of a system build and checked at the start of every survey or every 3 months whichever is sooner. Periodic calibration checks may be performed during defined routine maintenance inspections. Therefore, standard field procedures do not require adjustment of the physical equipment.

1.1.5. BASESTATION

We generally use a base station for our surveys to maintain better data reliability. A base station antenna is set in an open area, so that the GPS data is as complete and accurate as possible. If surveying for multiple days within a certain area, the antenna is located in the same position each day, thereby assuring consistency of the local GPS data.

1.2. FEATURES OF GPS VISIONSYSTEM

The components of GPS Vision System contribute to the following features:

- The external hardware is interfaced with a central data logger unit which stores the collected location, image and laser data for transfer to processing software. This systems is integrated with Inertial Navigation System (having pitch and roll accuracy of <0.4 degrees, Acceleration Input Range ± 4 g or ± 10 g), a differentially corrected Global Positioning system (GPS) and a Distance Measuring Instrument (DMI) for highly accurate vehicle positioning.
- Laser profilometers utilizes a class I profiler to collect roughness measurements in the form of the International Roughness Index (IRI). This system utilizes data from point lasers and accelerometers to output IRI at most posted speeds.
- Transverse profile of the pavement surface is generated based on the actual rut depth when compared to the pavement surface level outside the wheel path. The central data logger captures the transvers profile data for decoding into the profile and rutting measurements of the roadway.
- Rutting profile of the pavement surface is generated using two line laser mounted at each wheel path and two thermal cameras mounted at the roof of the vehicle over each wheel path laser enclosure to capture full lane rutting profile. The system can detect the overall rut profile and the maximum depth even with the vehicle deviating slightly from the wheel path.
- Cross Profile Straight Edge is used for quality control checks of the Transverse profile. GPS Vision uses this method to calibrate the continuous cross profile and can provide the transvers profile view in the image at each summary reading at multiple locations during an actual project.
- 3D profiles of the road are provided by stereo pair cameras which will be similar to the view that is required by the Pavement Condition Index (PCI) survey methodology. The images provide measurements of not only any cracks or pavement distresses but also the location and vital measurements of any right of way object that is in the image view.
- Pavement right of way image logs are captured which are geometrically correct to quickly locate and measure any roadway feature and extract that data for further plotting on maps or to populate databases. The Stereo pair images are very similar to how the operator sees the world and it is intuitive to use to capture road right of way information user friendly way to virtual visit the roadway and make measurements from the computer which is beneficial than only viewing the video based images.

- Road geometry measurement is done using built-in high resolution Inertial Navigation System to calculate the radius of curvature, cross-fall and etc.
- A GPS system with a ± 1 cm + 2 ppm Horizontal accuracy and ± 2 cm + 2 ppm Vertical accuracy of the vehicle location is utilized. GPS Vision is also integrated with a GPS Base Station to provide differential correction to the rover unit. The GPS is tightly integrated with the inertial navigation system and distance measuring system using the Kalman filter to calculate the position. When the proper numbers of satellites are not available this system is able to operate on the INS for up to 5 minutes.
- Inventory and rating for pavement condition and right of way asset data are done using manual visual input through the keyboard. The number of keys available to the vehicle system operator is programmable.
- Calibration for roughness meter is done using on known pavement sections where the profile ground truth is measured with a ASTM Class 1 and World Bank Standard Class 1 profiler. This reference pavement profile and the mobile IRI point laser are compared. Adjustments to the point laser are made to better correlate with the test section.
- The system has a built-in Distance Measuring Instrument (DMI) with less than 1 mm accuracy. The DMI is tightly integrated with the GPS and INS through a Kalman filter.
- The data acquisition software has a spatial data viewing feature to plan the survey and monitor the cameras and lasers during the survey. Feature logger includes image processing options which are used to define the attributes of the roadways collected and apply changes in brightness, color saturation to the real-time captured images for optimum viewing. The software stores the location data and images in a structured way based on the planned survey routes.
- GPS Vision System has desktop based software for extracting distresses and road right of way features (in the form of spatial features - point, line and polygon) and their related attribute data from the stereo-pair images captured during the survey. The extracted spatial features and their attributes are easily exportable in GIS format and any standardized RDBMS format.

1.3. PAVEMENT CONDITION AND RIGHT OF WAY DATA COLLECTION

The data collection process will involve following activities to ensure collection of accurate and quality data during the survey

- Field data collection personnel preparedness: The driving routine plan will be provided to the dedicated personnel for optimal viewing and consistent pattern driving on the roadway. The maps and support materials are check and verified
- Field data collection equipment preparation: Prior to field data collection, the GPS Vision system will be set up for optimum viewing and data collection efficiency based on data collection features desired. This calibration camera setting will be tested the day before safe operation and that all equipment is well maintained and in working order.
- Data collection procedure: During data collection, one driver and one navigator will operate the GPS Vision system following the project and safety procedures. The procedure will capture high resolution stereo-pair images to record the road distresses and right of way features. The point and line laser assembly along with high-end infrared cameras will record the transverse and longitudinal profile of the road for roughness, rutting and etc. One of the critical procedures is the automated image quality tools that provide a “dashboard” view of the actual images during the field survey. These are monitored during the entire data collection schedule. The broadcast GPS locations and rates will check for operation and monitored throughout the drive. Our staff will also establish and setup GPS base station throughout the project according to the established drive pattern in pre-

designated open areas established by the project manager. The use of both of these correction procedures is critical for the most accurate differentially correct data.

Highlights of the data collection process:

- The GPS Vision system will collect imagery per lane in both directions.
- The images will be captured at a user defined interval along the roadway. This will ensure that all features along the roadway will have good coverage and can be extracted accurately from images. This is especially important for roads with two or three lanes in one driving directions.
- High-resolution (1380 x 1024, 1600 x 1200 possible) cameras will be used to capture detailed images of the roadways.
- At the end of each data collection day, digital image data will be reviewed for quality, GPS data is checked for sufficient coverage from the base station and data is processed to check the completeness.
- Before the data collection is finished, all data will be compared with the required highways to make sure all required roads have valid data.
- The data will be combined and edited to clean overlaps or extra sections. The roadway information will be attached to image point data. Digital images will be reorganized based on their roadway attribute, like name.
- The attributed image point data will then serve as the database for web-based viewer software and can be accessed as driving down a specified street from its beginning to its end.
- Images will be included in ICARORMS.
- Field data collection QC: At the end of each day, collected data are processed and images are reviewed. The processed data will be compared with the planned road to see if any road is missing.

1.3.1. FEATURE EXTRACTION PROCESS METHODOLOGY

The images collected by GPS Vision system are used to obtain International Roughness Index (IRI), Pavement Condition Index (PCI) and other asset data of the road. These images organized based on the survey planned will be used in desktop based feature extraction software for extracting road distresses and right of way features and its attributes and storing them in industry standard RDBMS.

1.3.2. ROAD DISTRESS FEATURE EXTRACTION

The distresses on the roads will be identified and captured in a virtual environment through viewing of stereo-pair high resolution images.

Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1)
Annexure NSV



Figure 4 Snapshot of feature extraction software window



Figure 5 Snapshot of feature extraction software window



Figure 6. Snapshot of feature extraction of potholes

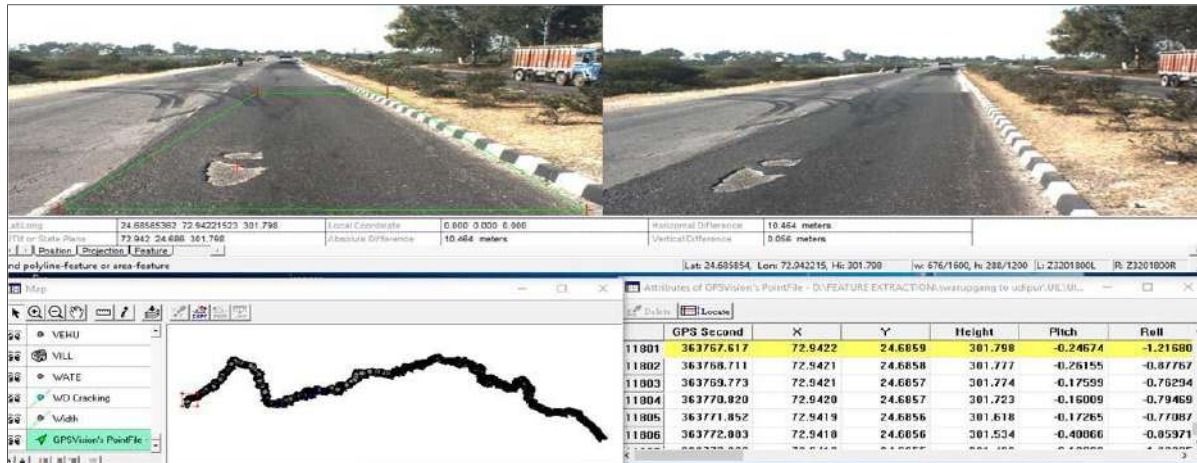


Figure 7. Snapshot of feature extraction of potholes

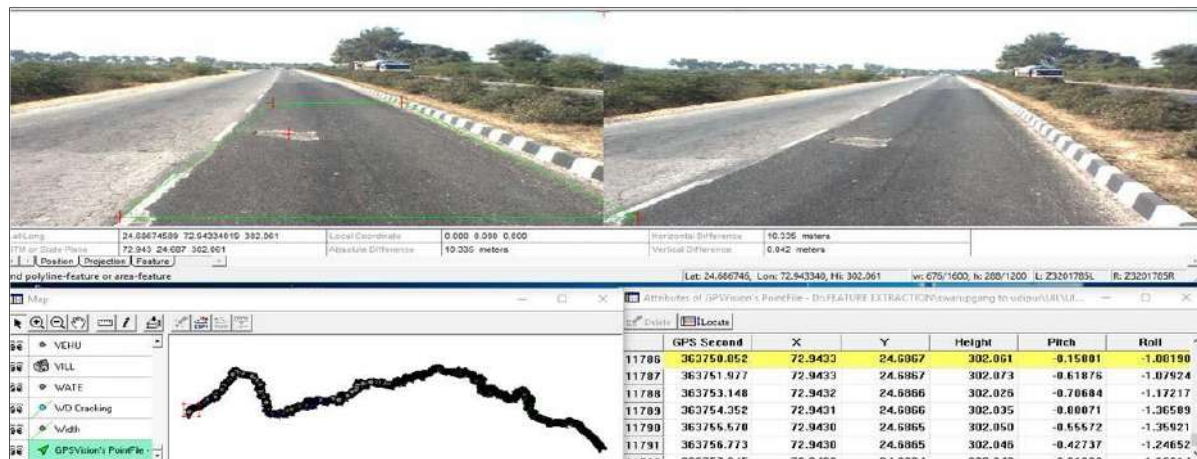


Figure 8. Snapshot of feature extraction of potholes



Figure 9. Snapshot of feature extraction of cracking

Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1)
Annexure NSV



Figure 10. Snapshot of feature extraction of cracking



Figure 11. Snapshot of feature extraction of cracking



Figure 12. Snapshot of feature extraction of wide cracking

Annexure NSV

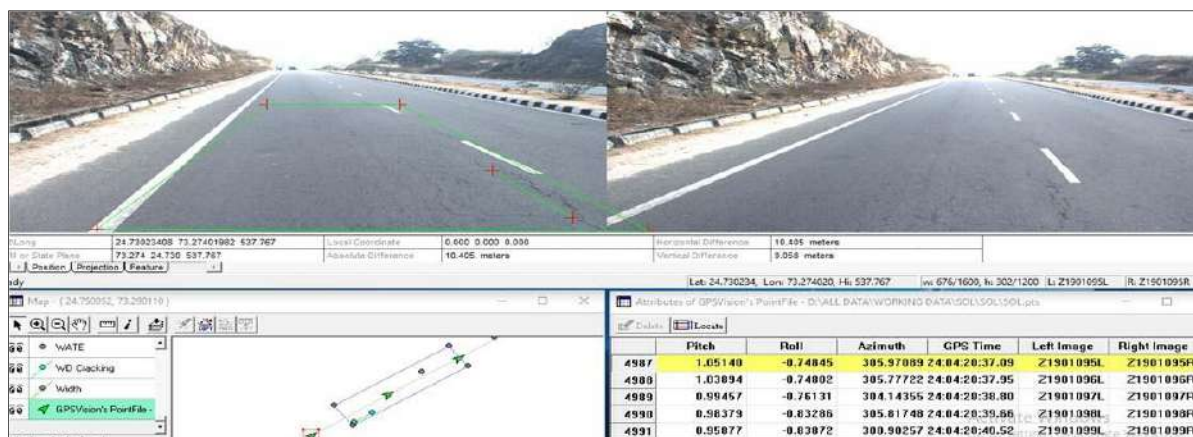


Figure 13. Snapshot of feature extraction of widecracking



Figure 14. Snapshot of feature extraction of widecracking

The images of the pavement captured are used to identify sample units. Multiple sample units are marked along the road and each sample unit are recorded with road distresses based on the surface type i.e., Asphalt, PCC and etc.

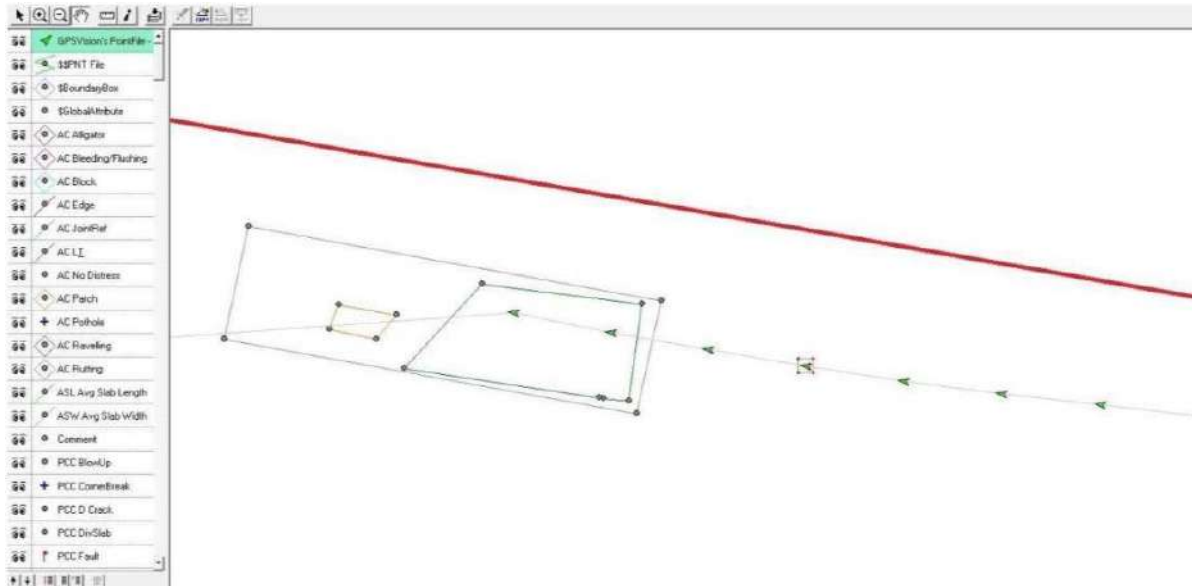


Figure 15 Window showing simple unit

The type and severity of pavement distress is assessed by visualizing the processed digital image in the feature extraction software and then marking the distresses in the sample unit.

The distress data are used to calculate the PCI for each sample unit using ASTM methodology. The PCI of the pavement section is determined based on the PCI of the inspected sample units within the section.

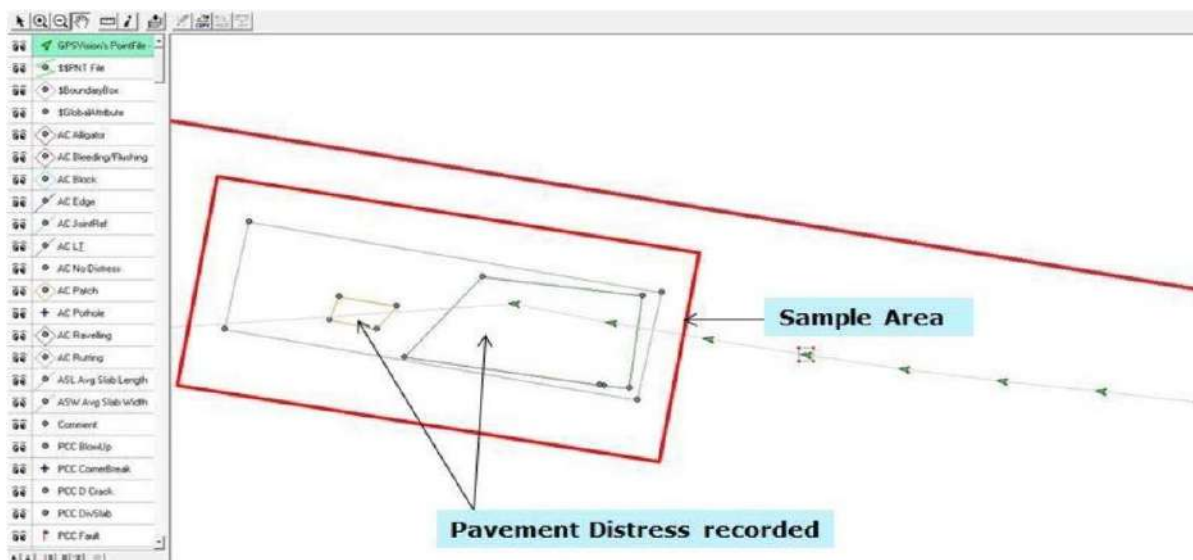


Figure 16 Snapshot showing captured simple units and recorded distresses

The data obtained from Lasers along the transverse and longitudinal profiles will be used to generate IRI and rutting.

The PCI and IRI rating for the roads will be done based on the required standards of road condition.

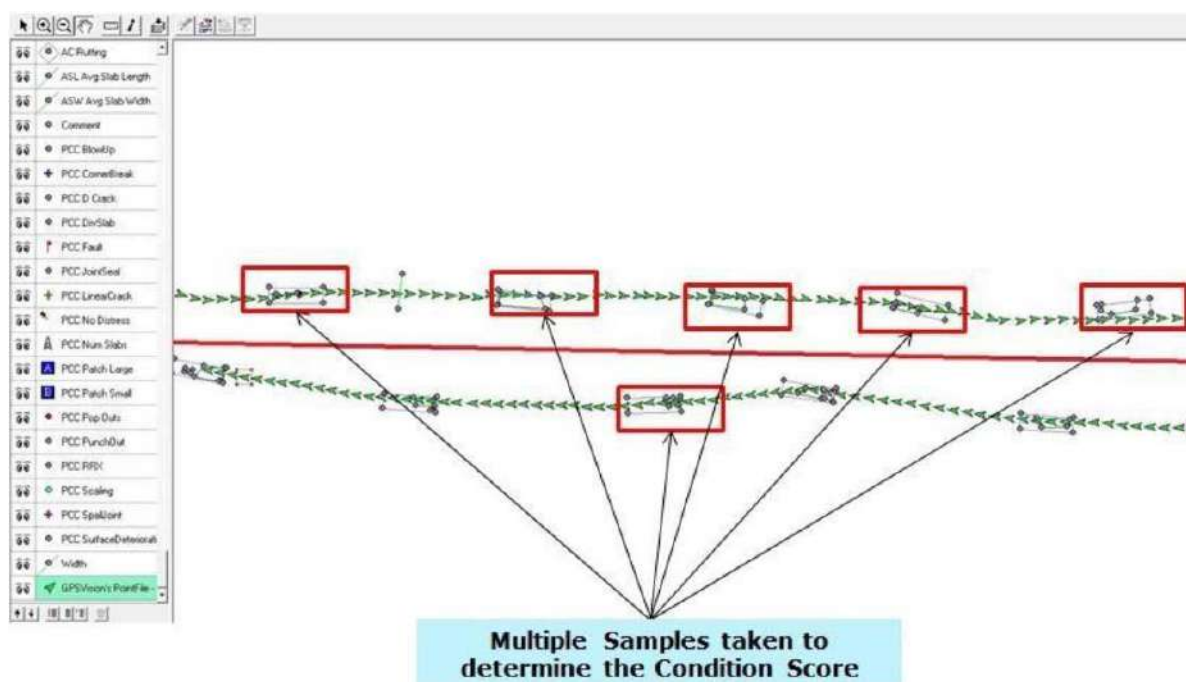


Figure 17 Window showing multiplesamples

1.3.3. ROAD RIGHT OF WAY FEATUREEXTRACTION

As in the road distress feature extraction process stereo pair images will be used in feature extraction software to extract right of way inventory.

As shown below, any element that is identified from the images can be extracted within the software. Additionally, when the element is located a record table is associated with each feature location which allows the user to populate the attribute database on the fly. Feature extraction will be done by simply clicking on the image itself to capture all relevant GIS, GPS and attribute data. Each feature could be assigned a separate symbol based on its type.

This process of inventory is repeated for all items on the inventory list that can be developed for the client. A final list of features to be inventoried and positioned along the right of way can be discussed and finalized with the client.

After the feature extraction process is completed, the output files including centerlines and related inventory feature data can be formatted to match specifications in a number of GIS and CAD systems.

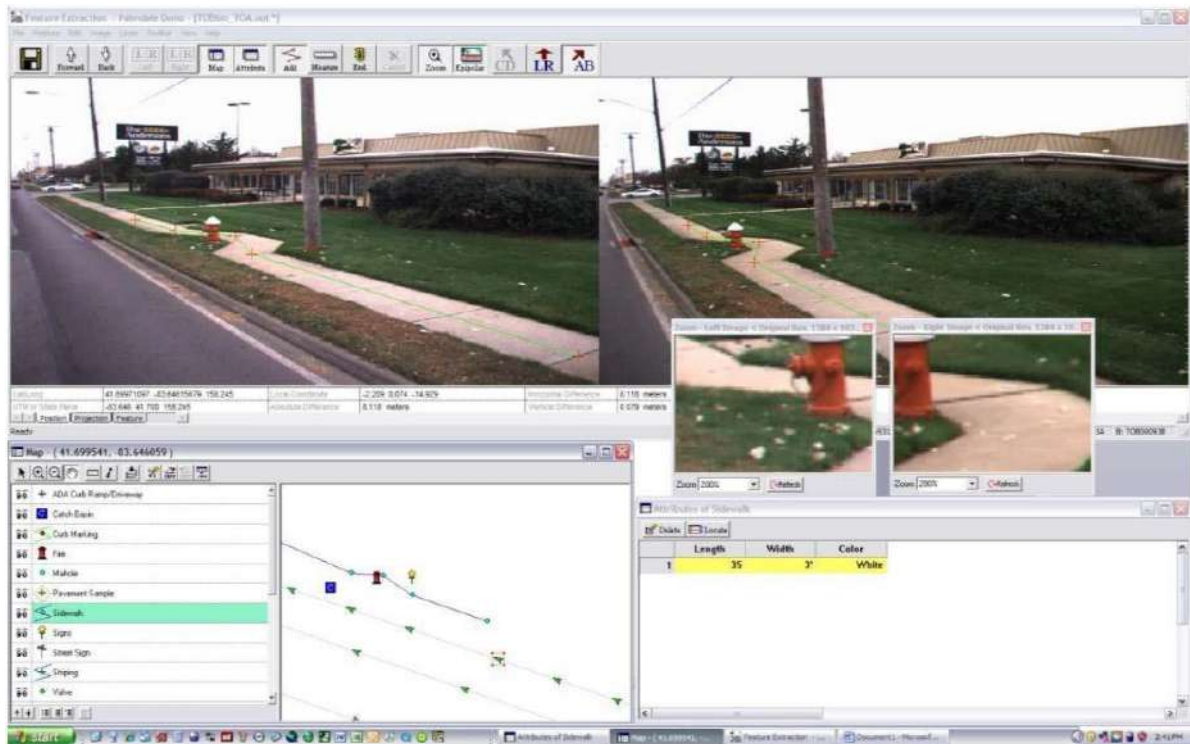


Figure 18 Snapshot showing extraction of Right of Way features

1.3.4. TYPE OF FEATURES EXTRACTED

The Feature Extraction software captures various types of features which are broadly categorized into road distresses and road right of way features.

1.3.4.1. FOR PAVEMENT CONDITION

The feature extraction software extracts pavement condition data such as distress features, its quantity and severity based on the surface type i.e., asphalt or PCC. The distress list for each surface type is as per the IRC or per ASTM defined distresses for each of the surface types, according to NHAI requirements.

1.3.4.2. FOR PAVEMENT RIGHT OF WAY

The extraction of pavement right-of-way data can be for the following, but not limited to, asset and its sub-types. The software can extract any right of way asset visible in the images based on the following.

- Affected service
- Bypass
- Carriageway
- Culvert (asset inventory included in further section)
- Delineator post
- Embankment
- Flyover
- Fuel station

- Guardpost
- Guidepost
- Hectometrestone
- High mastlights
- Junction
- Kilometrestone
- Landuse
- Linedrain
- Longitudinal roadmarking
- Major bridge (asset inventory included in furthersection)
- Medianopening
- Median
- Minor Bridge (asset inventory included in furthersection)
- Pedestrian cattleunderpass
- Pedestrianguardrail
- Punctual roadmarking
- Retainingstructure
- Right ofway
- Roadsidearboriculture
- Safetybarrier
- Shoulder
- Sign
- Slip-Serviceroad
- Solarblinker
- Streetlight
- Toiletblock
- Tollplaza
- Truck laybye
- Urbansection
- Vehicularunderpass
- Villagetown
- Waterbody
- Way sideamenity

The minimum aspects to be collected from each asset are as follows:

- Road
- Section (LHS /RHS)
- Kilometric Point (initial andfinal)
- Latitude andLongitude
- Date
- Margin (LEFT / RIGHT / BOTH (LEFT ANDRIGHT))

Special and additional details/attributes of some assets have been collected. They are described below.

- Affected service
 - Type (ELECTRICITY / TELEPHONE / WATER)
- Carriageway
 - Type (BITUMINOUS / CONCRETE / ER / GRANULAR)
- Embankment
 - Height(m)
- Hectometrestone
 - N°
- High mastlights
 - N° of lamps
- Junction
 - Type(X/Y/T)
 - Name of road leading to left
 - N° of road leading to left
 - Name of road leading to right
 - N° of road leading to right
- Kilometrestone
 - N°
- Land use
 - Type (AGRICULTURAL / BARREN / COMMERCIAL / FOREST / RESIDENTIAL)
- Longitudinal road marking
 - Location
 - Type (According to Indian types and codes)
 - Code (According to Indian types and codes)
 - Color (WHITE / YELLOW)
- Median
 - Width(m)
- Median opening
 - Width(m)
- Pedestrian guardrail
 - Height(m)
- Punctual road marking
 - Location
 - Type (According to Indian types and codes)
 - Code (According to Indian types and codes)
 - Color (WHITE / YELLOW)
- Right of way

- LHS(m)
- RHS(m)
- Safetybarrier
 - Type
 - Height (incm)
- Shoulder
 - Type (ES / GS /PS)
- Sign
 - Type (According to Indian types, codes and dimensions)
 - Code (According to Indian types, codes and dimensions)
 - Value (speedlimit)
 - Dimensions (SMALL / MEDIUM /LARGE)
 - Condition (FAIR / GOOD / POOR / VERYPOOR)
- Streetlight
 - N° of lamps
- Terrain
 - Type (PLAIN / ROLLING /HILLY)
- Tollplaza
 - Name
- Villagetown
 - Name
 - Waterbody
 - Type (LAKE / RIVER /STREAM)

1.3.5. DATAACCURACY

The integrated GPS/INS solution produces continuous, smooth position and orientation of the GPS Vision™ system even when the GPS signals are lost due to obstructions such as bridges, trees, tunnels or high-rise buildings.

An Inertial Navigation System (INS) is needed for measuring Camera location. Combining GPS, INS and Distance Measurement Indicator (DMI) data is a very efficient and accurate method to determine position (lat/long/height), azimuth, pitch and roll angles. The measurements of the inertial system come from two sensor triads, an accelerometer block and a gyro block. They are defined as three components of the specific force vector and three components of the body rotation rate. Integrated with GPS data, the system geometry data are calculated using the Kalman method.

The absolute accuracy that can be obtained for terrestrial data positions is sub-meter. If other companies are not specifying an absolute accuracy they most likely cannot meet sub meter accuracy. The GPS Vision™ system was designed to deliver sub-meter RMS positions when visible features are within the camera field of view at distances closest to the front of the camera lenses. The closer to the lenses the more accurate they become. See accuracy profile below:

ANNEXURE 2 PAVEMENT MATERIAL INVESTIGATION

Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1)
Annexure Pavement material investigation

S. No.	Chainage	Direct ion	Test Pit No.	Coordinat es	
				X	Y
1	671+050	LHS	2	288418.00	2726137.00
2	669+500	RHS	3	287397.00	27224978.00
3	667+000	LHS	4	286251.00	2722850.00
4	664+500	RHS	5	284767.00	2720808.00
5	662+000	LHS	6	283282.00	278851.00
6	659+750	RHS	7	281658.00	2717380.00
7	657+000	LHS	8	282095.00	2715315.00
8	654+500	RHS	9	280436.00	2713493.00
9	652+000	LHS	10	279637.00	2711261.00
10	649+500	RHS	11	277601.00	2710092.00
11	647+000	LHS	12	276038.00	2708077.00

Table1.TestPitsLocations



Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1)

.Annexure Pavement material investigation

S.No.	Chainage	Direction	Test Pit No.	Description of Each Layer Material	Road Side Thickness (mm)
1	671+050	LHS	2	Bit uminous Layer	205
				WBM/WMM (Base)	335
				GSB(Sub-base)	310
				TOTAL CRUST	850
2	669+500	RHS	3	Bit uminous Layer	220
				WBM/WMM (Base)	210
				GSB(Sub-base)	200
				TOTAL CRUST	630
3	667+000	LHS	4	Bit uminous Layer	110
				WBM/WMM (Base)	210
				GSB(Sub-base)	200
				TOTAL CRUST	520
4	664+500	RHS	5	Bit uminous Layer	280
				WBM/WMM (Base)	220
				GSB(Sub-base)	190
				TOTAL CRUST	690
5	662+000	LHS	6	Bit uminous Layer	100
				WBM/WMM (Base)	205
				GSB(Sub-base)	215
				TOTAL CRUST	520
6	659+750	RHS	7	Bit uminous Layer	280
				WBM/WMM (Base)	180
				GSB(Sub-base)	210
				TOTAL CRUST	670
7	657+000	LHS	8	Bit uminous Layer	205
				WBM/WMM (Base)	230
				GSB(Sub-base)	220
				TOTAL CRUST	655
8	654+500	RHS	9	Bit uminous Layer	230
				WBM/WMM (Base)	250
				GSB(Sub-base)	190
				TOTAL CRUST	670
9	652+000	LHS	10	Bit uminous Layer	235
				WBM/WMM (Base)	230
				GSB(Sub-base)	250
				TOTAL CRUST	715
10	649+500	RHS	11	Bit uminous Layer	250
				WBM/WMM (Base)	220
				GSB(Sub-base)	20
				TOTAL CRUST	490
11	647+000	LHS	12	Bit uminous Layer	185
				WBM/WMM (Base)	270
				GSB(Sub-base)	230
				TOTAL CRUST	685

Table2.Resultsoftotalcrustthickness

Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1)
Annexure Pavement material investigation

FIELD DENSITY AND MOISTURE CONTENT						
S.No.	Chainage	Direction	Test Pit No.	Bulk Density (gm/cc)	Moisture Content (%)	Dry Density (gm/cc)
1	671+050	LHS	2	1.91	9.22	1.75
2	669+500	RHS	3	1.78	6.17	1.68
3	667+000	LHS	4	1.85	7.7	1.72
4	664+500	RHS	5	1.85	4.75	1.77
5	662+000	LHS	6	1.88	7.31	1.75
6	659+750	RHS	7	1.82	8.99	1.67
7	657+000	LHS	8	1.78	5.84	1.68
8	654+500	RHS	9	1.87	7.89	1.73
9	652+000	LHS	10	1.71	8.03	1.58
10	649+500	RHS	11	2.18	8.74	2.00
11	647+000	LHS	12	1.74	8.45	1.60

Table3.Resultsoffielddensityandmoisturecontent

CBR values using DCPT						
S. No.	Chainage	Direction	DCPT No.	Test Pit No.	Layer	CBR Value (%)
1	671+050	LHS	2	2	Exposed Base	20.00
					Subgrade Base	30.90
2	669+500	RHS	3	3	Exposed Base	32.86
					Subgrade Base	9.07
3	667+000	LHS	4	4	Exposed Base	51.84
					Subgrade Base	22.02
4	664+500	RHS	5	5	Exposed Base	34.21
					Subgrade Base	23.49
5	662+000	LHS	6	6	Exposed Base	60.45
					Subgrade Base	48.70
6	659+750	RHS	7	7	Exposed Base	36.94
					Subgrade Base	17.74
7	657+000	LHS	8	8	Exposed Base	28.82
					Subgrade Base	17.91
8	654+500	RHS	9	9	Exposed Base	64.77
					Subgrade Base	12.28
9	652+000	LHS	10	10	Exposed Base	52.06
					Subgrade Base	8.22
10	649+500	RHS	11	11	Exposed Base	27.61
					Subgrade Base	48.10
11	647+000	LHS	12	12	Exposed Base	46.82
					Subgrade Base	31.17

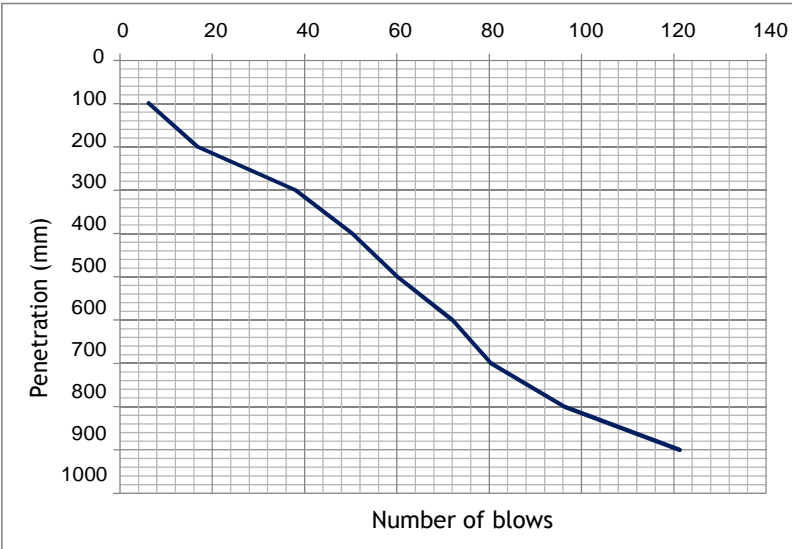
Table4.Results of CBR value using DCPT

APPENDIX-I					
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 671+050 LHS					
Test No.	DCPT -2	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	288418.00	Y :	2726137.00
			Exposed Base		
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
30	1	1			
55	2	1			
82	3	1			
99	4	1			
115	5	1			
127	6	1			
139	7	1			
147	8	1			
162	9	1			
175	10	1			
186	11	1			
195	12	1			
205	13	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 10.945 mm/blow</p> <p>CBR = 20 %</p>		
216	14	1			
229	15	1			
240	16	1			
249	17	1			
252	18	1			
263	19	1			
270	20	1			
280	21	1			
289	22	1			
295	23	1			
302	24	1			
309	25	1			
317	26	1			
325	27	1			
335	28	1			
347	29	1			
355	30	1			
365	31	1			
380	32	1			

Chainage : 671+050 LHS					
Test No.	DCPT -2	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	288418.00	Y :	2726137.00
		Exposed Base			
389	33	1			
405	34	1			
417	35	1			
425	36	1			
441	37	1			
452	38	1			
459	39	1			
467	40	1			
473	41	1			
480	42	1			
492	43	1			
499	44	1			
509	45	1			
520	46	1			
529	47	1			
540	48	1			
550	49	1			
565	50	1			
582	51	1			
595	52	1			
607	53	1			
619	54	1			
630	55	1			
641	56	1			
650	57	1			
665	58	1			
682	59	1			
689	60	1			
699	61	1			
710	62	1			
719	63	1			
732	64	1			
746	65	1			
757	66	1			
762	67	1			
766	68	1			
772	69	1			
779	70	1			
785	71	1			
795	72	1			
799	73	1			

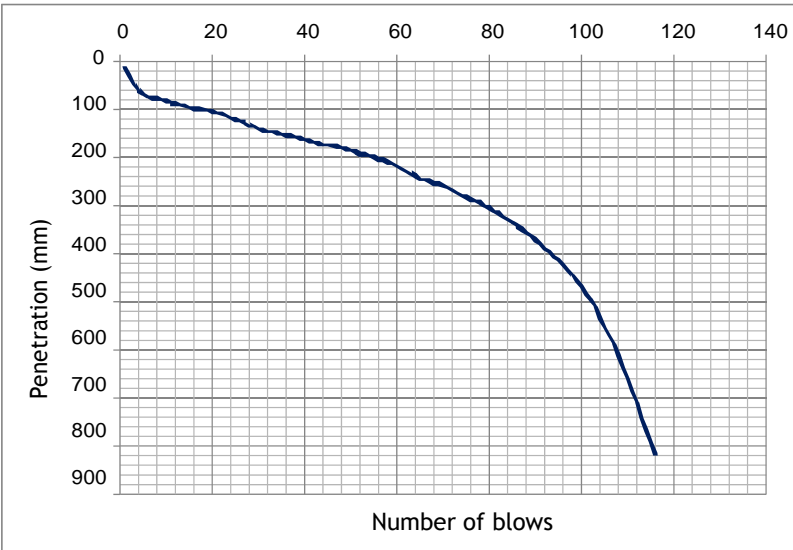
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 671+050 LHS					
Test No.	DCPT -2	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	288418.00	Y :	2726137.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	6	6
200	17	11
300	38	21
400	50	12
500	60	10
600	72	12
700	80	8
800	96	16
900	121	25



as per Road Note 31

Rate of Settlement	=	7.423	mm/blow
CBR	=	31	%

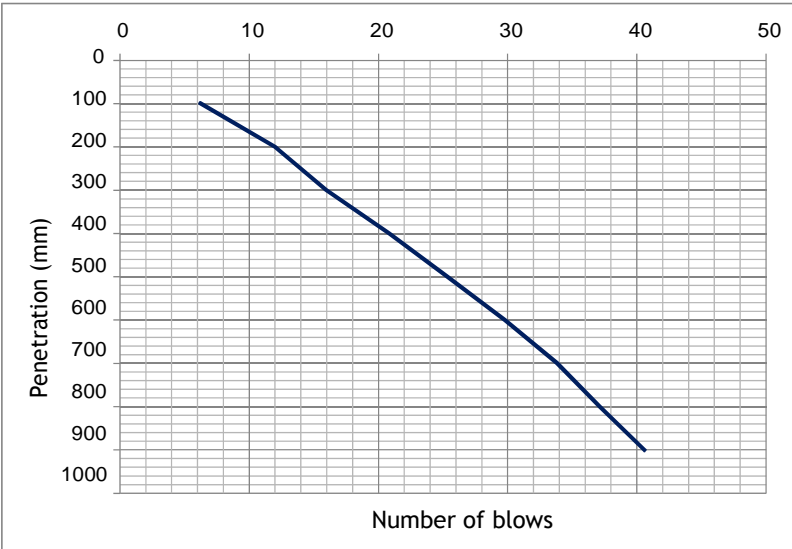
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 669+500 RHS					
Test No.	DCPT -3	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	287397.00	Y :	27224978.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
10	1	1			
26	2	1			
46	3	1			
58	4	1			
66	5	1			
71	6	1			
73	7	1			
75	8	1			
77	9	1			
80	10	1			
84	11	1			
86	12	1			
89	13	1			
91	14	1			
93	15	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 7.026 mm/blow</p> <p>CBR = 33 %</p>		
95	16	1			
96	17	1			
98	18	1			
100	19	1			
102	20	1			
104	21	1			
107	22	1			
111	23	1			
115	24	1			
119	25	1			
122	26	1			
125	27	1			
131	28	1			
133	29	1			
137	30	1			
140	31	1			
142	32	1			
144	33	1			
147	34	1			

Chainage : 669+500 RHS					
Test No.	DCPT -3	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	287397.00	Y :	27224978.00
		Exposed Base			
149	35	1			
151	36	1			
152	37	1			
155	38	1			
157	39	1			
160	40	1			
162	41	1			
165	42	1			
168	43	1			
170	44	1			
171	45	1			
173	46	1			
175	47	1			
177	48	1			
180	49	1			
182	50	1			
185	51	1			
190	52	1			
191	53	1			
193	54	1			
197	55	1			
201	56	1			
203	57	1			
207	58	1			
211	59	1			
215	60	1			
220	61	1			
225	62	1			
231	63	1			
235	64	1			
242	65	1			
244	66	1			
247	67	1			
250	68	1			
253	69	1			
257	70	1			
261	71	1			
266	72	1			
270	73	1			
275	74	1			
280	75	1			
283	76	1			
287	77	1			
290	78	1			
297	79	1			
302	80	1			
309	81	1			
313	82	1			
320	83	1			
325	84	1			
331	85	1			
340	86	1			
345	87	1			
353	88	1			

Chainage : 669+500 RHS					
Test No.	DCPT -3	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	287397.00	Y :	27224978.00
		Exposed Base			
360	89	1			
367	90	1			
377	91	1			
385	92	1			
394	93	1			
403	94	1			
411	95	1			
422	96	1			
431	97	1			
440	98	1			
455	99	1			
467	100	1			
480	101	1			
491	102	1			
507	103	1			
531	104	1			
551	105	1			
567	106	1			
584	107	1			
610	108	1			
634	109	1			
657	110	1			
683	111	1			
705	112	1			
740	113	1			
765	114	1			
790	115	1			
815	116	1			

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 669+500 RHS					
Test No.	DCPT -3	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	287397.00	Y :	27224978.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	6	6
200	12	6
300	16	4
400	21	5
500	25	5
600	30	4
700	34	4
800	37	3
900	41	3



as per Road Note 31

Rate of Settlement	=	22.175	mm/blow
CBR	=	9	%

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 667+000 LHS					
Test No.	DCPT -4	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	286251.00	Y :	2722850.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
17	1	1			
27	2	1			
36	3	1			
47	4	1			
56	5	1			
68	6	1			
75	7	1			
81	8	1			
89	9	1			
94	10	1			
99	11	1			
104	12	1			
109	13	1			
115	14	1			
120	15	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 4.677 mm/blow</p> <p>CBR = 52 %</p>		
127	16	1			
131	17	1			
135	18	1			
140	19	1			
145	20	1			
151	21	1			
155	22	1			
160	23	1			
165	24	1			
169	25	1			
174	26	1			
175	27	1			
180	28	1			
180	29	1			
183	30	1			
187	31	1			
190	32	1			
192	33	1			
194	34	1			

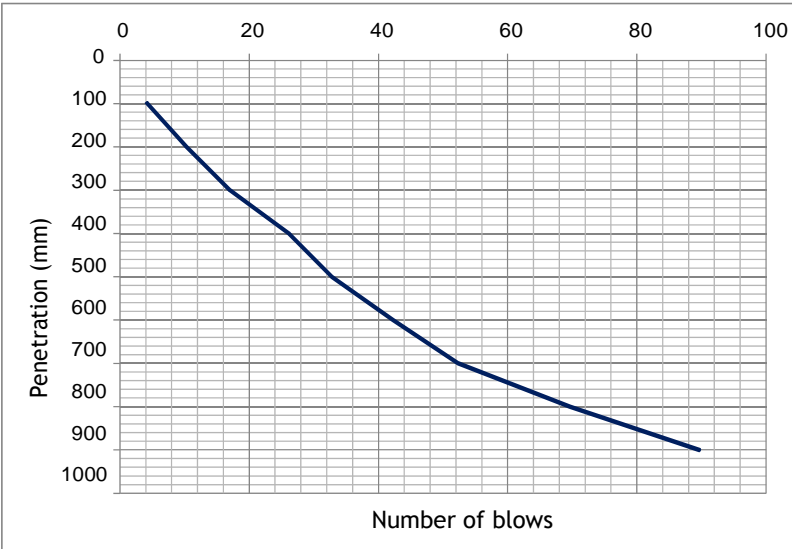
Chainage : 667+000 LHS					
Test No.	DCPT -4	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	286251.00	Y :	2722850.00
		Exposed Base			
195	35	1			
197	36	1			
199	37	1			
200	38	1			
202	39	1			
205	40	1			
207	41	1			
210	42	1			
214	43	1			
217	44	1			
220	45	1			
224	46	1			
229	47	1			
231	48	1			
235	49	1			
239	50	1			
243	51	1			
247	52	1			
250	53	1			
255	54	1			
258	55	1			
263	56	1			
267	57	1			
271	58	1			
274	59	1			
279	60	1			
283	61	1			
288	62	1			
292	63	1			
298	64	1			
301	65	1			
305	66	1			
310	67	1			
313	68	1			
317	69	1			
321	70	1			
324	71	1			
327	72	1			
332	73	1			
334	74	1			
338	75	1			
340	76	1			
343	77	1			
347	78	1			
350	79	1			
353	80	1			
355	81	1			
359	82	1			
365	83	1			
367	84	1			
368	85	1			
369	86	1			
374	87	1			
375	88	1			

Chainage : 667+000 LHS					
Test No.	DCPT -4	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	286251.00	Y :	2722850.00
		Exposed Base			
376	89	1			
378	90	1			
380	91	1			
385	92	1			
387	93	1			
390	94	1			
395	95	1			
400	96	1			
403	97	1			
405	98	1			
409	99	1			
414	100	1			
417	101	1			
422	102	1			
425	103	1			
430	104	1			
436	105	1			
441	106	1			
447	107	1			
452	108	1			
455	109	1			
459	110	1			
463	111	1			
471	112	1			
476	113	1			
480	114	1			
485	115	1			
493	116	1			
497	117	1			
507	118	1			
510	119	1			
514	120	1			
519	121	1			
524	122	1			
528	123	1			
535	124	1			
551	125	1			
555	126	1			
559	127	1			
564	128	1			
569	129	1			
580	130	1			
586	131	1			
593	132	1			
597	133	1			
604	134	1			
607	135	1			
614	136	1			
620	137	1			
626	138	1			
630	139	1			
634	140	1			
637	141	1			
645	142	1			

Chainage : 667+000 LHS					
Test No.	DCPT -4	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	286251.00	Y :	2722850.00
		Exposed Base			
650	143	1			
655	144	1			
660	145	1			
664	146	1			
674	147	1			
677	148	1			
683	149	1			
687	150	1			
693	151	1			
700	152	1			
707	153	1			
714	154	1			
719	155	1			
726	156	1			
735	157	1			
746	158	1			
735	159	1			
746	160	1			
753	161	1			
759	162	1			
764	163	1			
769	164	1			
774	165	1			
777	166	1			
781	167	1			

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 667+000 LHS					
Test No.	DCPT -4	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	286251.00	Y :	2722850.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	4	4
200	10	6
300	17	7
400	26	9
500	33	7
600	42	9
700	52	10
800	70	17
900	90	20




Number of blows	Penetration (mm)
4	100
10	200
17	300
26	400
33	500
42	600
52	700
70	800
90	900

as per Road Note 31

Rate of Settlement = 10.045 mm/blow

CBR = 22 %

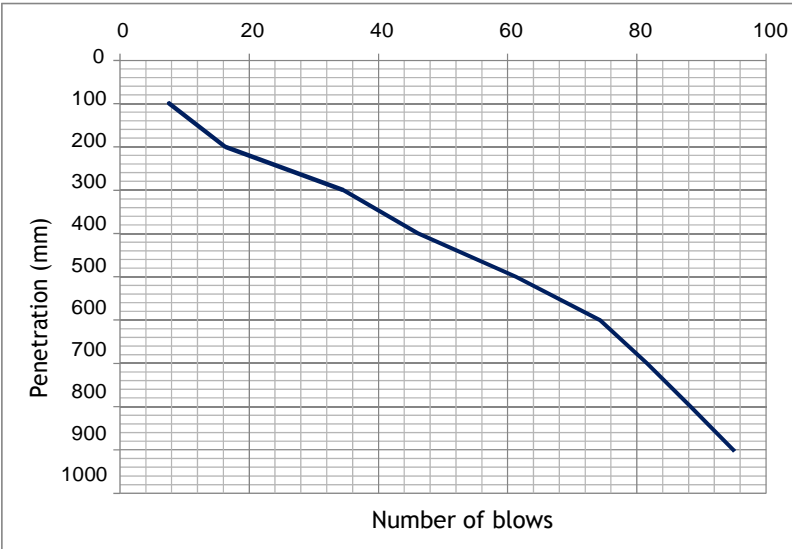
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 664+500 RHS					
Test No.	DCPT -5	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	284767.00	Y :	2720808.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
17	1	1			
20	2	1			
29	3	1			
42	4	1			
53	5	1			
65	6	1			
73	7	1			
81	8	1			
90	9	1			
95	10	1			
103	11	1			
110	12	1			
120	13	1			
123	14	1			
131	15	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 6.779 mm/blow</p> <p>CBR = 34 %</p>		
140	16	1			
146	17	1			
152	18	1			
160	19	1			
163	20	1			
167	21	1			
171	22	1			
175	23	1			
180	24	1			
185	25	1			
189	26	1			
192	27	1			
195	28	1			
200	29	1			
203	30	1			
207	31	1			
211	32	1			
215	33	1			
220	34	1			

Chainage : 664+500 RHS					
Test No.	DCPT -5	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	284767.00	Y :	2720808.00
		Exposed Base			
223	35	1			
225	36	1			
229	37	1			
232	38	1			
240	39	1			
245	40	1			
249	41	1			
252	42	1			
257	43	1			
261	44	1			
265	45	1			
269	46	1			
273	47	1			
276	48	1			
280	49	1			
285	50	1			
289	51	1			
292	52	1			
295	53	1			
300	54	1			
307	55	1			
312	56	1			
318	57	1			
323	58	1			
329	59	1			
332	60	1			
337	61	1			
341	62	1			
345	63	1			
352	64	1			
355	65	1			
360	66	1			
363	67	1			
366	68	1			
371	69	1			
374	70	1			
375	71	1			
380	72	1			
384	73	1			
390	74	1			
396	75	1			
400	76	1			
405	77	1			
410	78	1			
414	79	1			
421	80	1			
426	81	1			
432	82	1			
435	83	1			
441	84	1			
448	85	1			
456	86	1			
460	87	1			
467	88	1			

Chainage : 664+500 RHS					
Test No.	DCPT -5	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	284767.00	Y :	2720808.00
			Exposed Base		
472	89	1			
477	90	1			
486	91	1			
494	92	1			
500	93	1			
508	94	1			
514	95	1			
524	96	1			
535	97	1			
548	98	1			
565	99	1			
580	100	1			
592	101	1			
603	102	1			
614	103	1			
626	104	1			
642	105	1			
657	106	1			
664	107	1			
674	108	1			
680	109	1			
689	110	1			
697	111	1			
706	112	1			
714	113	1			
720	114	1			
735	115	1			
751	116	1			
765	117	1			
778	118	1			
789	119	1			
801	120	1			
810	121	1			
827	122	1			

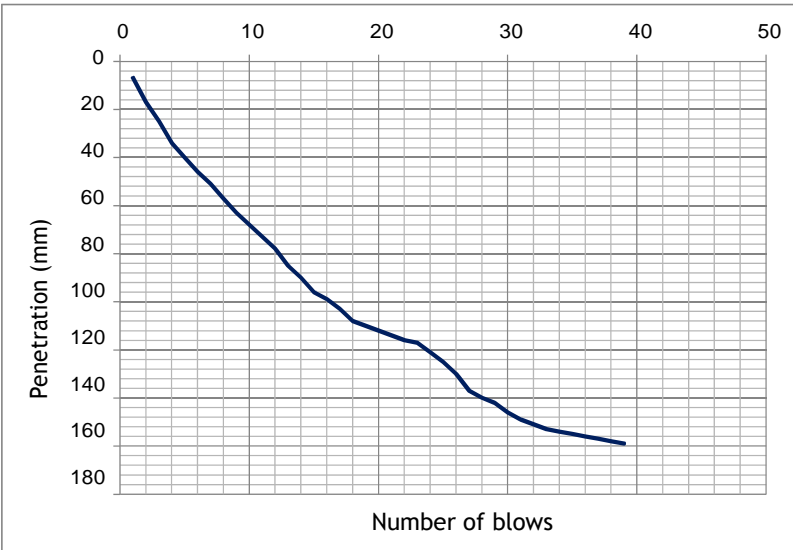
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 664+500 RHS					
Test No.	DCPT -5	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	284767.00	Y :	2720808.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	8	8
200	16	9
300	35	18
400	46	12
500	61	15
600	74	13
700	82	7
800	88	7
900	95	7



as per Road Note 31

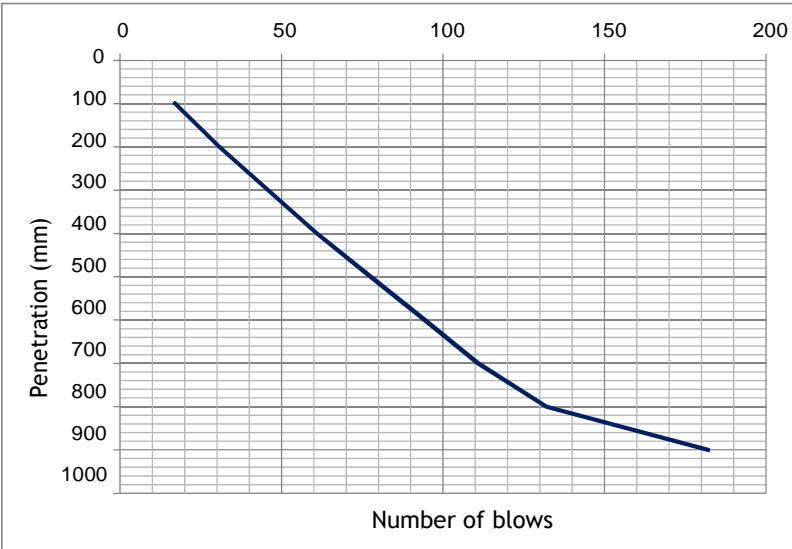
Rate of Settlement	=	9.480	mm/blow
CBR	=	23	%

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 662+000 LHS					
Test No.	DCPT -6	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	283282.00	Y :	278851.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
7	1	1			
17	2	1			
25	3	1			
34	4	1			
40	5	1			
46	6	1			
51	7	1			
57	8	1			
63	9	1			
68	10	1			
73	11	1			
78	12	1			
85	13	1			
90	14	1			
96	15	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 4.077 mm/blow</p> <p>CBR = 60 %</p>		
99	16	1			
103	17	1			
108	18	1			
110	19	1			
112	20	1			
114	21	1			
116	22	1			
117	23	1			
121	24	1			
125	25	1			
130	26	1			
137	27	1			
140	28	1			
142	29	1			
146	30	1			
149	31	1			
151	32	1			
153	33	1			
154	34	1			

Chainage : 662+000 LHS					
Test No.	DCPT -6	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	283282.00	Y :	278851.00
		Exposed Base			
155	35	1			
156	36	1			
157	37	1			
158	38	1			
159	39	1			


DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 662+000 LHS					
Test No.	DCPT -6	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	283282.00	Y :	278851.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	17	17
200	31	14
300	46	15
400	61	15
500	78	17
600	94	17
700	111	17
800	132	21
900	182	50



as per Road Note 31

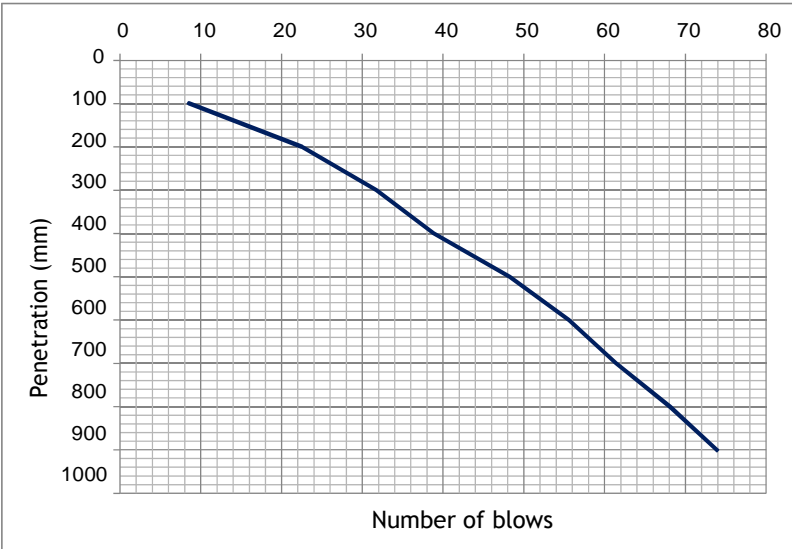
Rate of Settlement	=	4.945	mm/blow
CBR	=	49	%

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 659+750 RHS					
Test No.	DCPT -7	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	281658.00	Y :	2717380.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
13	1	1			
21	2	1			
35	3	1			
43	4	1			
51	5	1			
60	6	1			
67	7	1			
76	8	1			
85	9	1			
94	10	1			
106	11	1			
111	12	1			
118	13	1			
122	14	1			
129	15	1	as per Road Note 31		
137	16	1	Rate of Settlement	=	6.329 mm/blow
143	17	1	CBR	=	37 %
151	18	1			
159	19	1			
166	20	1			
174	21	1			
182	22	1			
189	23	1			
197	24	1			
201	25	1			
205	26	1			
210	27	1			
215	28	1			
219	29	1			
222	30	1			
224	31	1			
228	32	1			
229	33	1			
231	34	1			

Chainage : 659+750 RHS					
Test No.	DCPT -7	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	281658.00	Y :	2717380.00
		Exposed Base			
235	35	1			
238	36	1			
240	37	1			
242	38	1			

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 659+750 RHS					
Test No.	DCPT -7	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	281658.00	Y :	2717380.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	9	9
200	23	14
300	32	9
400	39	7
500	48	9
600	56	7
700	61	6
800	68	7
900	74	6

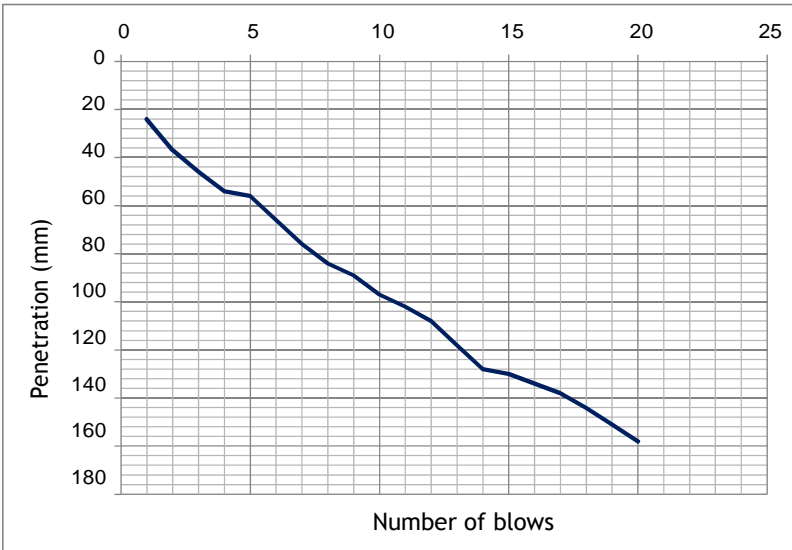


Number of blows	Penetration (mm)
9	100
23	200
32	300
39	400
48	500
56	600
61	700
68	800
74	900

as per Road Note 31

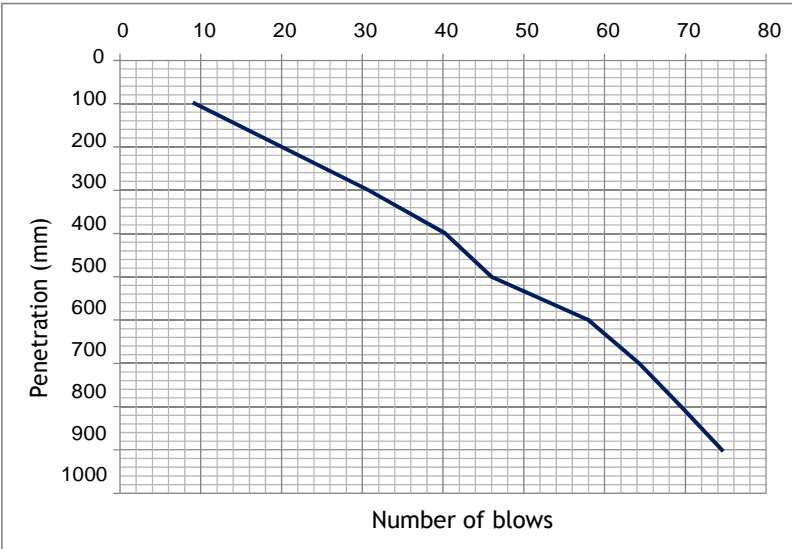
Rate of Settlement = 12.182 mm/blow

CBR = 18 %

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 657+000 LHS					
Test No.	DCPT -8	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	282095.00	Y :	2715315.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration	 <p>as per Road Note 31</p> <p>Rate of Settlement = 7.900 mm/blow</p> <p>CBR = 29 %</p>		
24	1	1			
37	2	1			
46	3	1			
54	4	1			
56	5	1			
66	6	1			
76	7	1			
84	8	1			
89	9	1			
97	10	1			
102	11	1			
108	12	1			
118	13	1			
128	14	1			
130	15	1			
134	16	1			
138	17	1			
144	18	1			
151	19	1			
158	20	1			

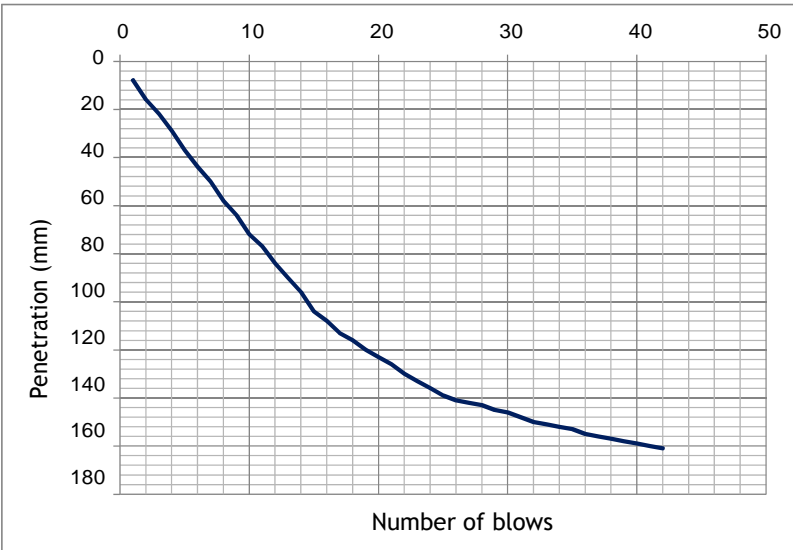
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 657+000 LHS					
Test No.	DCPT -8	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	282095.00	Y :	2715315.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	9	9
200	20	11
300	31	11
400	40	10
500	46	6
600	58	12
700	64	6
800	70	5
900	75	5



as per Road Note 31

Rate of Settlement	=	12.081	mm/blow
CBR	=	18	%

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 654+500 RHS					
Test No.	DCPT -9	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	280436.00	Y :	2713493.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration	 <p>as per Road Note 31</p> <p>Rate of Settlement = 3.833 mm/blow</p> <p>CBR = 65 %</p>		
8	1	1			
16	2	1			
22	3	1			
29	4	1			
37	5	1			
44	6	1			
50	7	1			
58	8	1			
64	9	1			
72	10	1			
77	11	1			
84	12	1			
90	13	1			
96	14	1			
104	15	1			
108	16	1			
113	17	1			
116	18	1			
120	19	1			
123	20	1			
126	21	1			
130	22	1			
133	23	1			
136	24	1			
139	25	1			
141	26	1			
142	27	1			
143	28	1			
145	29	1			
146	30	1			
148	31	1			
150	32	1			
151	33	1			
152	34	1			

Chainage : 654+500 RHS					
Test No.	DCPT -9	Location :	ABU ROAD TO SWAROOPGANJ		Date: 16.02.18
		X :	280436.00	Y :	2713493.00
		Exposed Base			
153	35	1			
155	36	1			
156	37	1			
157	38	1			
158	39	1			
159	40	1			
160	41	1			
161	42	1			

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 654+500 RHS					
Test No.	DCPT -9	Location :	ABU ROAD TO SWAROOPGANJ	Date:	16.02.18
		X :	280436.00	Y :	2713493.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	13	13
200	21	8
300	26	5
400	31	5
500	35	4
600	40	5
700	44	4
800	49	4
900	53	5

Number of blows	Penetration (mm)
13	100
21	200
26	300
31	400
35	500
40	600
44	700
49	800
53	900

as per Road Note 31

Rate of Settlement = 16.923 mm/blow


CBR = 12 %

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 652+000 LHS					
Test No.	DCPT -10	Location :	ABU ROAD TO SWAROOPGANJ		Date: 17.02.18
		X :	279637.00	Y :	2711261.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
20	1	1			
37	2	1			
50	3	1			
64	4	1			
73	5	1			
82	6	1			
94	7	1			
103	8	1			
108	9	1			
115	10	1			
120	11	1			
126	12	1			
129	13	1			
137	14	1			
142	15	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 4.659 mm/blow</p> <p>CBR = 52 %</p>		
147	16	1			
150	17	1			
154	18	1			
156	19	1			
159	20	1			
161	21	1			
163	22	1			
165	23	1			
167	24	1			
168	25	1			
170	26	1			
172	27	1			
173	28	1			
174	29	1			
175	30	1			
176	31	1			
179	32	1			
183	33	1			
185	34	1			

Chainage : 652+000 LHS					
Test No.	DCPT -10	Location :	ABU ROAD TO SWAROOPGANJ		Date: 17.02.18
		X :	279637.00	Y :	2711261.00
		Exposed Base			
189	35	1			
191	36	1			
193	37	1			
194	38	1			
195	39	1			
198	40	1			
200	41	1			
203	42	1			
204	43	1			
205	44	1			

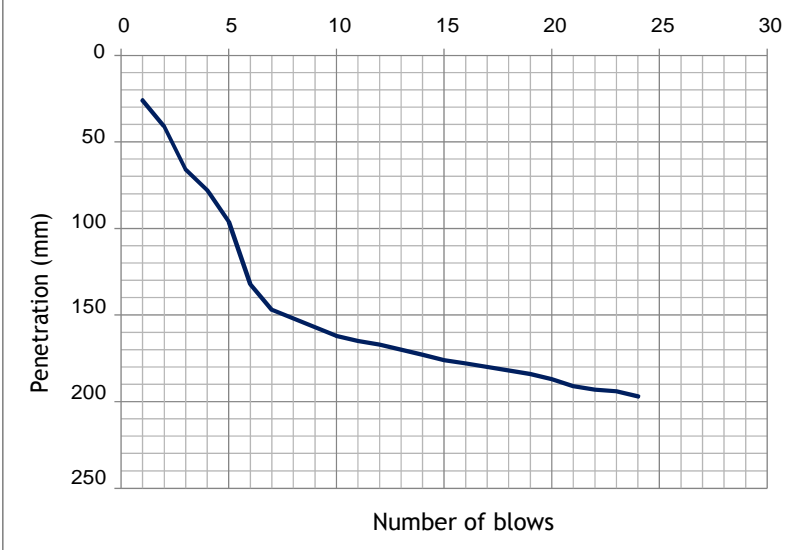
DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 652+000 LHS					
Test No.	DCPT -10	Location :	ABU ROAD TO SWAROOPGANJ	Date:	17.02.18
		X :	279637.00	Y :	2711261.00
		Subgrade Base			

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	4	4
200	10	6
300	15	6
400	22	7
500	27	5
600	30	3
700	32	2
800	34	2
900	37	3



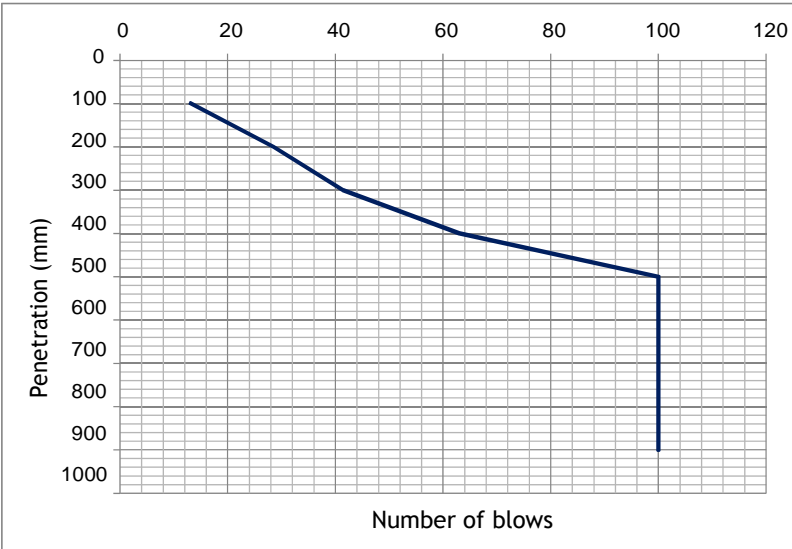
as per Road Note 31

Rate of Settlement	=	24.215	mm/blow
CBR	=	8	%

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 649+500 RHS					
Test No.	DCPT -11	Location :	ABU ROAD TO SWAROOPGANJ		Date: 17.02.18
		X :	277601.00	Y :	2710092.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration	 <p>as per Road Note 31</p> <p>Rate of Settlement = 8.208 mm/blow</p> <p>CBR = 28 %</p>		
26	1	1			
41	2	1			
66	3	1			
78	4	1			
96	5	1			
132	6	1			
147	7	1			
152	8	1			
157	9	1			
162	10	1			
165	11	1			
167	12	1			
170	13	1			
173	14	1			
176	15	1			
178	16	1			
180	17	1			
182	18	1			
184	19	1			
187	20	1			
191	21	1			
193	22	1			
194	23	1			
197	24	1			


DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)				
Chainage : 649+500 RHS				
Test No.	DCPT -11	Location :	ABU ROAD TO SWAROOPGANJ	Date: 17.02.18
		X :	277601.00	Y : 2710092.00
		Subgrade Base		

Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration
100	13	13
200	29	15
300	41	13
400	63	22
500	100	37
600	100	0
700	100	0
800	100	0
900	100	0



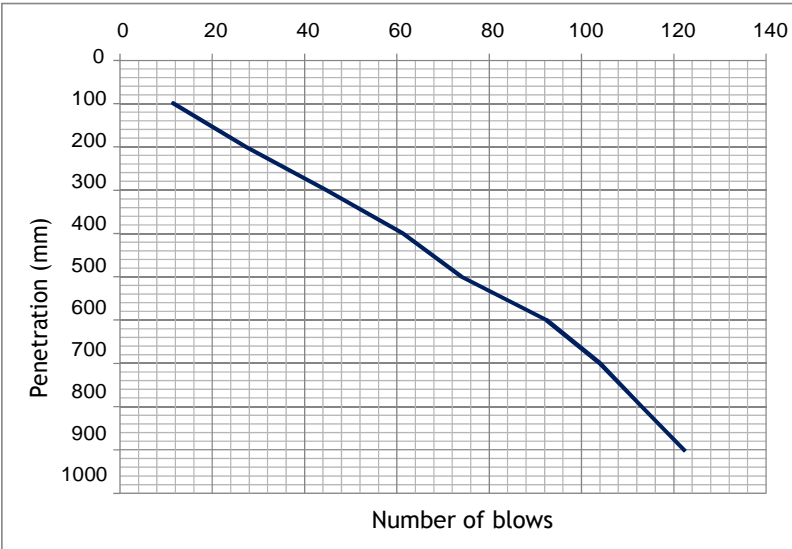
as per Road Note 31

Rate of Settlement	=	5.000	mm/blow
CBR	=	48	%

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 647+000 LHS					
Test No.	DCPT -12	Location :	ABU ROAD TO SWAROOPGANJ		Date: 17.02.18
		X :	276038.00	Y :	2708077.00
		Exposed Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
33	1	1			
60	2	1			
79	3	1			
90	4	1			
96	5	1			
106	6	1			
116	7	1			
125	8	1			
129	9	1			
135	10	1			
140	11	1			
148	12	1			
154	13	1			
158	14	1			
164	15	1	<p>as per Road Note 31</p> <p>Rate of Settlement = 5.122 mm/blow</p> <p>CBR = 47 %</p>		
168	16	1			
173	17	1			
178	18	1			
180	19	1			
185	20	1			
188	21	1			
194	22	1			
195	23	1			
199	24	1			
202	25	1			
206	26	1			
209	27	1			
211	28	1			
214	29	1			
216	30	1			
218	31	1			
221	32	1			
224	33	1			
226	34	1			

Chainage : 647+000 LHS					
Test No.	DCPT -12	Location :	ABU ROAD TO SWAROOPGANJ		Date: 17.02.18
		X :	276038.00	Y :	2708077.00
		Exposed Base			
229	35	1			
231	36	1			
234	37	1			
236	38	1			
237	39	1			
240	40	1			
241	41	1			
242	42	1			
244	43	1			
246	44	1			
247	45	1			
248	46	1			
249	47	1			
250	48	1			
251	49	1			

DYNAMIC CONE PENETRATION TEST (IS 4968 : Part I & II)					
Chainage : 647+000 LHS					
Test No.	DCPT -12	Location :	ABU ROAD TO SWAROOPGANJ		Date: 17.02.18
		X :	276038.00	Y :	2708077.00
		Subgrade Base			
Depth (mm)	Cumulative No. of blows	No. of blows per 10 cm penetration			
100	12	12			
200	27	16			
300	45	17			
400	61	17			
500	74	13			
600	92	18			
700	104	12			
800	113	9			
900	122	9			



Number of blows	Penetration (mm)
12	100
27	200
45	300
61	400
74	500
92	600
104	700
113	800
122	900

as per Road Note 31

Rate of Settlement = 7.366 mm/blow

CBR = 31 %

ANNEXURE 3 LABORATORY INVESTIGATION

Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1)
.Annexure Laboratory Investigation

S. No.	Chainage	Direct ion	Test Pit No.	Coordinat es	
				X	Y
1	671+050	LHS	2	288418.00	2726137.00
2	669+500	RHS	3	287397.00	27224978.00
3	667+000	LHS	4	286251.00	2722850.00
4	664+500	RHS	5	284767.00	2720808.00
5	662+000	LHS	6	283282.00	278851.00
6	659+750	RHS	7	281658.00	2717380.00
7	657+000	LHS	8	282095.00	2715315.00
8	654+500	RHS	9	280436.00	2713493.00
9	652+000	LHS	10	279637.00	2711261.00
10	649+500	RHS	11	277601.00	2710092.00
11	647+000	LHS	12	276038.00	2708077.00

Table1.TestPitsLocations

ANNEXURE																								
TEST RESULTS OF SOIL LAYER																								
Loaction:: ABUROAD TO																								
S.No.	CHAINAGE	Side	Soil Description	IS Classification	Gradation:PercentbyweightretainedontheSieve (IS:2720-IV)						Clay & silt content %	AtterbergLimits [IS :2720-Pt-V]			FSI [IS :2720-Pt-XXXX]	ModifiedProctorTest (IS:2720-Pt-VIII)		SOAKED CBR AT 3 ENERGY LEVEL			UNSOAKED CBR AT 3 ENERGY LEVEL			
					19 mm	10 mm	4.75 mm	2.0 mm	425 micron	75 micron		Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)		Max. dry density (gm/cc)	OMC (%)	15 No. Of Blows	35 No. 65 No. 15	15 No. Of Blows	35 No. 65 No. 15	15 No. Of Blows	35 No. 65 No. 15	
1	671+05	LHS	Silty Sand with Clay	SM-SC	0.00	13.50	8.60	10.30	12.10	19.30	36.20	27	20	7	6.23	2.07	9.0	7	13	19	12	17	22	
2	669+50	RHS	Silty Sand with Clay	SM-SC	0.00	16.40	9.70	6.70	13.50	24.90	28.80	26	20	6	NIL	2.06	10.0	8	14	18	13	16	22	
3	667+00	LHS	Silty Sand	SM	0.00	13.95	13.90	9.60	23.00	20.30	19.25	26	NIL	NP	NIL	2.10	8.0	9	14	19	12	19	26	
4	664+50	RHS	Silty Sand	SM	9.60	15.60	10.90	11.80	10.60	23.90	17.60	25	NIL	NP	NIL	2.12	8.5	7	14	20	13	21	28	
5	662+00	LHS	Silty Sand with Clay	SM-SC	5.80	10.80	4.90	7.10	11.40	29.40	30.60	26	20	6	NIL	2.11	9.0	6	13	19	10	18	26	
6	659+75	RHS	Silty Sand with Clay	SM-SC	1.30	11.80	3.50	4.50	10.80	36.80	31.30	25	20	5	NIL	2.07	10.0	7	10	16	10	15	22	
7	657+00	LHS	Silty Sand with Clay	SM-SC	2.50	8.90	10.50	6.40	16.70	25.40	29.60	25	20	5	NIL	2.08	9.5	7	12	18	11	18	24	
8	654+50	RHS	Silty Sand with Clay	SM-SC	3.20	7.20	8.40	3.40	8.80	41.20	27.80	26	20	6	NIL	2.02	9.5	6	10	16	10	15	22	
9	652+00	LHS	SandySilttoLowPlasticity	CL	7.20	12.50	14.20	4.10	7.90	3.90	50.20	34	20	14	12	2.11	11.0	4	7	10	7	9	13	
10	649+50	RHS	SandySilttoLowPlasticity	CL	8.90	12.40	5.60	4.80	10.10	5.10	53.10	32	20	12	10	2.09	10.0	8	12	21	17	22	31	
11	647+00	LHS	SandySilttoLowPlasticity	CL	6.50	11.40	6.90	3.70	12.40	7.90	51.20	32	21	11	11	2.06	11.0	9	14	20	15	21	29	

ANNEXURE																			
TEST RESULT OF GRANULAR SUB-BASE MATERIAL																			
LOCATION: ABU ROAD-SWAROOPGANJ																			
Sl. No.	Location / Name of Quarry	Side	Gradation: Percent by weight passing the Sieve (Close graded) (MORTH)								Atterberg limits (IS:2720-Part V)			Modified Proctor Test (IS:2720-Part VIII)		CBR Value at 98% dry density (Soaked)%	Specific Gravity	W.A. (%)	Impact Value (%)
								2.36 mm	425 micron	75 micron	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index(PI)	MaximumDry Density(gm/cc)	OMC %				
1	671+050	LHS	100.00	100.00	78.40	53.43	46.27	43.21	14.13	3.21	22	NIL	NP	2.18	7.0	36	2.76	1.02	25
2	669+500	RHS	100.00	100.00	77.60	57.88	47.32	41.38	14.40	3.49	23	NIL	NP	2.20	6.0	35	2.75	1.05	27
3	667+000	LHS	100.00	98.66	76.66	47.32	33.78	27.66	14.98	1.65	23	NIL	NP	2.19	6.5	39	2.8	0.85	23
4	664+500	RHS	100.00	100.00	81.34	57.26	46.52	40.82	14.52	2.81	24	NIL	NP	2.18	7.0	34	2.79	0.89	24
5	662+000	LHS	100.00	100.00	71.21	51.30	42.30	31.70	14.30	3.15	23	NIL	NP	2.19	6.5	33	2.77	0.88	24
6	659+750	RHS	100.00	100.00	80.82	57.54	48.28	39.87	14.18	4.08	23	NIL	NP	2.21	7.0	35	2.79	0.82	23
7	657+000	LHS	100.00	98.52	74.96	43.80	32.60	26.96	11.25	3.52	24	NIL	NP	2.16	7.0	37	2.77	0.87	25
8	654+500	RHS	100.00	100.00	82.90	57.98	42.92	36.34	14.12	2.66	23	NIL	NP	2.21	6.0	35	2.74	0.85	24
9	652+000	LHS	100.00	100.00	84.40	56.22	43.21	37.41	13.83	2.42	22	NIL	NP	2.19	6.5	33	2.72	0.98	26
10	649+500	RHS	100.00	100.00	73.43	53.83	41.20	31.70	13.22	1.22	24	NIL	NP	2.16	7.0	32	2.73	0.95	25
11	647+00	LHS	100.00	98.30	80.32	56.96	42.60	34.52	14.87	1.24	23	NIL	NP	2.19	6.5	36	2.77	0.81	24

ANNEXURE																		
TEST RESULT OF WET MIX MACADAM																		
LOCATION: ABU ROAD-SWAROOPGANJ																		
Sl. No.	Location / Name of Quarry	SIDE	Gradation: Percent by weight passing the Sieve (Close graded) (MORTH)								Atterberg limits (IS:2720-Part V)			Modified Proctor Test (IS:2720-Part VIII)		Specific Gravity	W.A. (%)	Impact Value (%)
			53 mm	45 mm	22.4 mm	11.2 mm	4.75 mm	2.36 mm	600 micron	75 micron	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Maximum Dry Density gm/cc	OMC %			
1	671+050	LHS	100.00	97.28	76	56.56	37.91	29.04	20.21	2.13	23	NIL	NP	2.28	6.0	2.76	0.7	26
2	669+500	RHS	100.00	96.50	78	57.50	39.10	28.81	20.18	1.76	25	NIL	NP	2.27	6.0	2.75	0.71	26
3	667+000	LHS	100.00	100.00	76	56.24	38.82	27.27	18.93	1.79	24	NIL	NP	2.26	5.0	2.77	0.68	25
4	664+500	RHS	100.00	100.00	78	58.60	39.30	29.54	19.70	1.55	25	NIL	NP	2.28	6.0	2.8	0.62	22
5	662+000	LHS	100.00	100.00	66	48.16	35.94	28.45	20.22	1.46	22	NIL	NP	2.27	6.5	2.81	0.59	20
6	659+750	RHS	100.00	100.00	65	47.39	33.64	29.54	21.95	1.20	22	NIL	NP	2.27	5.5	2.79	0.65	24
7	657+000	LHS	100.00	100.00	68	56.21	37.98	26.31	19.90	2.16	25	NIL	NP	2.28	6.0	2.79	0.64	24
8	654+500	RHS	100.00	100.00	78	58.10	38.12	27.24	20.56	1.80	24	NIL	NP	2.27	6.5	2.8	0.6	21
9	652+00	LHS	100.00	100.00	77	48.81	28.31	19.49	13.22	1.94	23	NIL	NP	2.25	6.5	2.75	0.71	26
10	649+500	RHS	100.00	100.00	77	56.41	37.38	27.23	19.24	2.41	25	NIL	NP	2.29	6.0	2.77	0.66	23
11	647+00	LHS	100.00	100.00	78	55.45	38.41	28.92	20.18	2.32	25	NIL	NP	2.29	6.0	2.81	0.58	20

ANNEXURE 4 DEFLECTIONS



1. DEFLECTIONSDATA

In following tables and graphs are represented original data collected from Falling Weight Deflectometer.



Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	LHS	IL	24°27.991'	73°46.932'	23/02/2018	10:09:51 AM	646,000	3	22	35	22	14	9	5	4	3	2	28,7	29,5
1	LHS	OL	24°27.992'	73°46.931'	22/02/2018	10:46:11 AM	646,000	3	22	35	24	15	9	5	4	3	2	30,0	30,6
1	LHS	OL	24°28.013'	73°47.075'	22/02/2018	10:47:47 AM	646,250	3	22	35	16	16	9	6	3	3	3	30,1	30,7
1	LHS	IL	24°28.058'	73°47.239'	23/02/2018	10:13:29 AM	646,500	3	22	35	25	16	7	3	1	1	0	28,8	29,5
1	LHS	OL	24°28.052'	73°47.216'	22/02/2018	10:49:16 AM	646,500	3	22	35	31	19	8	3	1	1	1	30,1	30,7
1	LHS	OL	24°28.150'	73°47.367'	22/02/2018	10:52:00 AM	646,750	3	22	35	25	17	9	6	3	3	3	30,1	30,6
1	LHS	IL	24°28.217'	73°47.426'	23/02/2018	10:15:24 AM	647,000	3	22	35	25	18	10	6	4	3	2	28,8	29,3
1	LHS	OL	24°28.216'	73°47.424'	22/02/2018	10:53:12 AM	647,000	3	22	35	19	14	9	5	3	3	2	30,1	30,7
1	LHS	OL	24°28.331'	73°47.507'	22/02/2018	10:54:42 AM	647,250	3	22	35	17	14	9	5	4	3	3	30,1	30,7
1	LHS	IL	24°28.446'	73°47.594'	23/02/2018	10:17:40 AM	647,500	3	22	35	31	21	12	7	4	3	2	28,9	29,7
1	LHS	OL	24°28.443'	73°47.589'	22/02/2018	10:56:07 AM	647,500	3	22	35	27	21	13	7	4	4	3	30,1	30,7
1	LHS	OL	24°28.541'	73°47.689'	22/02/2018	10:57:30 AM	647,750	3	22	35	25	16	9	4	3	3	2	30,1	30,7
1	LHS	IL	24°28.647'	73°47.805'	23/02/2018	10:19:41 AM	648,000	3	22	35	31	21	11	6	4	3	2	29,0	29,7
1	LHS	OL	24°28.649'	73°47.805'	22/02/2018	10:59:02 AM	648,000	3	22	35	20	16	10	6	4	3	2	30,1	30,7
1	LHS	OL	24°28.703'	73°47.905'	22/02/2018	11:00:34 AM	648,250	3	22	35	20	14	9	6	4	3	2	30,0	30,7
1	LHS	IL	24°28.856'	73°47.964'	23/02/2018	10:21:44 AM	648,500	3	22	35	29	21	13	6	4	3	3	29,0	29,7
1	LHS	OL	24°28.847'	73°47.957'	22/02/2018	11:01:49 AM	648,500	3	22	35	22	12	11	6	4	4	3	30,0	30,8
1	LHS	OL	24°28.964'	73°48.030'	22/02/2018	11:04:09 AM	648,750	3	22	35	36	26	15	8	5	5	4	29,9	30,7
1	LHS	IL	24°29.094'	73°48.128'	23/02/2018	10:23:36 AM	649,000	3	22	35	15	9	5	2	2	2	2	29,0	29,7
1	LHS	OL	24°29.093'	73°48.125'	22/02/2018	11:05:59 AM	649,000	3	22	35	13	9	6	4	3	2	2	29,7	30,7
1	LHS	OL	24°29.195'	73°48.208'	22/02/2018	11:07:36 AM	649,250	3	22	35	17	13	10	7	4	3	3	29,9	30,8
1	LHS	IL	24°29.294'	73°48.291'	23/02/2018	10:25:42 AM	649,500	3	22	35	17	12	6	3	2	1	1	29,1	29,9
1	LHS	OL	24°29.296'	73°48.291'	22/02/2018	11:08:58 AM	649,500	3	22	35	13	11	7	4	3	2	2	30,0	30,9
1	LHS	OL	24°29.401'	73°48.386'	22/02/2018	11:10:23 AM	649,750	3	22	35	20	15	10	7	5	3	3	30,1	31,1
1	LHS	IL	24°29.493'	73°48.532'	23/02/2018	10:28:00 AM	650,000	3	20	32	18	13	9	7	5	4	3	29,2	29,9
1	LHS	OL	24°29.494'	73°48.534'	22/02/2018	11:13:09 AM	650,000	3	20	32	11	8	6	4	3	2	2	30,2	30,8
1	LHS	OL	24°29.515'	73°48.617'	22/02/2018	11:14:47 AM	650,250	3	20	32	14	11	8	5	3	3	2	30,3	31,1
1	LHS	IL	24°29.554'	73°48.790'	23/02/2018	10:30:16 AM	650,500	3	20	32	16	12	8	5	3	3	2	29,3	29,9
1	LHS	OL	24°29.553'	73°48.783'	22/02/2018	11:16:25 AM	650,500	3	20	32	17	13	9	6	4	3	2	30,5	31,2
1	LHS	OL	24°29.587'	73°48.918'	22/02/2018	11:17:50 AM	650,750	3	20	32	21	14	8	5	4	3	3	30,4	31,2
1	LHS	IL	24°29.685'	73°49.069'	23/02/2018	10:32:24 AM	651,000	3	20	32	13	11	8	5	4	3	2	29,4	30,0
1	LHS	OL	24°29.684'	73°49.068'	22/02/2018	11:19:25 AM	651,000	3	20	32	11	9	7	5	3	2	2	30,5	31,3
1	LHS	OL	24°29.792'	73°49.179'	22/02/2018	11:21:19 AM	651,250	3	20	32	12	8	6	5	2	1	1	30,5	31,3
1	LHS	IL	24°29.864'	73°49.292'	23/02/2018	10:34:24 AM	651,500	3	20	32	15	15	8	4	2	2	1	29,4	30,0
1	LHS	OL	24°29.869'	73°49.300'	22/02/2018	11:23:46 AM	651,500	3	20	32	30	22	10	5	3	3	2	30,5	31,3
1	LHS	OL	24°29.932'	73°49.424'	22/02/2018	11:25:12 AM	651,750	3	20	32	20	15	11	8	6	4	4	30,4	31,3
1	LHS	IL	24°29.995'	73°49.548'	23/02/2018	10:36:17 AM	652,000	3	20	32	29	21	11	6	5	3	3	29,4	30,1
1	LHS	OL	24°29.997'	73°49.548'	22/02/2018	11:26:39 AM	652,000	3	20	32	28	20	12	7	5	3	2	30,4	31,2
1	LHS	OL	24°30.095'	73°49.643'	22/02/2018	11:28:17 AM	652,250	3	20	32	33	23	14	8	6	5	4	30,5	31,3
1	LHS	IL	24°30.217'	73°49.657'	23/02/2018	10:38:26 AM	652,500	3	20	32	23	17	10	6	4	3	2	29,3	30,0
1	LHS	OL	24°30.221'	73°49.655'	22/02/2018	11:29:47 AM	652,500	3	20	32	23	17	10	5	3	3	2	30,4	31,4
1	LHS	OL	24°30.381'	73°49.578'	22/02/2018	11:31:28 AM	652,750	3	20	32	16	15	9	6	4	3	2	30,5	31,5
1	LHS	IL	24°30.476'	73°49.566'	22/02/2018	5:35:42 PM	653,000	3	20	32	21	17	9	5	3	2	1	30,9	31,9
1	LHS	OL	24°30.474'	73°49.558'	22/02/2018	11:32:50 AM	653,000	3	20	32	27	19	11	7	4	4	3	30,4	31,5
1	LHS	OL	24°30.573'	73°49.579'	22/02/2018	11:34:15 AM	653,250	3	20	32	31	25	15	8	6	4	2	30,5	31,8
1	LHS	IL	24°30.725'	73°49.658'	22/02/2018	5:38:04 PM	653,500	3	20	32	23	15	9	6	4	3	3	30,7	31,8
1	LHS	OL	24°30.718'	73°49.651'	22/02/2018	11:35:57 AM	653,500	3	20	32	15	10	7	5	3	3	2	30,4	31,6
1	LHS	OL	24°30.858'	73°49.722'	22/02/2018	11:37:35 AM	653,750	3	20	32	18	12	7	4	3	3	2	30,5	31,8
1	LHS	IL	24°30.973'	73°49.789'	22/02/2018	5:40:02 PM	654,000	3	20	32	25	17	11	6	4	3	3	30,4	31,5



Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	LHS	OL	24°30.971'	73°49.784'	22/02/2018	11:39:55 AM	654,000	3	20	32	18	14	10	6	4	4	3	30,5	31,6
1	LHS	OL	24°31.103'	73°49.866'	22/02/2018	11:41:38 AM	654,250	3	20	32	11	8	6	4	3	3	2	30,5	31,6
1	LHS	IL	24°31.182'	73°49.954'	22/02/2018	5:41:58 PM	654,500	3	20	32	16	9	5	3	2	2	1	30,4	31,5
1	LHS	OL	24°31.176'	73°49.942'	22/02/2018	11:43:59 AM	654,500	3	20	32	15	11	8	6	4	3	3	30,5	31,8
1	LHS	OL	24°31.260'	73°50.034'	22/02/2018	11:45:27 AM	654,750	3	20	32	19	13	8	5	4	3	3	30,5	31,8
1	LHS	IL	24°31.383'	73°50.166'	22/02/2018	5:44:03 PM	655,000	3	22	33	14	14	9	6	4	3	3	30,5	31,6
1	LHS	OL	24°31.383'	73°50.161'	22/02/2018	11:47:00 AM	655,000	3	22	33	25	19	11	6	4	3	2	30,7	32,0
1	LHS	OL	24°31.506'	73°50.279'	22/02/2018	11:48:36 AM	655,250	3	22	33	12	8	5	3	2	2	2	30,8	32,0
1	LHS	IL	24°31.597'	73°50.352'	22/02/2018	5:46:26 PM	655,500	3	22	33	18	13	8	5	4	3	2	30,5	31,6
1	LHS	OL	24°31.591'	73°50.343'	22/02/2018	11:50:01 AM	655,500	3	22	33	26	21	13	7	6	4	2	30,7	31,9
1	LHS	OL	24°31.674'	73°50.433'	22/02/2018	11:51:32 AM	655,750	3	22	33	14	10	8	5	4	3	2	30,8	32,0
1	LHS	IL	24°31.787'	73°50.569'	22/02/2018	5:48:28 PM	656,000	3	22	33	18	15	9	5	3	2	2	30,5	31,6
1	LHS	OL	24°31.789'	73°50.566'	22/02/2018	11:54:54 AM	656,000	3	22	33	23	16	9	5	3	2	2	30,9	32,1
1	LHS	OL	24°31.847'	73°50.633'	22/02/2018	11:56:38 AM	656,250	3	22	33	21	14	9	5	3	2	2	31,1	31,9
1	LHS	IL	24°31.948'	73°50.770'	22/02/2018	5:50:22 PM	656,500	3	22	33	19	13	8	5	4	3	2	30,5	31,8
1	LHS	OL	24°31.949'	73°50.765'	22/02/2018	2:18:55 PM	656,500	3	22	33	15	14	9	5	4	3	2	31,2	31,3
1	LHS	OL	24°32.044'	73°50.845'	22/02/2018	2:20:28 PM	656,750	3	22	33	14	11	8	5	3	3	2	31,3	32,1
1	LHS	IL	24°32.191'	73°50.941'	22/02/2018	5:52:25 PM	657,000	3	22	33	21	16	9	6	4	2	1	30,5	31,6
1	LHS	OL	24°32.195'	73°50.939'	22/02/2018	2:22:11 PM	657,000	3	22	33	27	17	10	6	5	4	2	31,5	30,5
1	LHS	OL	24°32.330'	73°50.961'	22/02/2018	2:24:11 PM	657,250	3	22	33	27	20	13	8	5	4	3	31,4	32,6
1	LHS	IL	24°32.419'	73°50.934'	22/02/2018	5:54:31 PM	657,500	3	22	33	25	18	11	7	4	4	3	30,1	31,2
1	LHS	OL	24°32.452'	73°50.919'	22/02/2018	2:26:38 PM	657,500	3	22	33	31	22	14	8	6	5	4	31,3	32,4
1	LHS	OL	24°32.582'	73°50.838'	22/02/2018	2:28:11 PM	657,750	3	22	33	23	16	11	6	4	3	3	31,4	32,3
1	LHS	IL	24°32.557'	73°50.617'	22/02/2018	5:56:25 PM	658,000	3	22	33	20	18	11	7	4	3	2	30,1	31,2
1	LHS	OL	24°32.726'	73°50.632'	22/02/2018	2:30:19 PM	658,250	3	22	33	27	19	11	7	3	3	2	31,7	32,8
1	LHS	IL	24°32.827'	73°50.468'	22/02/2018	5:57:48 PM	658,500	3	22	33	18	16	11	6	4	3	2	30,0	31,2
1	LHS	OL	24°32.823'	73°50.475'	22/02/2018	2:33:28 PM	658,500	3	22	33	19	18	11	7	5	4	3	31,7	32,7
1	LHS	OL	24°32.899'	73°50.390'	22/02/2018	2:34:55 PM	658,750	3	22	33	24	16	8	5	3	2	2	31,7	32,8
1	LHS	IL	24°33.028'	73°50.354'	22/02/2018	5:59:38 PM	659,000	3	22	33	24	18	10	5	3	3	2	30,1	31,3
1	LHS	OL	24°33.029'	73°50.353'	22/02/2018	2:36:34 PM	659,000	3	22	33	23	16	8	4	3	2	0	31,7	32,8
1	LHS	OL	24°33.114'	73°50.417'	22/02/2018	2:37:24 PM	659,250	3	22	33	25	16	9	5	3	2	1	31,9	32,8
1	LHS	IL	24°33.245'	73°50.556'	22/02/2018	6:01:40 PM	659,500	3	22	33	29	19	10	6	4	3	2	30,3	31,5
1	LHS	OL	24°33.230'	73°50.515'	22/02/2018	2:38:52 PM	659,500	3	22	33	26	17	10	5	3	3	2	31,9	33,1
1	LHS	OL	24°33.302'	73°50.637'	22/02/2018	2:40:22 PM	659,750	3	22	33	33	23	15	8	4	3	2	31,9	33,1
1	LHS	IL	24°33.429'	73°50.716'	22/02/2018	6:04:34 PM	660,000	3	25	36	30	20	8	4	3	3	2	30,3	31,5
1	LHS	OL	24°33.431'	73°50.715'	22/02/2018	2:41:55 PM	660,000	3	25	36	25	15	8	4	3	2	2	31,9	33,0
1	LHS	OL	24°33.559'	73°50.776'	22/02/2018	2:43:50 PM	660,250	3	25	36	36	26	14	7	4	4	4	31,8	32,9
1	LHS	IL	24°33.634'	73°50.886'	22/02/2018	6:07:46 PM	660,500	3	25	36	17	11	9	6	4	3	2	30,4	31,5
1	LHS	OL	24°33.635'	73°50.880'	22/02/2018	2:46:20 PM	660,500	3	25	36	22	17	10	7	5	3	2	31,9	32,9
1	LHS	OL	24°33.697'	73°50.998'	22/02/2018	2:48:47 PM	660,750	3	25	36	18	14	10	6	4	3	2	31,7	32,6
1	LHS	IL	24°33.776'	73°51.140'	22/02/2018	6:10:38 PM	661,000	3	25	36	26	17	9	6	3	2	2	30,4	31,6
1	LHS	OL	24°33.779'	73°51.139'	22/02/2018	2:50:28 PM	661,000	3	25	36	22	15	9	5	3	3	2	31,6	32,7
1	LHS	OL	24°33.856'	73°51.262'	22/02/2018	2:52:07 PM	661,250	3	25	36	24	17	10	5	4	3	2	31,7	32,8
1	LHS	IL	24°33.913'	73°51.369'	22/02/2018	6:12:44 PM	661,500	3	25	36	25	18	10	5	3	3	2	30,5	31,6
1	LHS	OL	24°33.933'	73°51.392'	22/02/2018	2:53:44 PM	661,500	3	25	36	29	19	11	6	4	3	3	31,6	32,7
1	LHS	OL	24°34.011'	73°51.489'	22/02/2018	2:55:19 PM	661,750	3	25	36	34	24	12	6	4	3	2	31,6	32,8
1	LHS	IL	24°34.106'	73°51.609'	22/02/2018	6:14:45 PM	662,000	3	25	36	16	11	7	4	2	2	2	30,3	31,4
1	LHS	OL	24°34.112'	73°51.611'	22/02/2018	2:56:52 PM	662,000	3	25	36	20	14	8	5	3	2	2	31,7	32,9
1	LHS	OL	24°34.185'	73°51.700'	22/02/2018	2:58:14 PM	662,250	3	25	36	13	11	7	4	2	1	1	31,8	33,0



Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	LHS	IL	24°34.250'	73°51.783'	22/02/2018	6:16:22 PM	662,500	3	25	36	27	18	11	6	4	3	2	30,1	30,9
1	LHS	OL	24°34.281'	73°51.812'	22/02/2018	2:59:55 PM	662,500	3	25	36	29	19	11	6	3	2	2	31,7	32,9
1	LHS	OL	24°34.388'	73°51.889'	22/02/2018	3:01:32 PM	662,750	3	25	36	17	15	9	5	3	2	2	31,8	32,9
1	LHS	IL	24°34.526'	73°51.970'	22/02/2018	6:18:34 PM	663,000	3	25	36	28	17	8	4	2	2	1	29,9	30,9
1	LHS	OL	24°34.531'	73°51.969'	22/02/2018	3:03:31 PM	663,000	3	25	36	25	16	8	5	4	3	3	31,9	33,1
1	LHS	OL	24°34.631'	73°52.025'	22/02/2018	3:34:14 PM	663,250	3	25	36	32	20	11	5	3	2	2	31,2	31,9
1	LHS	IL	24°34.733'	73°52.095'	22/02/2018	6:20:45 PM	663,500	3	25	36	31	20	12	6	4	3	3	29,6	30,8
1	LHS	OL	24°34.741'	73°52.099'	22/02/2018	3:37:50 PM	663,500	3	25	36	17	12	9	6	3	3	2	31,4	32,3
1	LHS	OL	24°34.860'	73°52.193'	22/02/2018	3:39:29 PM	663,750	3	25	36	20	14	9	6	4	3	2	31,4	32,6
1	LHS	IL	24°34.974'	73°52.289'	22/02/2018	6:25:09 PM	664,000	3	25	36	27	17	10	5	4	3	2	29,6	30,8
1	LHS	OL	24°34.974'	73°52.286'	22/02/2018	3:41:07 PM	664,000	3	25	36	31	20	11	6	3	1	1	31,5	32,8
1	LHS	OL	24°35.081'	73°52.373'	22/02/2018	3:48:31 PM	664,250	3	25	36	22	14	8	4	3	2	2	31,6	32,4
1	LHS	IL	24°35.182'	73°52.456'	22/02/2018	6:27:11 PM	664,500	3	25	36	20	14	8	4	2	2	1	29,7	30,9
1	LHS	OL	24°35.176'	73°52.449'	22/02/2018	3:49:56 PM	664,500	3	25	36	19	14	8	5	3	2	2	31,7	32,3
1	LHS	OL	24°35.305'	73°52.552'	21/02/2018	5:29:09 PM	664,750	3	25	36	32	24	14	7	4	3	2	31,4	32,4
1	LHS	IL	24°35.419'	73°52.646'	22/02/2018	6:29:22 PM	665,000	3	23	32	25	17	10	5	3	2	1	29,6	30,8
1	LHS	OL	24°35.420'	73°52.646'	21/02/2018	5:31:34 PM	665,000	3	23	32	25	16	10	6	3	2	2	31,3	32,4
1	LHS	OL	24°35.532'	73°52.735'	21/02/2018	5:33:20 PM	665,250	3	23	32	26	19	11	6	4	3	2	31,3	32,4
1	LHS	IL	24°35.622'	73°52.811'	22/02/2018	6:31:23 PM	665,500	3	23	32	31	20	10	6	4	3	3	29,5	30,6
1	LHS	OL	24°35.632'	73°52.816'	21/02/2018	5:34:55 PM	665,500	3	23	32	33	23	14	6	4	4	3	31,2	32,4
1	LHS	OL	24°35.739'	73°52.906'	21/02/2018	5:36:29 PM	665,750	3	23	32	18	13	8	5	3	3	2	30,9	32,2
1	LHS	IL	24°35.850'	73°52.997'	22/02/2018	6:33:31 PM	666,000	3	23	32	20	14	9	5	3	2	2	29,5	30,7
1	LHS	OL	24°35.852'	73°52.998'	21/02/2018	5:38:12 PM	666,000	3	23	32	21	14	9	5	3	2	2	30,9	32,2
1	LHS	OL	24°35.948'	73°53.076'	21/02/2018	5:39:51 PM	666,250	3	23	32	17	13	9	6	4	3	3	30,9	32,1
1	LHS	IL	24°36.050'	73°53.160'	22/02/2018	6:35:38 PM	666,500	3	23	32	14	8	6	4	3	2	1	29,4	30,6
1	LHS	OL	24°36.064'	73°53.172'	21/02/2018	5:41:27 PM	666,500	3	23	32	14	9	6	4	2	2	2	30,8	32,0
1	LHS	OL	24°36.162'	73°53.250'	21/02/2018	5:43:00 PM	666,750	3	23	32	22	15	9	5	3	2	2	30,7	32,0
1	LHS	IL	24°36.292'	73°53.335'	22/02/2018	6:37:44 PM	667,000	3	23	32	28	18	11	7	5	2	2	29,4	30,6
1	LHS	OL	24°36.295'	73°53.336'	21/02/2018	5:44:35 PM	667,000	3	23	32	21	15	9	5	3	2	2	30,6	31,9
1	LHS	OL	24°36.408'	73°53.397'	21/02/2018	5:46:53 PM	667,250	3	23	32	22	16	10	6	4	3	2	30,6	31,8
1	LHS	IL	24°36.512'	73°53.455'	22/02/2018	6:40:09 PM	667,500	3	23	32	23	16	9	5	3	3	1	29,4	30,5
1	LHS	OL	24°36.524'	73°53.460'	21/02/2018	5:48:22 PM	667,500	3	23	32	20	12	8	5	4	3	3	30,6	31,9
1	LHS	OL	24°36.655'	73°53.453'	21/02/2018	5:49:55 PM	667,750	3	23	32	23	16	9	5	3	3	2	30,7	32,1
1	LHS	IL	24°36.776'	73°53.009'	22/02/2018	6:42:11 PM	668,000	3	23	32	23	14	8	5	3	2	2	29,4	30,6
1	LHS	OL	24°36.778'	73°53.607'	21/02/2018	5:51:32 PM	668,000	3	23	32	15	9	5	3	2	2	2	30,7	32,1
1	LHS	OL	24°36.884'	73°53.664'	21/02/2018	5:53:03 PM	668,250	3	23	32	21	14	8	5	3	2	2	30,7	32,0
1	LHS	IL	24°37.986'	73°53.721'	22/02/2018	6:45:03 PM	668,500	3	23	32	22	13	7	4	2	2	2	29,3	30,4
1	LHS	OL	24°37.010'	73°53.731'	21/02/2018	5:54:34 PM	668,500	3	23	32	28	18	10	5	4	3	3	30,7	32,0
1	LHS	OL	24°37.136'	73°53.800'	21/02/2018	5:56:07 PM	668,750	3	23	32	32	22	12	7	5	4	3	30,7	31,9
1	LHS	IL	24°37.262'	73°53.869'	22/02/2018	6:47:16 PM	669,000	3	23	32	19	17	10	6	4	2	2	29,1	30,3
1	LHS	OL	24°37.265'	73°53.868'	21/02/2018	3:16:10 PM	669,000	3	23	32	19	13	8	5	3	2	1	31,4	32,7
1	LHS	OL	24°37.340'	73°53.988'	21/02/2018	3:14:35 PM	669,250	3	23	32	18	13	8	5	3	3	2	31,5	32,7
1	LHS	IL	24°37.465'	73°53.977'	22/02/2018	6:49:35 PM	669,500	3	23	32	30	20	12	7	5	3	3	29,1	30,3
1	LHS	OL	24°37.500'	73°53.994'	21/02/2018	3:13:09 PM	669,500	3	23	32	25	17	11	6	4	3	3	31,6	32,7
1	LHS	OL	24°37.589'	73°54.034'	21/02/2018	6:02:31 PM	669,750	3	23	32	19	13	8	5	3	3	2	30,4	31,6
1	LHS	IL	24°37.733'	73°54.092'	22/02/2018	6:51:46 PM	670,000	3	24	34	14	10	6	4	2	2	2	29,2	30,4
1	LHS	OL	24°37.737'	73°54.093'	21/02/2018	6:04:15 PM	670,000	3	24	34	20	15	7	4	3	3	1	30,3	31,4
1	LHS	OL	24°37.866'	73°54.165'	21/02/2018	6:06:02 PM	670,250	3	24	34	18	14	9	6	3	3	2	30,2	31,3
1	LHS	IL	24°37.971'	73°54.302'	22/02/2018	6:54:05 PM	670,500	3	24	34	33	23	11	5	3	2	2	29,2	30,4

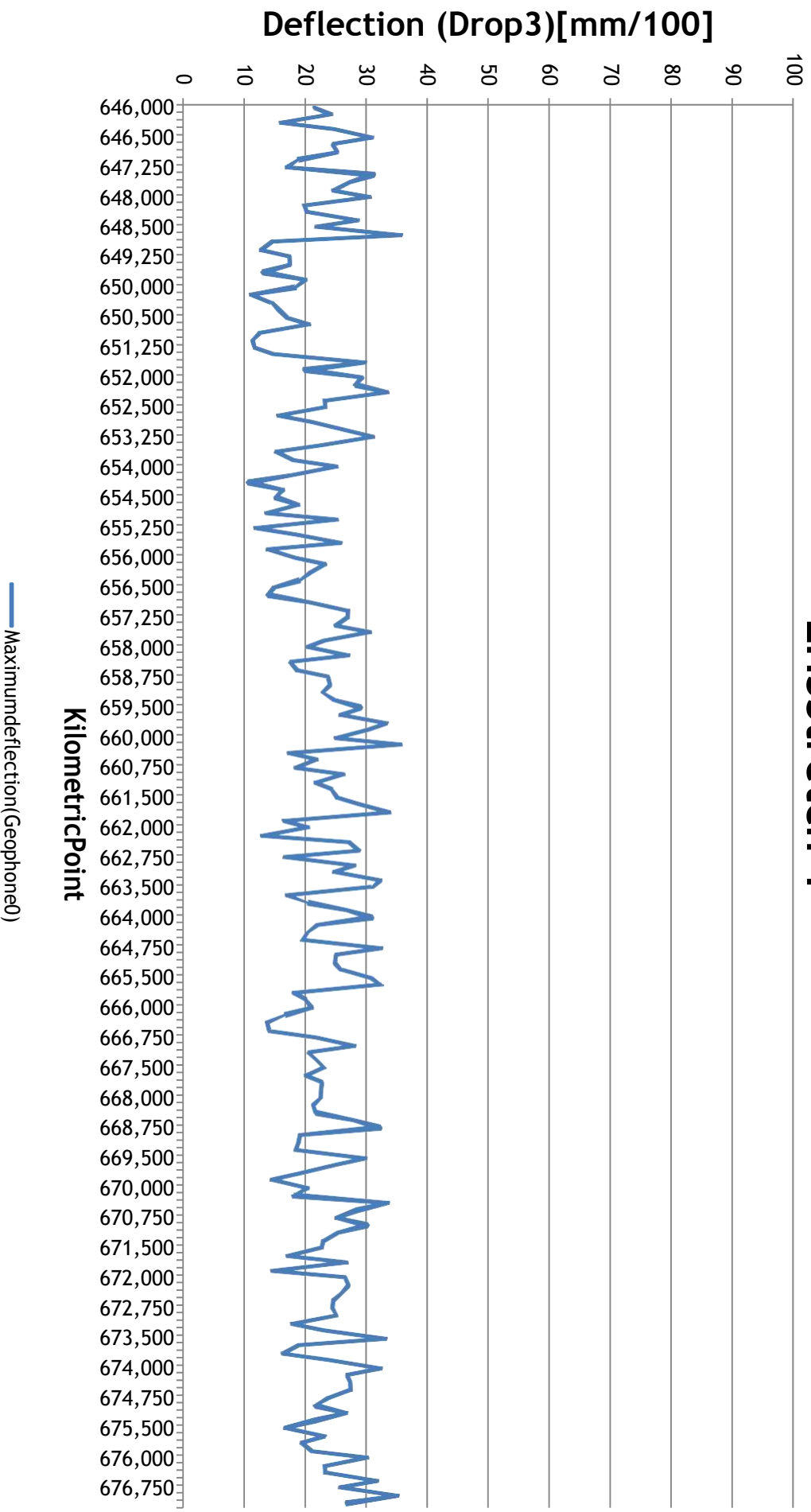


Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	LHS	OL	24°37.950'	73°54.276'	21/02/2018	6:07:39 PM	670,500	3	24	34	28	21	12	6	4	4	2	30,3	31,5
1	LHS	OL	24°37.027'	73°54.394'	21/02/2018	2:18:43 PM	670,750	3	24	34	25	14	8	5	4	3	2	31,9	31,9
1	LHS	IL	24°38.083'	73°54.563'	21/02/2018	6:13:17 PM	671,000	3	24	34	30	21	12	5	3	3	2	30,4	31,6
1	LHS	OL	24°38.083'	73°54.557'	21/02/2018	2:20:28 PM	671,000	3	24	34	25	14	8	5	4	3	2	31,7	32,9
1	LHS	OL	24°38.141'	73°54.683'	21/02/2018	2:22:11 PM	671,250	3	24	34	23	14	8	5	3	3	2	31,8	33,0
1	LHS	IL	24°38.211'	73°54.813'	21/02/2018	6:15:12 PM	671,500	3	24	34	23	15	8	5	4	3	2	30,4	31,5
1	LHS	OL	24°38.224'	73°54.824'	21/02/2018	2:24:19 PM	671,500	3	24	34	17	13	8	5	3	2	1	31,8	33,0
1	LHS	OL	24°38.224'	73°54.824'	21/02/2018	2:26:38 PM	671,500	3	24	34	27	20	9	6	4	3	3	31,9	33,0
1	LHS	IL	24°38.457'	73°54.986'	21/02/2018	6:17:17 PM	672,000	3	24	34	15	9	8	5	4	3	2	30,5	31,6
1	LHS	OL	24°38.456'	73°54.983'	21/02/2018	2:28:11 PM	672,000	3	24	34	27	19	9	6	4	4	3	31,8	32,9
1	LHS	OL	24°38.534'	73°55.073'	21/02/2018	2:29:36 PM	672,250	3	24	34	27	19	9	6	4	3	2	31,9	33,1
1	LHS	IL	24°38.613'	73°55.181'	21/02/2018	6:19:05 PM	672,500	3	24	34	26	18	11	6	4	3	2	30,5	31,5
1	LHS	OL	24°38.626'	73°55.192'	21/02/2018	2:30:19 PM	672,500	3	24	34	25	19	9	6	4	3	3	31,9	33,1
1	LHS	OL	24°38.786'	73°55.273'	21/02/2018	2:33:28 PM	672,750	3	24	34	24	20	10	6	4	2	2	31,9	33,1
1	LHS	IL	24°38.876'	73°55.347'	21/02/2018	6:21:16 PM	673,000	3	24	34	25	18	10	6	4	3	2	30,5	31,4
1	LHS	OL	24°38.873'	73°55.342'	21/02/2018	3:18:00 PM	673,000	3	24	34	18	12	8	5	3	3	2	31,4	32,7
1	LHS	OL	24°38.996'	73°55.417'	21/02/2018	3:19:41 PM	673,250	3	24	34	23	16	10	5	4	3	2	31,4	32,8
1	LHS	IL	24°39.123'	73°55.490'	21/02/2018	6:23:38 PM	673,500	3	24	34	33	25	14	7	5	3	2	30,4	31,4
1	LHS	OL	24°39.095'	73°55.474'	21/02/2018	3:21:27 PM	673,500	3	24	34	19	13	8	5	3	2	2	31,5	33,0
1	LHS	OL	24°39.210'	73°55.508'	21/02/2018	3:23:13 PM	673,750	3	24	34	16	12	7	5	3	2	1	31,5	32,9
1	LHS	IL	24°39.358'	73°55.497'	21/02/2018	6:25:37 PM	674,000	3	24	34	24	16	9	6	3	2	1	30,4	31,4
1	LHS	OL	24°39.354'	73°55.496'	21/02/2018	3:24:50 PM	674,000	3	24	34	32	23	12	6	5	3	3	31,6	32,8
1	LHS	OL	24°39.487'	73°55.526'	21/02/2018	3:31:17 PM	674,250	3	24	34	27	18	10	6	4	4	3	31,2	32,2
1	LHS	IL	24°39.602'	73°55.576'	21/02/2018	6:27:36 PM	674,500	3	24	34	27	18	9	5	4	3	3	30,4	31,5
1	LHS	OL	24°39.618'	73°55.582'	21/02/2018	3:33:03 PM	674,500	3	24	34	27	19	9	5	4	3	2	31,3	32,6
1	LHS	OL	24°39.732'	73°55.646'	21/02/2018	3:34:35 PM	674,750	3	24	34	24	16	9	6	4	3	2	31,4	32,7
1	LHS	IL	24°39.823'	73°55.798'	21/02/2018	6:30:00 PM	675,000	3	25	35	22	14	9	6	3	2	2	30,4	31,4
1	LHS	OL	24°39.824'	73°55.790'	21/02/2018	3:36:14 PM	675,000	3	25	35	27	20	11	5	3	1	1	31,5	32,8
1	LHS	OL	24°39.819'	73°55.915'	21/02/2018	3:37:45 PM	675,250	3	25	35	22	16	11	6	4	3	2	31,5	32,8
1	LHS	IL	24°39.938'	73°55.019'	21/02/2018	6:31:56 PM	675,500	3	25	35	17	11	8	5	3	2	2	30,3	31,3
1	LHS	OL	24°39.963'	73°56.043'	21/02/2018	3:39:21 PM	675,500	3	25	35	23	16	10	6	4	4	3	31,5	32,8
1	LHS	OL	24°40.207'	73°56.115'	21/02/2018	3:40:50 PM	675,750	3	25	35	19	16	11	7	5	3	2	31,4	32,7
1	LHS	IL	24°40.184'	73°56.184'	21/02/2018	6:33:54 PM	676,000	3	25	35	21	17	11	6	4	3	2	30,0	30,9
1	LHS	OL	24°40.182'	73°56.115'	21/02/2018	3:42:24 PM	676,000	3	25	35	30	21	11	7	4	4	2	31,4	32,7
1	LHS	OL	24°40.316'	73°56.272'	21/02/2018	3:45:00 PM	676,250	3	25	35	23	16	10	6	4	3	3	31,4	32,7
1	LHS	IL	24°40.473'	73°56.217'	21/02/2018	6:36:06 PM	676,500	3	25	35	23	16	11	7	4	3	3	29,9	30,9
1	LHS	OL	24°40.483'	73°56.219'	21/02/2018	3:46:19 PM	676,500	3	25	35	32	23	12	6	4	3	3	31,4	32,6
1	LHS	OL	24°40.581'	73°56.218'	21/02/2018	3:48:13 PM	676,750	3	25	35	26	18	10	6	4	3	3	31,4	32,4
1	LHS	IL	24°40.702'	73°56.254'	21/02/2018	6:38:00 PM	677,000	3	25	35	35	26	14	8	5	3	3	29,7	30,8
1	LHS	OL	24°40.702'	73°56.251'	21/02/2018	3:50:35 PM	677,000	3	25	35	27	20	12	7	4	3	2	31,4	32,6

PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE NATIONAL
HIGHWAYS ON ROADS UNDER (THE NATIONAL HIGHWAYS
INFRA TRUST)

Technical Due Diligence Report of NH27 (NH14) Abu

LHS Stretch 1



Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	RHS	OL	24°40.696'	72°56.260'	21/02/2018	11.08.52 AM	677,000	3	21	35	16	12	9	7	5	4	3	30,1	30,1
1	RHS	IL	24°40.695'	72°56.260'	21/02/2018	4.19.08 PM	677,000	3	21	35	9	5	4	3	2	2	2	30,8	32,1
1	RHS	OL	24°40.567'	72°56.226'	21/02/2018	11.11.07 AM	676,750	3	21	35	18	13	8	5	3	2	2	30,3	30,4
1	RHS	OL	24°40.434'	72°56.230'	21/02/2018	11.13.50 AM	676,500	3	21	35	16	12	8	5	3	3	2	30,4	30,6
1	RHS	IL	24°40.430'	72°56.229'	21/02/2018	4.21.12 PM	676,500	3	21	35	30	20	10	6	4	4	3	31,3	32,3
1	RHS	OL	24°40.317'	72°56.233'	21/02/2018	11.22.34 AM	676,250	3	21	35	24	17	10	6	4	3	2	30,9	30,5
1	RHS	OL	24°40.170'	72°56.172'	21/02/2018	11.25.04 AM	676,000	3	21	35	29	19	10	6	6	5	5	30,9	30,7
1	RHS	IL	24°40.174'	72°56.172'	21/02/2018	4.23.10 PM	676,000	3	21	35	28	21	11	6	4	3	3	31,5	32,4
1	RHS	OL	24°40.062'	72°56.121'	21/02/2018	11.26.36 AM	675,750	3	21	35	22	16	11	7	4	3	3	30,9	30,7
1	RHS	OL	24°39.949'	72°56.043'	21/02/2018	11.28.13 AM	675,500	3	23	36	8	7	5	4	2	2	1	30,8	30,8
1	RHS	IL	24°39.929'	72°56.020'	21/02/2018	4.25.12 PM	675,500	3	23	36	16	11	7	4	2	2	1	31,5	32,3
1	RHS	OL	24°39.875'	72°55.927'	21/02/2018	11.29.51 AM	675,250	3	23	36	9	7	6	5	4	3	2	30,7	30,9
1	RHS	OL	24°39.811'	72°55.786'	21/02/2018	11.31.29 AM	675,000	3	23	36	23	15	9	5	3	3	2	30,7	31,1
1	RHS	IL	24°39.811'	72°55.784'	21/02/2018	4.26.59 PM	675,000	3	23	36	26	17	9	4	3	2	2	31,6	32,6
1	RHS	OL	24°39.740'	72°55.671'	21/02/2018	11.33.06 AM	674,750	3	23	36	14	10	7	4	3	2	2	30,7	31,1
1	RHS	OL	24°39.626'	72°55.597'	21/02/2018	11.35.49 AM	674,500	3	23	36	18	13	8	4	3	2	2	30,7	31,2
1	RHS	IL	24°39.620'	72°55.594'	21/02/2018	4.29.09 PM	674,500	3	23	36	24	17	9	4	3	2	1	31,6	32,6
1	RHS	OL	24°39.480'	72°55.520'	21/02/2018	11.37.23 AM	674,250	3	23	36	23	15	7	4	3	2	2	30,7	31,3
1	RHS	OL	24°39.357'	72°55.507'	21/02/2018	11.39.27 AM	674,000	3	23	36	18	14	8	5	3	3	2	30,8	31,3
1	RHS	IL	24°39.342'	72°55.506'	21/02/2018	4.31.28 PM	674,000	3	23	36	20	14	9	5	3	3	2	31,7	32,7
1	RHS	OL	24°39.221'	72°55.519'	21/02/2018	11.41.23 AM	673,750	3	23	36	18	11	6	3	2	2	2	31,1	31,4
1	RHS	OL	24°39.091'	72°55.484'	21/02/2018	11.43.03 AM	673,500	3	23	36	30	22	11	6	4	3	2	31,1	31,3
1	RHS	IL	24°39.094'	72°55.985'	21/02/2018	4.33.38 PM	673,500	3	23	36	24	18	11	6	4	3	2	31,8	32,7
1	RHS	OL	24°38.977'	72°55.419'	21/02/2018	11.45.31 AM	673,250	3	23	36	15	10	7	4	3	2	2	30,9	31,2
1	RHS	OL	24°38.866'	72°55.349'	21/02/2018	12.02.52 PM	673,000	3	23	36	20	14	9	5	4	3	3	31,7	31,2
1	RHS	IL	24°38.869'	72°55.347'	21/02/2018	4.35.38 PM	673,000	3	23	36	24	17	10	5	3	2	1	31,8	32,7
1	RHS	OL	24°38.746'	72°55.288'	21/02/2018	12.05.14 PM	672,750	3	23	36	25	16	9	5	3	3	2	31,6	31,3
1	RHS	OL	24°38.641'	72°55.220'	21/02/2018	12.07.20 PM	672,500	3	23	36	30	21	11	5	3	3	2	31,4	31,3
1	RHS	IL	24°38.616'	72°55.198'	21/02/2018	4.37.34 PM	672,500	3	23	36	28	19	10	6	4	3	3	31,8	32,7
1	RHS	OL	24°38.565'	72°55.130'	21/02/2018	12.08.55 PM	672,250	3	23	36	29	20	9	6	4	3	3	31,4	31,5
1	RHS	OL	24°38.445'	72°54.986'	21/02/2018	12.11.39 PM	672,000	3	23	36	28	17	9	4	1	1	1	31,4	31,8
1	RHS	IL	24°38.446'	72°54.986'	21/02/2018	4.39.31 PM	672,000	3	23	36	23	16	9	4	2	2	1	31,6	32,7
1	RHS	OL	24°38.348'	72°54.926'	21/02/2018	12.14.38 PM	671,750	3	23	36	36	26	14	7	4	3	3	31,5	31,6
1	RHS	OL	24°38.234'	72°54.849'	21/02/2018	12.16.16 PM	671,500	3	23	36	29	20	12	6	4	3	2	31,5	31,9
1	RHS	IL	24°38.215'	72°54.827'	21/02/2018	4.42.54 PM	671,500	3	23	36	25	19	12	7	5	4	3	31,6	32,8
1	RHS	OL	24°38.150'	72°54.723'	21/02/2018	12.17.56 PM	671,250	3	23	36	27	19	11	6	4	3	2	31,5	31,8
1	RHS	OL	24°38.074'	72°54.562'	21/02/2018	12.19.45 PM	671,000	3	23	36	27	18	11	6	3	3	2	31,6	31,9
1	RHS	IL	24°38.074'	72°54.560'	21/02/2018	4.44.58 PM	671,000	3	23	36	32	23	13	6	4	3	3	31,6	32,7
1	RHS	OL	24°38.996'	72°54.415'	21/02/2018	12.21.23 PM	670,750	3	23	36	23	16	10	6	3	2	2	31,7	32,0
1	RHS	OL	24°37.953'	72°54.305'	21/02/2018	4.50.37 PM	670,500	3	23	36	21	16	9	6	3	2	2	31,7	32,8
1	RHS	IL	24°37.955'	72°54.311'	22/02/2018	8.17.20 AM	670,500	3	23	36	25	20	12	7	4	3	2	24,5	25,4
1	RHS	OL	24°37.879'	72°54.191'	21/02/2018	4.52.14 PM	670,250	3	23	36	26	18	11	6	4	3	3	31,6	32,7
1	RHS	OL	24°37.720'	72°54.098'	21/02/2018	4.53.51 PM	670,000	3	14	27	12	9	7	5	4	3	2	31,5	32,6
1	RHS	IL	24°37.725'	72°54.096'	22/02/2018	8.20.52 AM	670,000	3	14	27	7	5	4	3	2	2	1	24,7	25,8
1	RHS	OL	24°37.580'	72°54.052'	21/02/2018	4.55.32 PM	669,750	3	14	27	10	7	5	4	3	2	1	31,5	32,4
1	RHS	OL	24°37.467'	72°53.987'	21/02/2018	4.57.02 PM	669,500	3	14	27	13	10	8	6	4	3	2	31,6	32,4
1	RHS	IL	24°37.456'	72°53.980'	22/02/2018	8.23.07 AM	669,500	3	14	27	5	3	3	2	2	2	1	24,9	25,9
1	RHS	OL	24°37.352'	72°53.927'	21/02/2018	4.58.33 PM	669,250	3	14	27	6	4	4	3	3	2	1	31,6	32,7
1	RHS	OL	24°37.248'	72°53.871'	21/02/2018	5.00.14 PM	669,000	3	14	27	10	7	5	4	3	3	2	31,7	32,7

Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	RHS	IL	24°37.252'	72°53.871'	22/02/2018	8.25.11 AM	669,000	3	14	27	6	4	3	3	2	2	2	25,2	25,8
1	RHS	OL	24°37.124'	72°53.805'	21/02/2018	5.01.40 PM	668,750	3	14	27	10	8	7	5	4	3	2	31,7	32,7
1	RHS	OL	24°36.980'	72°53.728'	21/02/2018	5.03.12 PM	668,500	3	14	27	27	20	12	8	5	3	3	31,7	32,7
1	RHS	IL	24°37.004'	72°53.738'	22/02/2018	8.27.27 AM	668,500	3	14	27	11	8	6	4	3	2	1	25,2	25,6
1	RHS	OL	24°36.882'	72°53.675'	21/02/2018	5.04.53 PM	668,250	3	14	27	22	16	10	5	3	2	2	31,6	32,6
1	RHS	OL	24°36.764'	72°53.612'	21/02/2018	5.06.26 PM	668,000	3	14	27	9	5	4	3	2	2	1	31,6	32,7
1	RHS	IL	24°36.766'	72°53.610'	22/02/2018	8.29.27 AM	668,000	3	14	27	7	4	3	2	1	1	1	25,3	26,0
1	RHS	OL	24°36.643'	72°53.547'	21/02/2018	5.08.00 PM	667,750	3	14	27	19	13	8	4	3	2	1	31,7	32,7
1	RHS	OL	24°36.524'	72°53.473'	21/02/2018	5.09.31 PM	667,500	3	14	27	15	11	8	5	3	2	2	31,7	32,8
1	RHS	IL	24°36.519'	72°53.467'	22/02/2018	8.31.45 AM	667,500	3	14	27	23	15	10	6	3	2	2	25,6	26,5
1	RHS	OL	24°36.393'	72°53.400'	21/02/2018	5.11.24 PM	667,250	3	14	27	19	14	9	6	4	3	2	31,7	32,8
1	RHS	OL	24°36.280'	72°53.340'	21/02/2018	5.13.07 PM	667,000	3	14	27	22	16	11	6	3	3	2	31,7	32,7
1	RHS	IL	24°36.284'	72°52.339'	22/02/2018	8.33.39 AM	667,000	3	14	27	13	10	7	5	4	2	2	25,9	26,7
1	RHS	OL	24°36.167'	72°53.266'	21/02/2018	5.14.43 PM	666,750	3	14	27	16	12	8	5	4	3	2	31,7	32,7
1	RHS	OL	24°36.065'	72°53.182'	21/02/2018	5.16.06 PM	666,500	3	14	27	17	12	9	6	4	3	2	31,7	32,7
1	RHS	IL	24°36.040'	72°53.161'	22/02/2018	8.36.00 AM	666,500	3	14	27	22	16	10	6	4	2	2	26,1	26,8
1	RHS	OL	24°35.957'	72°53.096'	21/02/2018	5.17.42 PM	666,250	3	14	27	19	14	9	6	4	3	2	31,6	32,7
1	RHS	OL	24°35.847'	72°53.005'	21/02/2018	5.19.12 PM	666,000	3	14	27	12	9	7	5	3	3	2	31,5	32,6
1	RHS	IL	24°35.843'	72°53.000'	22/02/2018	8.38.00 AM	666,000	3	14	27	10	7	5	4	3	2	2	26,3	26,8
1	RHS	OL	24°35.739'	72°52.918'	21/02/2018	5.20.47 PM	665,750	3	14	27	10	6	5	4	3	2	2	31,6	32,7
1	RHS	OL	24°35.641'	72°52.837'	21/02/2018	5.22.19 PM	665,500	3	14	27	8	4	4	3	2	2	2	31,5	32,7
1	RHS	IL	24°35.630'	72°53.834'	22/02/2018	8.47.43 AM	665,500	3	14	27	5	3	3	2	2	2	2	26,6	27,0
1	RHS	OL	24°35.522'	72°52.740'	21/02/2018	5.23.51 PM	665,250	3	14	27	28	20	11	6	4	3	2	31,6	32,7
1	RHS	OL	24°35.403'	72°52.645'	21/02/2018	5.25.27 PM	665,000	3	19	32	29	21	14	8	5	3	2	31,6	32,7
1	RHS	IL	24°35.407'	72°52.643'	22/02/2018	8.50.09 AM	665,000	3	19	32	24	17	10	5	3	2	2	26,7	27,0
1	RHS	OL	24°35.311'	72°52.570'	21/02/2018	5.27.10 PM	664,750	3	19	32	25	18	12	7	4	3	3	31,6	32,7
1	RHS	OL	24°35.201'	72°52.483'	22/02/2018	3.53.32 PM	664,500	3	19	32	10	7	6	5	4	3	2	31,6	32,6
1	RHS	IL	24°35.198'	72°52.477'	22/02/2018	8.52.11 AM	664,500	3	19	32	7	4	4	3	2	2	1	26,7	27,0
1	RHS	OL	24°35.096'	72°52.399'	22/02/2018	3.55.02 PM	664,250	3	19	32	18	14	9	6	4	3	2	31,6	32,6
1	RHS	OL	24°34.961'	72°52.291'	22/02/2018	3.56.43 PM	664,000	3	19	32	17	11	7	5	2	1	1	31,6	32,6
1	RHS	IL	24°34.962'	72°52.287'	22/02/2018	8.54.22 AM	664,000	3	19	32	12	8	5	3	2	2	1	26,6	27,2
1	RHS	OL	24°34.859'	72°52.208'	22/02/2018	3.58.22 PM	663,750	3	19	32	11	8	5	3	2	1	1	31,8	32,9
1	RHS	OL	24°34.758'	72°52.126'	22/02/2018	3.59.52 PM	663,500	3	19	32	13	9	6	4	2	2	1	31,8	32,7
1	RHS	IL	24°34.750'	72°52.117'	22/02/2018	8.56.36 AM	663,500	3	19	32	18	13	8	4	3	2	2	26,6	27,2
1	RHS	OL	24°34.638'	72°52.042'	22/02/2018	4.01.26 PM	663,250	3	19	32	16	11	7	4	3	2	2	31,8	32,8
1	RHS	OL	24°34.516'	72°51.975'	22/02/2018	4.03.04 PM	663,000	3	19	32	17	10	6	4	3	2	2	31,7	32,6
1	RHS	IL	24°34.514'	72°52.972'	22/02/2018	8.58.32 AM	663,000	3	19	32	11	8	5	3	2	1	0	26,7	27,3
1	RHS	OL	24°34.410'	72°51.917'	22/02/2018	4.12.10 PM	662,750	3	19	32	14	9	6	3	2	1	1	31,5	32,3
1	RHS	OL	24°34.271'	72°51.819'	22/02/2018	4.13.59 PM	662,500	3	19	32	31	21	11	6	4	3	3	31,7	32,6
1	RHS	IL	24°34.266'	72°51.811'	22/02/2018	9.00.35 AM	662,500	3	19	32	26	23	12	5	3	3	2	26,7	27,3
1	RHS	OL	24°34.178'	72°51.707'	22/02/2018	4.15.33 PM	662,250	3	19	32	26	20	12	7	4	3	3	31,7	32,6
1	RHS	OL	24°34.099'	72°51.612'	22/02/2018	4.17.03 PM	662,000	3	19	32	21	14	9	5	3	3	2	31,7	32,7
1	RHS	IL	24°34.098'	72°51.610'	22/02/2018	9.02.30 AM	662,000	3	19	32	14	10	6	4	3	2	2	26,8	27,3
1	RHS	OL	24°34.011'	72°51.508'	22/02/2018	4.18.35 PM	661,750	3	19	32	30	19	11	6	4	3	2	31,5	32,4
1	RHS	OL	24°33.923'	72°51.399'	22/02/2018	4.20.09 PM	661,500	3	19	32	24	17	11	7	4	3	2	31,4	32,3
1	RHS	IL	24°33.908'	72°51.374'	22/02/2018	9.04.35 AM	661,500	3	19	32	18	13	9	6	4	3	2	26,7	27,4
1	RHS	OL	24°33.869'	72°51.310'	22/02/2018	4.21.45 PM	661,250	3	19	32	21	14	8	4	2	1	1	31,4	32,4
1	RHS	OL	24°33.765'	72°51.142'	22/02/2018	4.23.35 PM	661,000	3	19	32	26	16	10	7	4	3	3	31,5	32,7
1	RHS	IL	24°33.767'	72°51.139'	22/02/2018	9.06.33 AM	661,000	3	19	32	28	18	10	6	4	3	2	26,8	27,5

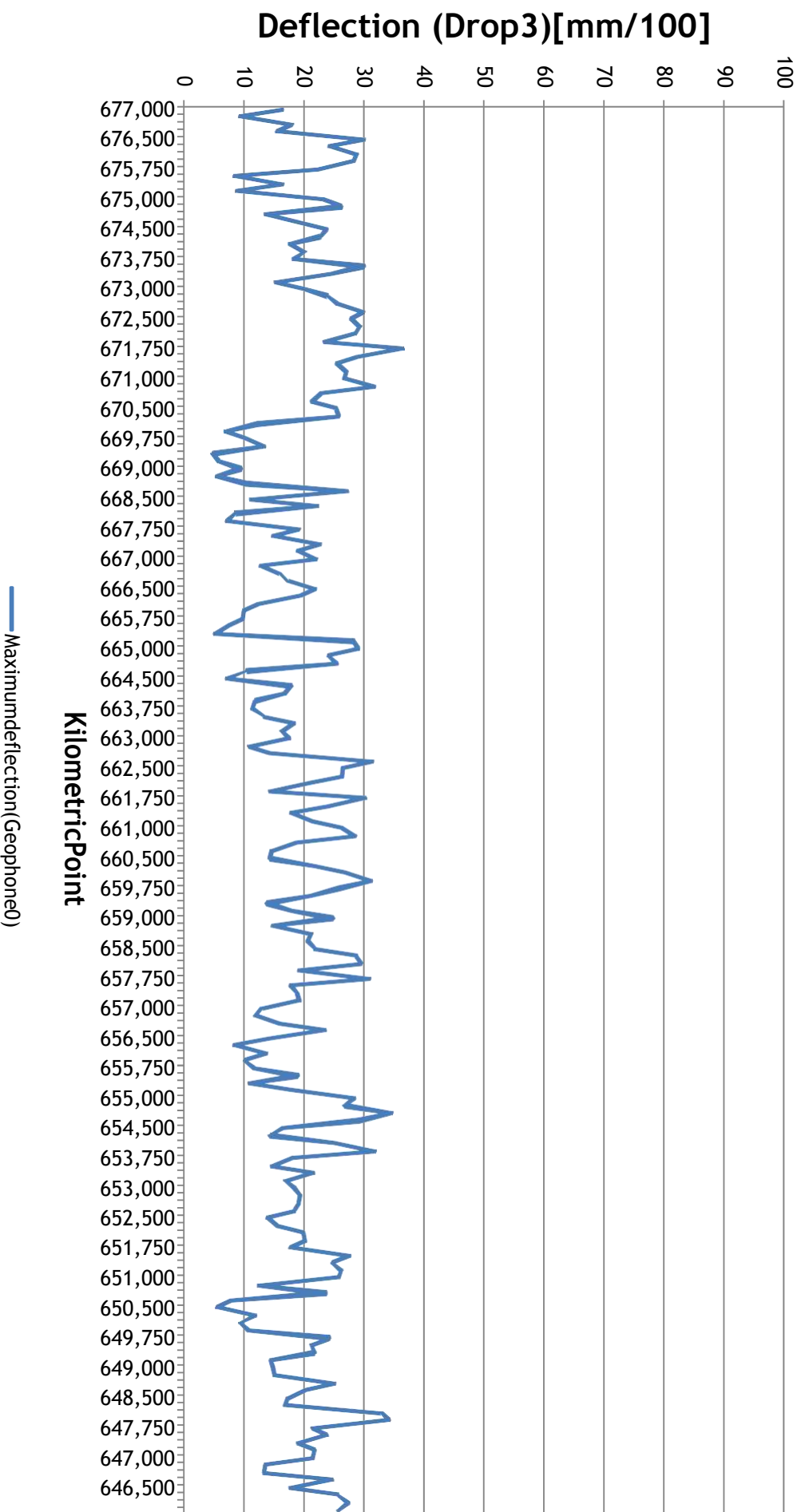
Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	RHS	OL	24°33.703'	72°51.036'	22/02/2018	4.25.01 PM	660,750	3	19	32	19	12	7	4	3	2	2	31,4	32,4
1	RHS	OL	24°33.611'	72°50.861'	22/02/2018	4.26.40 PM	660,500	3	19	32	15	12	7	4	3	2	1	31,3	32,3
1	RHS	IL	24°33.626'	72°50.886'	22/02/2018	9.09.07 AM	660,500	3	19	32	14	10	6	4	3	2	2	26,9	27,2
1	RHS	OL	24°33.496'	72°50.753'	22/02/2018	4.30.09 PM	660,250	3	19	32	22	15	10	6	4	3	2	31,5	32,7
1	RHS	OL	24°33.418'	72°50.722'	22/02/2018	4.31.34 PM	660,000	3	19	32	27	19	11	7	4	3	3	31,7	32,8
1	RHS	IL	24°33.416'	72°50.718'	22/02/2018	9.11.07 AM	660,000	3	19	32	31	24	14	6	4	3	2	26,9	27,7
1	RHS	OL	24°33.295'	72°50.649'	22/02/2018	4.33.13 PM	659,750	3	19	32	26	18	11	6	4	3	2	31,8	32,8
1	RHS	OL	24°33.225'	72°50.530'	22/02/2018	4.34.45 PM	659,500	3	19	32	21	15	10	6	4	3	2	31,7	32,7
1	RHS	IL	24°33.238'	72°50.552'	22/02/2018	9.13.53 AM	659,500	3	19	32	14	10	6	6	4	2	2	27,2	27,8
1	RHS	OL	24°33.129'	72°50.400'	22/02/2018	4.36.21 PM	659,250	3	19	32	18	13	9	5	4	3	2	31,6	32,8
1	RHS	OL	24°33.020'	72°50.364'	22/02/2018	4.37.48 PM	659,000	3	19	32	25	16	10	6	4	3	3	31,7	32,4
1	RHS	IL	24°33.014'	72°50.360'	22/02/2018	9.16.01 AM	659,000	3	19	32	15	12	8	6	4	3	2	27,2	27,6
1	RHS	OL	24°32.898'	72°50.401'	22/02/2018	4.39.39 PM	658,750	3	19	32	21	14	8	4	3	2	2	31,6	32,1
1	RHS	OL	24°32.779'	72°50.564'	22/02/2018	4.41.52 PM	658,500	3	19	32	21	14	8	4	3	3	3	31,4	32,4
1	RHS	IL	24°32.775'	72°50.564'	22/02/2018	9.18.47 AM	658,500	3	19	32	22	16	10	6	3	3	2	27,2	27,7
1	RHS	OL	24°32.733'	72°50.637'	22/02/2018	4.43.12 PM	658,250	3	19	32	29	19	11	5	4	2	2	31,4	32,4
1	RHS	OL	24°32.612'	72°50.776'	22/02/2018	4.44.24 PM	658,000	3	19	32	29	18	11	6	4	2	2	31,2	32,3
1	RHS	IL	24°32.535'	72°50.644'	22/02/2018	09:19:64 AM	658,000	3	19	32	19	15	10	7	4	3	2	27,2	27,9
1	RHS	OL	24°32.561'	72°50.869'	22/02/2018	4.45.46 PM	657,750	3	19	32	31	21	13	7	4	3	2	31,2	32,2
1	RHS	OL	24°32.457'	72°50.927'	22/02/2018	4.47.12 PM	657,500	3	19	32	18	12	8	5	4	3	3	30,9	32,1
1	RHS	IL	24°32.463'	72°50.921'	22/02/2018	9.22.12 AM	657,500	3	19	32	19	15	10	7	5	4	3	27,2	28,1
1	RHS	OL	24°32.318'	72°50.974'	22/02/2018	4.48.48 PM	657,250	3	19	32	19	11	10	6	4	3	3	30,9	32,0
1	RHS	OL	24°32.180'	72°50.946'	22/02/2018	4.51.24 PM	657,000	3	19	32	13	10	7	4	4	2	1	30,9	32,1
1	RHS	IL	24°32.179'	72°50.942'	22/02/2018	9.25.20 AM	657,000	3	19	32	12	9	6	5	3	3	2	27,6	28,2
1	RHS	OL	24°32.060'	72°50.869'	22/02/2018	4.53.04 PM	656,750	3	19	32	16	12	8	5	3	2	1	31,1	32,2
1	RHS	OL	24°31.958'	72°50.792'	22/02/2018	4.54.38 PM	656,500	3	19	32	23	14	9	6	4	3	2	31,3	32,3
1	RHS	IL	24°31.981'	72°50.812'	22/02/2018	9.27.50 AM	656,500	3	19	32	14	11	7	5	4	3	2	27,9	28,2
1	RHS	OL	24°31.864'	72°50.678'	22/02/2018	4.56.08 PM	656,250	3	19	32	8	5	4	3	3	2	2	31,4	32,4
1	RHS	OL	24°31.776'	72°50.568'	22/02/2018	4.58.32 PM	656,000	3	19	32	14	10	6	4	3	2	2	31,3	32,3
1	RHS	IL	24°31.776'	72°50.566'	22/02/2018	9.30.44 AM	656,000	3	19	32	10	7	4	3	2	1	1	27,9	28,3
1	RHS	OL	24°31.683'	72°50.462'	22/02/2018	5.00.13 PM	655,750	3	19	32	12	8	5	4	2	2	1	31,3	32,3
1	RHS	OL	24°31.592'	72°50.360'	22/02/2018	5.01.39 PM	655,500	3	19	32	19	14	8	5	3	2	2	31,2	32,3
1	RHS	IL	24°31.602'	72°50.367'	22/02/2018	9.32.46 AM	655,500	3	19	32	11	7	5	4	3	2	1	27,9	28,4
1	RHS	OL	24°31.487'	72°50.277'	22/02/2018	5.03.12 PM	655,250	3	19	32	18	12	8	5	4	3	2	31,1	32,2
1	RHS	OL	24°31.370'	72°50.162'	22/02/2018	5.04.46 PM	655,000	3	20	34	28	19	11	6	4	4	3	31,1	32,2
1	RHS	IL	24°31.372'	72°50.162'	22/02/2018	9.36.07 AM	655,000	3	20	34	27	19	10	5	3	2	1	28,0	28,5
1	RHS	OL	24°31.278'	72°50.067'	22/02/2018	5.06.15 PM	654,750	3	20	34	34	25	14	8	4	2	1	30,9	32,2
1	RHS	OL	24°31.189'	72°49.972'	22/02/2018	5.07.38 PM	654,500	3	20	34	29	19	10	6	4	3	2	30,9	32,1
1	RHS	IL	24°31.209'	72°49.992'	22/02/2018	9.38.07 AM	654,500	3	20	34	16	11	7	5	3	3	2	28,0	28,5
1	RHS	OL	24°31.101'	72°49.880'	22/02/2018	5.10.00 PM	654,250	3	20	34	14	10	7	4	3	3	2	30,9	32,1
1	RHS	OL	24°30.963'	72°49.792'	22/02/2018	5.11.38 PM	654,000	3	20	34	25	17	9	5	3	2	2	30,8	31,8
1	RHS	IL	24°30.957'	72°49.787'	22/02/2018	9.40.30 AM	654,000	3	20	34	32	23	12	5	4	3	3	28,1	28,7
1	RHS	OL	24°30.821'	72°49.716'	22/02/2018	5.17.55 PM	653,750	3	20	34	18	14	8	4	3	2	2	31,1	31,8
1	RHS	OL	24°30.699'	72°49.655'	22/02/2018	5.19.29 PM	653,500	3	20	34	15	8	5	3	3	2	2	31,1	31,5
1	RHS	IL	24°30.739'	72°49.672'	22/02/2018	9.10.28 AM	653,500	3	20	34	17	18	9	5	3	3	2	28,1	28,8
1	RHS	OL	24°30.566'	72°49.588'	22/02/2018	5.21.10 PM	653,250	3	20	34	21	11	10	6	4	3	2	31,1	32,0
1	RHS	OL	24°30.406'	72°49.570'	22/02/2018	5.22.44 PM	653,000	3	20	34	18	11	6	3	2	2	1	31,2	32,1
1	RHS	IL	24°30.469'	72°49.566'	22/02/2018	9.42.26 AM	653,000	3	20	34	19	10	6	5	3	2	2	28,1	28,8
1	RHS	OL	24°30.342'	72°49.627'	22/02/2018	5.23.49 PM	652,750	3	20	34	19	11	7	5	3	2	1	26,4	26,4

Road	Segment	Lane	Latitude	Longitude	Date	Time	Kilometric Point (Km)	Drop	Average deflection	Characteristic deflection	Deflection (mm/100)						Air temperature	Pavement temperature	
											Maximum deflection (Geophone 0)	Geophone 300	Geophone 600	Geophone 900	Geophone 1200	Geophone 1500			Geophone 1800
1	RHS	OL	24°30.229'	72°49.668'	23/02/2018	9.02.59 AM	652,500	3	20	34	18	12	8	5	3	3	2	26,4	27,3
1	RHS	IL	24°30.235'	72°49.664'	22/02/2018	10.07.34 AM	652,500	3	20	34	14	10	8	6	3	3	2	29,5	29,5
1	RHS	OL	24°30.088'	72°49.654'	23/02/2018	9.06.37 AM	652,250	3	20	34	16	12	7	4	1	1	0	26,9	27,4
1	RHS	OL	24°29.981'	72°49.542'	23/02/2018	9.08.14 AM	652,000	3	20	34	20	18	10	6	3	3	3	27,0	27,5
1	RHS	IL	24°29.983'	72°49.542'	22/02/2018	10.09.52 AM	652,000	3	20	34	20	15	11	6	5	4	2	29,5	29,5
1	RHS	OL	24°29.916'	72°49.416'	23/02/2018	9.11.01 AM	651,750	3	20	34	18	13	8	6	4	3	3	27,0	27,5
1	RHS	OL	24°29.855'	72°49.294'	23/02/2018	9.12.30 AM	651,500	3	20	34	27	18	9	4	3	3	3	27,0	27,5
1	RHS	IL	24°29.357'	72°49.293'	22/02/2018	10.11.46 AM	651,500	3	20	34	25	15	8	5	2	1	1	29,3	29,5
1	RHS	OL	24°29.776'	72°49.177'	23/02/2018	9.16.07 AM	651,250	3	20	34	26	18	10	4	3	3	2	26,9	27,6
1	RHS	OL	24°29.667'	72°49.066'	23/02/2018	9.17.41 AM	651,000	3	20	34	26	20	10	6	5	4	3	26,9	27,6
1	RHS	IL	24°29.672'	72°49.067'	22/02/2018	10.13.48 AM	651,000	3	20	34	13	8	5	3	3	2	2	29,2	29,6
1	RHS	OL	24°29.585'	72°48.941'	23/02/2018	9.20.19 AM	650,750	3	20	34	24	15	9	5	3	3	3	27,0	27,6
1	RHS	OL	24°29.549'	72°48.807'	23/02/2018	9.21.45 AM	650,500	3	20	34	8	4	3	3	2	2	1	27,0	27,6
1	RHS	IL	24°29.546'	72°48.787'	22/02/2018	10.15.59 AM	650,500	3	20	34	6	4	3	2	2	2	1	29,2	29,6
1	RHS	OL	24°29.516'	72°48.671'	23/02/2018	9.23.19 AM	650,250	3	20	34	12	9	5	3	2	2	2	27,0	27,5
1	RHS	OL	24°29.477'	72°48.511'	23/02/2018	9.26.00 AM	650,000	3	20	33	9	7	7	4	3	2	2	27,0	27,7
1	RHS	IL	24°29.474'	72°48.498'	22/02/2018	10.17.59 AM	650,000	3	20	33	11	8	5	4	3	2	2	29,1	29,6
1	RHS	OL	24°29.406'	72°48.405'	23/02/2018	9.28.23 AM	649,750	3	20	33	24	17	10	5	3	2	1	27,1	27,8
1	RHS	OL	24°29.307'	72°48.314'	23/02/2018	9.29.58 AM	649,500	3	20	33	21	15	10	6	4	3	3	27,2	28,0
1	RHS	IL	24°29.339'	72°48.342'	22/02/2018	10.20.03 AM	649,500	3	20	33	22	14	8	5	3	3	2	29,0	29,7
1	RHS	OL	24°29.180'	72°48.210'	23/02/2018	9.31.37 AM	649,250	3	20	33	14	10	7	5	3	2	2	27,5	28,1
1	RHS	OL	24°29.080'	72°48.132'	23/02/2018	9.33.08 AM	649,000	3	20	33	15	12	8	5	4	3	2	27,6	28,2
1	RHS	IL	24°29.084'	72°48.130'	22/02/2018	10.22.15 AM	649,000	3	20	33	15	12	7	4	3	2	1	29,1	29,8
1	RHS	OL	24°28.976'	72°48.051'	23/02/2018	9.35.41 AM	648,750	3	20	33	25	17	10	5	3	2	2	27,8	28,3
1	RHS	OL	24°28.875'	72°47.988'	23/02/2018	9.37.13 AM	648,500	3	20	33	20	14	9	5	3	2	2	27,9	28,3
1	RHS	IL	24°28.884'	72°47.991'	22/02/2018	10.24.06 AM	648,500	3	20	33	17	13	8	5	3	2	2	29,2	29,9
1	RHS	OL	24°28.746'	72°47.908'	23/02/2018	9.38.52 AM	648,250	3	20	33	17	11	8	5	4	3	3	28,0	28,3
1	RHS	OL	24°28.635'	72°47.806'	23/02/2018	9.41.32 AM	648,000	3	20	33	33	27	15	7	4	3	2	28,0	28,3
1	RHS	IL	24°28.637'	72°47.806'	22/02/2018	10.26.18 AM	648,000	3	20	33	34	22	12	6	4	3	3	29,4	29,9
1	RHS	OL	24°28.530'	72°47.691'	23/02/2018	9.45.13 AM	647,750	3	20	33	21	18	11	7	4	3	2	27,9	28,2
1	RHS	OL	24°28.435'	72°47.596'	23/02/2018	9.47.31 AM	647,500	3	20	33	24	16	9	5	3	3	2	28,0	28,4
1	RHS	IL	24°28.455'	72°47.611'	22/02/2018	10.28.34 AM	647,500	3	20	33	19	14	8	5	4	3	3	29,4	30,0
1	RHS	OL	24°28.348'	72°47.533'	23/02/2018	9.49.00 AM	647,250	3	20	33	22	17	10	6	3	3	1	28,0	28,5
1	RHS	OL	24°28.208'	72°47.432'	23/02/2018	9.50.45 AM	647,000	3	20	33	21	16	10	6	4	3	2	28,1	28,7
1	RHS	IL	24°28.208'	72°47.429'	22/02/2018	10.30.43 AM	647,000	3	20	33	14	9	7	4	3	3	3	29,5	30,1
1	RHS	OL	24°28.117'	72°47.346'	23/02/2018	9.52.39 AM	646,750	3	20	33	13	12	8	5	3	2	2	28,3	28,8
1	RHS	OL	24°28.046'	72°47.237'	23/02/2018	9.54.12 AM	646,500	3	20	33	25	19	11	5	4	3	2	28,3	28,7
1	RHS	IL	24°27.037'	72°47.202'	22/02/2018	10.32.50 AM	646,500	3	20	33	18	17	9	5	3	2	2	29,6	30,0
1	RHS	OL	24°28.009'	72°47.103'	23/02/2018	9.56.35 AM	646,250	3	20	33	26	17	10	6	4	3	2	28,4	28,7
1	RHS	OL	24°27.984'	72°46.933'	23/02/2018	9.58.08 AM	646,000	3	20	33	27	19	14	11	6	4	3	28,4	29,1
1	RHS	IL	24°27.984'	72°47.924'	22/02/2018	10.34.44 AM	646,000	3	20	33	26	17	10	5	3	1	1	29,6	30,4

PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE NATIONAL
HIGHWAYS ON ROADS UNDER (THE NATIONAL HIGHWAYS
INFRA TRUST)

Technical Due Diligence Report of NH27 (NH14) Abu
road - Swaroopganj (Stretch 1)

Annexure Deflections



ANNEXURE 5 IRI AND RUT RESULTS

INTERNATIONAL ROUGHNESS INDEX (IRI) - LHS

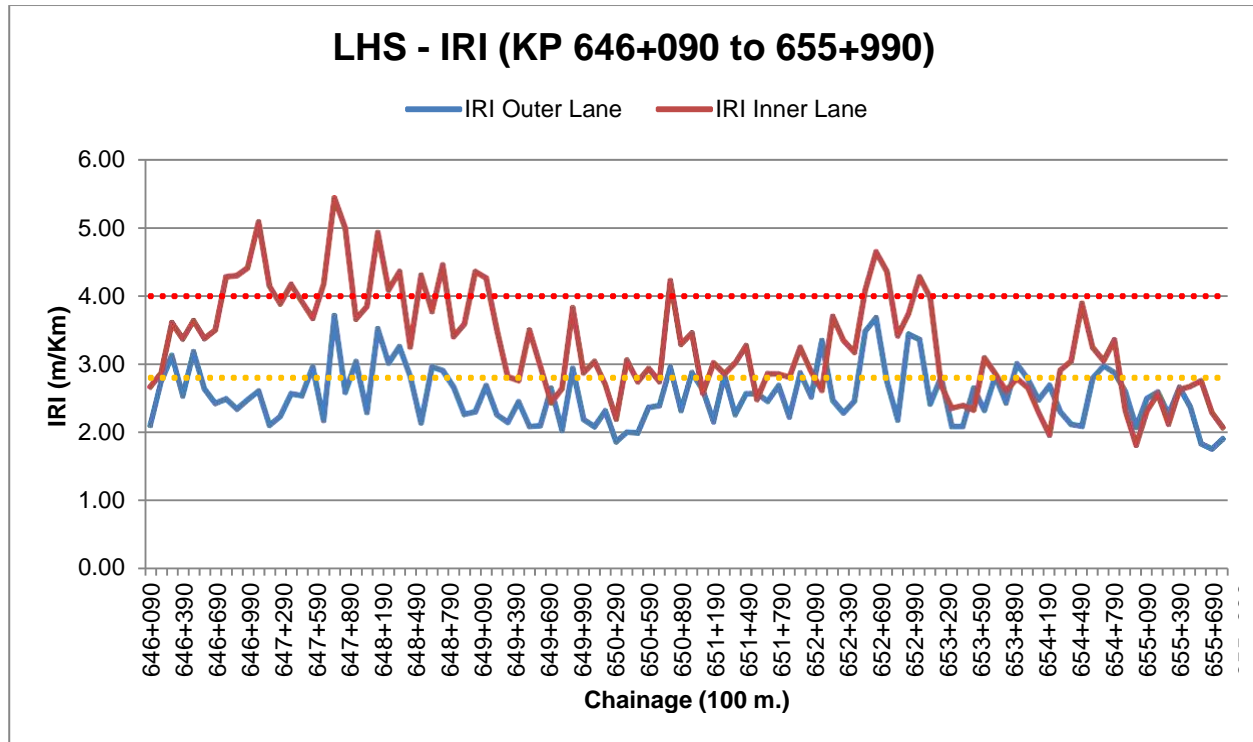


Figure1.LHS-IRI(KP646+090to655+990)

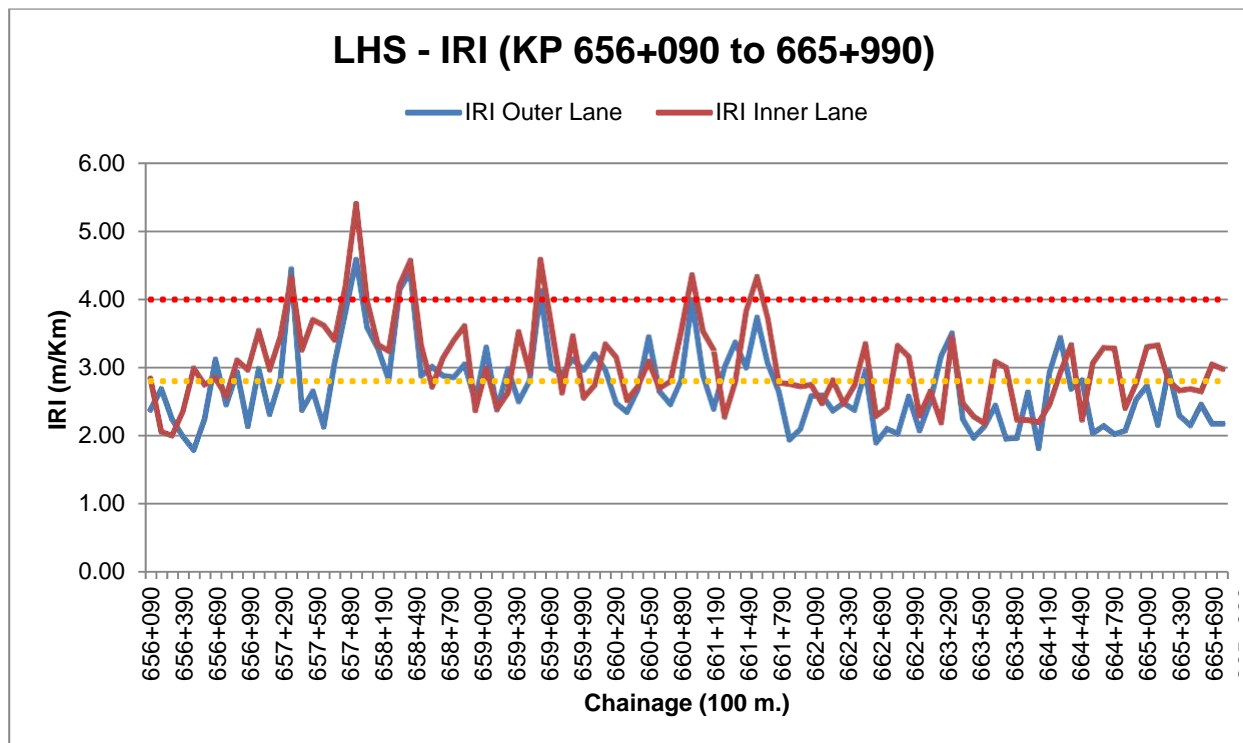


Figure2.LHS-IRI(KP656+090to665+990)

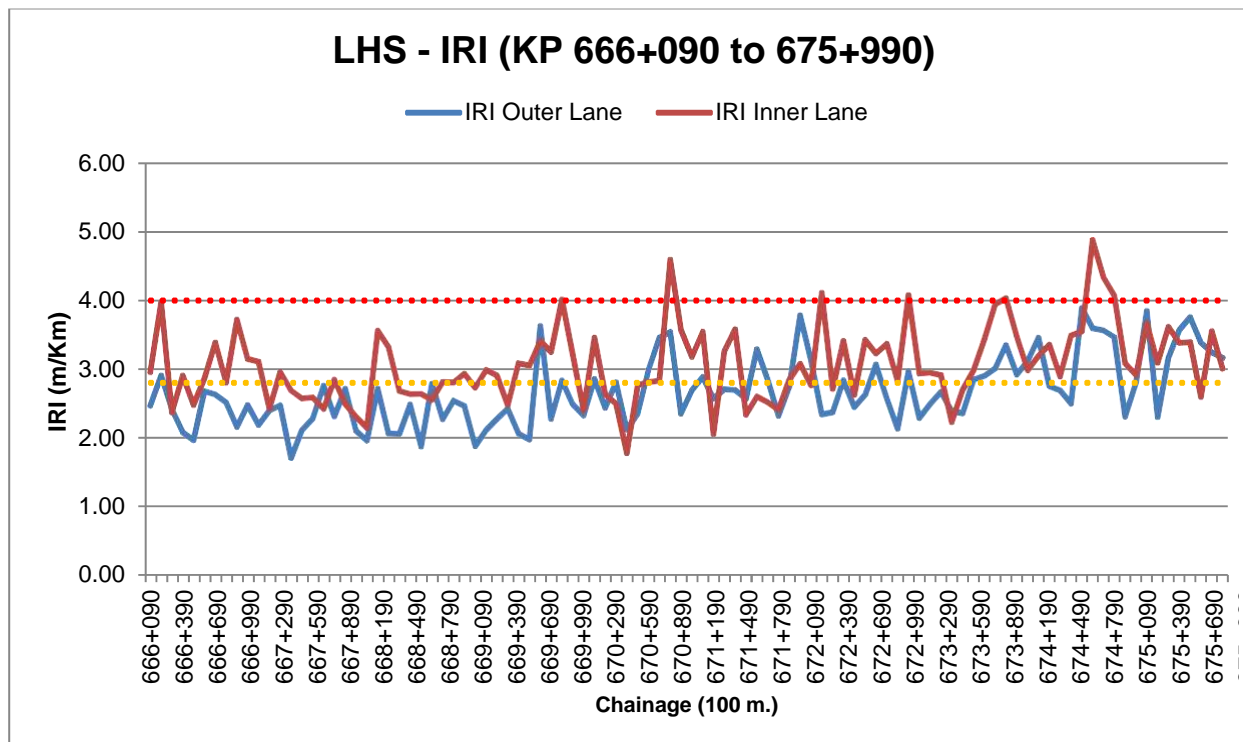


Figure3.LHS-IRI(KP666+090to675+990)

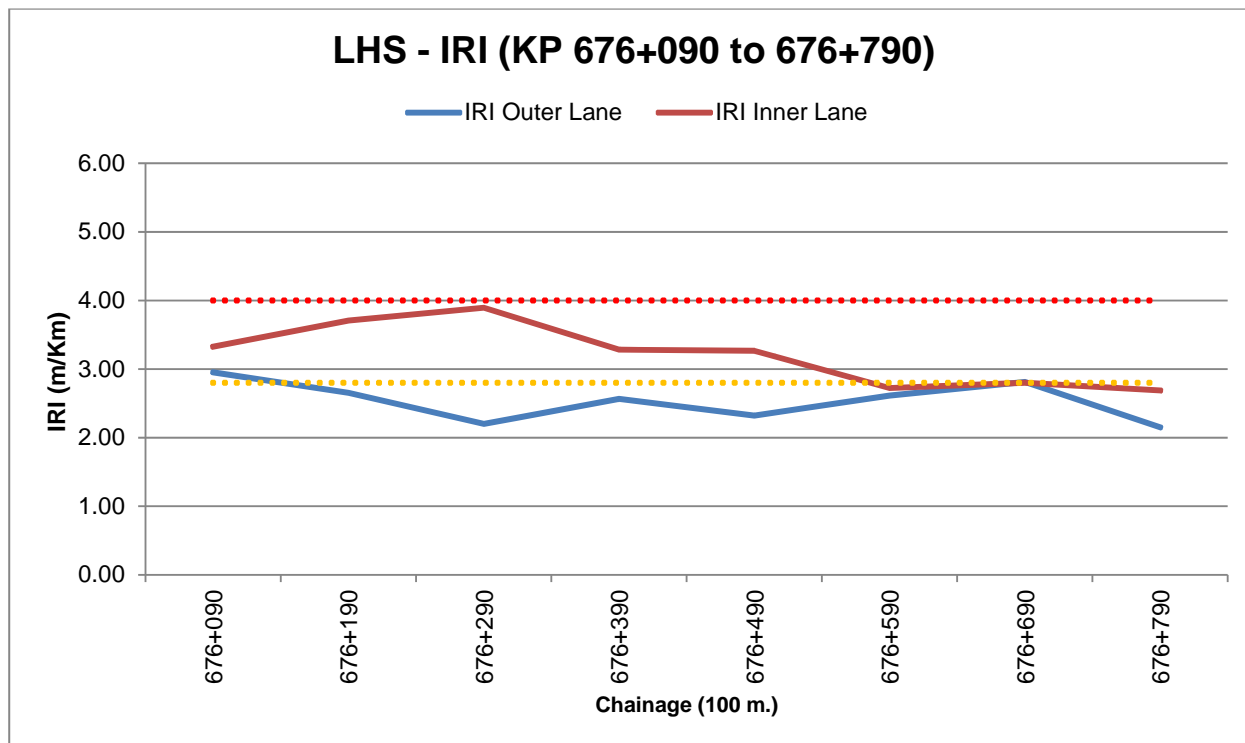


Figure4.LHS-IRI(KP676+090to676+990)

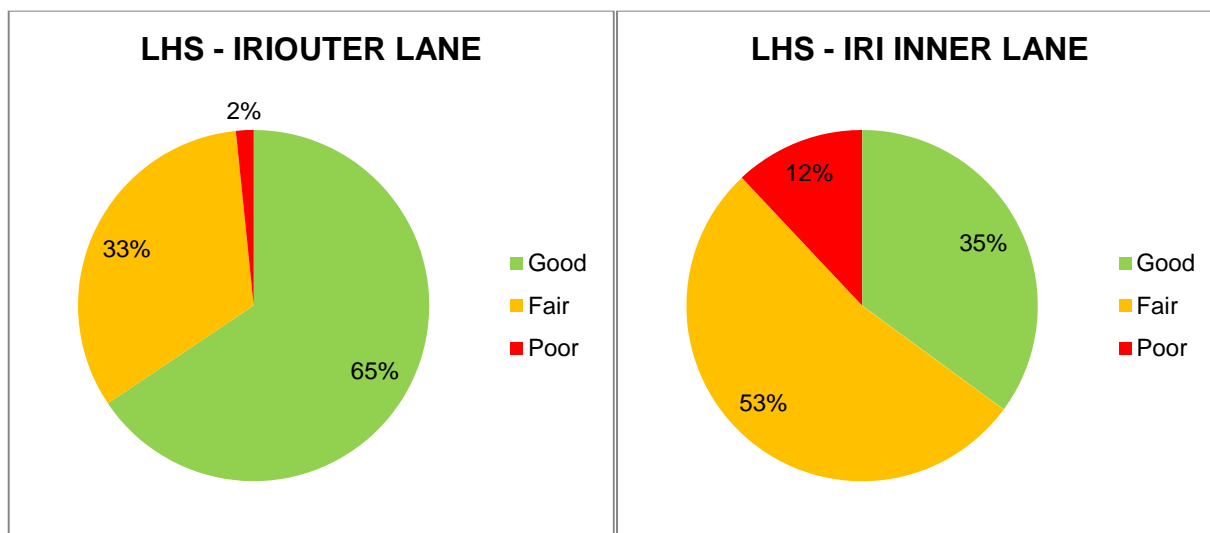


Figure5.LHSIRIOuterandInnerLaneResults

KP	LHS Outer Lane	LHS Inner Lane
646+090	2.1	2.7
646+190	2.8	2.9
646+290	3.1	3.6

KP	LHS Outer Lane	LHS Inner Lane
646+390	2.5	3.4
646+490	3.2	3.6
646+590	2.6	3.4
646+690	2.4	3.5
646+790	2.5	4.3
646+890	2.3	4.3
646+990	2.5	4.4
647+090	2.6	5.1
647+190	2.1	4.1
647+290	2.2	3.9
647+390	2.6	4.2
647+490	2.5	3.9
647+590	3.0	3.7
647+690	2.2	4.2
647+790	3.7	5.4
647+890	2.6	5.0
647+990	3.0	3.7
648+090	2.3	3.8
648+190	3.5	4.9
648+290	3.0	4.1
648+390	3.3	4.4
648+490	2.8	3.3
648+590	2.1	4.3
648+690	3.0	3.8
648+790	2.9	4.4
648+890	2.7	3.4
648+990	2.3	3.6
649+090	2.3	4.4
649+190	2.7	4.3
649+290	2.3	3.5
649+390	2.2	2.8
649+490	2.5	2.8
649+590	2.1	3.5
649+690	2.1	3.0
649+790	2.6	2.4
649+890	2.0	2.6
649+990	2.9	3.8
650+090	2.2	2.9
650+190	2.1	3.0
650+290	2.3	2.7
650+390	1.9	2.2
650+490	2.0	3.1
650+590	2.0	2.7
650+690	2.4	2.9
650+790	2.4	2.7
650+890	3.0	4.2

KP	LHS Outer Lane	LHS Inner Lane
650+990	2.3	3.3
651+090	2.9	3.5
651+190	2.6	2.6
651+290	2.2	3.0
651+390	2.8	2.9
651+490	2.3	3.0
651+590	2.6	3.3
651+690	2.6	2.5
651+790	2.5	2.9
651+890	2.7	2.9
651+990	2.2	2.8
652+090	2.9	3.2
652+190	2.5	2.9
652+290	3.3	2.6
652+390	2.5	3.7
652+490	2.3	3.3
652+590	2.5	3.2
652+690	3.5	4.1
652+790	3.7	4.6
652+890	2.8	4.4
652+990	2.2	3.4
653+090	3.4	3.7
653+190	3.4	4.3
653+290	2.4	4.0
653+390	2.8	2.7
653+490	2.1	2.4
653+590	2.1	2.4
653+690	2.7	2.3
653+790	2.3	3.1
653+890	2.8	2.9
653+990	2.4	2.6
654+090	3.0	2.8
654+190	2.8	2.7
654+290	2.5	2.3
654+390	2.7	2.0
654+490	2.3	2.9
654+590	2.1	3.0
654+690	2.1	3.9
654+790	2.8	3.2
654+890	3.0	3.1
654+990	2.9	3.4
655+090	2.6	2.3
655+190	2.1	1.8
655+290	2.5	2.3
655+390	2.6	2.6
655+490	2.3	2.1

KP	LHS Outer Lane	LHS Inner Lane
655+590	2.7	2.6
655+690	2.4	2.7
655+790	1.8	2.8
655+890	1.8	2.3
655+990	1.9	2.1
656+090	2.4	2.8
656+190	2.7	2.1
656+290	2.2	2.0
656+390	2.0	2.4
656+490	1.8	3.0
656+590	2.2	2.7
656+690	3.1	2.8
656+790	2.5	2.6
656+890	2.9	3.1
656+990	2.1	3.0
657+090	3.0	3.5
657+190	2.3	3.0
657+290	2.8	3.5
657+390	4.4	4.3
657+490	2.4	3.3
657+590	2.7	3.7
657+690	2.1	3.6
657+790	3.1	3.4
657+890	3.8	4.2
657+990	4.6	5.4
658+090	3.6	4.0
658+190	3.3	3.3
658+290	2.8	3.2
658+390	4.1	4.2
658+490	4.4	4.6
658+590	2.9	3.3
658+690	3.0	2.7
658+790	2.9	3.1
658+890	2.9	3.4
658+990	3.0	3.6
659+090	2.5	2.4
659+190	3.3	3.0
659+290	2.4	2.4
659+390	3.0	2.6
659+490	2.5	3.5
659+590	2.8	2.9
659+690	4.1	4.6
659+790	3.0	3.6
659+890	2.9	2.6
659+990	3.1	3.5
660+090	3.0	2.6

KP	LHS Outer Lane	LHS Inner Lane
660+190	3.2	2.7
660+290	3.0	3.3
660+390	2.5	3.1
660+490	2.3	2.5
660+590	2.7	2.7
660+690	3.4	3.1
660+790	2.6	2.7
660+890	2.5	2.8
660+990	2.8	3.5
661+090	4.0	4.4
661+190	2.9	3.5
661+290	2.4	3.3
661+390	3.0	2.3
661+490	3.4	2.8
661+590	3.0	3.8
661+690	3.7	4.3
661+790	3.1	3.7
661+890	2.6	2.8
661+990	1.9	2.8
662+090	2.1	2.7
662+190	2.6	2.7
662+290	2.6	2.5
662+390	2.4	2.8
662+490	2.5	2.5
662+590	2.4	2.7
662+690	2.9	3.3
662+790	1.9	2.3
662+890	2.1	2.4
662+990	2.0	3.3
663+090	2.6	3.2
663+190	2.1	2.3
663+290	2.5	2.7
663+390	3.2	2.2
663+490	3.5	3.4
663+590	2.2	2.5
663+690	2.0	2.3
663+790	2.1	2.2
663+890	2.4	3.1
663+990	2.0	3.0
664+090	2.0	2.2
664+190	2.6	2.2
664+290	1.8	2.2
664+390	2.9	2.5
664+490	3.4	2.9
664+590	2.7	3.3
664+690	2.8	2.2

KP	LHS Outer Lane	LHS Inner Lane
664+790	2.0	3.1
664+890	2.1	3.3
664+990	2.0	3.3
665+090	2.1	2.4
665+190	2.5	2.8
665+290	2.7	3.3
665+390	2.2	3.3
665+490	3.0	2.8
665+590	2.3	2.7
665+690	2.2	2.7
665+790	2.5	2.6
665+890	2.2	3.0
665+990	2.2	3.0
666+090	2.5	3.0
666+190	2.9	4.0
666+290	2.4	2.4
666+390	2.1	2.9
666+490	2.0	2.5
666+590	2.7	2.9
666+690	2.6	3.4
666+790	2.5	2.8
666+890	2.2	3.7
666+990	2.5	3.2
667+090	2.2	3.1
667+190	2.4	2.4
667+290	2.5	3.0
667+390	1.7	2.7
667+490	2.1	2.6
667+590	2.3	2.6
667+690	2.8	2.4
667+790	2.3	2.9
667+890	2.7	2.5
667+990	2.1	2.3
668+090	2.0	2.2
668+190	2.7	3.6
668+290	2.1	3.3
668+390	2.1	2.7
668+490	2.5	2.6
668+590	1.9	2.6
668+690	2.8	2.6
668+790	2.3	2.8
668+890	2.5	2.8
668+990	2.5	2.9
669+090	1.9	2.7
669+190	2.1	3.0
669+290	2.3	2.9

KP	LHS Outer Lane	LHS Inner Lane
669+390	2.4	2.5
669+490	2.1	3.1
669+590	2.0	3.1
669+690	3.6	3.4
669+790	2.3	3.3
669+890	2.8	4.0
669+990	2.5	3.2
670+090	2.3	2.4
670+190	2.9	3.5
670+290	2.4	2.6
670+390	2.8	2.5
670+490	2.1	1.8
670+590	2.4	2.8
670+690	3.0	2.8
670+790	3.5	2.8
670+890	3.5	4.6
670+990	2.4	3.6
671+090	2.7	3.2
671+190	2.9	3.5
671+290	2.6	2.1
671+390	2.7	3.3
671+490	2.7	3.6
671+590	2.6	2.3
671+690	3.3	2.6
671+790	2.9	2.5
671+890	2.3	2.4
671+990	2.8	2.9
672+090	3.8	3.1
672+190	3.1	2.8
672+290	2.4	4.1
672+390	2.4	2.7
672+490	2.8	3.4
672+590	2.5	2.6
672+690	2.6	3.4
672+790	3.1	3.2
672+890	2.6	3.4
672+990	2.1	2.8
673+090	3.0	4.1
673+190	2.3	2.9
673+290	2.5	3.0
673+390	2.7	2.9
673+490	2.4	2.2
673+590	2.4	2.7
673+690	2.9	3.0
673+790	2.9	3.4
673+890	3.0	3.9

KP	LHS Outer Lane	LHS Inner Lane
673+990	3.4	4.0
674+090	2.9	3.5
674+190	3.1	3.0
674+290	3.5	3.2
674+390	2.8	3.4
674+490	2.7	2.9
674+590	2.5	3.5
674+690	3.9	3.6
674+790	3.6	4.9
674+890	3.6	4.3
674+990	3.5	4.1
675+090	2.3	3.1
675+190	2.8	2.9
675+290	3.8	3.7
675+390	2.3	3.1
675+490	3.2	3.6
675+590	3.6	3.4
675+690	3.8	3.4
675+790	3.4	2.6
675+890	3.2	3.6
675+990	3.2	3.0
676+090	3.0	3.3
676+190	2.7	3.7
676+290	2.2	3.9
676+390	2.6	3.3
676+490	2.3	3.3
676+590	2.6	2.7
676+690	2.8	2.8
676+790	2.2	2.7

Table 1. LHS IRI Results

INTERNATIONAL ROUGHNESS INDEX (IRI) - RHS

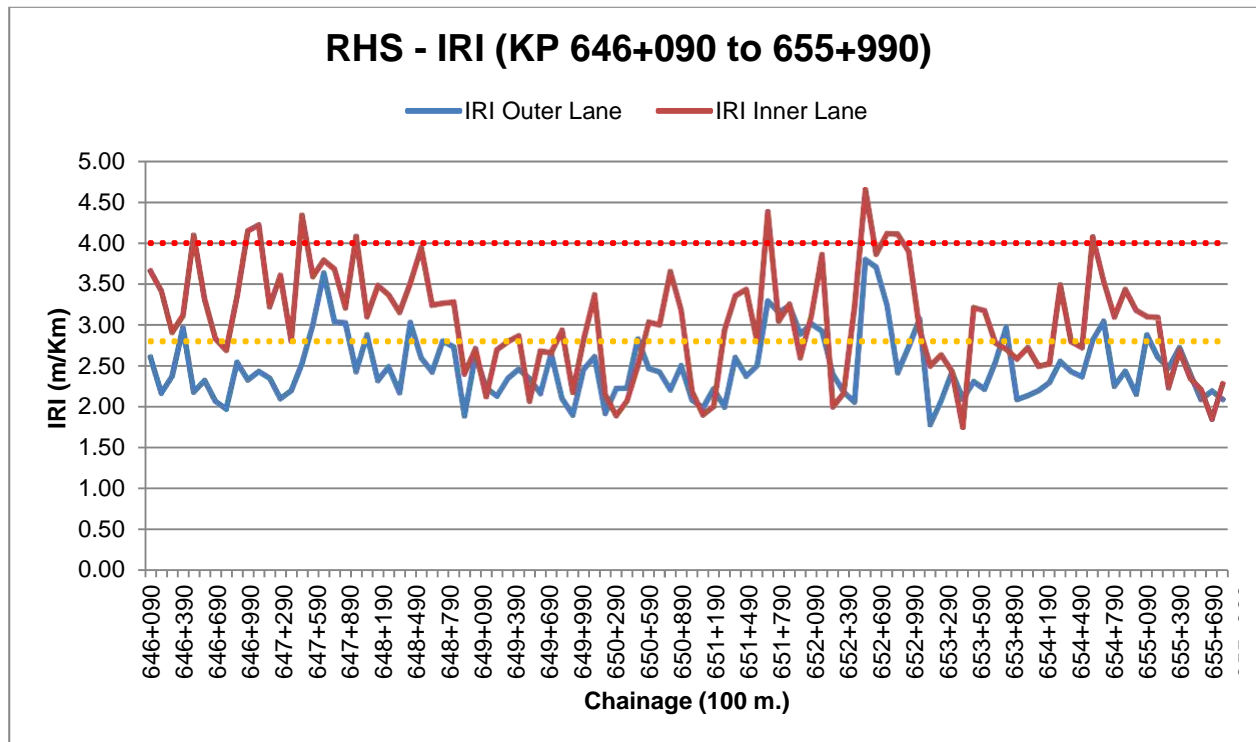


Figure6.RHS-IRI (KP 646+090 to KP655+990)

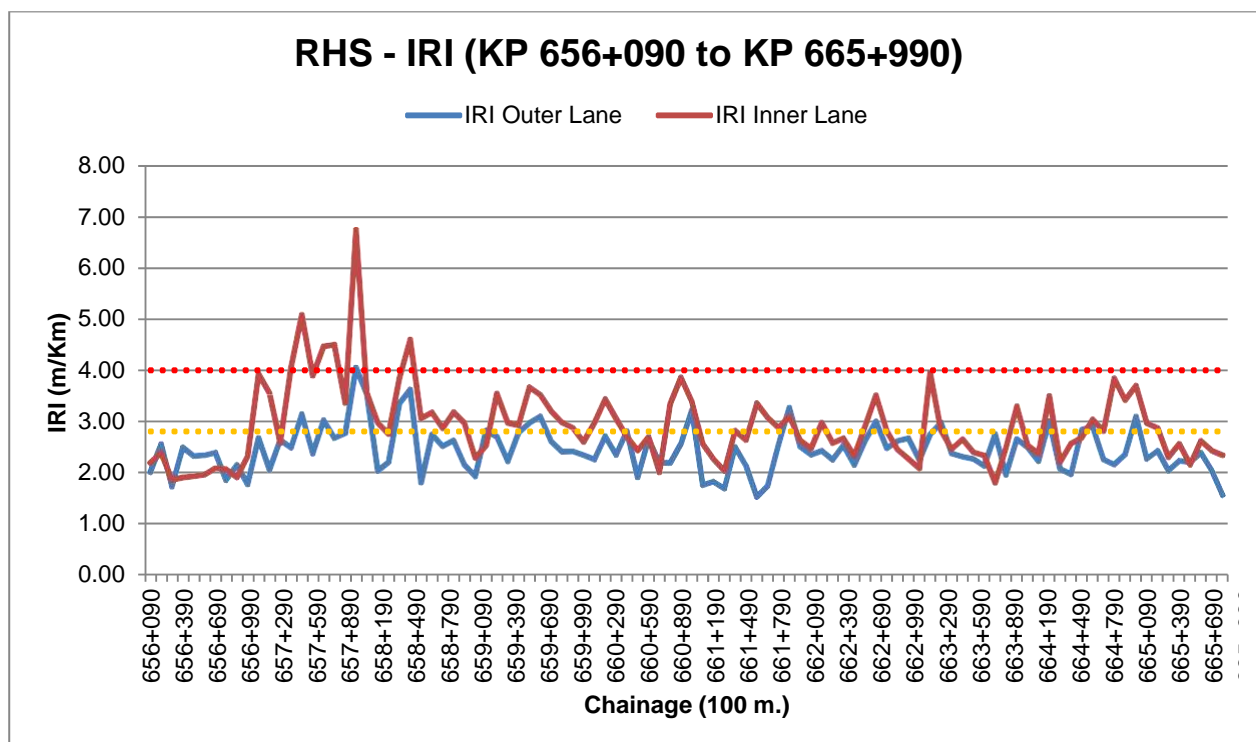


Figure7.RHS-IRI(KP656+090toKP665+990)

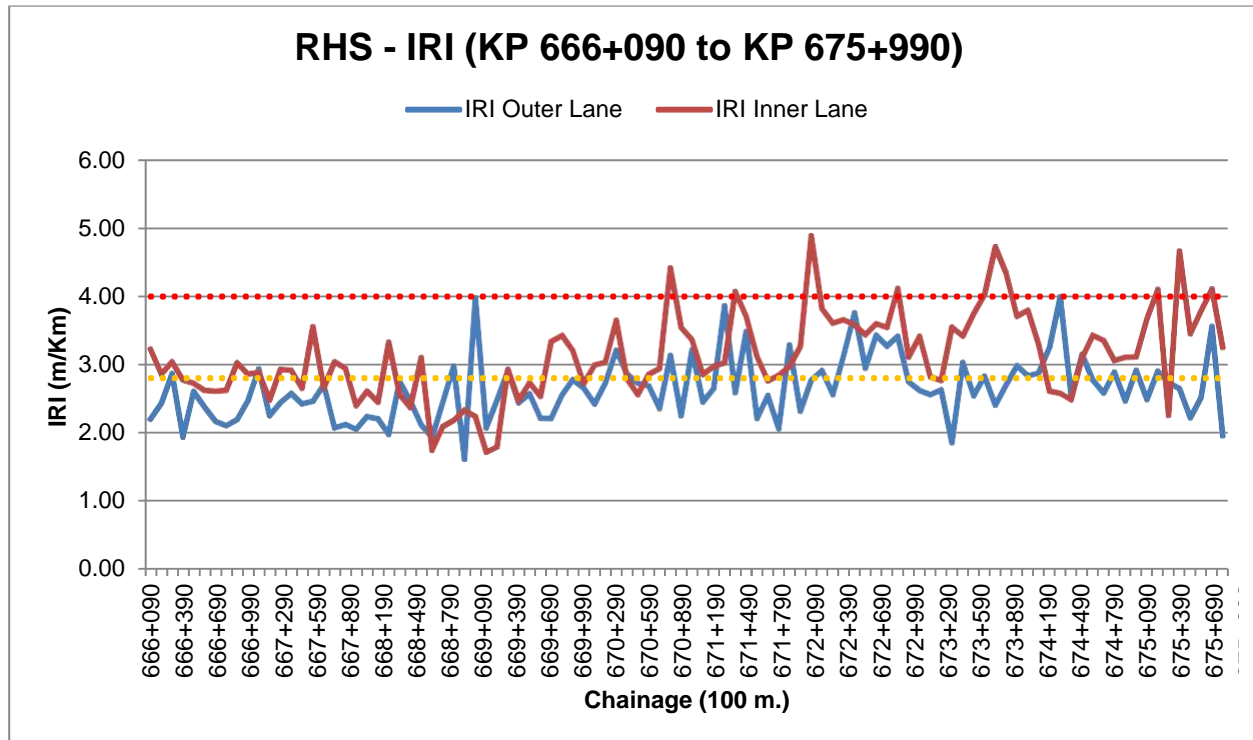


Figure8.RHS-IRI(KP666+090toKP675+990)

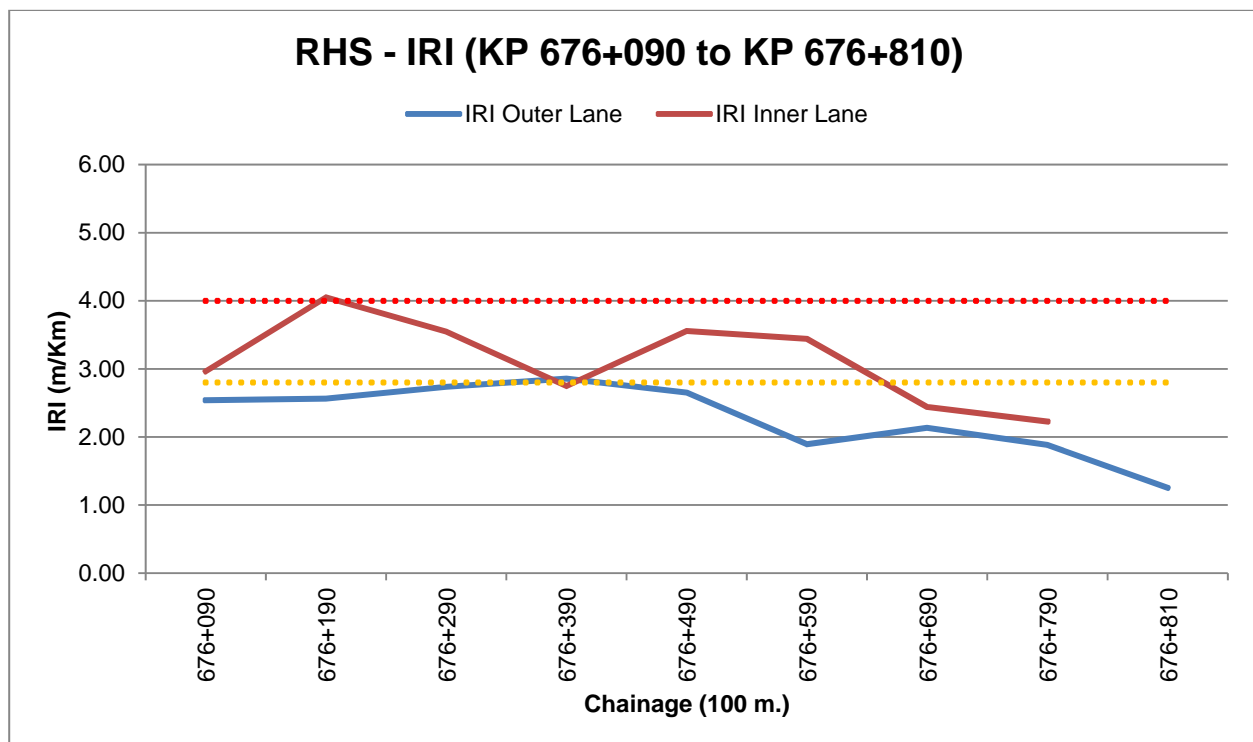


Figure9.RHS-IRI(KP676+090toKP676+810)

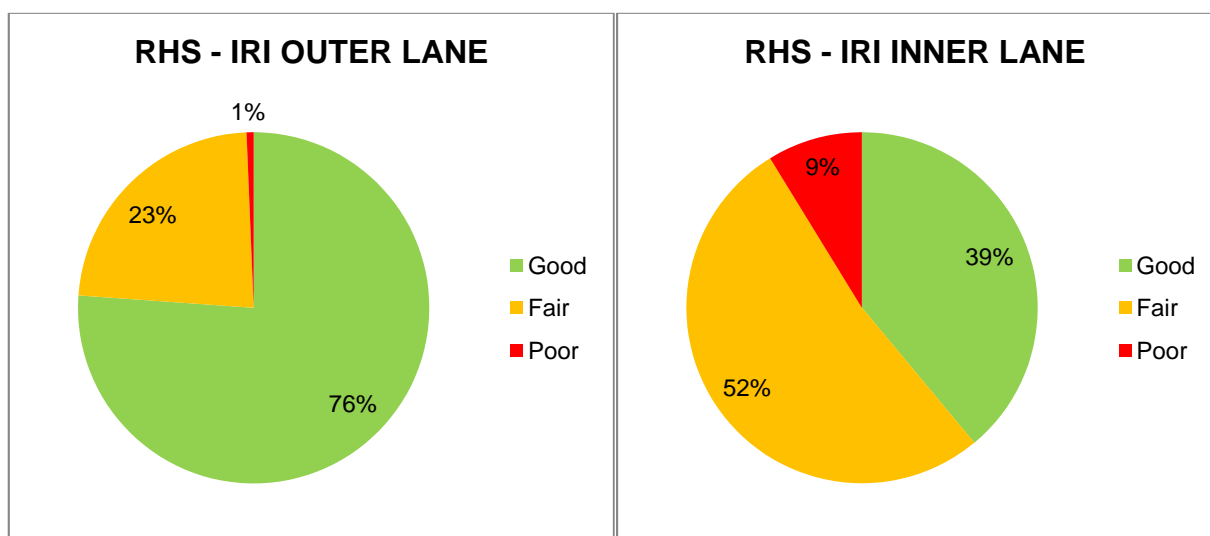


Figure10.RHSIRIOuterandInnerLaneResults

KP	RHS Outer Lane	RHS Inner Lane
646+090	2.6	3.7
646+190	2.2	3.4
646+290	2.4	2.9
646+390	3.0	3.1
646+490	2.2	4.1
646+590	2.3	3.3
646+690	2.1	2.8
646+790	2.0	2.7
646+890	2.5	3.4
646+990	2.3	4.1
647+090	2.4	4.2
647+190	2.4	3.2
647+290	2.1	3.6
647+390	2.2	2.8
647+490	2.5	4.3
647+590	3.0	3.6
647+690	3.6	3.8
647+790	3.0	3.7
647+890	3.0	3.2
647+990	2.4	4.1
648+090	2.9	3.1
648+190	2.3	3.5
648+290	2.5	3.4
648+390	2.2	3.2
648+490	3.0	3.5
648+590	2.6	3.9
648+690	2.4	3.2

KP	RHS Outer Lane	RHS Inner Lane
648+790	2.8	3.3
648+890	2.7	3.3
648+990	1.9	2.4
649+090	2.6	2.7
649+190	2.2	2.1
649+290	2.1	2.7
649+390	2.3	2.8
649+490	2.5	2.9
649+590	2.3	2.1
649+690	2.2	2.7
649+790	2.7	2.7
649+890	2.1	2.9
649+990	1.9	2.2
650+090	2.5	2.8
650+190	2.6	3.4
650+290	1.9	2.1
650+390	2.2	1.9
650+490	2.2	2.1
650+590	2.8	2.5
650+690	2.5	3.0
650+790	2.4	3.0
650+890	2.2	3.7
650+990	2.5	3.2
651+090	2.1	2.2
651+190	2.0	1.9
651+290	2.2	2.0
651+390	2.0	2.9
651+490	2.6	3.4
651+590	2.4	3.4
651+690	2.5	2.8
651+790	3.3	4.4
651+890	3.2	3.0
651+990	3.2	3.3
652+090	2.9	2.6
652+190	3.0	3.1
652+290	2.9	3.9
652+390	2.4	2.0
652+490	2.2	2.2
652+590	2.1	3.2
652+690	3.8	4.6
652+790	3.7	3.9
652+890	3.2	4.1
652+990	2.4	4.1
653+090	2.7	3.9
653+190	3.1	2.9
653+290	1.8	2.5

KP	RHS Outer Lane	RHS Inner Lane
653+390	2.1	2.6
653+490	2.4	2.4
653+590	2.1	1.8
653+690	2.3	3.2
653+790	2.2	3.2
653+890	2.5	2.8
653+990	3.0	2.7
654+090	2.1	2.6
654+190	2.1	2.7
654+290	2.2	2.5
654+390	2.3	2.5
654+490	2.6	3.5
654+590	2.4	2.8
654+690	2.4	2.7
654+790	2.8	4.1
654+890	3.0	3.5
654+990	2.3	3.1
655+090	2.4	3.4
655+190	2.2	3.2
655+290	2.9	3.1
655+390	2.6	3.1
655+490	2.5	2.2
655+590	2.7	2.7
655+690	2.4	2.3
655+790	2.1	2.2
655+890	2.2	1.9
655+990	2.1	2.3
656+090	2.0	2.2
656+190	2.6	2.4
656+290	1.7	1.9
656+390	2.5	1.9
656+490	2.3	1.9
656+590	2.3	2.0
656+690	2.4	2.1
656+790	1.9	2.1
656+890	2.2	1.9
656+990	1.8	2.3
657+090	2.7	3.9
657+190	2.1	3.6
657+290	2.6	2.6
657+390	2.5	4.1
657+490	3.1	5.1
657+590	2.4	3.9
657+690	3.0	4.5
657+790	2.7	4.5
657+890	2.8	3.4

KP	RHS Outer Lane	RHS Inner Lane
657+990	4.0	6.7
658+090	3.5	3.6
658+190	2.0	3.0
658+290	2.2	2.8
658+390	3.3	3.8
658+490	3.6	4.6
658+590	1.8	3.1
658+690	2.7	3.2
658+790	2.5	2.9
658+890	2.6	3.2
658+990	2.2	3.0
659+090	1.9	2.3
659+190	2.8	2.5
659+290	2.7	3.5
659+390	2.2	3.0
659+490	2.8	2.9
659+590	3.0	3.7
659+690	3.1	3.5
659+790	2.6	3.2
659+890	2.4	3.0
659+990	2.4	2.9
660+090	2.3	2.6
660+190	2.3	3.0
660+290	2.7	3.4
660+390	2.3	3.1
660+490	2.8	2.7
660+590	1.9	2.4
660+690	2.7	2.7
660+790	2.2	2.0
660+890	2.2	3.3
660+990	2.6	3.9
661+090	3.2	3.4
661+190	1.8	2.6
661+290	1.8	2.3
661+390	1.7	2.0
661+490	2.5	2.8
661+590	2.1	2.6
661+690	1.5	3.4
661+790	1.7	3.1
661+890	2.6	2.9
661+990	3.3	3.1
662+090	2.5	2.6
662+190	2.3	2.5
662+290	2.4	3.0
662+390	2.3	2.6
662+490	2.5	2.7

KP	RHS Outer Lane	RHS Inner Lane
662+590	2.2	2.3
662+690	2.6	2.9
662+790	3.0	3.5
662+890	2.5	2.8
662+990	2.6	2.4
663+090	2.7	2.3
663+190	2.2	2.1
663+290	2.7	4.0
663+390	3.0	2.8
663+490	2.4	2.5
663+590	2.3	2.7
663+690	2.3	2.4
663+790	2.1	2.3
663+890	2.8	1.8
663+990	2.0	2.5
664+090	2.7	3.3
664+190	2.5	2.5
664+290	2.2	2.4
664+390	3.0	3.5
664+490	2.1	2.2
664+590	2.0	2.6
664+690	2.8	2.7
664+790	2.9	3.0
664+890	2.3	2.8
664+990	2.2	3.8
665+090	2.4	3.4
665+190	3.1	3.7
665+290	2.3	3.0
665+390	2.4	2.9
665+490	2.0	2.3
665+590	2.2	2.6
665+690	2.2	2.2
665+790	2.4	2.6
665+890	2.0	2.4
665+990	1.6	2.3
666+090	2.2	3.2
666+190	2.4	2.9
666+290	2.9	3.0
666+390	1.9	2.8
666+490	2.6	2.7
666+590	2.4	2.6
666+690	2.2	2.6
666+790	2.1	2.6
666+890	2.2	3.0
666+990	2.5	2.9
667+090	2.9	2.9

KP	RHS Outer Lane	RHS Inner Lane
667+190	2.3	2.5
667+290	2.5	2.9
667+390	2.6	2.9
667+490	2.4	2.7
667+590	2.5	3.6
667+690	2.7	2.7
667+790	2.1	3.1
667+890	2.1	3.0
667+990	2.1	2.4
668+090	2.2	2.6
668+190	2.2	2.5
668+290	2.0	3.3
668+390	2.8	2.6
668+490	2.5	2.4
668+590	2.1	3.1
668+690	1.9	1.8
668+790	2.5	2.1
668+890	3.0	2.2
668+990	1.6	2.3
669+090	4.0	2.3
669+190	2.1	1.7
669+290	2.5	1.8
669+390	2.9	2.9
669+490	2.5	2.5
669+590	2.6	2.7
669+690	2.2	2.5
669+790	2.2	3.3
669+890	2.6	3.4
669+990	2.8	3.2
670+090	2.7	2.7
670+190	2.4	3.0
670+290	2.7	3.0
670+390	3.2	3.7
670+490	2.9	2.8
670+590	2.7	2.6
670+690	2.7	2.9
670+790	2.4	2.9
670+890	3.1	4.4
670+990	2.3	3.6
671+090	3.2	3.4
671+190	2.5	2.9
671+290	2.7	3.0
671+390	3.9	3.0
671+490	2.6	4.1
671+590	3.5	3.7
671+690	2.2	3.1

KP	RHS Outer Lane	RHS Inner Lane
671+790	2.6	2.8
671+890	2.1	2.9
671+990	3.3	3.0
672+090	2.3	3.3
672+190	2.8	4.9
672+290	2.9	3.8
672+390	2.6	3.6
672+490	3.1	3.7
672+590	3.8	3.6
672+690	3.0	3.4
672+790	3.4	3.6
672+890	3.3	3.6
672+990	3.4	4.1
673+090	2.8	3.1
673+190	2.6	3.4
673+290	2.6	2.8
673+390	2.6	2.8
673+490	1.9	3.6
673+590	3.0	3.4
673+690	2.6	3.8
673+790	2.8	4.0
673+890	2.4	4.7
673+990	2.7	4.3
674+090	3.0	3.7
674+190	2.8	3.8
674+290	2.9	3.3
674+390	3.3	2.6
674+490	4.0	2.6
674+590	2.6	2.5
674+690	3.2	3.1
674+790	2.8	3.4
674+890	2.6	3.4
674+990	2.9	3.1
675+090	2.5	3.1
675+190	2.9	3.1
675+290	2.5	3.7
675+390	2.9	4.1
675+490	2.7	2.3
675+590	2.7	4.7
675+690	2.2	3.5
675+790	2.5	3.8
675+890	3.6	4.1
675+990	2.0	3.3
676+090	2.5	3.0
676+190	2.6	4.0
676+290	2.7	3.5

KP	RHS Outer Lane	RHS Inner Lane
676+390	2.9	2.7
676+490	2.7	3.6
676+590	1.9	3.4
676+690	2.1	2.4
676+790	1.9	2.2
676+810	1.3	

Table2.RHSIRIRResults

RUT DEPTH – LHS

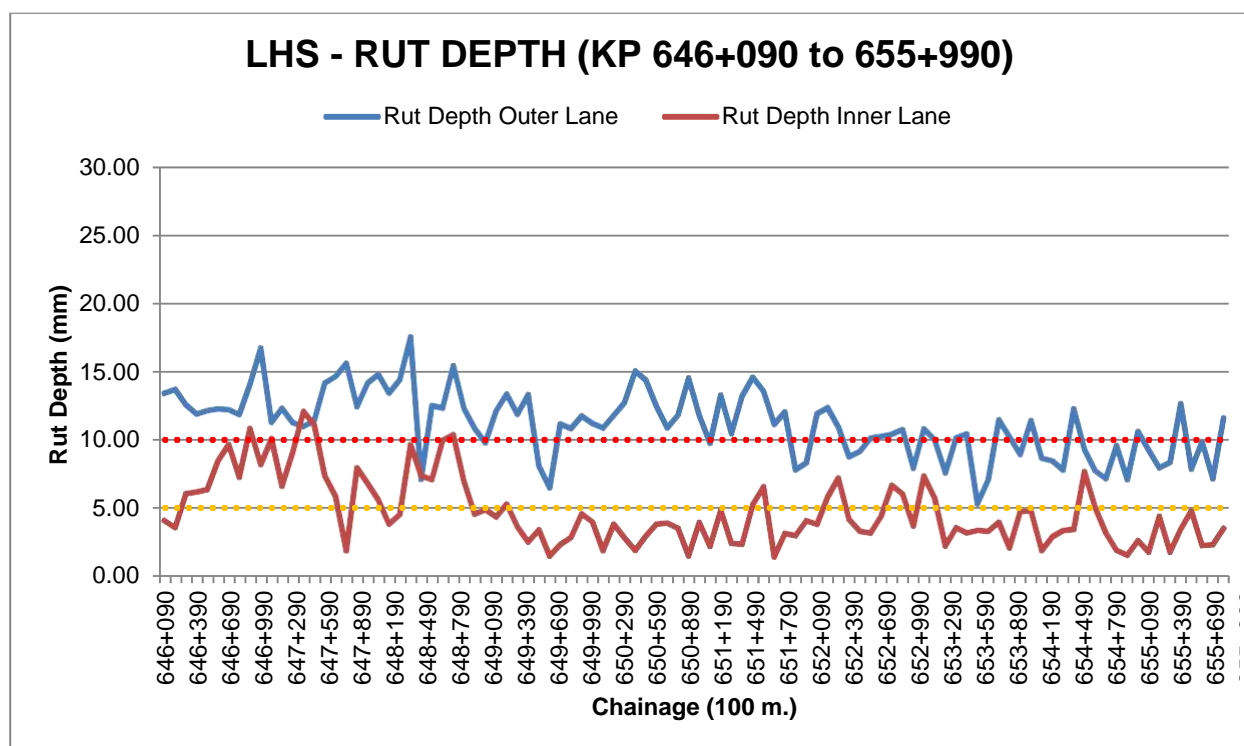


Figure11.LHS-RUTDEPTH(KP646+090to655+990)

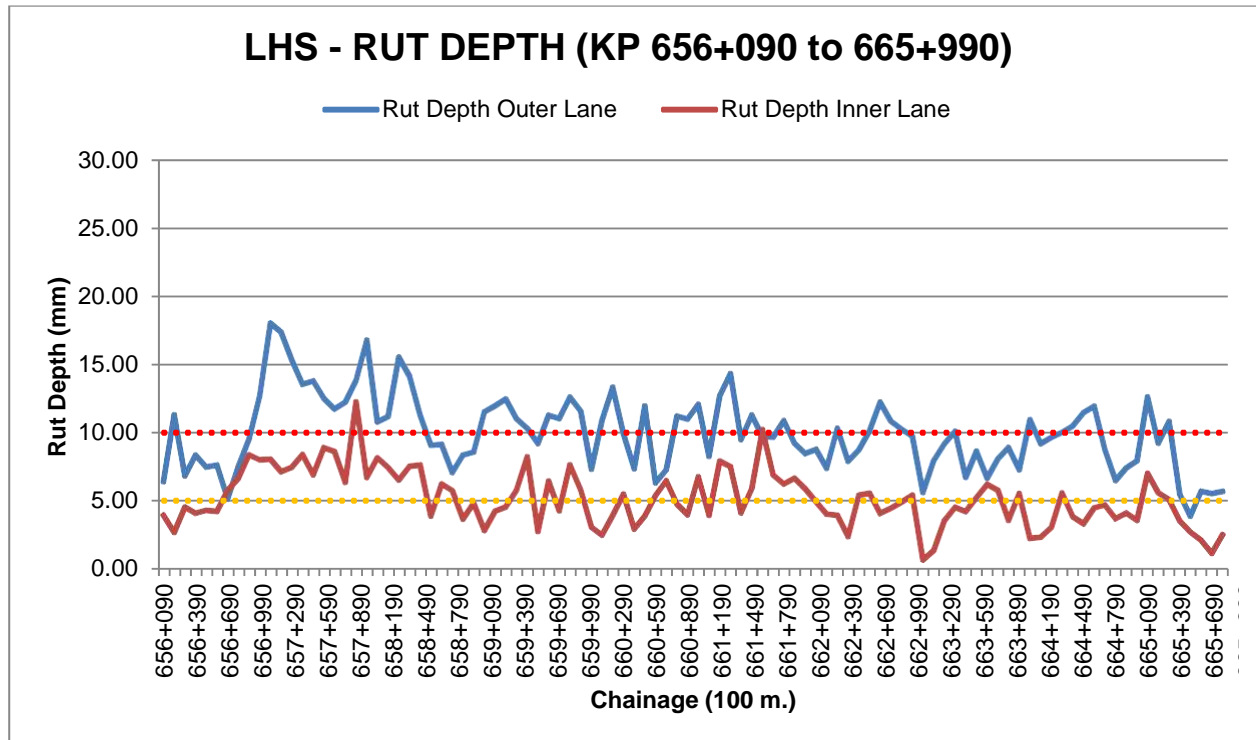


Figure12.LHS-RUTDEPTH(KP656+090to665+990)

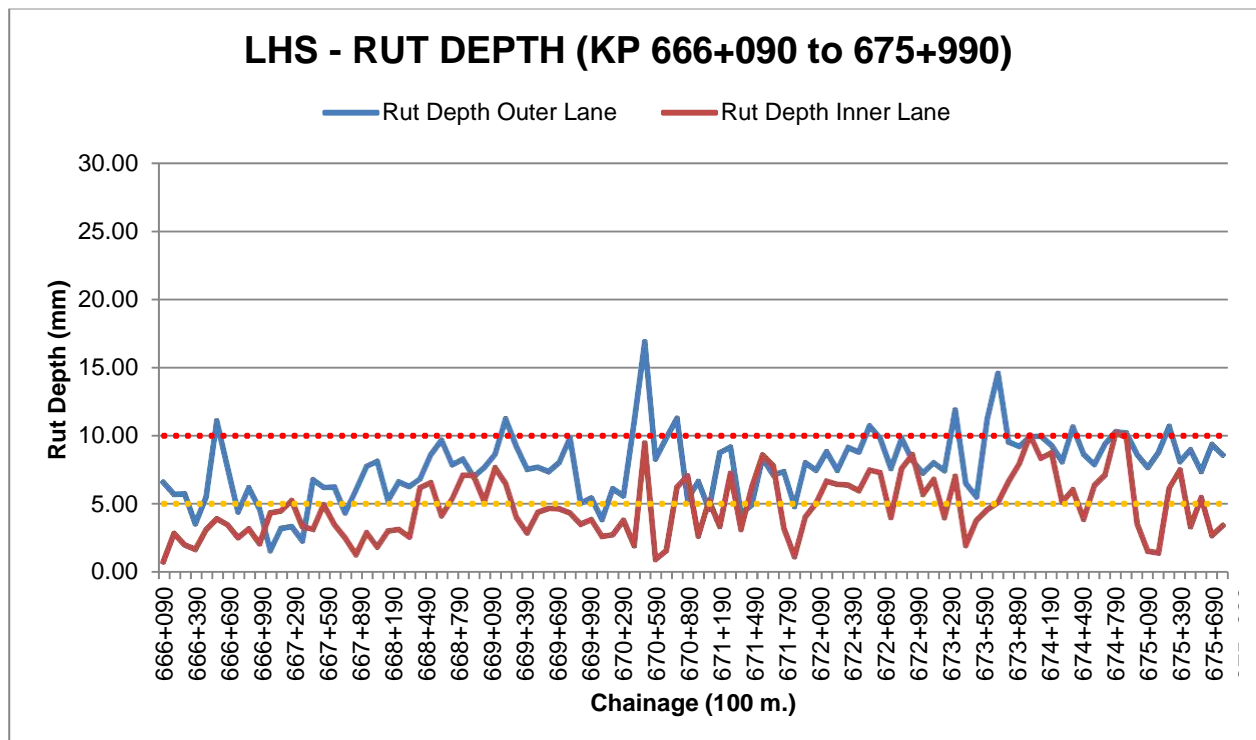


Figure13.LHS-RUTDEPTH(KP666+090to675+990)

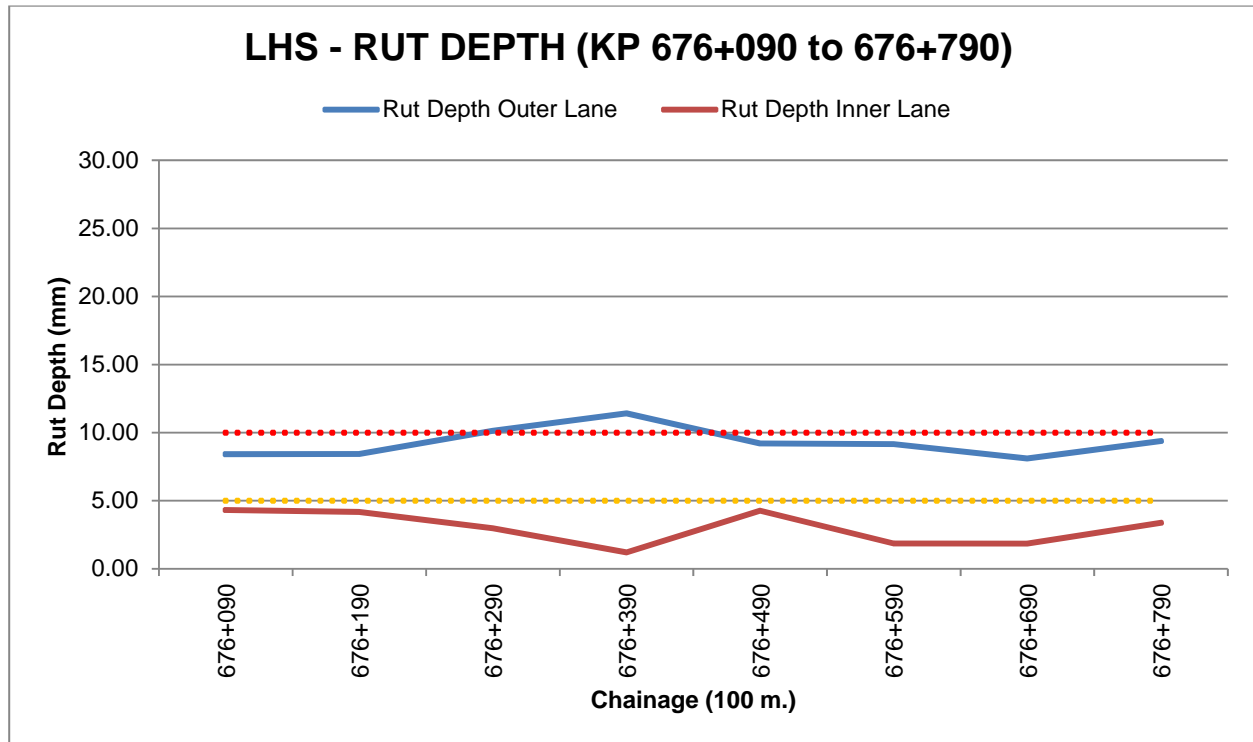


Figure14.LHS-RUTDEPTH(KP676+090to676+790)

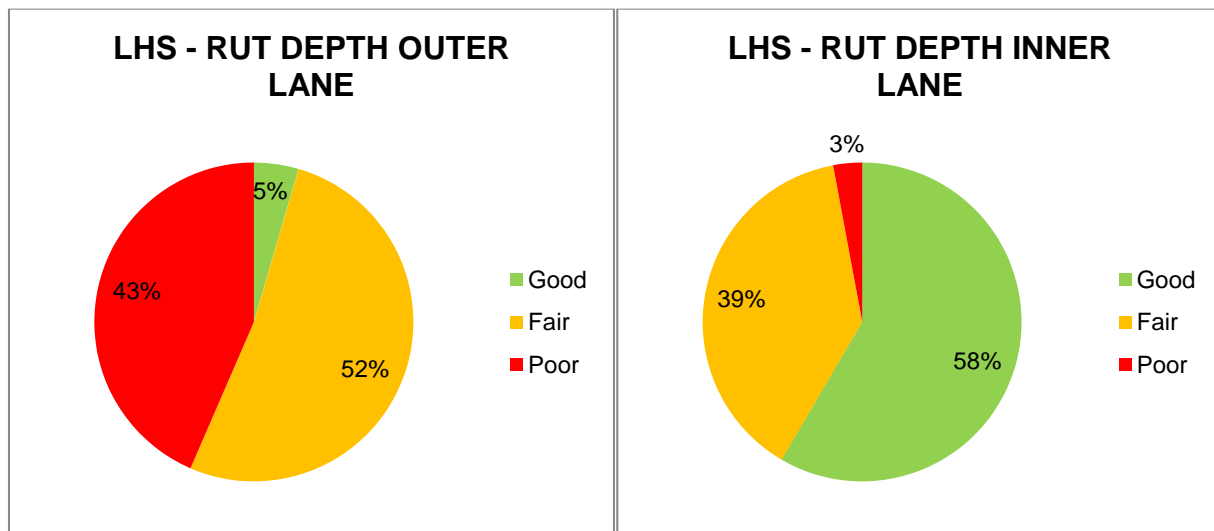


Figure15.LHSRutDepthOuterandInnerLaneResults

KP	LHS Outer Lane	LHS Inner Lane
646+090	13	4
646+190	14	4
646+290	13	6
646+390	12	6
646+490	12	6
646+590	12	8
646+690	12	10
646+790	12	7
646+890	14	11
646+990	17	8
647+090	11	10
647+190	12	7
647+290	11	9
647+390	11	12
647+490	11	11
647+590	14	7
647+690	15	6
647+790	16	2
647+890	12	8
647+990	14	7
648+090	15	6
648+190	13	4
648+290	14	5
648+390	18	10
648+490	7	7
648+590	12	7
648+690	12	10
648+790	15	10
648+890	12	7
648+990	11	5
649+090	10	5
649+190	12	4
649+290	13	5
649+390	12	4
649+490	13	3
649+590	8	3
649+690	6	1
649+790	11	2
649+890	11	3
649+990	12	5
650+090	11	4
650+190	11	2
650+290	12	4
650+390	13	3
650+490	15	2
650+590	14	3

KP	LHS Outer Lane	LHS Inner Lane
650+690	12	4
650+790	11	4
650+890	12	4
650+990	15	1
651+090	12	4
651+190	10	2
651+290	13	5
651+390	10	2
651+490	13	2
651+590	15	5
651+690	14	7
651+790	11	1
651+890	12	3
651+990	8	3
652+090	8	4
652+190	12	4
652+290	12	6
652+390	11	7
652+490	9	4
652+590	9	3
652+690	10	3
652+790	10	4
652+890	10	7
652+990	11	6
653+090	8	4
653+190	11	7
653+290	10	6
653+390	8	2
653+490	10	4
653+590	10	3
653+690	5	3
653+790	7	3
653+890	11	4
653+990	10	2
654+090	9	5
654+190	11	5
654+290	9	2
654+390	8	3
654+490	8	3
654+590	12	3
654+690	9	8
654+790	8	5
654+890	7	3
654+990	10	2
655+090	7	2
655+190	11	3

KP	LHS Outer Lane	LHS Inner Lane
655+290	9	2
655+390	8	4
655+490	8	2
655+590	13	3
655+690	8	5
655+790	10	2
655+890	7	2
655+990	12	4
656+090	6	4
656+190	11	3
656+290	7	5
656+390	8	4
656+490	7	4
656+590	8	4
656+690	5	6
656+790	8	7
656+890	10	8
656+990	13	8
657+090	18	8
657+190	17	7
657+290	15	7
657+390	14	8
657+490	14	7
657+590	12	9
657+690	12	9
657+790	12	6
657+890	14	12
657+990	17	7
658+090	11	8
658+190	11	7
658+290	15	7
658+390	14	8
658+490	11	8
658+590	9	4
658+690	9	6
658+790	7	6
658+890	8	4
658+990	9	5
659+090	11	3
659+190	12	4
659+290	12	5
659+390	11	6
659+490	10	8
659+590	9	3
659+690	11	6
659+790	11	4

KP	LHS Outer Lane	LHS Inner Lane
659+890	13	8
659+990	12	6
660+090	7	3
660+190	11	3
660+290	13	4
660+390	10	5
660+490	7	3
660+590	12	4
660+690	6	5
660+790	7	6
660+890	11	5
660+990	11	4
661+090	12	7
661+190	8	4
661+290	13	8
661+390	14	8
661+490	9	4
661+590	11	6
661+690	10	10
661+790	10	7
661+890	11	6
661+990	9	7
662+090	8	6
662+190	9	5
662+290	7	4
662+390	10	4
662+490	8	2
662+590	9	5
662+690	10	6
662+790	12	4
662+890	11	4
662+990	10	5
663+090	10	5
663+190	6	1
663+290	8	1
663+390	9	4
663+490	10	5
663+590	7	4
663+690	9	5
663+790	7	6
663+890	8	6
663+990	9	4
664+090	7	6
664+190	11	2
664+290	9	2
664+390	10	3

KP	LHS Outer Lane	LHS Inner Lane
664+490	10	6
664+590	10	4
664+690	11	3
664+790	12	4
664+890	9	5
664+990	6	4
665+090	7	4
665+190	8	4
665+290	13	7
665+390	9	6
665+490	11	5
665+590	5	4
665+690	4	3
665+790	6	2
665+890	6	1
665+990	6	3
666+090	7	1
666+190	6	3
666+290	6	2
666+390	4	2
666+490	5	3
666+590	11	4
666+690	8	3
666+790	4	3
666+890	6	3
666+990	5	2
667+090	2	4
667+190	3	4
667+290	3	5
667+390	2	3
667+490	7	3
667+590	6	5
667+690	6	3
667+790	4	2
667+890	6	1
667+990	8	3
668+090	8	2
668+190	5	3
668+290	7	3
668+390	6	3
668+490	7	6
668+590	9	7
668+690	10	4
668+790	8	5
668+890	8	7
668+990	7	7

KP	LHS Outer Lane	LHS Inner Lane
669+090	8	5
669+190	9	8
669+290	11	6
669+390	9	4
669+490	8	3
669+590	8	4
669+690	7	5
669+790	8	5
669+890	10	4
669+990	5	3
670+090	5	4
670+190	4	3
670+290	6	3
670+390	6	4
670+490	11	2
670+590	17	9
670+690	8	1
670+790	10	2
670+890	11	6
670+990	5	7
671+090	7	3
671+190	5	5
671+290	9	3
671+390	9	7
671+490	4	3
671+590	5	6
671+690	8	9
671+790	7	8
671+890	7	3
671+990	5	1
672+090	8	4
672+190	7	5
672+290	9	7
672+390	7	6
672+490	9	6
672+590	9	6
672+690	11	7
672+790	10	7
672+890	8	4
672+990	10	8
673+090	8	9
673+190	7	6
673+290	8	7
673+390	7	4
673+490	12	7
673+590	6	2

KP	LHS Outer Lane	LHS Inner Lane
673+690	6	4
673+790	11	5
673+890	15	5
673+990	10	7
674+090	9	8
674+190	10	10
674+290	10	8
674+390	9	9
674+490	8	5
674+590	11	6
674+690	9	4
674+790	8	6
674+890	9	7
674+990	10	10
675+090	10	10
675+190	9	4
675+290	8	2
675+390	9	1
675+490	11	6
675+590	8	7
675+690	9	3
675+790	7	5
675+890	9	3
675+990	9	3
676+090	8	4
676+190	8	4
676+290	10	3
676+390	11	1
676+490	9	4
676+590	9	2
676+690	8	2
676+790	9	3

Table3.LHSRutDepthResults

RUT DEPTH – RHS

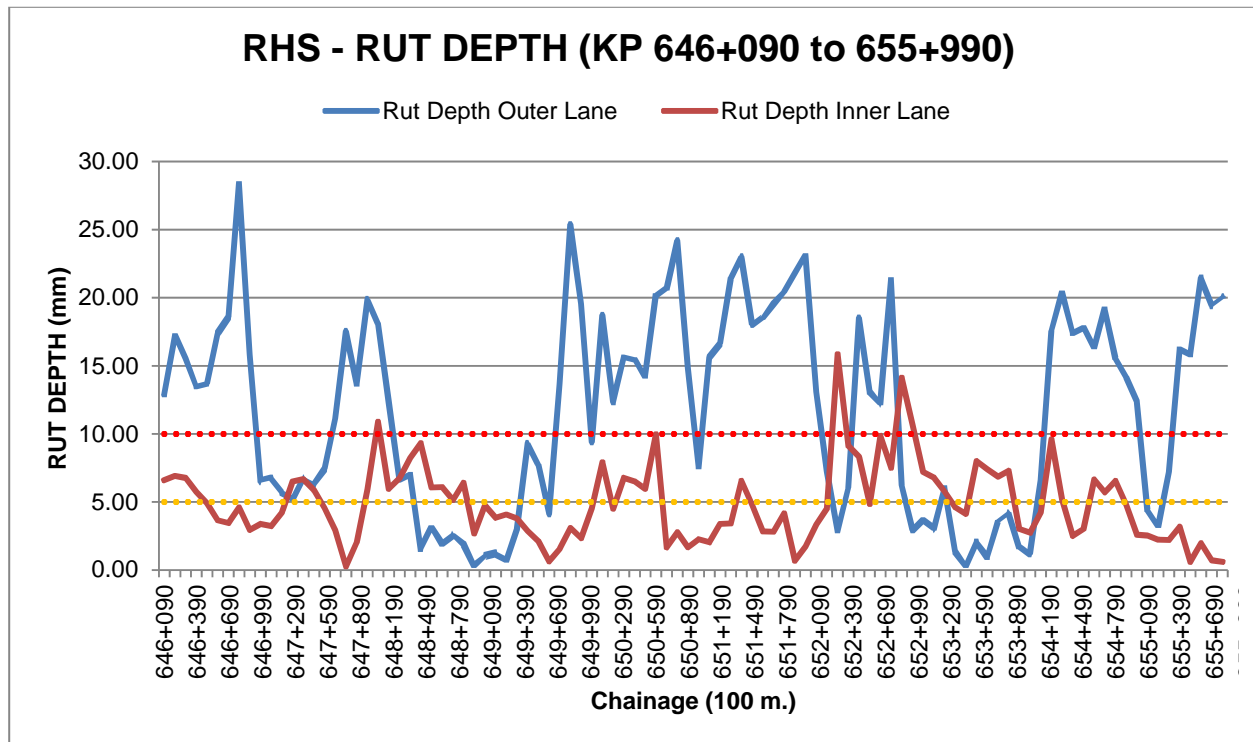


Figure16.RHS-RUTDEPTH(KP646+090to655+990)

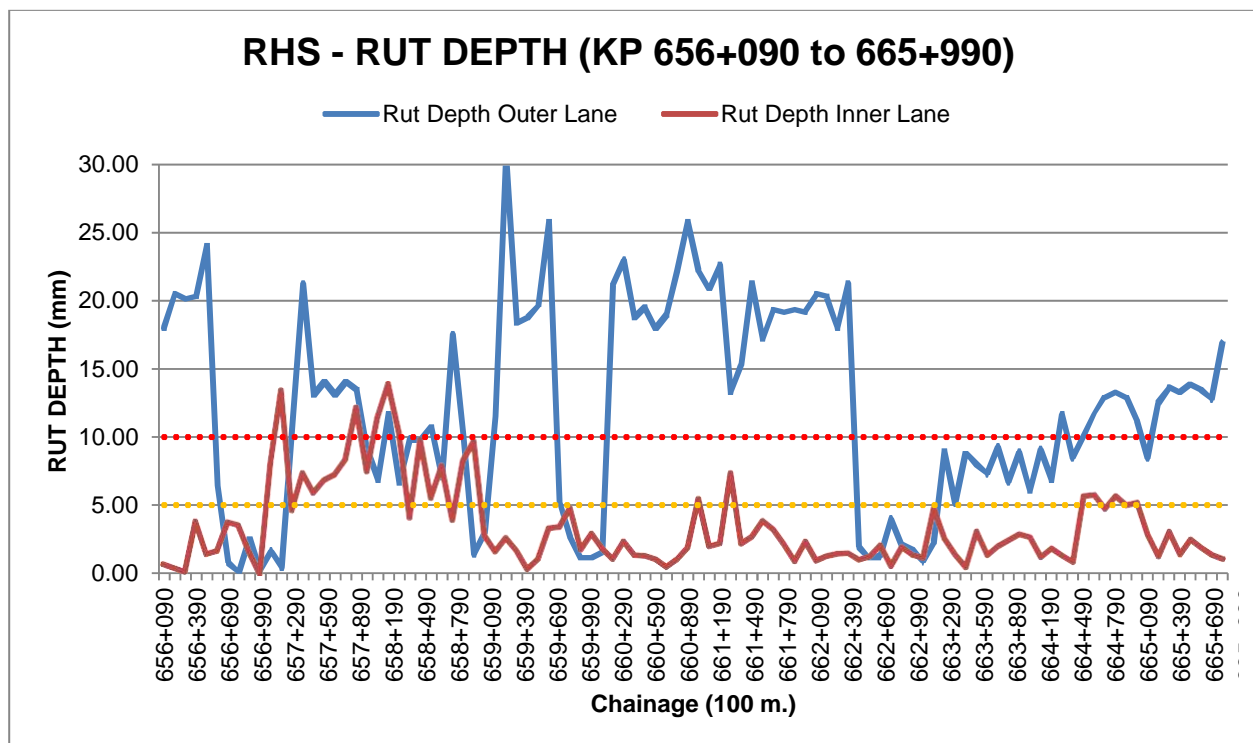


Figure17.RHS-RUTDEPTH(KP656+090to665+990)

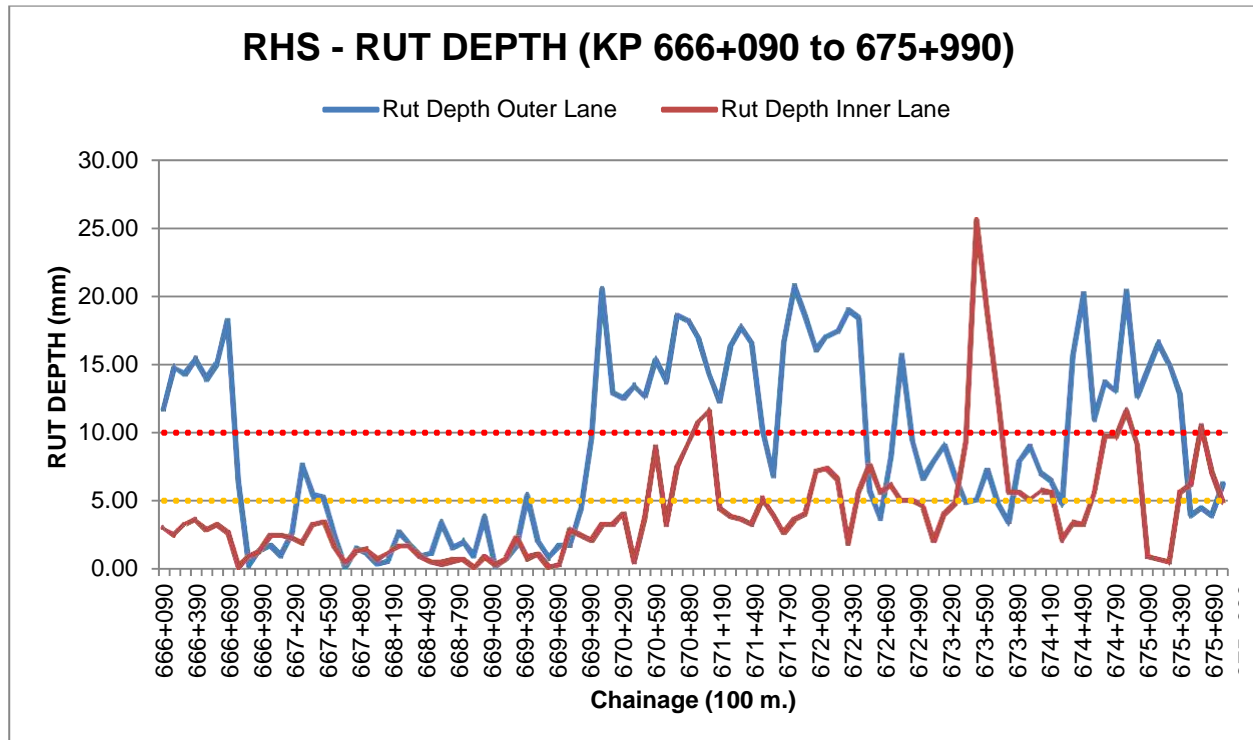


Figure18.RHS-RUTDEPTH(KP666+090to675+990)

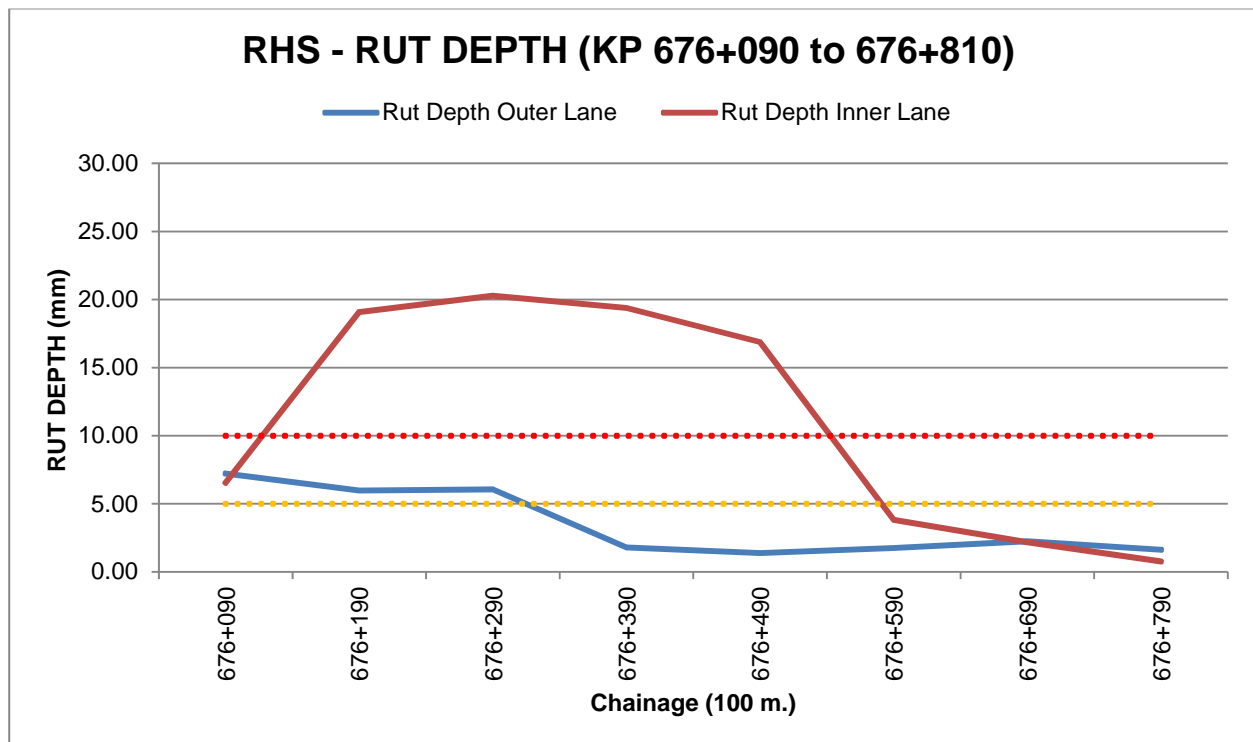


Figure19.RHS-RUTDEPTH(KP676+090to676+810)

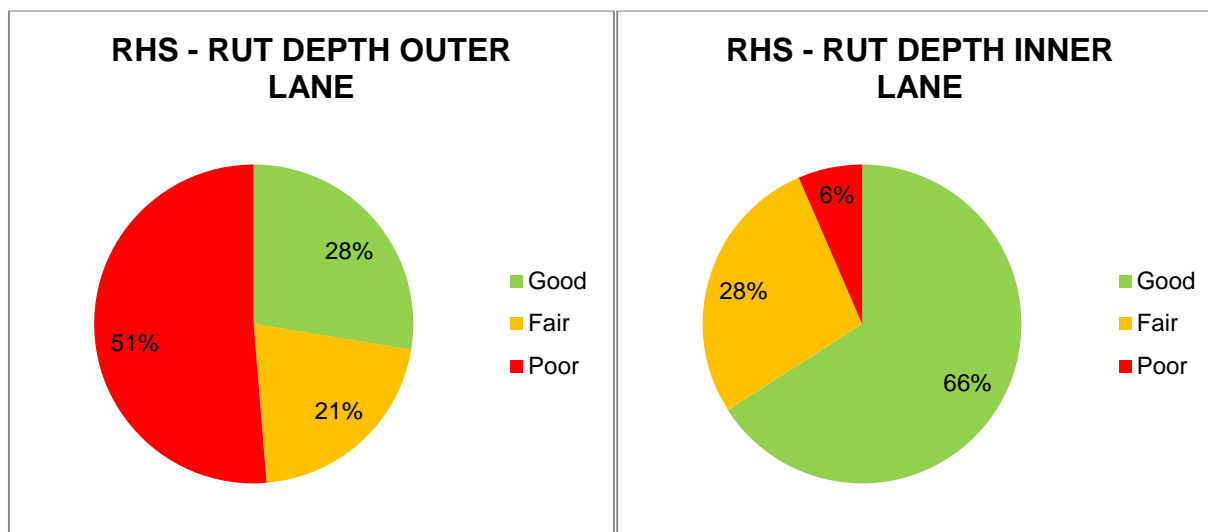


Figure20.RHSRutDepthOuterandInnerLaneResults

KP	RHS Outer Lane	RHS Inner Lane
646+090	13	7
646+190	17	7
646+290	16	7
646+390	14	6
646+490	14	5
646+590	18	4
646+690	19	3
646+790	29	5
646+890	16	3
646+990	7	3
647+090	7	3
647+190	6	4
647+290	5	7
647+390	7	7
647+490	6	6
647+590	7	5
647+690	11	3
647+790	18	0
647+890	14	2
647+990	20	6
648+090	18	11
648+190	13	6
648+290	7	7
648+390	7	8
648+490	2	9
648+590	3	6
648+690	2	6
648+790	3	5

KP	RHS Outer Lane	RHS Inner Lane
648+890	2	6
648+990	0	3
649+090	1	5
649+190	1	4
649+290	1	4
649+390	3	4
649+490	9	3
649+590	8	2
649+690	4	1
649+790	14	2
649+890	25	3
649+990	20	2
650+090	10	5
650+190	19	8
650+290	12	5
650+390	16	7
650+490	16	7
650+590	14	6
650+690	20	10
650+790	21	2
650+890	24	3
650+990	15	2
651+090	8	2
651+190	16	2
651+290	17	3
651+390	21	3
651+490	23	7
651+590	18	5
651+690	19	3
651+790	20	3
651+890	21	4
651+990	22	1
652+090	23	2
652+190	13	3
652+290	7	5
652+390	3	16
652+490	6	9
652+590	19	8
652+690	13	5
652+790	12	10
652+890	21	8
652+990	6	14
653+090	3	11
653+190	4	7
653+290	3	7
653+390	6	6

KP	RHS Outer Lane	RHS Inner Lane
653+490	1	5
653+590	0	4
653+690	2	8
653+790	1	7
653+890	4	7
653+990	4	7
654+090	2	3
654+190	1	3
654+290	7	4
654+390	18	10
654+490	20	5
654+590	17	3
654+690	18	3
654+790	16	7
654+890	19	6
654+990	16	7
655+090	14	5
655+190	12	3
655+290	4	3
655+390	3	2
655+490	7	2
655+590	16	3
655+690	16	1
655+790	22	2
655+890	20	1
655+990	20	1
656+090	18	1
656+190	21	0
656+290	20	0
656+390	20	4
656+490	24	1
656+590	7	2
656+690	1	4
656+790	0	4
656+890	3	2
656+990	0	0
657+090	2	8
657+190	1	13
657+290	11	5
657+390	21	7
657+490	13	6
657+590	14	7
657+690	13	7
657+790	14	8
657+890	14	12
657+990	9	8

KP	RHS Outer Lane	RHS Inner Lane
658+090	7	11
658+190	12	14
658+290	7	10
658+390	10	4
658+490	10	10
658+590	11	6
658+690	7	8
658+790	18	4
658+890	10	8
658+990	1	10
659+090	3	3
659+190	12	2
659+290	31	3
659+390	18	2
659+490	19	0
659+590	20	1
659+690	26	3
659+790	5	3
659+890	3	5
659+990	1	2
660+090	1	3
660+190	2	2
660+290	21	1
660+390	23	2
660+490	19	1
660+590	20	1
660+690	18	1
660+790	19	1
660+890	22	1
660+990	26	2
661+090	22	5
661+190	21	2
661+290	23	2
661+390	13	7
661+490	15	2
661+590	21	3
661+690	17	4
661+790	19	3
661+890	19	2
661+990	19	1
662+090	19	2
662+190	21	1
662+290	20	1
662+390	18	1
662+490	21	2
662+590	2	1

KP	RHS Outer Lane	RHS Inner Lane
662+690	1	1
662+790	1	2
662+890	4	1
662+990	2	2
663+090	2	1
663+190	1	1
663+290	2	5
663+390	9	3
663+490	5	1
663+590	9	1
663+690	8	3
663+790	7	1
663+890	9	2
663+990	7	2
664+090	9	3
664+190	6	3
664+290	9	1
664+390	7	2
664+490	12	1
664+590	9	1
664+690	10	6
664+790	12	6
664+890	13	5
664+990	13	6
665+090	13	5
665+190	11	5
665+290	9	3
665+390	13	1
665+490	14	3
665+590	13	1
665+690	14	3
665+790	14	2
665+890	13	1
665+990	17	1
666+090	12	3
666+190	15	3
666+290	14	3
666+390	15	4
666+490	14	3
666+590	15	3
666+690	18	3
666+790	7	0
666+890	0	1
666+990	1	1
667+090	2	3
667+190	1	3

KP	RHS Outer Lane	RHS Inner Lane
667+290	3	2
667+390	8	2
667+490	5	3
667+590	5	4
667+690	3	2
667+790	0	1
667+890	2	1
667+990	1	2
668+090	1	1
668+190	1	1
668+290	3	2
668+390	2	2
668+490	1	1
668+590	1	1
668+690	4	1
668+790	2	1
668+890	2	1
668+990	1	0
669+090	4	1
669+190	0	0
669+290	1	1
669+390	2	2
669+490	5	1
669+590	2	1
669+690	1	0
669+790	2	0
669+890	2	3
669+990	4	3
670+090	10	2
670+190	21	3
670+290	13	3
670+390	13	4
670+490	14	1
670+590	13	4
670+690	15	9
670+790	14	3
670+890	19	8
670+990	18	9
671+090	17	11
671+190	14	12
671+290	12	4
671+390	16	4
671+490	18	4
671+590	17	3
671+690	10	5
671+790	7	4

KP	RHS Outer Lane	RHS Inner Lane
671+890	17	3
671+990	21	4
672+090	19	4
672+190	16	7
672+290	17	7
672+390	17	7
672+490	19	2
672+590	18	6
672+690	6	8
672+790	4	6
672+890	8	6
672+990	16	5
673+090	9	5
673+190	7	5
673+290	8	2
673+390	9	4
673+490	7	5
673+590	5	9
673+690	5	26
673+790	7	19
673+890	5	13
673+990	4	6
674+090	8	6
674+190	9	5
674+290	7	6
674+390	7	6
674+490	5	2
674+590	16	3
674+690	20	3
674+790	11	6
674+890	14	10
674+990	13	10
675+090	21	12
675+190	13	9
675+290	15	1
675+390	17	1
675+490	15	1
675+590	13	6
675+690	4	6
675+790	5	11
675+890	4	7
675+990	6	5
676+090	7	7
676+190	6	19
676+290	6	20
676+390	2	19

KP	RHS Outer Lane	RHS Inner Lane
676+490	1	17
676+590	2	4
676+690	2	2
676+790	2	1

Table4.RHSRutDepthResults



Technical Due Diligence Report of NH27 (NH14) Abu road – Swaroopganj (Stretch1)).

ANNEXURE-6 HDM-4 RESULTS

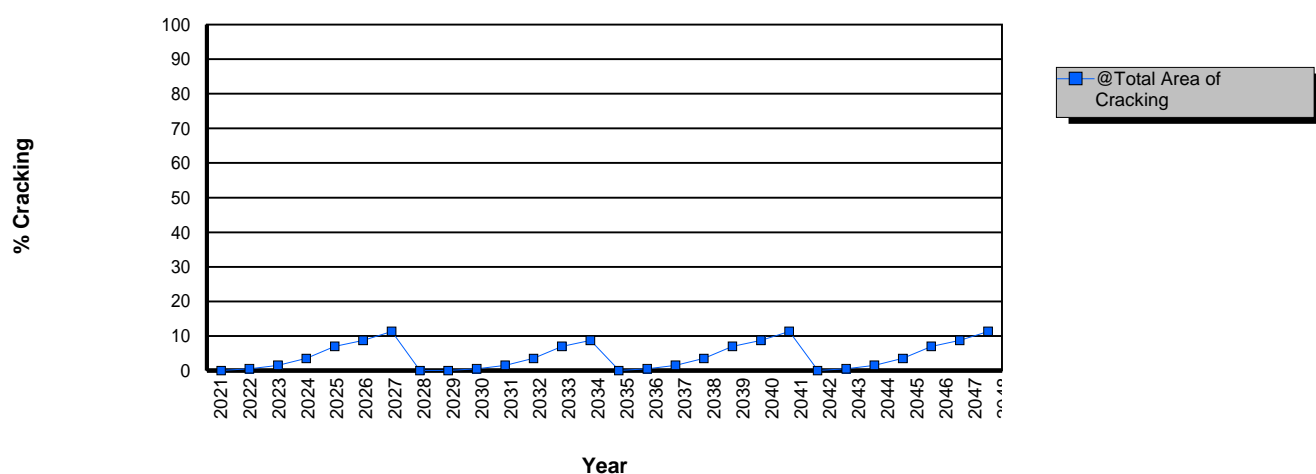
Section: Str 1-01 - LHS -646+000-649+000

Alternative: Base Alternative

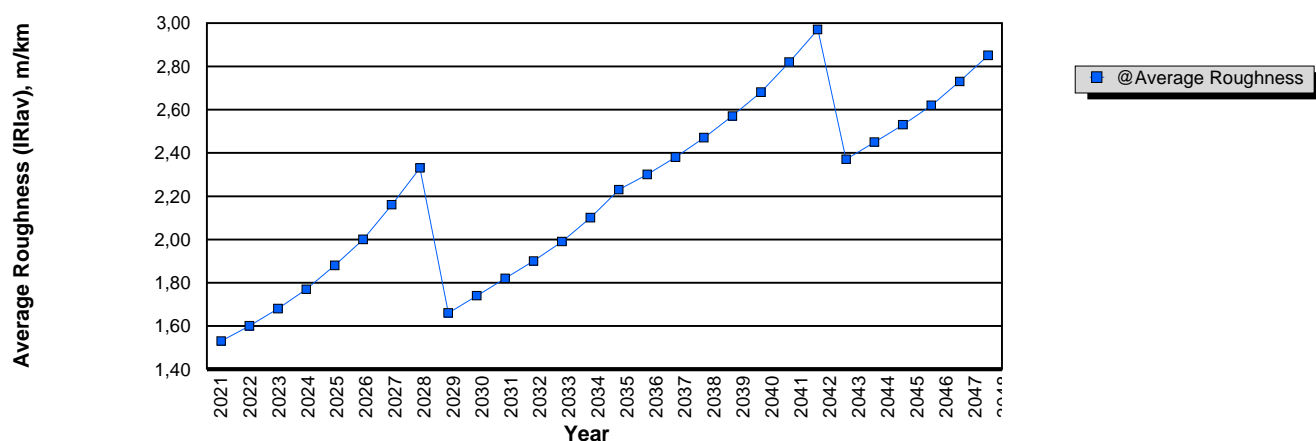
Sensitivity: No Sensitivity Analysis Conducted

Length: 3,00km Width: 7,00m Rise + Fall: 1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

Progression of Cracking over time
(after works values)

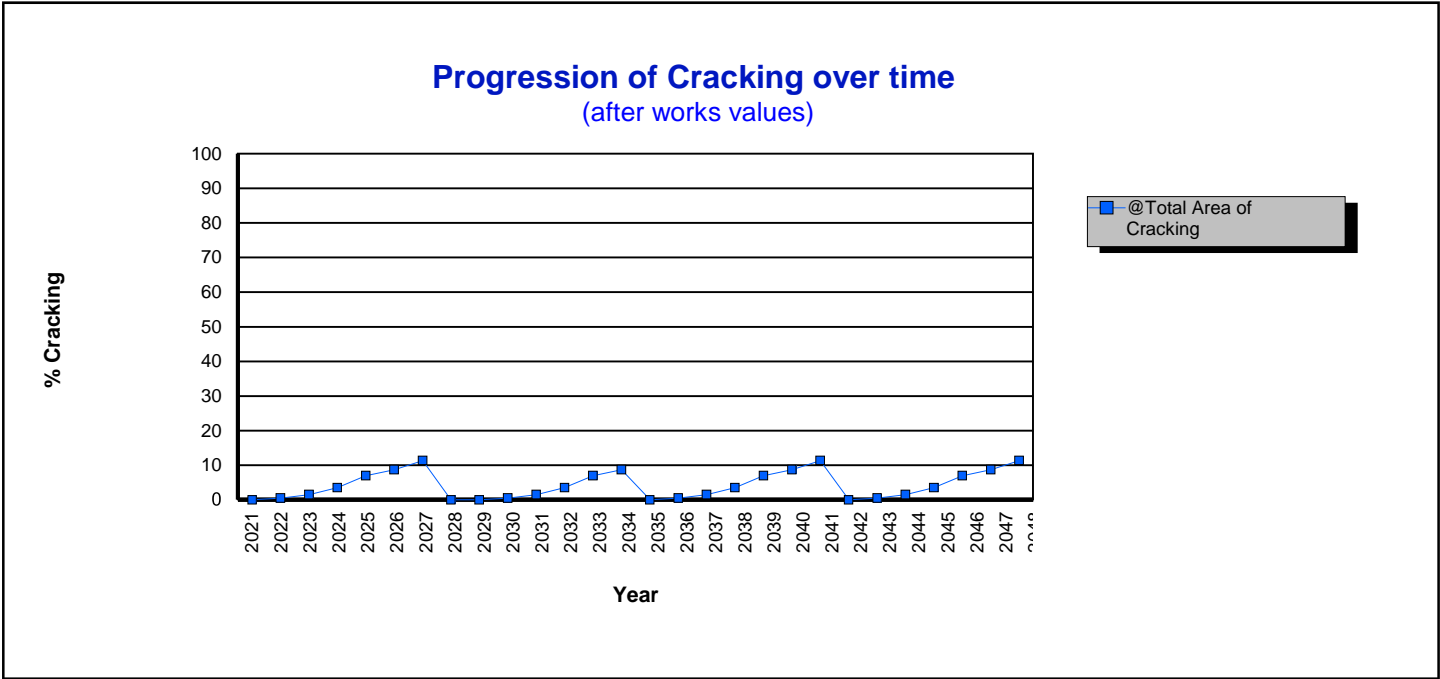


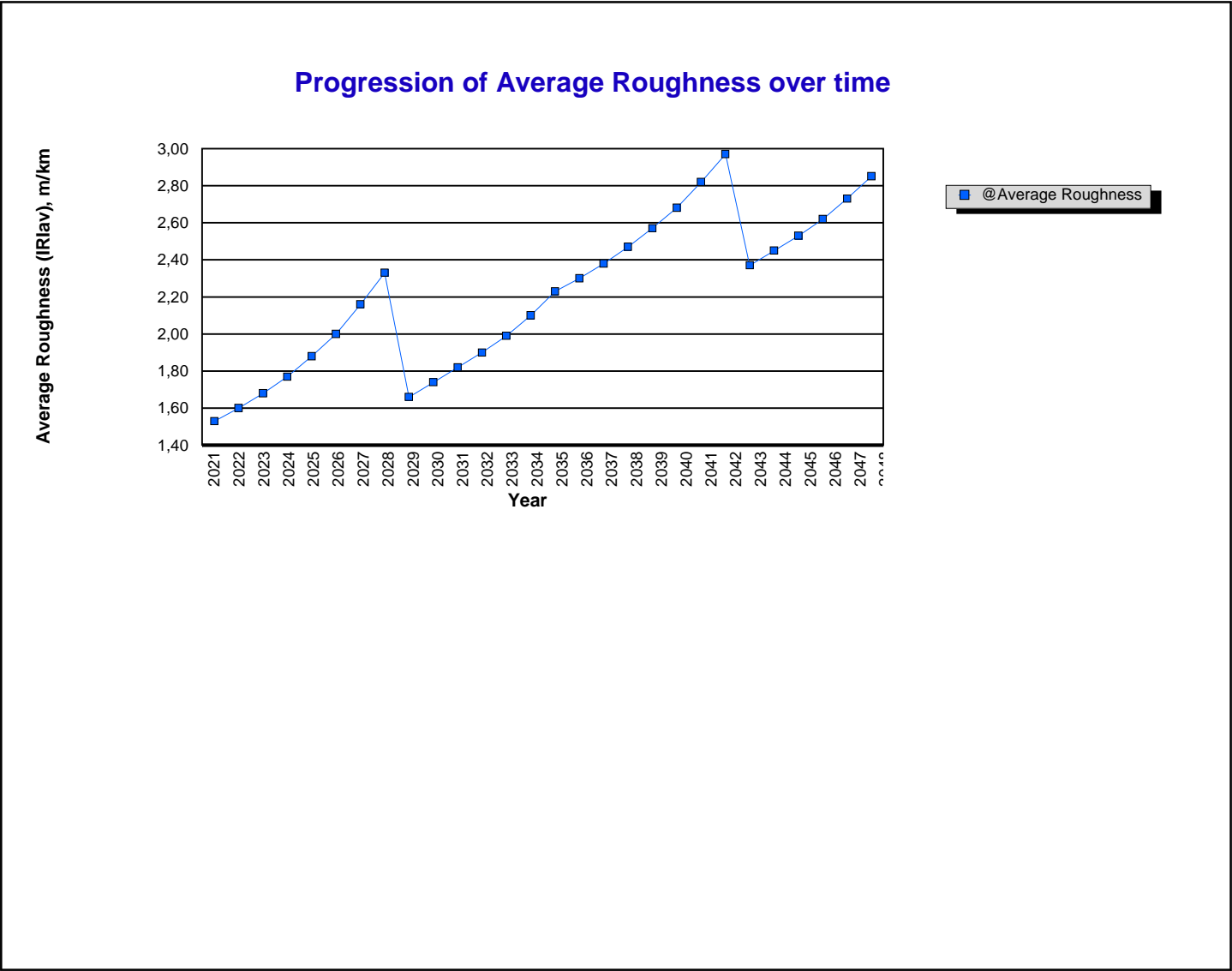
Progression of Average Roughness over time



Section: Str 1-02 - LHS -649+000-652+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 3,00km Width: 7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

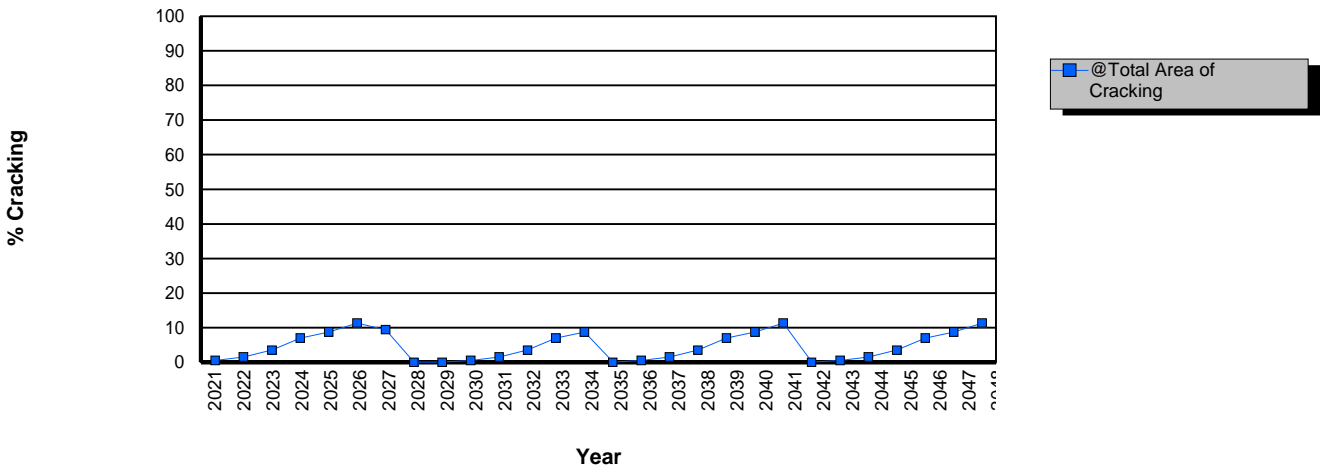




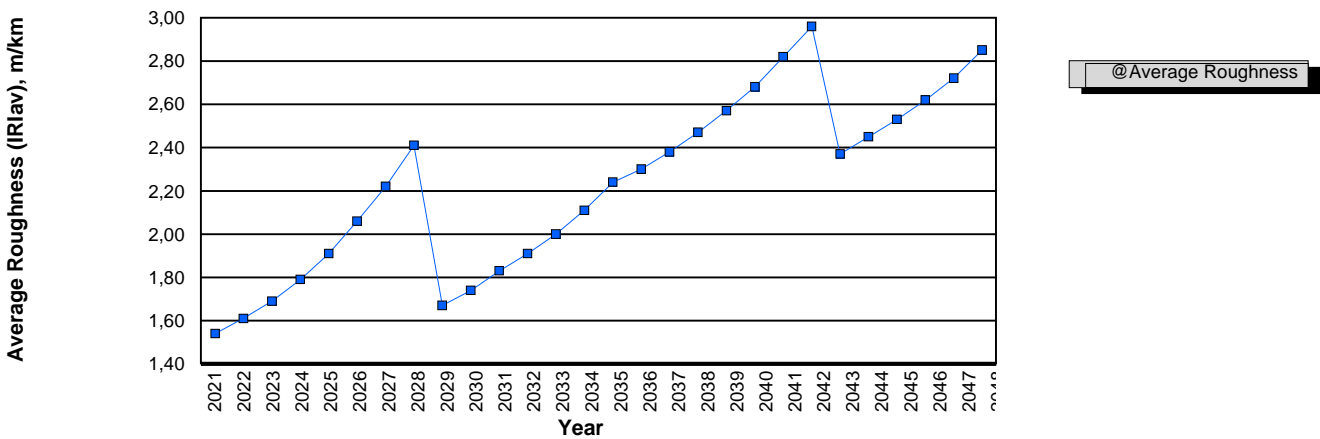
Section: Str 1-03 - LHS -652+000-656+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 4,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

Progression of Cracking over time
(after works values)

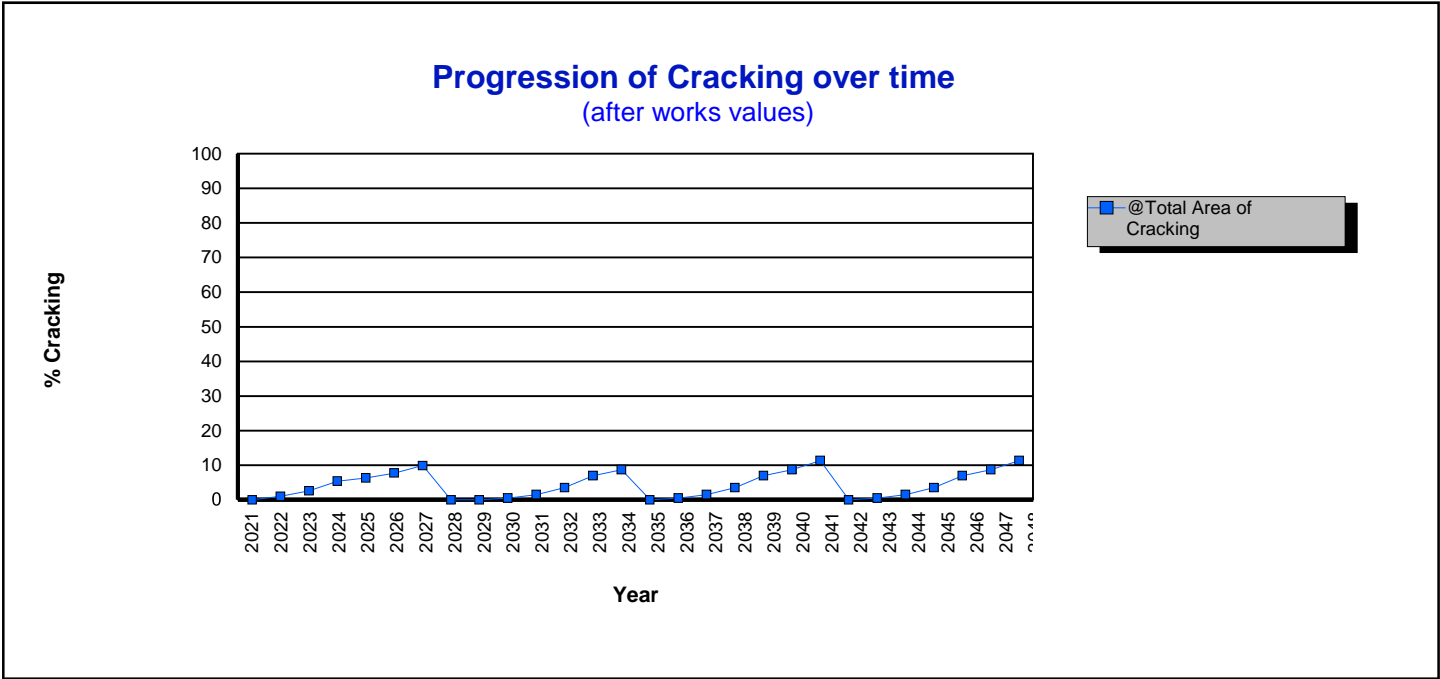


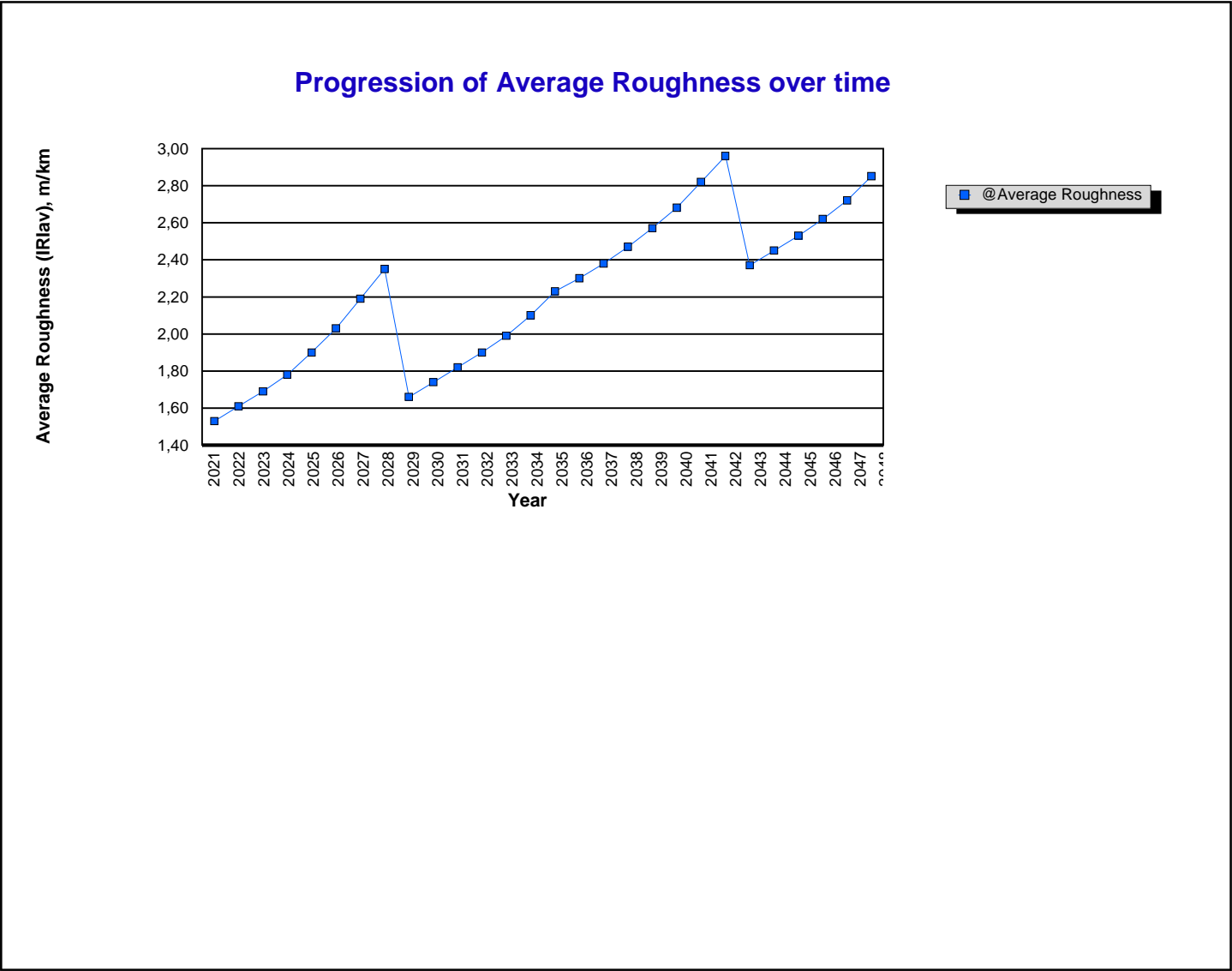
Progression of Average Roughness over time



Section: Str 1-04 - LHS -656+000-660+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

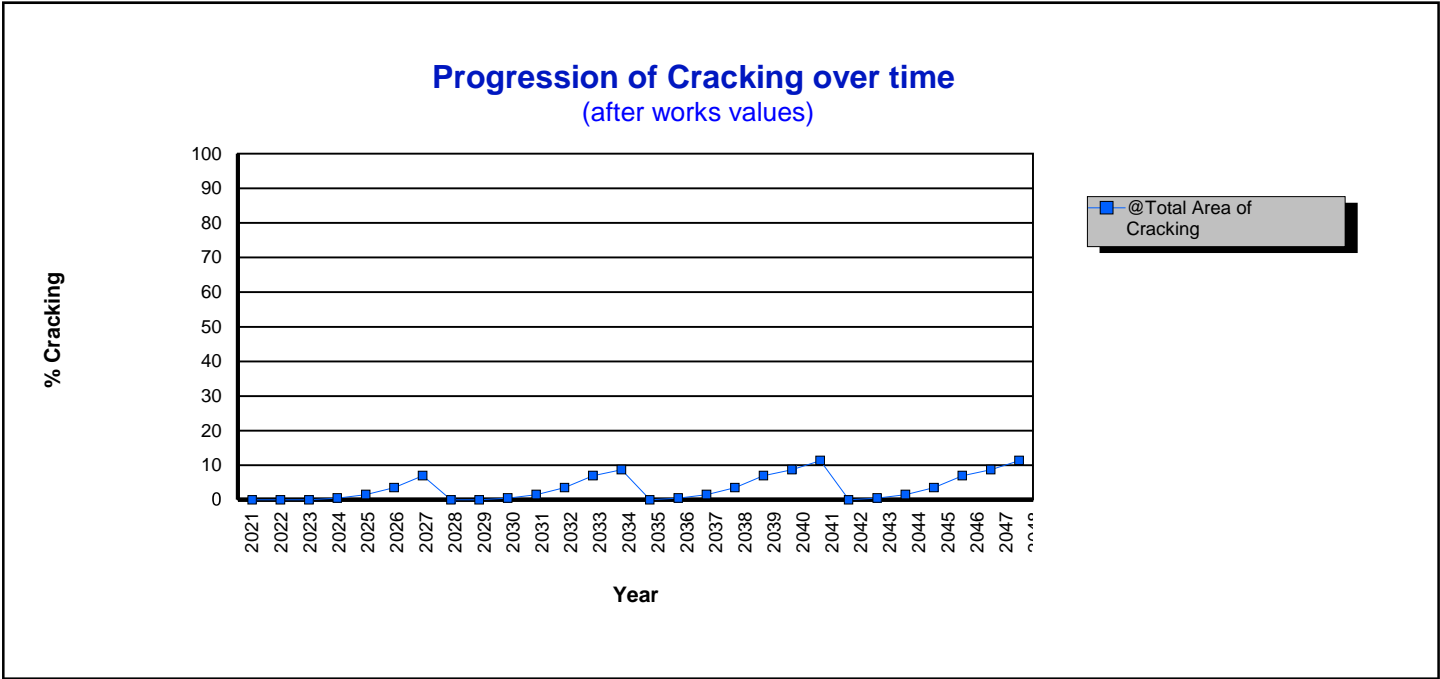
Length: 4,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

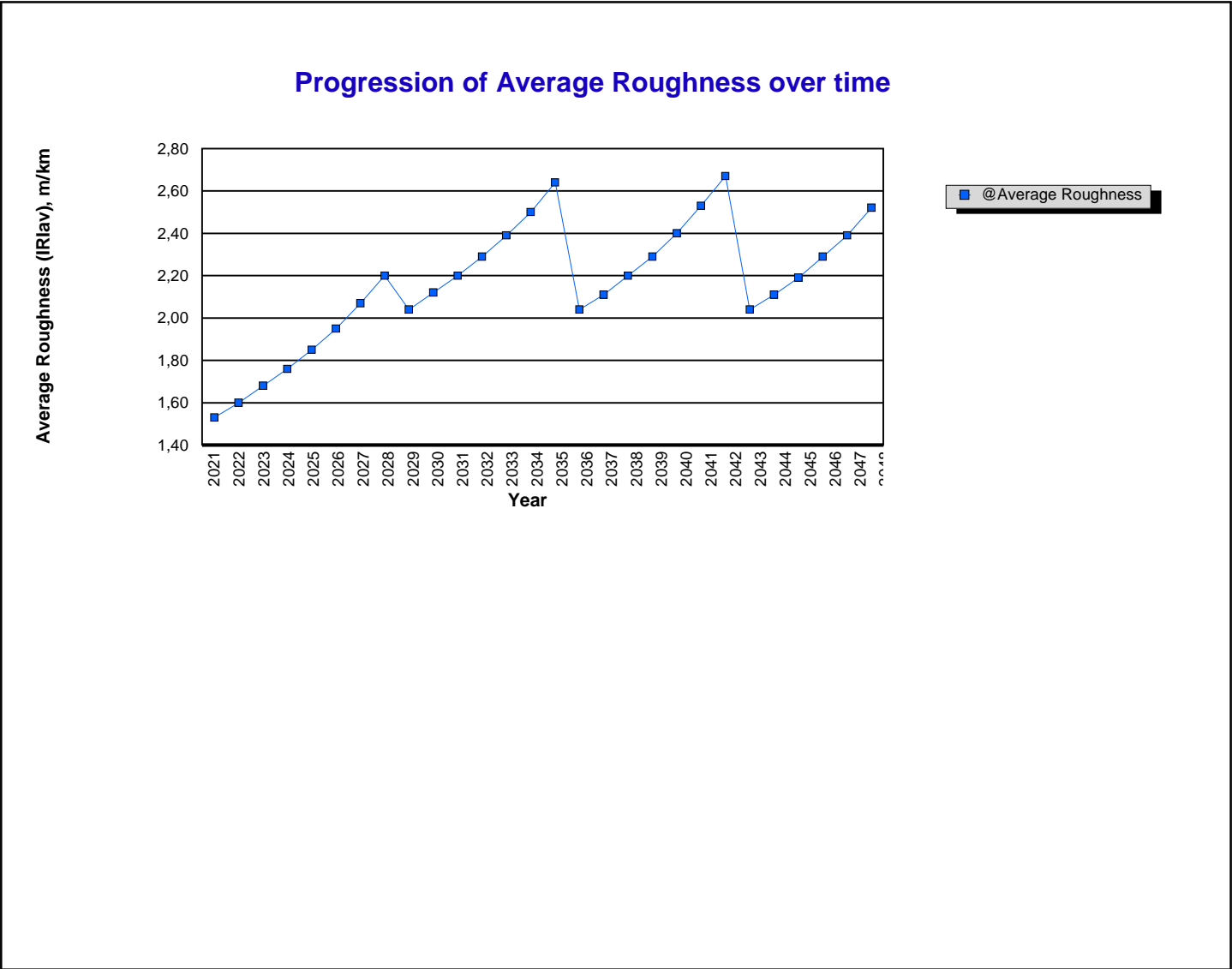




Section: Str 1-05 - LHS -660+000-665+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

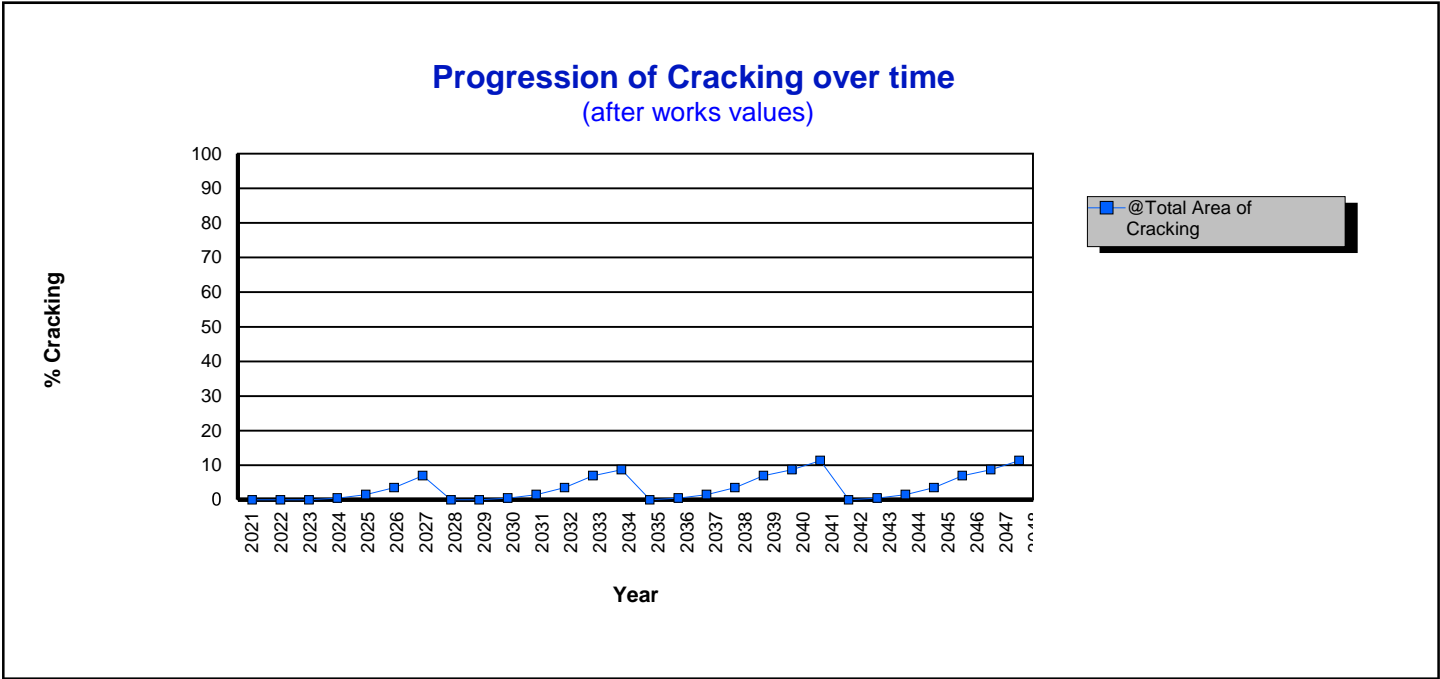
Length: 5,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

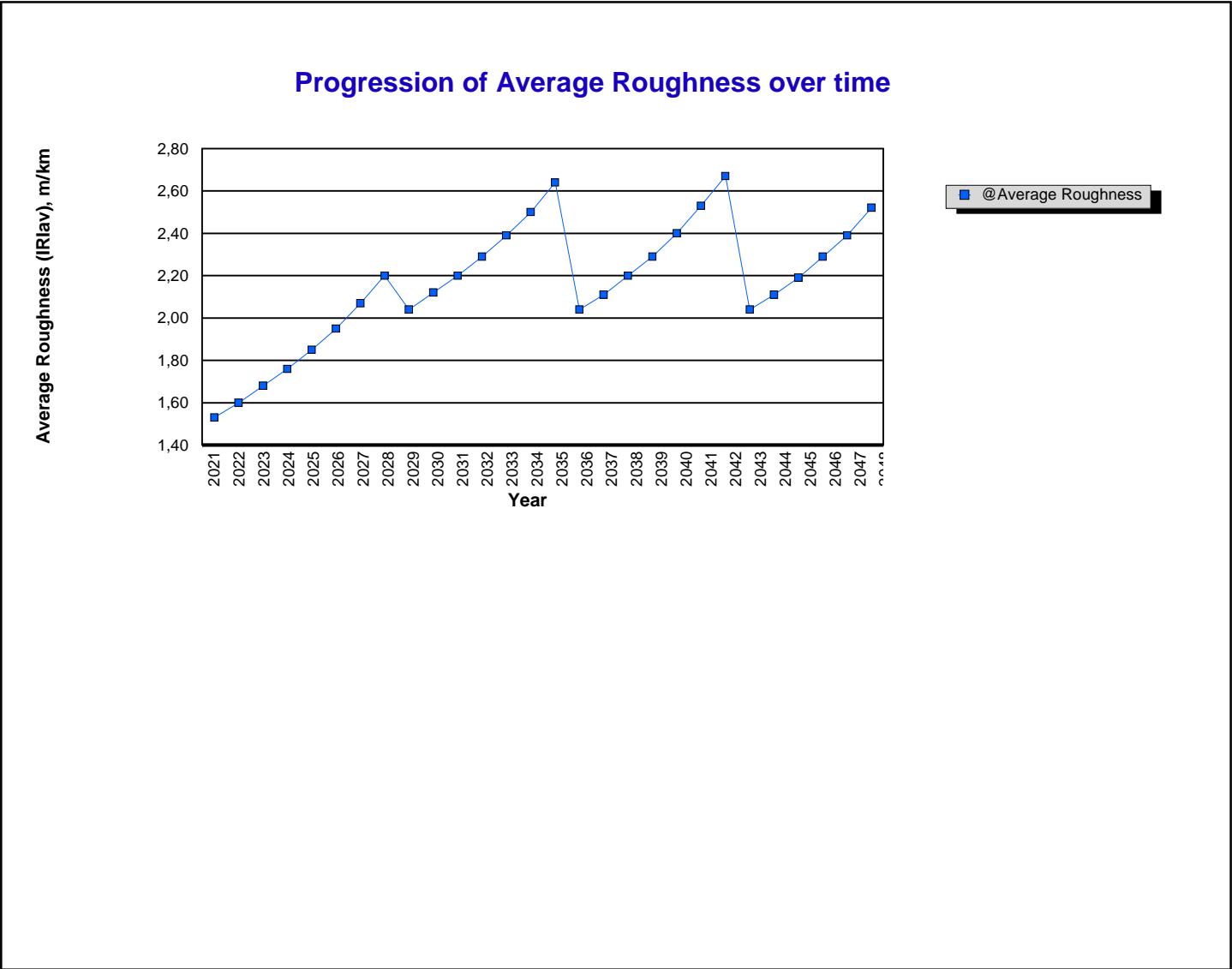




Section: Str 1-06 - LHS -665+000-671+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 6,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

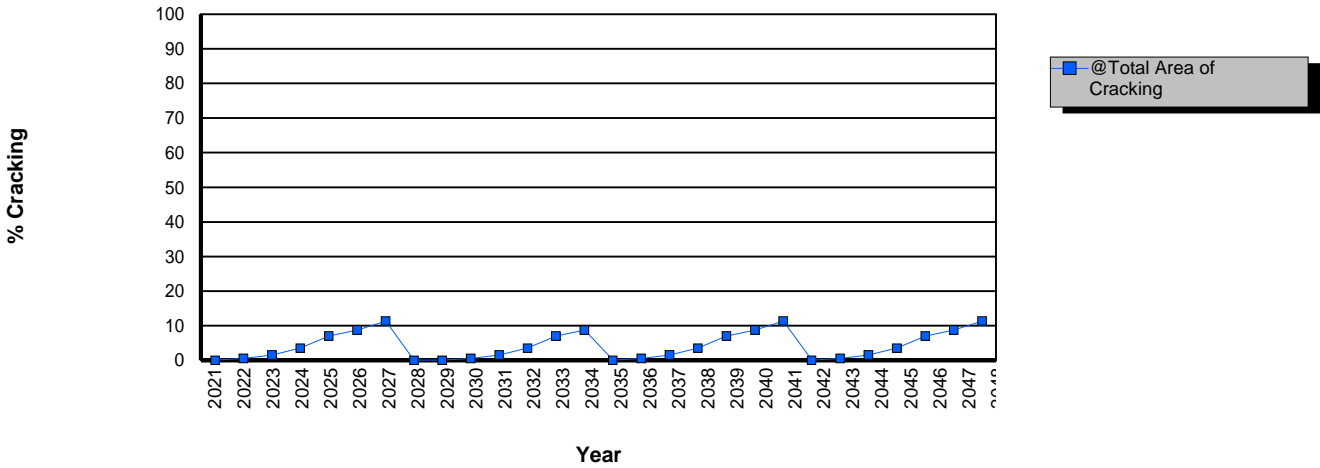




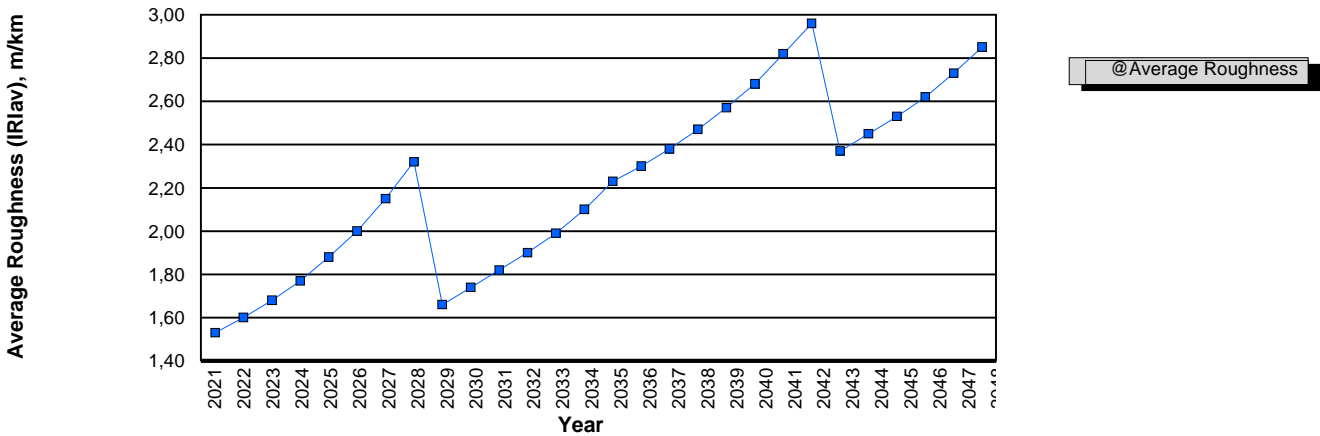
Section: Str 1-07 - LHS -671+000-674+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 3,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

Progression of Cracking over time
(after works values)



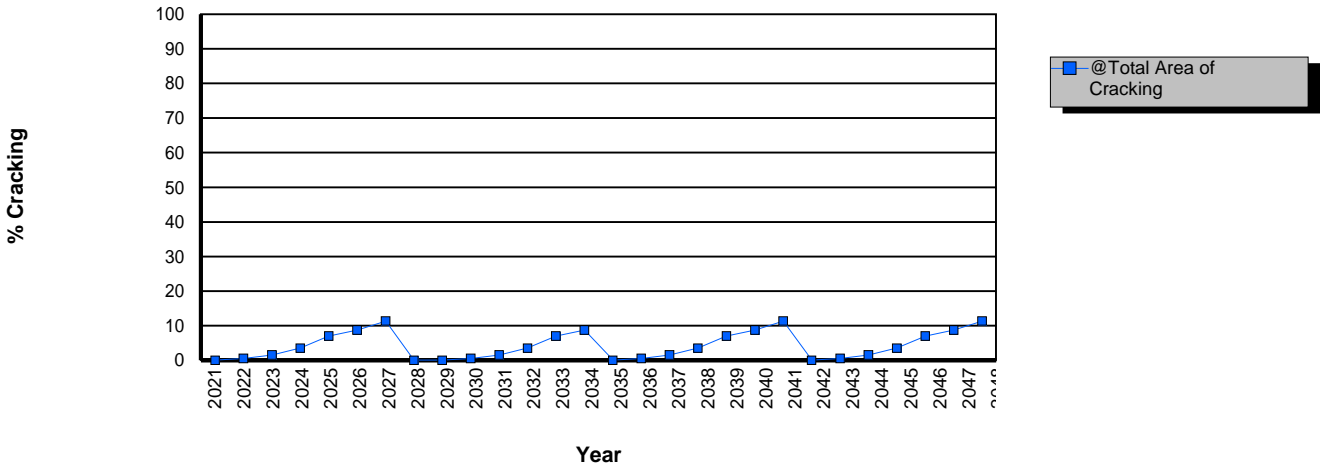
Progression of Average Roughness over time



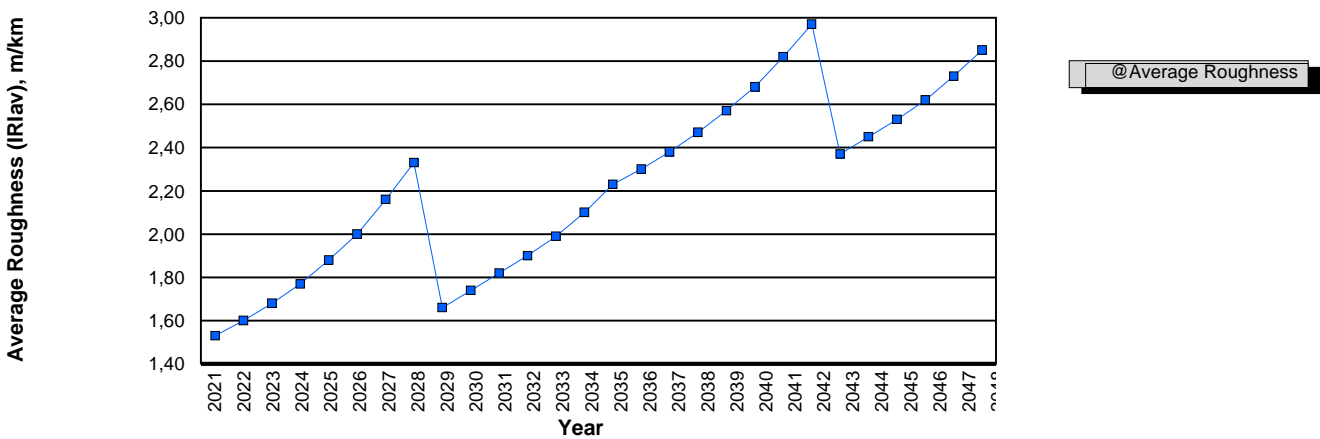
Section: Str 1-08 - LHS -674+000-677+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 3,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

Progression of Cracking over time
(after works values)



Progression of Average Roughness over time



Road Works Summary (by Section)

Study Name: **INDIA Str 1 LHS**

Run Date: **06-06-2018**

Currency: **Dollars**

Note: only sections that have works triggered are displayed.

Section: Str 1-01 - LHS -646+000-649+000
Alternative: BaseAlternative
Sensitivity: No Sensitivity AnalysisConducted
Surface Class: Bituminous
Length: 3,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	762,22 sq. m
2028	Overlay 2028	028	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	o35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m

Total cost for the section:

0.0

0.0

Section: Str 1-02 - LHS -649+000-652+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted
Surface Class: Bituminous
Length: 3,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	762,22 sq. m
2028	Overlay 2028	o28	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m

Total cost for the section:

0.0

0.0

Section: Str 1-03 - LHS -652+000-656+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted
Surface Class: Bituminous
Length: 4,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
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H D M - 4 Road Works Summary (by Section)

2025	Patching	Patch	0.0	0.0	1.016,30 sq. m
2026	Patching	Patch	0.0	0.0	1.016,30 sq. m
2027	Patching	Patch	0.0	0.0	2.635,90 sq. m
2028	Overlay 2028	o28	0.0	0.0	28.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.016,30 sq. m
2035	Overlay 2035	035	0.0	0.0	28.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.016,30 sq. m
2041	Patching	Patch	0.0	0.0	1.016,30 sq. m
2042	Overlay 2042	O42	0.0	0.0	28.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.016,30 sq. m
2048	Patching	Patch	0.0	0.0	1.016,30 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section: Str 1-04 - LHS -656+000-660+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted
Surface Class: Bituminous
Length: 4,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	1.016,30 sq. m
2026	Patching	Patch	0.0	0.0	1.016,30 sq. m
2027	Patching	Patch	0.0	0.0	1.016,30 sq. m
2028	Overlay 2028	o28	0.0	0.0	28.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.016,30 sq. m
2035	Overlay 2035	035	0.0	0.0	28.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.016,30 sq. m
2041	Patching	Patch	0.0	0.0	1.016,30 sq. m
2042	Overlay 2042	O42	0.0	0.0	28.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.016,30 sq. m
2048	Patching	Patch	0.0	0.0	1.016,30 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section: Str 1-05 - LHS -660+000-665+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted
Surface Class: Bituminous
Length: 5,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2028	Overlay 2028	O28	0.0	0.0	35.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.270,37 sq. m
2035	Overlay 2035	O35	0.0	0.0	35.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.270,37 sq. m
2041	Patching	Patch	0.0	0.0	1.270,37 sq. m
2042	Milling and Overlay 2042	MO40	0.0	0.0	35.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.270,37 sq. m
2048	Patching	Patch	0.0	0.0	1.270,37 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-06 - LHS -665+000-671+000	Road Class: Primary or Trunk Width: 7,00m
Alternative:	Base Alternative	
Sensitivity:	No Sensitivity Analysis Conducted	
Surface Class:	Bituminous	
Length:	6,00km	

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2028	Overlay 2028	O28	0.0	0.0	42.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.524,45 sq. m
2035	Overlay 2035	O35	0.0	0.0	42.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.524,45 sq. m
2041	Patching	Patch	0.0	0.0	1.524,45 sq. m
2042	Milling and Overlay 2042	MO40	0.0	0.0	42.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.524,45 sq. m
2048	Patching	Patch	0.0	0.0	1.524,45 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section: Str 1-07 - LHS -671+000-674+000
Alternative: BaseAlternative
Sensitivity: No Sensitivity AnalysisConducted
Surface Class: Bituminous
Length: 3,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	762,22 sq. m
2028	Overlay 2028	O28	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section: Str 1-08 - LHS -674+000-677+000
Alternative: BaseAlternative
Sensitivity: No Sensitivity AnalysisConducted
Surface Class: Bituminous
Length: 3,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	762,22 sq. m
2028	Overlay 2028	O28	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m
Total cost for the section:			0.0	0.0	

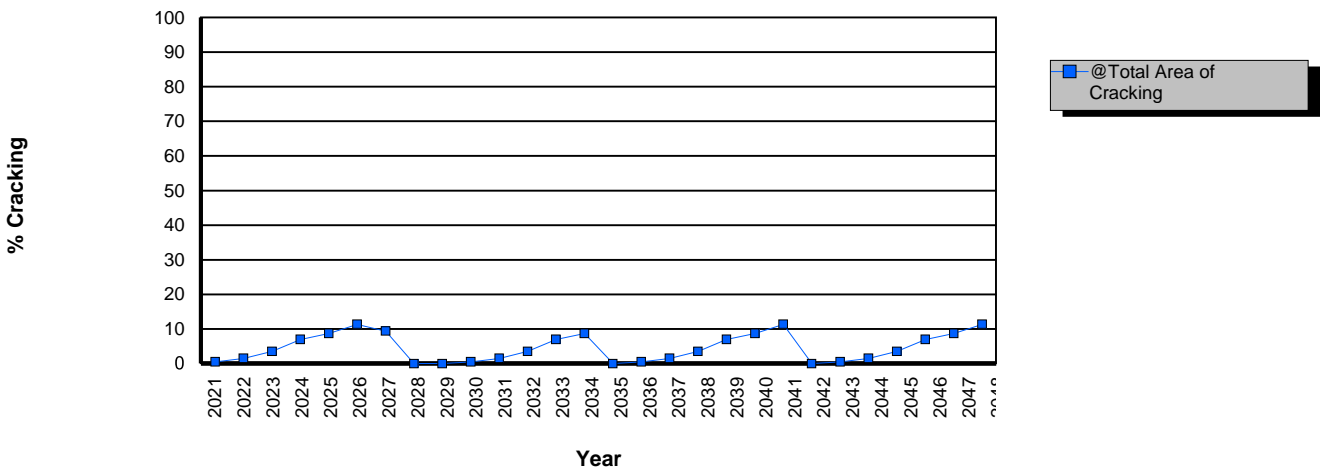
Summary of Total Annual Economic Costs**:Base Sensitivity Scenario**

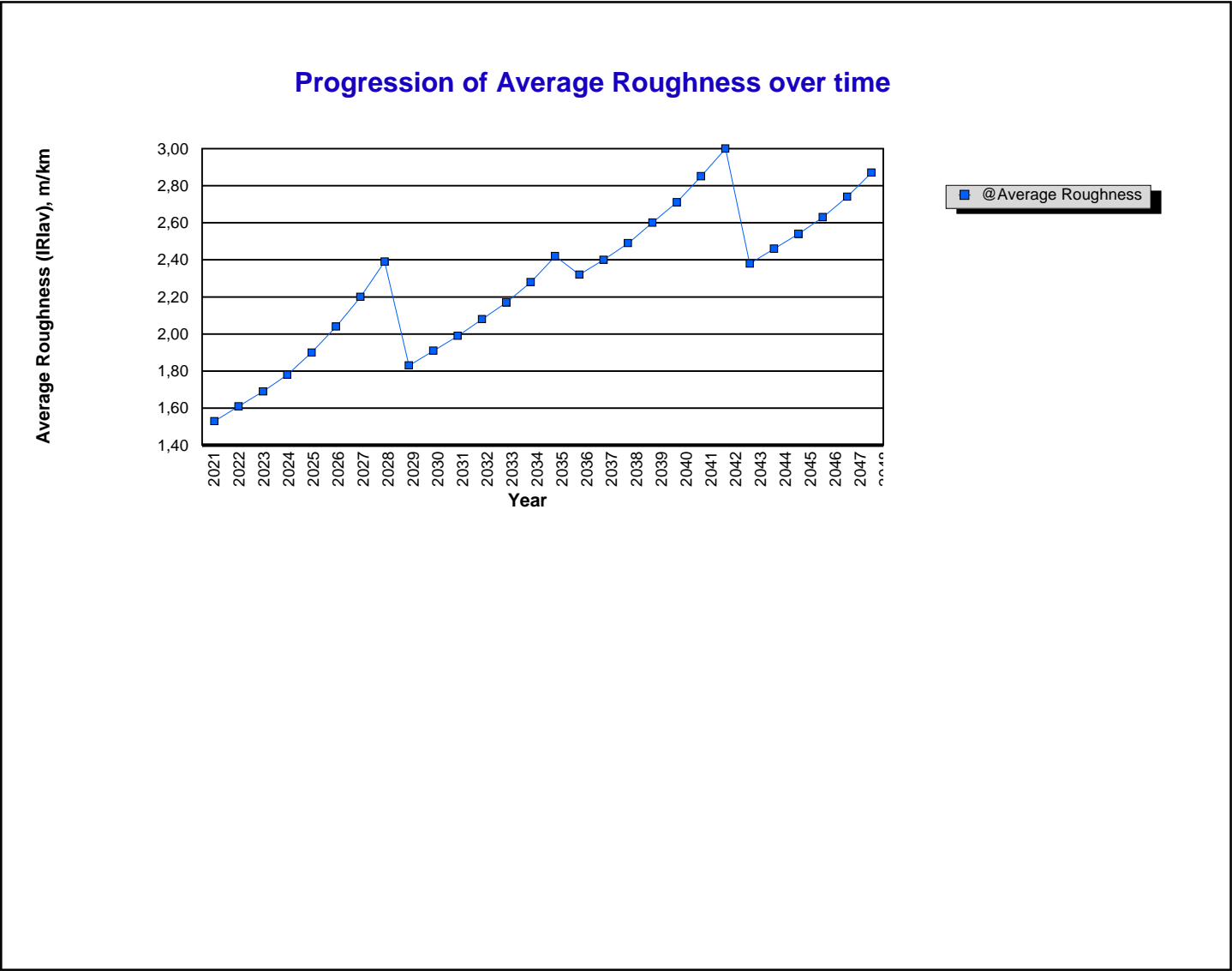
	Base Alternative
2025	0.00
2026	0.00
2027	0.00
2028	0.00
2034	0.00
2035	0.00
2040	0.00
2041	0.00
2042	0.00
2047	0.00
2048	0.00
Total	0,00

Section: Str 1-01 - RHS -646+000-648+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 2,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km oad Class: Primary or Trunk

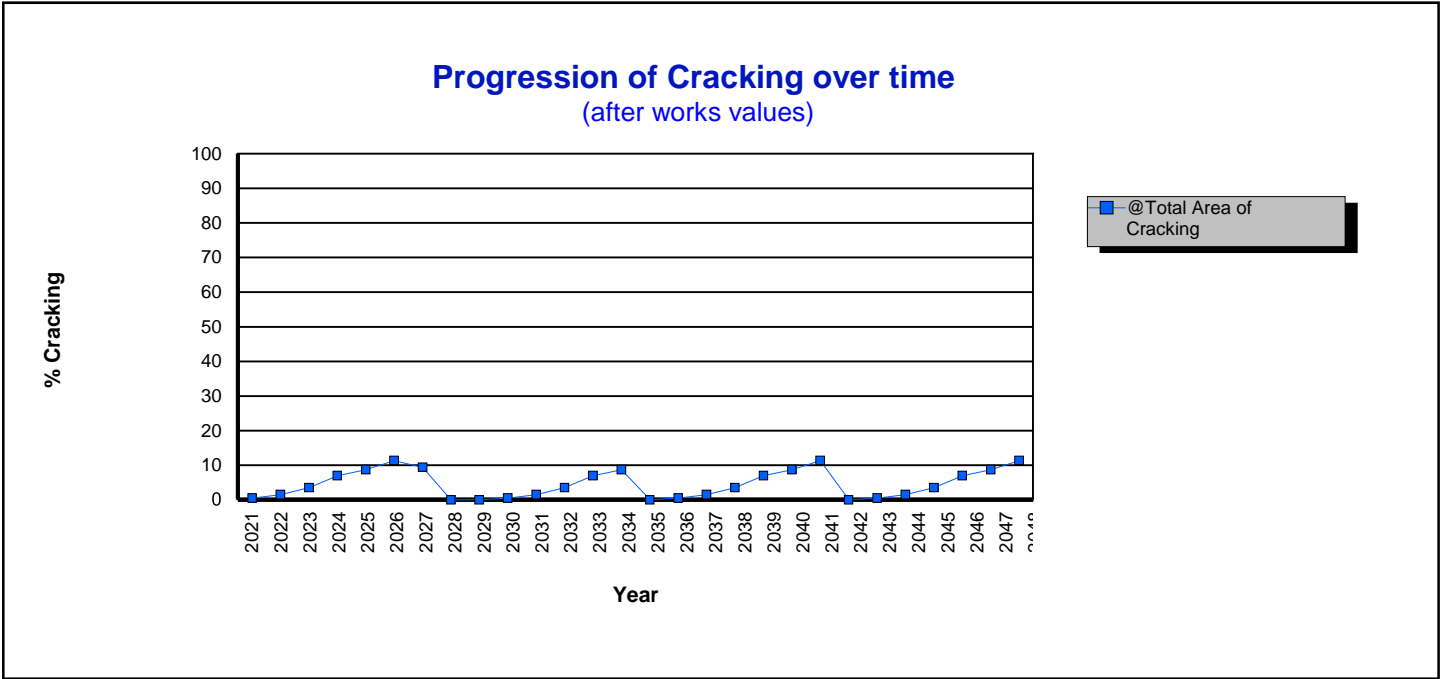
Progression of Cracking over time
(after works values)

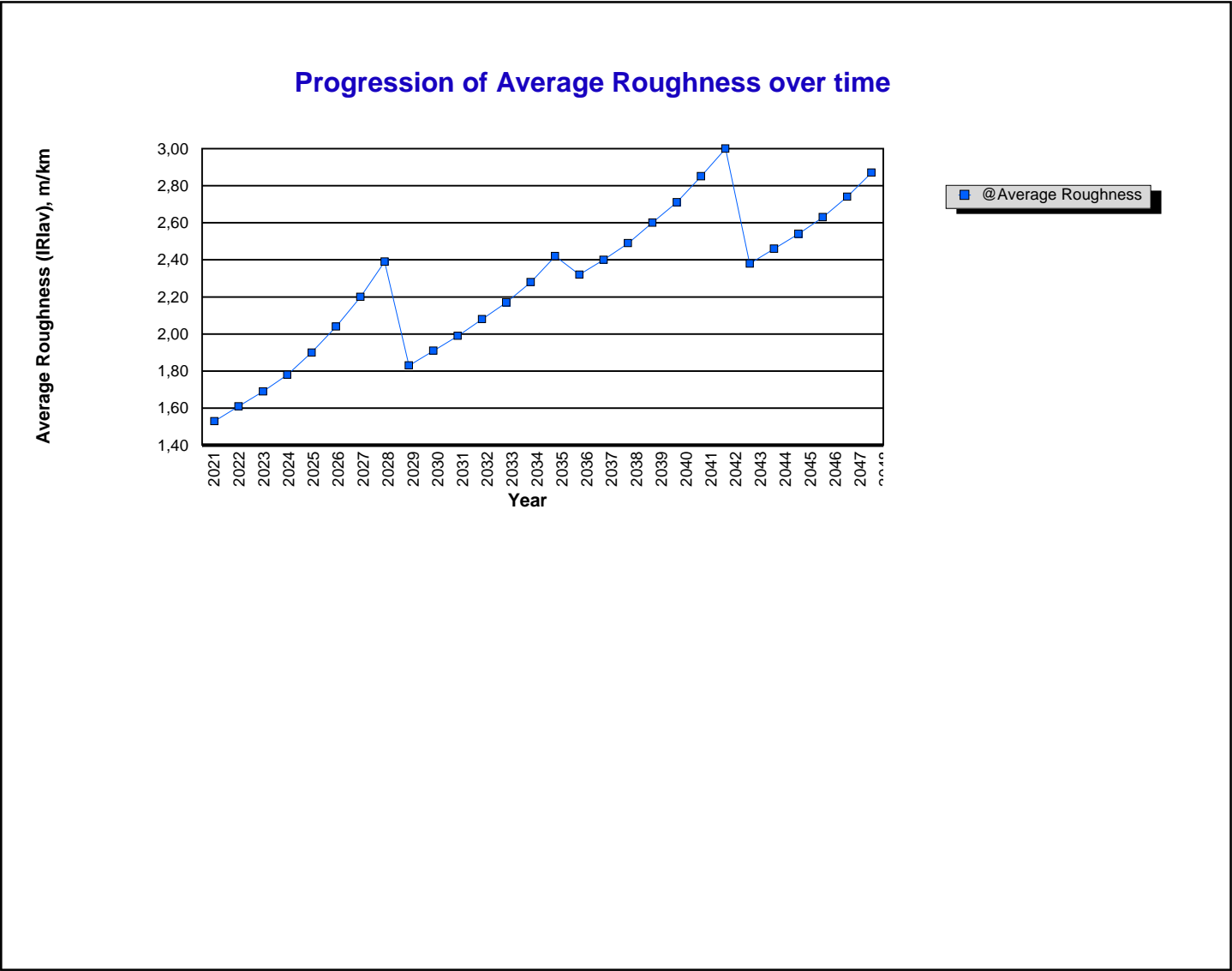




Section: Str 1-02 - RHS -648+000-651+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

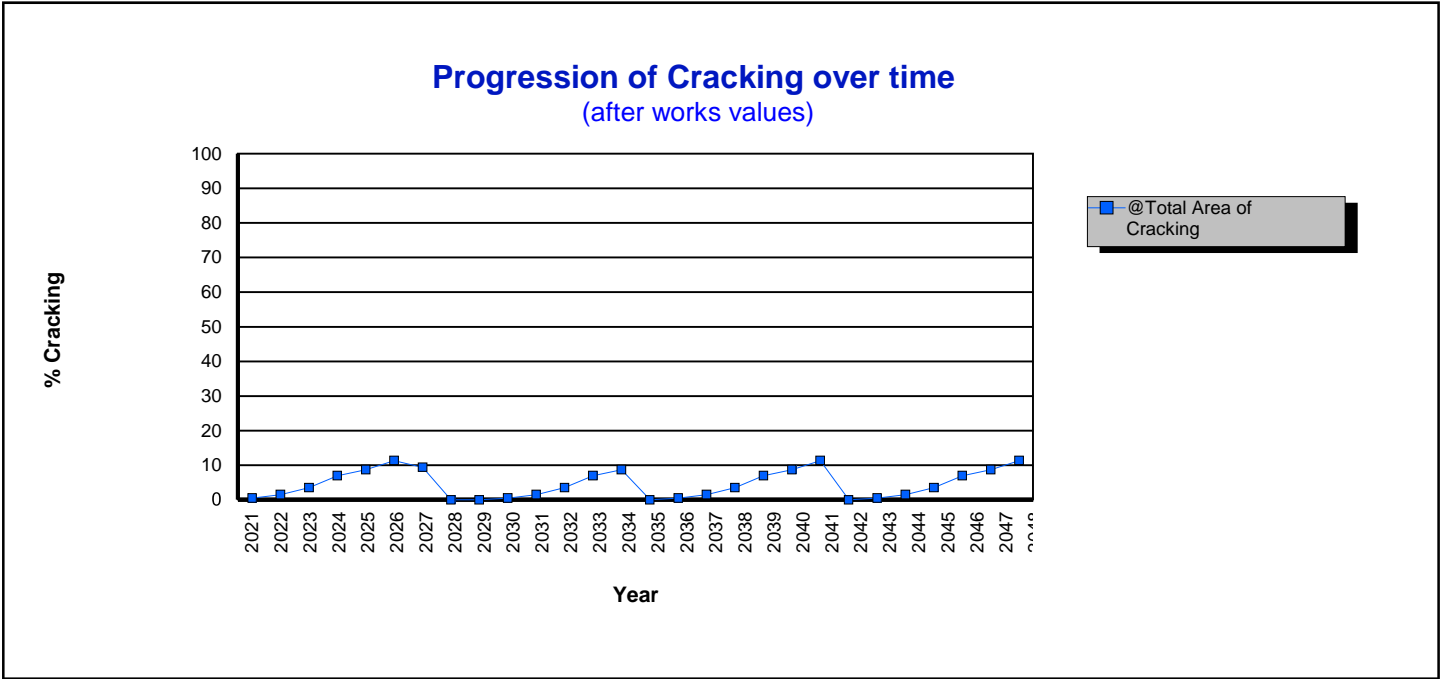
Length: 3,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

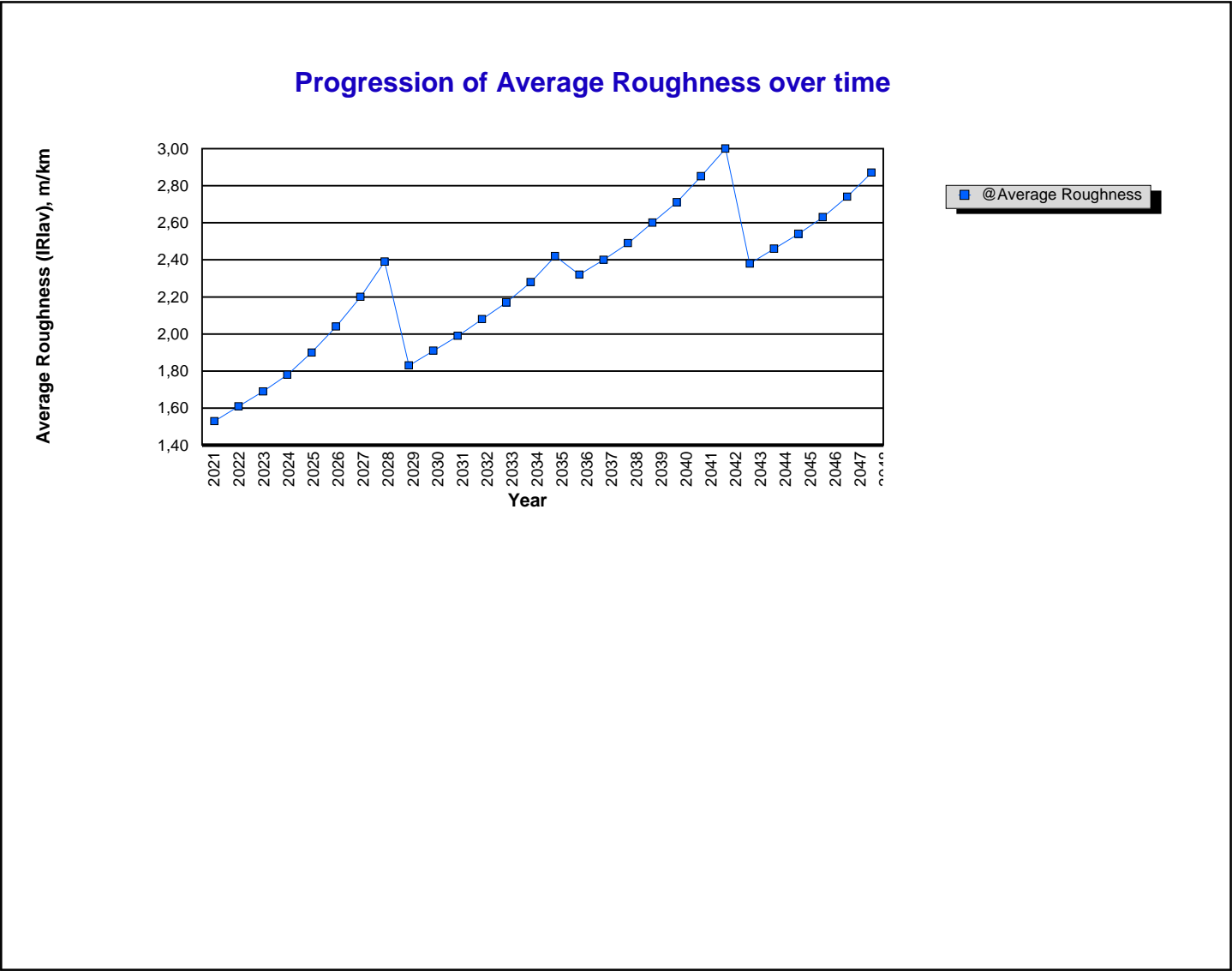




Section: Str 1-03 - RHS -651+000-654+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 3,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

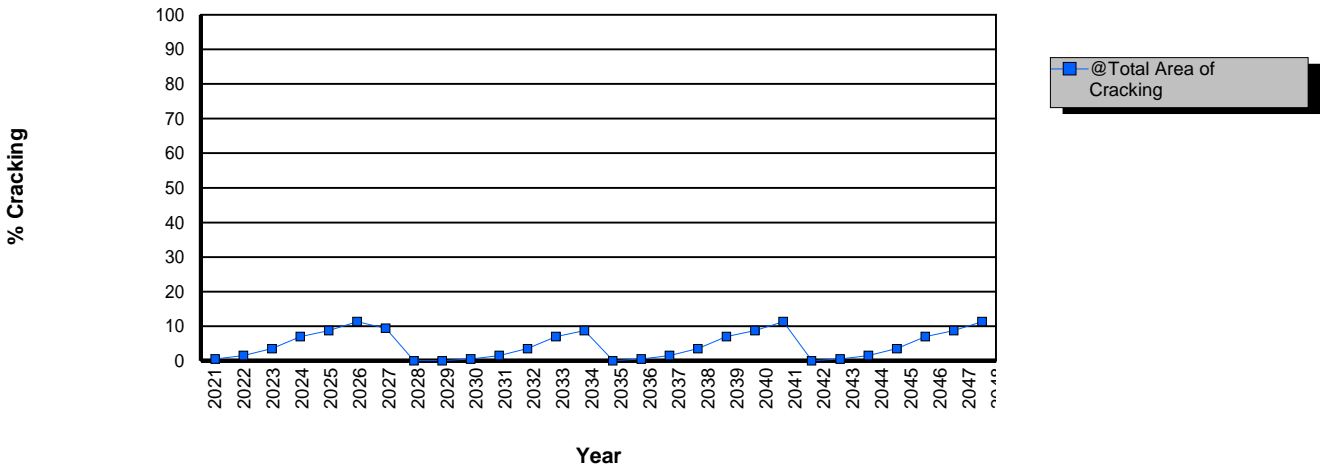




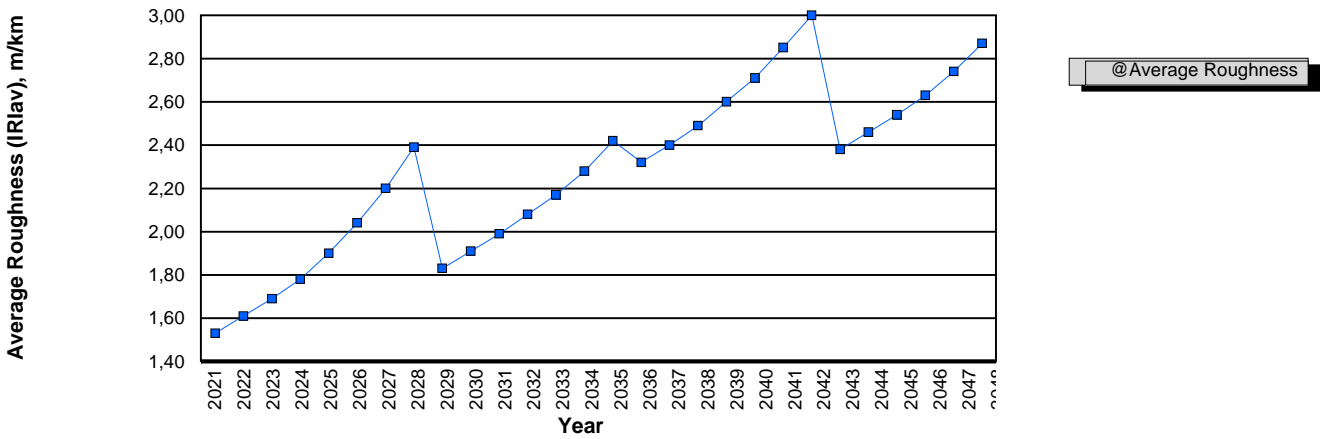
Section: Str 1-04 - RHS -654+000-660+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 6,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km oad Class: Primary or Trunk

Progression of Cracking over time
(after works values)



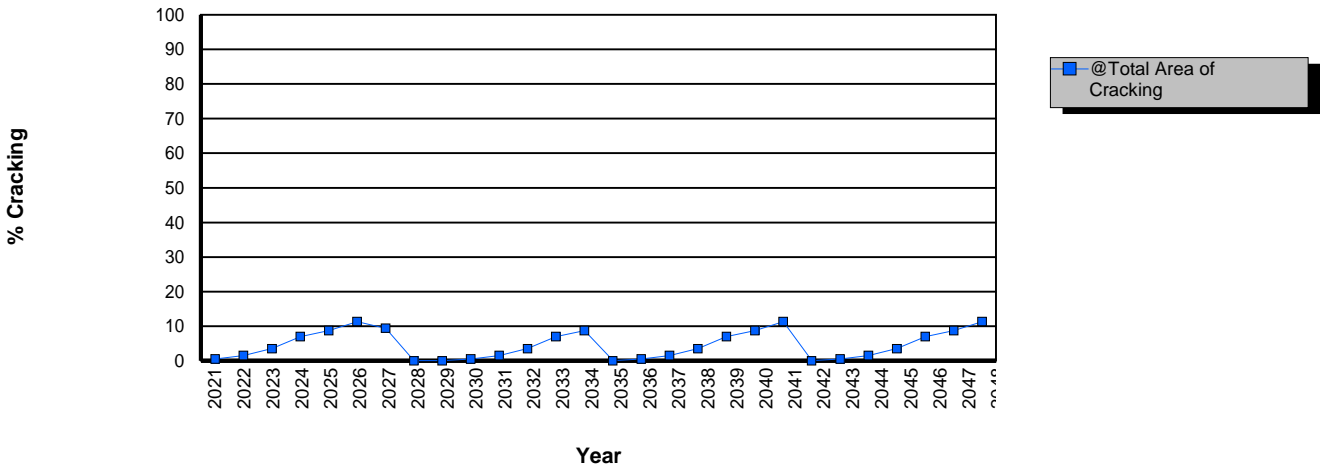
Progression of Average Roughness over time



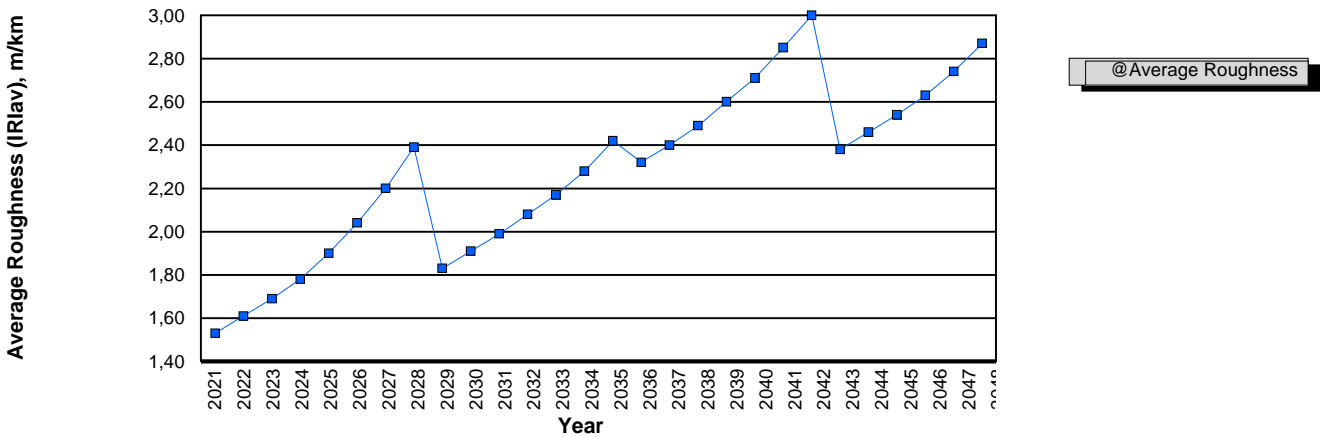
Section: Str 1-05 - RHS -660+000-663+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 3,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km oad Class: Primary or Trunk

Progression of Cracking over time
(after works values)

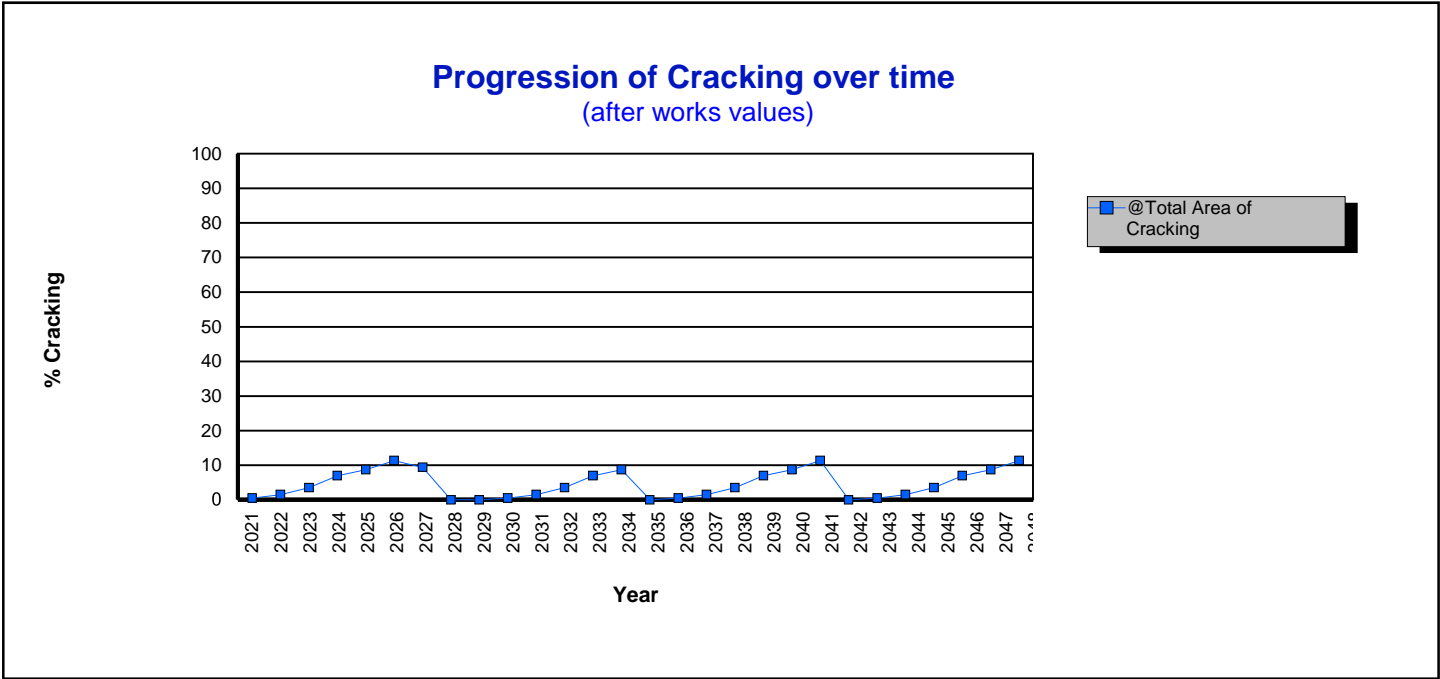


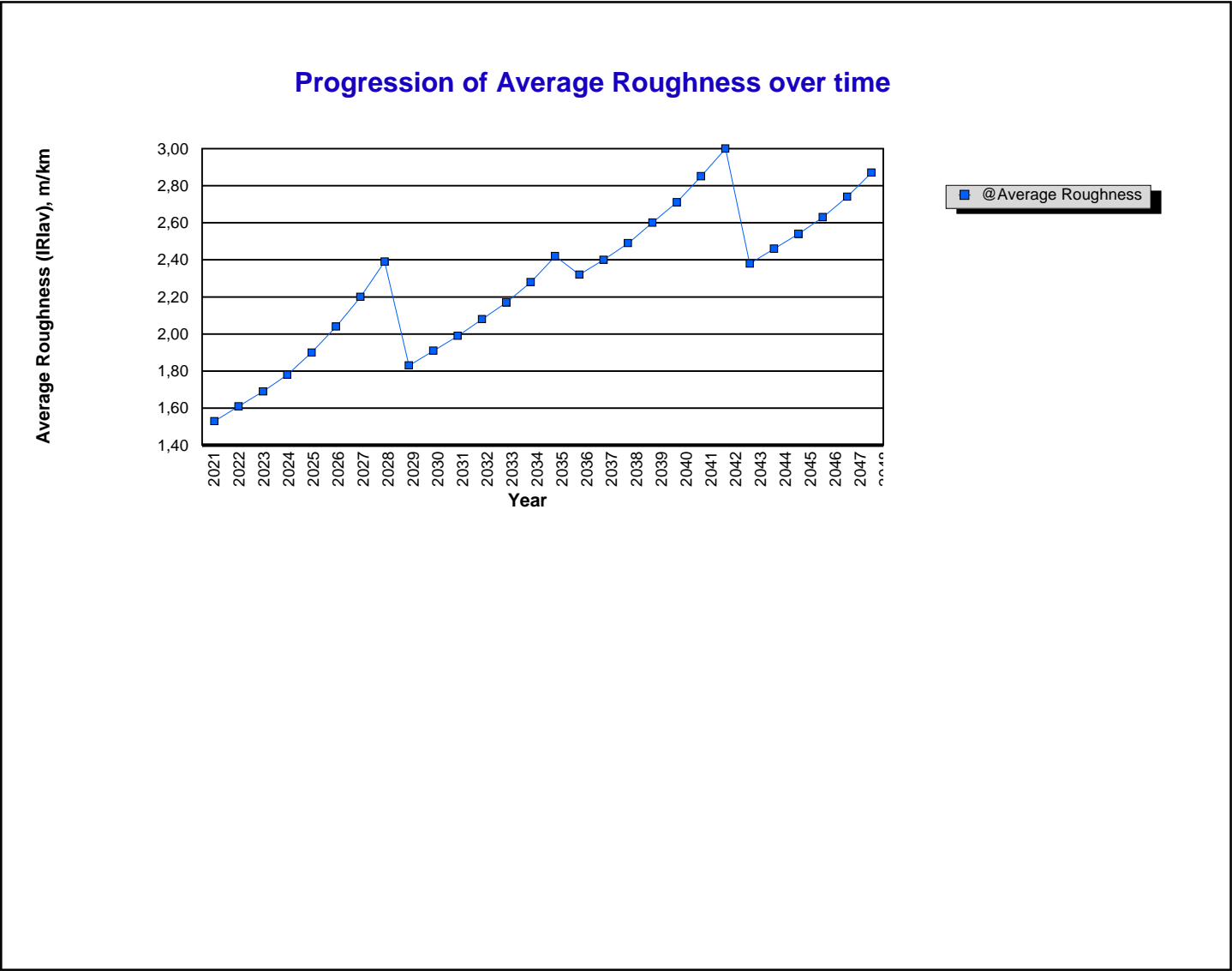
Progression of Average Roughness over time



Section: Str 1-06 - RHS -663+000-666+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

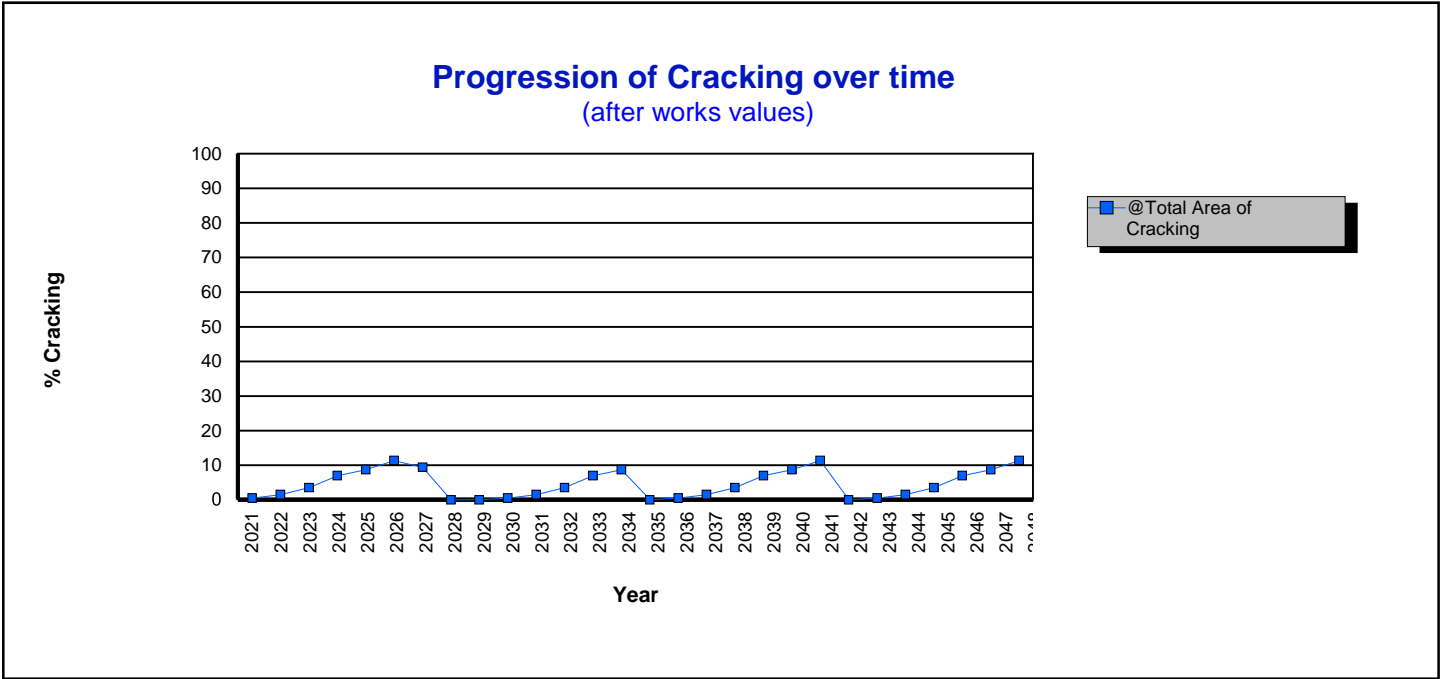
Length: 3,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km oad Class: Primary or Trunk

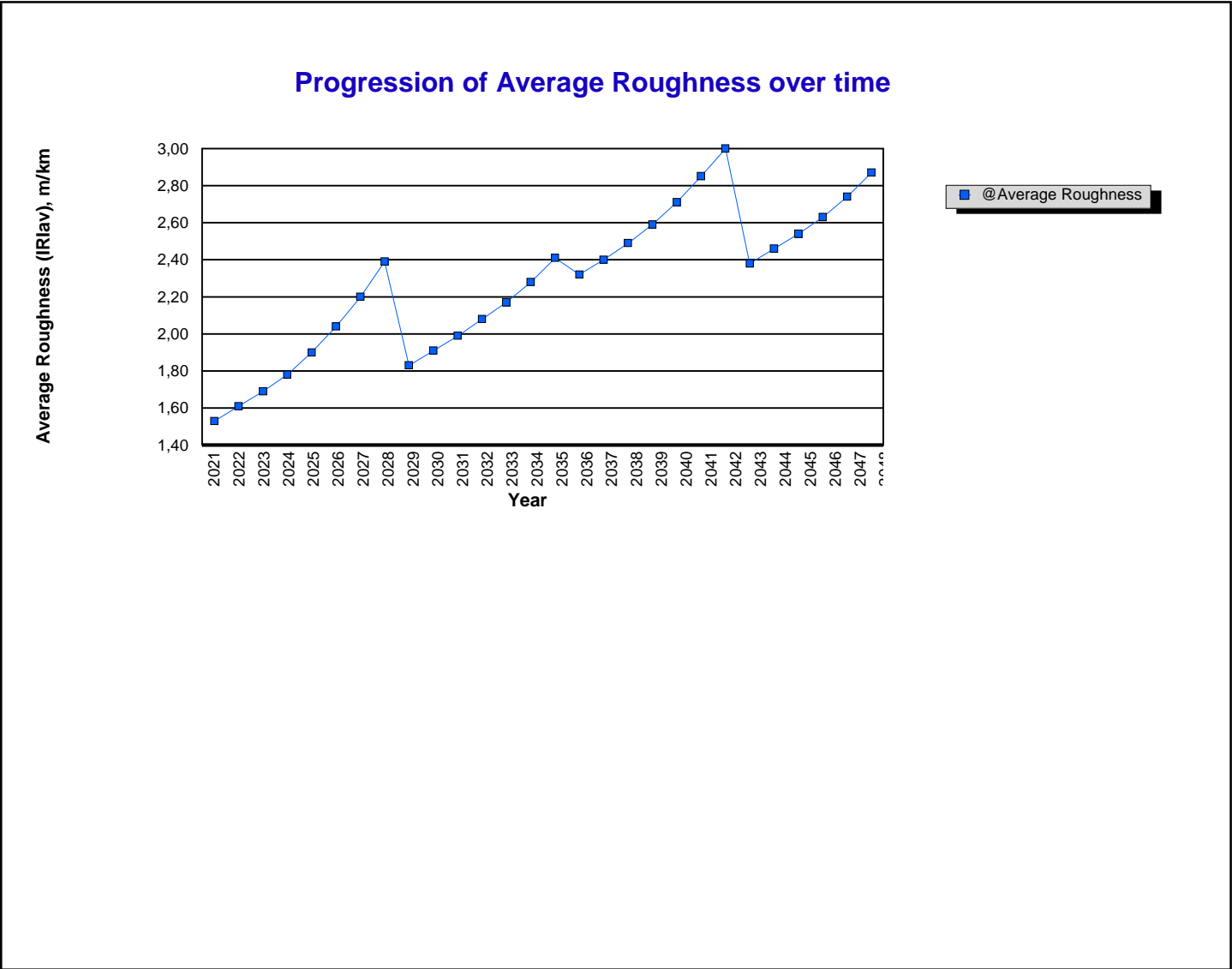




Section: Str 1-07 - RHS -666+000-671+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 5,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km Road Class: Primary or Trunk

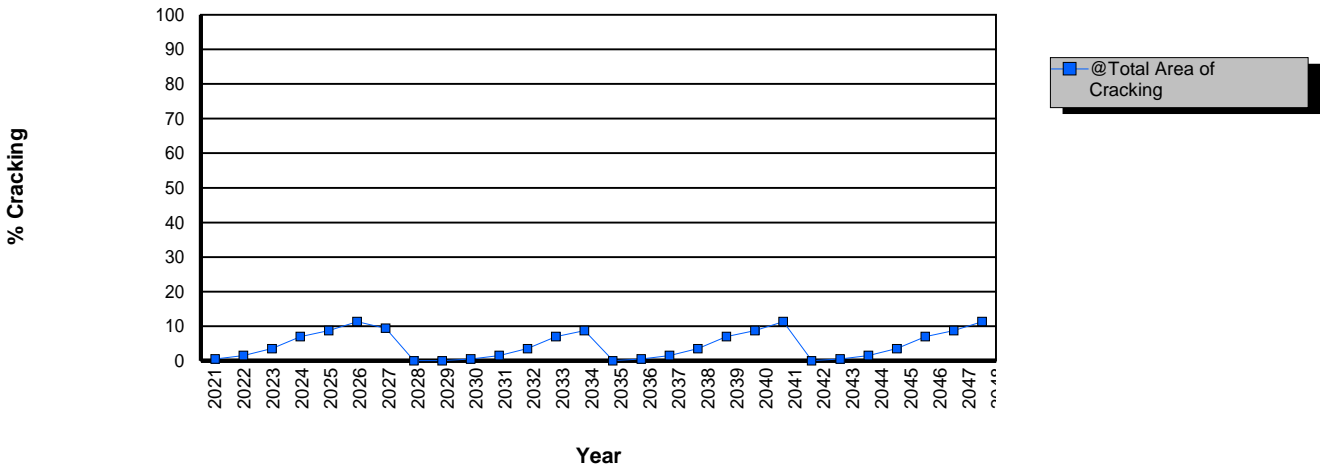




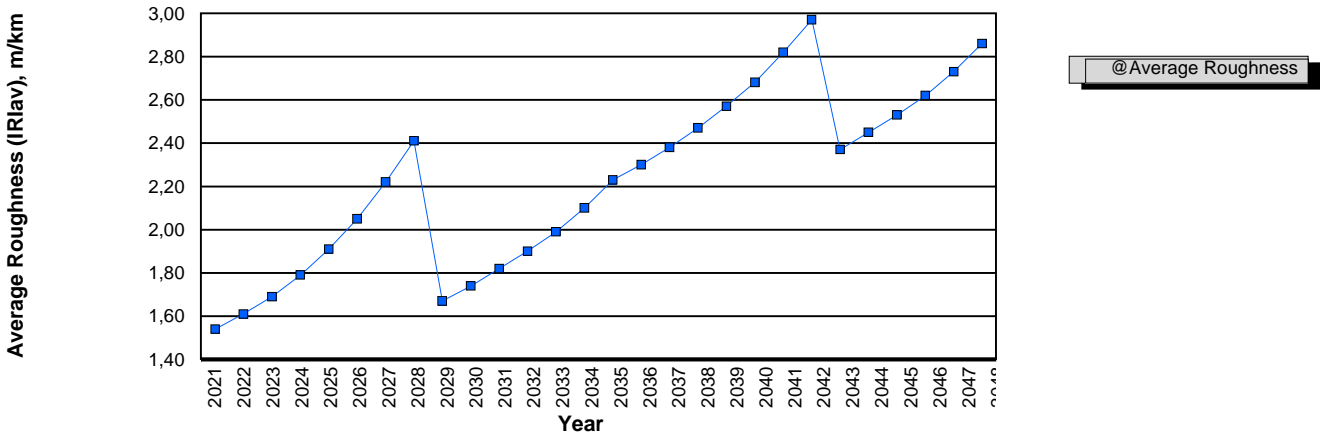
Section: Str 1-08 - RHS -671+000-675+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 4,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km oad Class: Primary or Trunk

Progression of Cracking over time
(after works values)



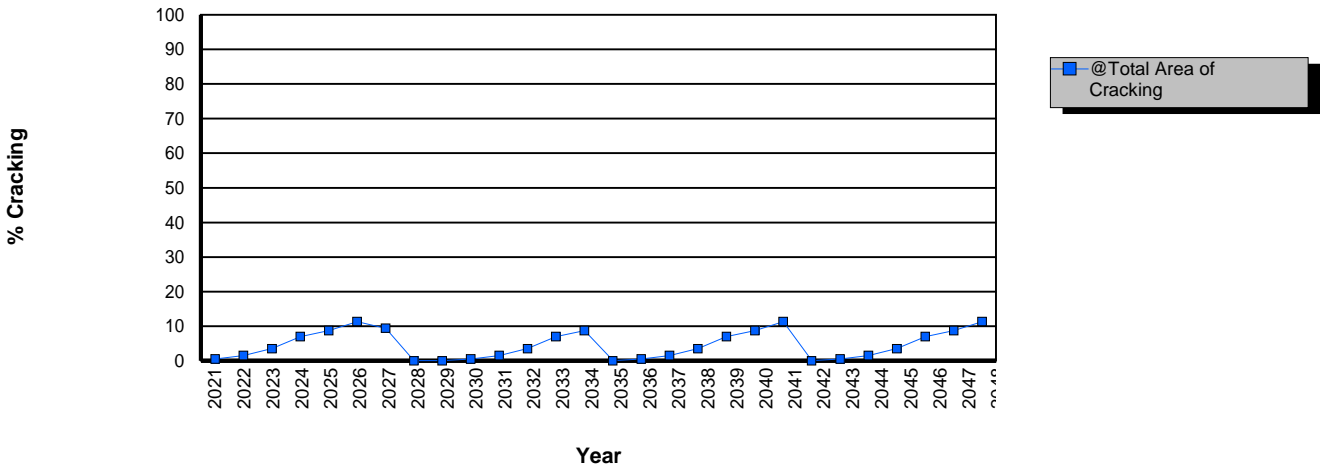
Progression of Average Roughness over time



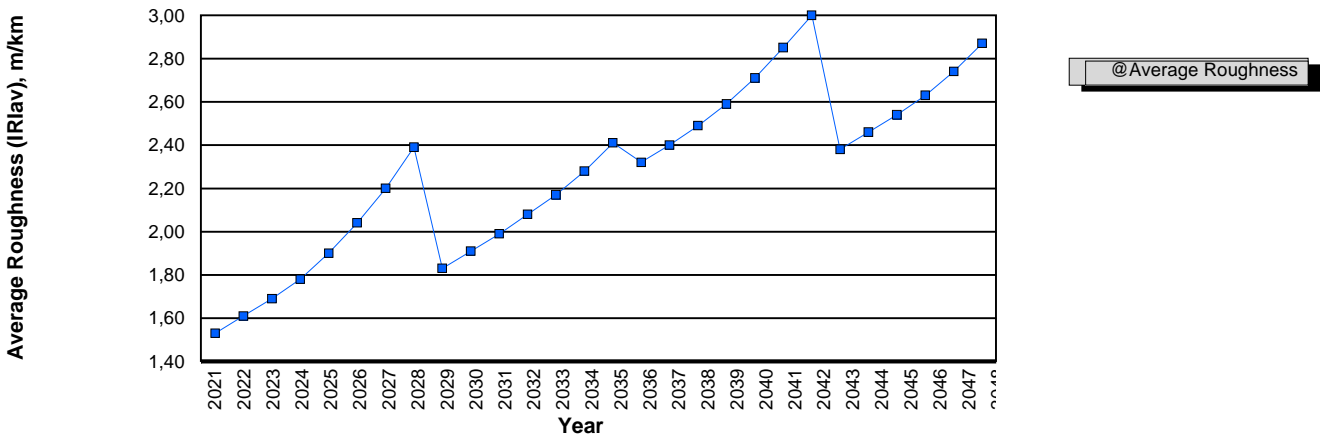
Section: Str 1-09 - RHS -675+000-677+000
Alternative: Base Alternative
Sensitivity: No Sensitivity Analysis Conducted

Length: 2,00km Width:7,00m Rise + Fall:1,00m/km Curvature: 3,00deg/km oad Class: Primary or Trunk

Progression of Cracking over time
(after works values)



Progression of Average Roughness over time



Road Works Summary (by Section)

Study Name: **INDIA Str 1 RHS**

Run Date: **06-06-2018**

Currency: **Dollars**

Note: only sections that have works triggered are displayed.

Section: Str 1-01 - RHS -646+000-648+000

Alternative: BaseAlternative

Sensitivity: No Sensitivity AnalysisConducted

Surface Class: Bituminous

Length: 2,00km

Road Class: Primary or Trunk

Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	508,15 sq. m
2026	Patching	Patch	0.0	0.0	508,15 sq. m
2027	Patching	Patch	0.0	0.0	1.317,95 sq. m
2028	Overlay 2028	028	0.0	0.0	14.000,00 sq. m
2034	Patching	Patch	0.0	0.0	508,15 sq. m
2035	Overlay 2035	O35	0.0	0.0	14.000,00 sq. m
2040	Patching	Patch	0.0	0.0	508,15 sq. m
2041	Patching	Patch	0.0	0.0	508,15 sq. m
2042	Overlay 2042	O42	0.0	0.0	14.000,00 sq. m
2047	Patching	Patch	0.0	0.0	508,15 sq. m
2048	Patching	Patch	0.0	0.0	508,15 sq. m
Total cost for the section:			0.0	0.0	

Section: Str 1-02 - RHS -648+000-651+000

Alternative: BaseAlternative

Sensitivity: No Sensitivity AnalysisConducted

Surface Class: Bituminous

Length: 3,00km

Road Class: Primary or Trunk

Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	762,22 sq. m
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	1.976,93 sq. m
2028	Overlay 2028	028	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-03 - RHS -651+000-654+000	Road Class: Primary or Trunk Width: 7,00m
Alternative:	BaseAlternative	
Sensitivity:	No Sensitivity AnalysisConducted	
Surface Class:	Bituminous	
Length:	3,00km	

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	762,22 sq. m
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	1.976,93 sq. m
2028	Overlay 2028	028	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section: Str 1-04 - RHS -654+000-660+000
Alternative: BaseAlternative
Sensitivity: No Sensitivity AnalysisConducted
Surface Class: Bituminous
Length: 6,00km

Road Class: Primary or Trunk
Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	1.524,45 sq. m
2026	Patching	Patch	0.0	0.0	1.524,45 sq. m
2027	Patching	Patch	0.0	0.0	3.953,85 sq. m
2028	Overlay 2028	028	0.0	0.0	42.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.524,45 sq. m
2035	Overlay 2035	O35	0.0	0.0	42.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.524,45 sq. m
2041	Patching	Patch	0.0	0.0	1.524,45 sq. m
2042	Overlay 2042	O42	0.0	0.0	42.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.524,45 sq. m
2048	Patching	Patch	0.0	0.0	1.524,45 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-05 - RHS -660+000-663+000	Road Class: Primary or Trunk Width: 7,00m
Alternative:	BaseAlternative	
Sensitivity:	No Sensitivity AnalysisConducted	
Surface Class:	Bituminous	
Length:	3,00km	

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	762,22 sq. m
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	1.976,93 sq. m
2028	Overlay 2028	028	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-06 - RHS -663+000-666+000	
Alternative:	BaseAlternative	
Sensitivity:	No Sensitivity AnalysisConducted	
Surface Class:	Bituminous	Road Class: Primary or Trunk
Length:	3,00km	Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	762,22 sq. m
2026	Patching	Patch	0.0	0.0	762,22 sq. m
2027	Patching	Patch	0.0	0.0	1.976,93 sq. m
2028	Overlay 2028	028	0.0	0.0	21.000,00 sq. m
2034	Patching	Patch	0.0	0.0	762,22 sq. m
2035	Overlay 2035	O35	0.0	0.0	21.000,00 sq. m
2040	Patching	Patch	0.0	0.0	762,22 sq. m
2041	Patching	Patch	0.0	0.0	762,22 sq. m
2042	Overlay 2042	O42	0.0	0.0	21.000,00 sq. m
2047	Patching	Patch	0.0	0.0	762,22 sq. m
2048	Patching	Patch	0.0	0.0	762,22 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-07 - RHS -666+000-671+000	Road Class: Primary or Trunk Width: 7,00m
Alternative:	BaseAlternative	
Sensitivity:	No Sensitivity AnalysisConducted	
Surface Class:	Bituminous	
Length:	5,00km	

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	1.270,37 sq. m
2026	Patching	Patch	0.0	0.0	1.270,37 sq. m
2027	Patching	Patch	0.0	0.0	3.294,88 sq. m
2028	Overlay 2028	028	0.0	0.0	35.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.270,37 sq. m
2035	Overlay 2035	O35	0.0	0.0	35.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.270,37 sq. m
2041	Patching	Patch	0.0	0.0	1.270,37 sq. m
2042	Overlay 2042	O42	0.0	0.0	35.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.270,37 sq. m
2048	Patching	Patch	0.0	0.0	1.270,37 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-08 - RHS -671+000-675+000	Road Class: Primary or Trunk Width: 7,00m
Alternative:	BaseAlternative	
Sensitivity:	No Sensitivity AnalysisConducted	
Surface Class:	Bituminous	
Length:	4,00km	

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	1.016,30 sq. m
2026	Patching	Patch	0.0	0.0	1.016,30 sq. m
2027	Patching	Patch	0.0	0.0	2.635,90 sq. m
2028	Overlay 2028	028	0.0	0.0	28.000,00 sq. m
2034	Patching	Patch	0.0	0.0	1.016,30 sq. m
2035	Overlay 2035	O35	0.0	0.0	28.000,00 sq. m
2040	Patching	Patch	0.0	0.0	1.016,30 sq. m
2041	Patching	Patch	0.0	0.0	1.016,30 sq. m
2042	Overlay 2042	O42	0.0	0.0	28.000,00 sq. m
2047	Patching	Patch	0.0	0.0	1.016,30 sq. m
2048	Patching	Patch	0.0	0.0	1.016,30 sq. m
Total cost for the section:			0.0	0.0	

H D M - 4 Road Works Summary (by Section)

Section:	Str 1-09 - RHS -675+000-677+000	
Alternative:	BaseAlternative	
Sensitivity:	No Sensitivity AnalysisConducted	
Surface Class:	Bituminous	Road Class: Primary or Trunk
Length:	2,00km	Width: 7,00m

Year	Description	Code	Economic Cost	Financial Cost	Work Quantity
2025	Patching	Patch	0.0	0.0	508,15 sq. m
2026	Patching	Patch	0.0	0.0	508,15 sq. m
2027	Patching	Patch	0.0	0.0	1.317,95 sq. m
2028	Overlay 2028	028	0.0	0.0	14.000,00 sq. m
2034	Patching	Patch	0.0	0.0	508,15 sq. m
2035	Overlay 2035	O35	0.0	0.0	14.000,00 sq. m
2040	Patching	Patch	0.0	0.0	508,15 sq. m
2041	Patching	Patch	0.0	0.0	508,15 sq. m
2042	Overlay 2042	O42	0.0	0.0	14.000,00 sq. m
2047	Patching	Patch	0.0	0.0	508,15 sq. m
2048	Patching	Patch	0.0	0.0	508,15 sq. m
Total cost for the section:			0.0	0.0	

Summary of Total Annual Economic Costs

:Base Sensitivity Scenario

	Base Alternative
2025	0.00
2026	0.00
2027	0.00
2028	0.00
2034	0.00
2035	0.00
2040	0.00
2041	0.00
2042	0.00
2047	0.00
2048	0.00
Total	0,00



ANNEXURE 7 AAHSTO-HDM CALCULATIONS RESULTS

PREPARATION OF REPORT ON PHYSICAL CONDITION OF THE NATIONAL HIGHWAYS ON
ROADS UNDER (THE NATIONAL HIGHWAYS INFRA TRUST)

Technical Due Diligence Report of NH27 (NH14) Abu road - Swaroopganj (Stretch1)).AnnexureHDM-AASHTOCalculations' Results



STRETCH 1. LHS # HDM-4 ID	Geometry				Current structural condition (2018)			
	Section	From	To	Length (m)	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 1-01 - LHS	1	646+000	649+000	3000	24	28.80	7.01	185
Str 1-02 - LHS	2	649+000	652+000	3000	19	23.10	8.06	185
Str 1-03 - LHS	3	652+000	656+000	4000	20	24.90	7.68	235
Str 1-04 - LHS	4	656+000	660+000	4000	24	29.10	6.96	205
Str 1-05 - LHS	5	660+000	665+000	5000	24	29.90	6.85	100
Str 1-06 - LHS	6	665+000	671+000	6000	23	28.10	7.12	100
Str 1-07 - LHS	7	671+000	674+000	3000	23	28.40	7.07	162
Str 1-08 - LHS	8	674+000	677+000	3000	25	30.20	6.80	205

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STRETCH 1. LHS # HDM-4 ID	Proposed Overlay (2021)						MSA/day (2021)
	SN before works	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional	
Str 1-01 - LHS	6.66	30	40	70	7.79	Structural	21867
Str 1-02 - LHS	7.65	30	40	70	8.78	Structural	21867
Str 1-03 - LHS	7.30	30	0	30	7.80	Structural	21867
Str 1-04 - LHS	6.62	40	0	40	7.28	Structural	21867
Str 1-05 - LHS	6.50	40	110	150	8.90	Structural	21867
Str 1-06 - LHS	6.76	40	100	140	9.00	Structural	21867
Str 1-07 - LHS	6.72	30	40	70	7.84	Structural	21867
Str 1-08 - LHS	6.46	30	30	60	7.43	Structural	21867

STRETCH 1. LHS # HDM-4 ID	Proposed Work (2028)								
	MSA 2028 -2037	SN before works	Required SN 2028 - 2037	Milling (mm)	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional
Str 1-01 - LHS	140.99	6.75	7.78	0	30	40	70	7.86	Structural
Str 1-02 - LHS	140.99	6.75	7.78	0	30	40	70	7.86	Structural
Str 1-03 - LHS	140.99	6.77	7.78	0	30	40	70	7.88	Structural
Str 1-04 - LHS	140.99	6.77	7.78	0	30	40	70	7.88	Structural
Str 1-05 - LHS	140.99	6.81	7.78	0	30	40	70	7.97	Structural
Str 1-06 - LHS	140.99	6.81	7.78	0	30	40	70	7.97	Structural
Str 1-07 - LHS	140.99	6.76	7.78	0	30	40	70	7.87	Structural
Str 1-08 - LHS	140.99	6.74	7.78	0	30	40	70	7.86	Structural

STRETCH 1. LHS # HDM-4 ID	Proposed Work (2035)								
	MSA 2035-2044	SN before works	Required SN 2035 - 2044	Milling (mm)	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional
Str 1-01 - LHS	192.51	7.81	8.09	0	30	0	30	8.32	Structural
Str 1-02 - LHS	192.51	7.08	8.09	0	30	0	30	8.32	Structural
Str 1-03 - LHS	192.51	7.83	8.09	0	30	0	30	8.34	Structural
Str 1-04 - LHS	192.51	7.83	8.09	0	30	0	30	8.34	Structural
Str 1-05 - LHS	192.51	7.92	8.09	0	30	0	30	8.38	Structural
Str 1-06 - LHS	192.51	7.92	8.09	0	30	0	30	8.38	Structural
Str 1-07 - LHS	192.51	7.82	8.09	0	30	0	30	8.33	Structural
Str 1-08 - LHS	192.51	7.80	8.09	0	30	0	30	8.32	Structural

STRETCH 1. LHS # HDM-4 ID	Proposed Work (2042)								
	MSA 2042 -2051	SN before works	Required SN 2042 - 2051	Milling (mm)	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional
Str 1-01 - LHS	273.01	8.28	8.45	0	30	0	30	8.80	Structural
Str 1-02 - LHS	273.01	8.28	8.45	0	30	0	30	8.80	Structural
Str 1-03 - LHS	273.01	8.29	8.45	0	30	0	30	8.81	Structural
Str 1-04 - LHS	273.01	8.30	8.45	0	30	0	30	8.82	Structural
Str 1-05 - LHS	273.01	8.33	8.45	30	30	0	0	8.46	Structural
Str 1-06 - LHS	273.01	8.33	8.45	30	30	0	0	8.46	Structural
Str 1-07 - LHS	273.01	8.29	8.45	0	30	0	30	8.81	Structural
Str 1-08 - LHS	273.01	8.27	8.45	0	30	0	30	8.79	Structural

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STRETCH 1. RHS # HDM-4 ID	Geometry				Current structural condition (2018)			
	Section	From	To	Length (m)	Average Deflection (mm ⁻²)	Normalized Deflection to HDM (mm ⁻²)	SN before works	Old BT thickness (mm)
Str 1-01 - RHS	1	646+000	648+000	2000	21	25.50	7.57	250
Str 1-02 - RHS	2	648+000	651+000	3000	18	22.30	8.24	250
Str 1-03 - RHS	3	651+000	654+000	3000	21	25.30	7.61	250
Str 1-04 - RHS	4	654+000	660+000	6000	20	24.40	7.78	230
Str 1-05 - RHS	5	660+000	663+000	3000	23	27.80	7.17	280
Str 1-06 - RHS	6	663+000	666+000	3000	16	19.80	8.88	280
Str 1-07 - RHS	7	666+000	671+000	5000	15	18.90	9.14	220
Str 1-08 - RHS	8	671+000	675+000	4000	25	30.50	6.76	220
Str 1-09 - RHS	9	675+000	677+000	2000	20	24.00	7.86	220

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STRETCH 1. RHS # HDM-4 ID	Proposed Overlay (2021)						MSA/day (2021)
	SN before works	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional	
Str 1-01 - RHS	7.19	30.00	0.00	30.00	7.69	Functional	20557
Str 1-02 - RHS	7.82	30.00	0.00	30.00	8.32	Functional	20557
Str 1-03 - RHS	7.23	30.00	0.00	30.00	7.72	Functional	20557
Str 1-04 - RHS	7.39	30.00	0.00	30.00	7.89	Structural	20557
Str 1-05 - RHS	6.81	30.00	0.00	30.00	7.31	Functional	20557
Str 1-06 - RHS	8.43	30.00	0.00	30.00	8.93	Functional	20557
Str 1-07 - RHS	8.68	30.00	0.00	30.00	9.18	Functional	20557
Str 1-08 - RHS	6.42	30.00	0.00	30.00	6.92	Structural	20557
Str 1-09 - RHS	7.47	30.00	0.00	30.00	7.97	Structural	20557

STRETCH 1. RHS # HDM-4 ID	Proposed Work (2028)								
	MSA 2028 -2037	SN before works	Required SN 2028 - 2037	Milling (mm)	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional
Str 1-01 - RHS	129.96	6.76	7.70	0	30	30	60	7.72	Structural
Str 1-02 - RHS	129.96	6.76	7.70	0	30	30	60	7.72	Structural
Str 1-03 - RHS	129.96	6.76	7.70	0	30	30	60	7.72	Structural
Str 1-04 - RHS	129.96	6.77	7.70	0	30	30	60	7.73	Structural
Str 1-05 - RHS	129.96	6.75	7.70	0	30	30	60	7.70	Structural
Str 1-06 - RHS	129.96	6.75	7.70	0	30	30	60	7.70	Structural
Str 1-07 - RHS	129.96	6.78	7.70	0	30	30	60	7.73	Structural
Str 1-08 - RHS	129.96	6.70	7.70	0	30	40	70	7.81	Structural
Str 1-09 - RHS	129.96	6.78	7.70	0	30	30	60	7.73	Structural

STRETCH 1. RHS # HDM-4 ID	Proposed Work (2035)								
	MSA 2035-2044	SN before works	Required SN 2035 - 2044	Milling (mm)	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional
Str 1-01 - RHS	176.74	7.67	8.00	0	30	0	30	8.18	Structural
Str 1-02 - RHS	176.74	7.67	8.00	0	30	0	30	8.18	Structural
Str 1-03 - RHS	176.74	7.67	8.00	0	30	0	30	8.18	Structural
Str 1-04 - RHS	176.74	7.68	8.00	0	30	0	30	8.19	Structural
Str 1-05 - RHS	176.74	7.66	8.00	0	30	0	30	8.17	Structural
Str 1-06 - RHS	176.74	7.66	8.00	0	30	0	30	8.17	Structural
Str 1-07 - RHS	176.74	7.68	8.00	0	30	0	30	8.20	Structural
Str 1-08 - RHS	176.74	7.76	8.00	0	30	0	30	8.27	Structural
Str 1-09 - RHS	176.74	7.68	8.00	0	30	0	30	8.20	Structural

STRETCH 1. RHS # HDM-4 ID	Proposed Work (2042)								
	MSA 2042 -2051	SN before works	Required SN 2042 - 2051	Milling (mm)	BC (a1=0,42) (mm)	DBM (a2=0,40) (mm)	Total overlay thickness (mm)	SN after works	Structural/ Functional
Str 1-01 - RHS	250.65	8.14	8.36	0	30	0	30	8.66	Structural
Str 1-02 - RHS	250.65	8.14	8.36	0	30	0	30	8.66	Structural
Str 1-03 - RHS	250.65	8.14	8.36	0	30	0	30	8.66	Structural
Str 1-04 - RHS	250.65	8.15	8.36	0	30	0	30	8.67	Structural
Str 1-05 - RHS	250.65	8.12	8.36	0	30	0	30	8.64	Structural
Str 1-06 - RHS	250.65	8.12	8.36	0	30	0	30	8.64	Structural
Str 1-07 - RHS	250.65	8.15	8.36	0	30	0	30	8.67	Structural
Str 1-08 - RHS	250.65	8.22	8.36	0	30	0	30	8.74	Structural
Str 1-09 - RHS	250.65	8.15	8.36	0	30	0	30	8.67	Structural

ANNEXURE-8 STRUCTURES

Annexure- Box Culvert

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
1	647/1	646+320	1 x 2.00	Good	Fair	Cleaning of vent way
2	648/1	646+980	1 x 2.00	Good	Good	Over all condition is good
3	648/2	647+070	1 x 2.00	Good	Good	Cleaning of vegetation
4	649/1	648+165	1 x 2.00	Good	Good	Cleaning of vegetation
5	649/2	648+880	1 x 2.90	Good	Good	Stone pitching and cleaning required
6	650/2	649+680	1 x 2.40	Good	Good	Over all condition is good
7	650/3	649+785	1 x 2.50	Good	Good	Over all condition is good
8	650/4	649+900	1 x 2.00	Good	Good	Over all condition is good
9	651/1	649+995	1 x 5.70	Good	Good	Over all condition is good
10	652/2	651+685	1 x 4.00	Good	Good	Over all condition is good
11	652/3	651+797	1 x 2.00	Good	Good	Cleaning of vegetation
12	654/1	653+125	1 x 1.20	Good	Good	Over all condition is good
13	655/1	654+105	1 x 2.90	Good	Good	Over all condition is good
14	655/2	654+890	1 x 2.90	Good	Good	Stone pitching required
15	656/2	657+690	1 x 2.50	Fair	Fair	Not Reachable

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
16	657/1	656+185	1 x 4.00	Fair	Fair	Not Reachable
17	658/2	657+700	1 x 2.00	Fair	Fair	Not Reachable
18	660/1	659+015	1 x 3.00	Good	Good	Cleaning of vent way, Stone pitching and cleaning of vegetation required
19	660/4	659+705	1 x 2.90	Good	Good	Over all condition is good
20	661/1	660+460	1 x 2.00	Good	Good	Cleaning of vegetation
21	661/2	660+960	1 x 2.00	Good	Good	Over all condition is good
22	662/2	661+490	1 x 1.50	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
23	662/4	661+800	1 x 1.00	Good	Good	Over all condition is good
24	663/1	662+255	1 x 2.90	Good	Fair	Cleaning of vegetation and waterway surface
25	665/1	664+002	1 x 3.40	Good	Good	Cleaning of vegetation

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
26	665/2	664+805	1 x 2.50	Good	Good	Stone pitching improvement and cleaning of vegetation
27	666/1	665+470	1 x 2.00	Good	Good	Cleaning of vegetation
28	667/1	666+166	1 x 2.00	Good	Good	Improvement of stone pitching and cleaning of vegetation
29	667/2	666+380	1 x 2.00	Good	Good	Cleaning of waterway surface and vegetation
30	668/1	667+035	1 x 2.30	Good	Good	Over all condition is good
31	669/2	668+503	1 x 2.30	Good	Good	Cleaning of waterway surface and vegetation
32	669/3	668+761	1 x 4.20	Good	Good	Cleaning of waterway surface and vegetation
33	670/1	669+210	1 x 2.00	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
34	671/1	670+697	1 x 2.70	Good	Good	Cleaning of vegetation

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
35	672/2	671+545	1 x 2.90	Good	Good	Cleaning of vegetation
36	672/1	671+195	1 x 2.00	Good	Good	Over all condition is good
37	672/2	671+545	1 x 2.90	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
38	672/3	971+940	1 x 2.00	Good	Fair	Cleaning of vent way , stone pitching and cleaning of vegetation
39	673/1	672+340	1 x 3.00	Good	Good	Cleaning of vent way and vegetation
40	673/3	672+810	1 x 4.10	Good	Good	Improvement stone pitching required
41	674/1	673+255	1 x 2.00	Good	Good	Improvement stone pitching required
42	674/3	678+945	1 x 2.00	Good	Good	Cleaning of waterway improvement of stone pitching and cleaning vegetation
43	675/4	674+520	1 x 2.20	Good	Good	Cleaning of waterway surface and vegetation

Sr.No.	Structure No	Chainage in km	Span Arrangement in (m)	Condition of Protection work	Condition of Structure	Remark
44	675/5	674+935	1 x 3.00	Good	Good	Cleaning of vegetation
45	676/1	675+300	1 x 3.00	Good	Fair	Str. choked with silt, need cleaning
46	676/2	676+580	1 x 4.00	Good	Good	Over all condition is good
47	676/3	675+800	1 x 2.20	Good	Good	cleaning of vegetation
48	677/1	676+020	1 x 2.40	Good	Good	Improvement of stone pitching
49	677/3	676+275	1 x 3.00	Good	Fair	Improvement of stone pitching, veg.

Slab Culvert

Sr.	Str. No	Chainage	Span Arrangement	Condition of Protection Work	Condition of Structure	Remark
1	656/1	655+255	1 x 1.85	Good	Poor	Over all condition is good
2	675/2	674+155	1 x 2.00	Fair	Fair	Cleaning of water way

Pipe Culvert

S.No	Structure No	Chainage	Span Arrangement	Condition of Protection Work	Condition of Structure	Remark
1	651/2	650+130	1 x 1.00	Good	Good	Cleaning of water way, cleaning of vegetation and improvement of stone pitching
2	653/1	652+050	1 x 1.00	Good	Good	Fully choked by water need cleaning of water way
3	662/3	661+750	1 x 1.00	Fair	Fair	-
4	663/2	662+640	1 x 1.00	Good	Good	Cleaning of water way, cleaning of vegetation and improvement of stone pitching
5	669/1	668+060	3 x 0.60	Fair	Fair	Cleaning of vegetation
6	675/1	674+005	2 x 1.20	Good	Good	Over all condition is good
7	677/2	676+200	1 x 1.00	Fair	Fair	Cleaning of water way and vegetation

VUP/LVUP

S. No	Location (km)	Chain age	Type of Structures (Pipe, Slab, Box, Arch)	Span Arrangement and Total Length (No x Length) (m)	Clear Height (m)	Horizontal Clearance (m)	Carriageway width (m)	Width of structure (m)	Condition of Protection Work	Condition of Structure	Remark
1	653/2	652+328	Box (VUP)	1 X 11.00	5.5	11	2 X 8.50	24.5	Good	Good	Overall condition is good
2	660/2	659+240	Box (VUP)	1 X 11.00	5.5	11	2 X 8.50	24.5	Good	Good	Overall condition is good
3	673/2	672+402	Box (LVUP)	1 X 4.50	3	4.5	2 X 8.50	24.5	Good	Good	Overall condition is good
4	675/3	674+418	Box (VUP)	1 X 11.00	5.5	11	2 X 8.50	24.5	Good	Good	Overall condition is good
5	659/2	658+060	Box (LVUP)	1 X 11.00	3	11	2 X 8.50	24.5	Good	Good	Overall condition is good
6	662/1	661+100	Box (LVUP)	1 X 4.50	3	4.5	2 X 8.50	24.5	Good	Good	Overall condition is good

Major Bridge

S.N o.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width of carriageway	Remarks
1	652+745	653/3	LHS	T-Beamslab	(3*24.00)	72	10.2	2*8.50	Overall structure is in good condition.
			RHS		(3*24.00)				
2	658+475	659/3	LHS	T-Beamslab	(5*21.00)	105	10.2	2*8.50	UPV reading is doubtful. Rebound hammer gives strength of 26 MPa and below. The strength of the span appears to be low. Pressure Grouting is recommended to achieve proper strength.
			RHS		(5*21.00)				UPV reading is doubtful. Rebound hammer gives strength of 21 MPa and below. The strength of the span appears to be low. Pressure Grouting is recommended to achieve proper strength.



ROB

S.No.	Chainage	S. No.	Side	Type of Structures	Span Arrangement	Length of Structure (m)	Deck width (m)	Width of carriageway
1	658+031	659/1	LHS	T-Beam girder	1 x 40.950	40.95	10.5	2 x 7.5
			RHS		1 x 40.950	40.95	10.75	2 x 7.5

S. No.		1
Structure No.		659/1
Chainage		658+031
Type of Structures		T-Beam
Span Arrangements		1 X 40.950
Details of Protection Work	Type	Crash Barrier
	Condition	Good
Present Condition of the Bridge	Abutment	Good
	Piers	Good
	Slab	Good
	Bearings	Good
	Parapet	Good
Condition of various features of bridge	Carriageway surface	Good
	Drainage Spout	Good
	Return wall / Wing wall	-
	Head wall	Good
Remarks		Reinforcement exposed in deck slab.cover to be provided. Removal of debris from expansion joints & removal of vegetation from side slopes required



Minor Bridge

S.No.	Chainage (km)	Side	Span Arrangement (m)	Total Length (m)	Carriageway Width (m)	Deck Width (m)	Footpath (Present/Not Present)(m)	Type of Superstructure	Type of Substructure	Condition of Protection Work	Condition of Structure	Remark
1	647+935	Both	2 x 5.00	10	8.5	35.25	No	Box	-	Good	Good	Cleaning of water way
2	647+765	LHS	2 x 6.20	12.4	8.5	10.25	Present	T- Beam Slab	RCC	Good	Good	Improvement of stone pitching and cleaning of vegetation
		RHS	6 x 5.40	32.4	8.5	14	Present	RCC	RCC			
3	649+492	Both	2 x 5.74	11.48	8.5	26.25	No	Box	-	Good	Good	Improvement of stone
4	651+318	Both	4 x 3.4	13.6	8.5	25.5	No	Box	-	Fair	Fair	-
5	657+100	Both	2 x 6.6	13.2	8.5	24.25	No	Box	-	Good	Good	Cleaning of vegetation
6	669+470	Both	3 x 4.8	14.4	8.5	26.25	No	Box	-	Good	Good	Over all condition is good
7	673+530	Both	2 x 5.3	10.6	8.5	40	No	Box	-	Good	Good	Cleaning of vegetation, stone pitching improvement
8	676+935	Both	2 x 4.40	8.8	8.5	35.25	No	Box	-	Fair	Fair	-

INVENTORY

1. Bridge identification Number		
1	State Code	RJ
2	Highway	NH27
3	Chainage	652.745 Km
4	Bridge Number	653-3
5	Bridge ID	NA
6	Name of River/NH No./or Crossing Feature	NH-27/Abu Road
7	Date of inspection	20/02/2018
8	Popular name	Ore

2. Bridge Classification		
1	Structural Form	Slab
2	Material of Construction	RCC
3	Type of Bridge	Major Bridge
4	Loading as per IRC	70R
5	Year of Construction	NA
6	Traffic Lane on Bridge	2 Lane Carriageway
7	Bridge Structure Crossing Features	River
8	Length of Bridge	72 m
9	Width of Carriage way	8.5 m (Both Carriageway)

3. Bridge Structural Rating Number		
1	Rating for Integral and Non-integral Deck	: 9
2	Rating for Superstructure	: 8
3	Rating for Substructure	: 8
4	Rating for Bank and Channel	: 8
5	Rating for Structural Evaluation	: 8
6	Rating for Deck Geometry	: 7
7	Rating for Vertical & Horizontal Clearance	: 3
8	Rating for Waterway Adequacy	: 7
9	Rating for Scour efficiency	: 8

INSPECTION

1. STRUCTURE DATA		
1.1	Road Width (m)	2 x 7.0
1.2	Overall Deck Width (m)	2 x 10.5 m
1.3	Approach Roadway Width Including Shoulder (m)	2 x 8.5 m
1.4	Height of Approach Embankment	NA
1.5	Average Skew	NO
1.6	Whether Navigable	NO
1.7	Horizontal Clearance	3x24 m
1.8	Vertical Clearance	6.5 m

2. GENERAL		
2.1	Corrosion Protection Measures	No Corrosion Protection Measures
2.2	Bank Protection & Type	Stone pitching
2.3	Floor Protection & Type	NA
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No back water

3. APPROACHES		
3.1	Type of Approach	Embankment
3.2	Material of Approach	Soil
3.3	Approach Geometrics (Straight/Curvilinear etc.)	Straight
3.4	If Approaches having any Span then provide Span details	No spans in approaches
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc.)	Cracking is observed
3.6	Sideslopes (Check pitched or un-pitched, Condition of pitching/turfing, any signs of slope failure etc.)	Un-pitched and no slope failure
3.7	Erosion of Embankment by rain cuts or any other damage to Embankment.	No erosion of embankment by rain cuts.
3.8	Approach slab (Check, settlement, cracks, movement etc.)	No settlement, cracks, movements
3.9	Retaining walls Type	NA
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc.)	NA
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment.)	Accumulation of silt, debris & vegetation observed

4. PROTECTION WORKS		
4.1	Type (Mention whether guide-bund or protection around abutments or spurs.)	Not present
4.2	Layout, cross section profile (Check damage to the layout and the general cross section are in order.)	No damage to the layout
4.3	Slope pitching, apron, and toe walls (Check for proper slope, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc.)	Pitching, apron damage & erosion of toe wall observed
4.4	Floor Protection works (Condition if impervious floor, flexible apron, curtain walls and indicate nature of damage if any etc.)	No floor protection
4.5	Scour (Check any abnormal scour noticed.)	scouring is noticed
4.6	Reserve store material	No

5. WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc.		NA
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)		No change in meandering in flow
5.3	Maximum Flood Level observed during the year and mark the same on the pier / abutment both on the U/s and D/s (Local enquiry if necessary)		NA
5.4	Afflux from U / sand D / s (Check signs of abnormal Afflux from U / sand D / s water mark on piers if any)		NA
5.5	Check of erosion of bank		Yes
6. FOUNDATION			
6.1	Type (Main bridge and approach spans if any)		Not visible
6.2	Material		Not visible
6.3	Condition of Foundation (Check Settlement, abnormal Scour, Tilting, if any etc)		Not visible
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)		Not visible
6.5	Seepage, vehicle impact etc (For sub-ways report seepage, vehicle impact, if any damage to the foundations etc.)		Not visible
6.6	Check cracking, disintegration, decay, erosion, Cavitation etc.,		Not visible
7. SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed S	NA	NA
7.1.4	Efficiency of drainage of the back fill behind abutments (Check)	Weep holes present	Weep holes present
7.1.5	Maximum Depth of Abutment Foundation	NA	NA
7.1.6	Abutment Width	NA	NA
7.1.7	Abutment Thickness	NA	NA
7.2	Pier	Pier-1	Pier-2
7.2.1	Type	Wall Type	NA
7.2.2	Material	RCC	NA
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed S	NA	NA
7.2.4	Maximum Depth of Pier Foundation	NA	NA
7.2.5	Pier Width	NA	NA
7.2.6	Pier Thickness	1.1 m	NA
8. FOR SUBWAYS			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any		Not applicable
8.2	Check large excavations done in the road below in the vicinity of flyover or road over bridge or viaduct		Not applicable
8.3	Check damage to protective measures to pier and abutments (For viaducts, Flyover and R.O.Bs.		Not applicable
8.4	Check damages to protective coating or paint.		Not applicable

9. BEARING & PEDESTAL			
S. No.	Particulars	Bearing	Pedestal
9.1	No. per Abutment	3	3
9.2	No. per Pier	3	3
9.3	Type	NA	NA
9.4	Material	NA	NA
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	NA	NA
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	NA	NA
9.7	Check Condition of Pads (oxidation, creep, Flattening, Bulging, splitting & displacement any	NA	NA
9.8	Check for general cleanness	NA	NA
9.9	Check any signs of distress cracking, spalling, disintegration & any excessive shifting	NA	NA
9.10	Check loss of shape	NA	NA
9.11	Check cracks if any supporting members such as pier cap, abutment, Pedestal etc.,	NA	NA
9.12	Condition of D/s stoppers (For submergible Bridges	NA	NA
10. SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	3 x 24	
10.2	Type of Span (T-beam, slab/box-girder etc.)	PSC Girder	
10.3	Structural System (Simply supported/continuous/Continuous overhang/balance cantilever etc.)	Continuous	
10.4	Type of Material (RCC/PSC/Steel/Timber/Masonry etc)	RCC/PSC	
10.5	Check spalling disintegration or honeycombing, (special attention: to be given at points of bearings)	No spalling disintegration or honey combing	
10.6	Check cracks (Pattern, location, explains preferably by photograph and plotting on sketch. A map of crackings should be produced. The size and distribution of cracks and their penetration should be noted)	No cracks observed	
10.7	Check exposed reinforcement, if any	No reinforcement exposed	
10.8	Check wear of deck surface	Wear of deck surface is in Fair condition	
10.9	Check scaling (This is gradual and continuous loss of surface mortar and aggregate over irregular areas.)	No scaling observed	
10.10	Check surface stains and rust stains along with the locations	No surface stains and rust stains	
10.11	Check leaching (Effects are most usually evident on the soffit of decks)	-	
10.12	Check corrosion of reinforcements, sheathing and tendon if visible	-	
10.13	Check leakage (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck viz., kerbs, etc.)	-	
10.14	Check damages if any due to moving vehicle	-	
10.15	Check Condition of articulation (Cracks, exposed reinforcement if any)	No articulation	
10.16	Check excessive vibrations, if any	No vibrations on bridge observed	
10.17	Check excessive deflections (sag) or loss of camber if any at same point each time	Not applicable	
10. SUPERSTRUCTURE			
10.18	Check cracks, if any, around anchorage zone for prestressed concrete members	Not applicable	

10.19	Check excessive deflection (sag) at central hinge, tip, of cantilever for cantilever bridge	Not applicable
10.20	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of water or debris. Interior diaphragms will also require examination, particularly for any signs of cracking at their junction to the webs	-
10.21	Check accumulation of slit and debris on surface of deck (for submersible bridges)	Not applicable
10.22	Check peeling off of protective coat or paint	No paint
10.23	Check steel members	-
10.24	Check condition of protective system	Good
10.25	Check corrosion, if any	-
10.26	Check excessive vibrations, if any	Not applicable
10.27	Check alignment of members	-
10.28	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringer to cross girders, cross girder to main girders, gusset or splices, condition of hinges, splices, etc.)	Not applicable
10.29	Check excessive loss of camber and excessive deflections and deformations, if any	Not applicable
10.3	Check buckling, kinking, warping and waviness	Not applicable
10.31	Check apparent fracture if any	Not applicable
10.32	Check excessive wear (such as in pins in joints of truss) and their locations requiring close monitoring	Not applicable
10.33	Check conditions inside the closed members	Not applicable
10.34	Check masonry arches	Not applicable
10.35	Check condition of joints mortar, pointing, masonry, etc.	Not applicable
10.36	Check profile, report flattening by observing rise of the arch at centre and quarter points	Not applicable
10.37	Check cracks (indicate location, pattern, extent, depth; explain by sketches)	Not applicable
10.38	Check drainage of spandrel fillings (check bulging of spandrel walls, if any)	Not applicable
10.39	Check growth of vegetation	Growth of vegetation observed
10.4	Check all cast iron/wrought iron components	Not applicable
10.41	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable
10.42	In case of masonry bridges (Pointing/joints mortar and bulging of spandrel)	Not applicable
10.43	Vegetation (Yes/No)	Yes

11. EXPANSION JOINT		
11.1	Type	Strip seal
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc.	NA
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, excessive noise, etc.	Cracks on wearing course observed
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler., check hardening, cracking, etc.	NA
11.5	Check secureness of the joints	Not visible
11.6	Top sliding plate i.e. check corrosion, damage to welds, etc.	Not applicable
11.7	Locking of joints i.e. Check locking of joints especially for finger type expansion joints.	NA
11.8	Check for debris in joints	Debris observed in joints
11.9	Report rattling, if any	No rattling
11.10	Check drainage from expansion joint	No drainage from expansion joint
11.11	Check alignment and clearance	Proper alignment and clearance
12. WEARING COAT		
12.1	Material	Bituminous
12.2	Surface Condition i.e. Cracks/ potholes/ Bulges, spalling, disintegration, etc.	Cracks observed
12.3	Check Evidence of wear (Tell tale rings check for thickness against actual thickness, check data of last inspection)	NA
12.4	Compare additional thickness with design thickness with reference to kerb height	NA
13. DRAINAGE SPOUTS AND VEST HOLES		
13.1	Check clogging, deterioration and damage, if any	NA
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not affected
13.3	Check adequacies thereof	Sufficient
13.4	For subways report about adequacy of drainage and pumping arrangement etc.	Not applicable
13.5	For submersible bridges, report on functioning	Not applicable
13.6	Report absence of Drainage Spouts	No drainage spouts absence
13.7	Check choking of drainage holes provided in the bottom booms	NA
14. HAND RAILS & PARAPETS WALLS		
14.1	Check General Condition (Check expansion Gaps and Missing parts if)	No expansion gaps observed
14.2	Check Damage due to collision	No damage due to collision
14.3	Check alignment (Report any abruptness in profile)	Good
15. FOOT PATHS		
15.1	Check general condition (Damaged due to mounting of vehicles)	NA
15.2	Check missing footpath slabs	NA
15.3	Cleanliness of ducts along footpaths	NA

16. UTILITIES		
16.1	Check leakage of water and sewage pipes	NA
16.2	Check any damage by telephone and electric cables.	NA
16.3	Check condition of lighting facilities	No lighting facilities
16.4	Check damages due to any other utilities	No damage due to utilities
17. BRIDGE NUMBER		
17.1	Check condition of painting	Fair Condition
18. ENVIRONMENT		
18.1	Check for signs of aggressiveness	NA
19. AESTHETICS		
19.1	Check any visual intrusion, hoardings, vegetation on structural	NA
19.2	Check Whether all actions for maintenance and recommended	NA
20. RECOMMENDATION		
20.1	Recommendation for testing YES or NO	NO - Bridge requires localized repairs

PHOTOGRAPHS



Picture-1: Cracks on surface



Picture-2: Weep holes present



Picture-3: Side Protection Work



Picture-4: Bed Section



Picture-5: Exposed reinforcement



Picture-6: Vegetation observed



Picture-7: Carbonation test on bridge



Picture-7: Ultrasonic velocity test

INVENTORY

1. Bridge identification Number		
1	State Code	RJ
2	Highway	NH27
3	Chainage	658.475
4	Bridge Number	659/3
5	Bridge ID	NA
6	Name of River/NH No/or Crossing Feature	NH-27/Abu Road
7	Date of inspection	20/02/2018
8	Popular name	Kivarali

2. Bridge Classification		
1	Structural Form	Slab
2	Material of Construction	RCC
3	Type of Bridge	Major Bridge
4	Loading as per IRC	70R
5	Year of Construction	NA
6	Traffic Lane on Bridge	2 Lane Carriageway
7	Bridge Structure Crossing Features	River
8	Length of Bridge	105 m
9	Width of Carriage way	8.5 m (Both Carriageway)

3. Bridge Structural Rating Number		
1	Rating for Integral and Non-integral Deck	: 9
2	Rating for Superstructure	: 8
3	Rating for Substructure	: 8
4	Rating for Bank and Channel	: 8
5	Rating for Structural Evaluation	: 8
6	Rating for Deck Geometry	: 7
7	Rating for Vertical & Horizontal Clearance	: 3
8	Rating for Waterway Adequacy	: 7
9	Rating for Scour efficiency	: 8

INSPECTION

1. STRUCTURE DATA		
1.1	Road Width (m)	2 x 7.0
1.2	Overall Deck Width (m)	2 x 10.5 m
1.3	Approach Roadway Width Including Shoulder (m)	2 x 8.5 m
1.4	Height of Approach Embankment	-
1.5	Average Skew	NO
1.6	Whether Navigable	NO
1.7	Horizontal Clearance	5x21
1.8	Vertical Clearance	5.5 m
2. GENERAL		
2.1	Corrosion Protection Measures	No Corrosion Protection Measures
2.2	Bank Protection & Type	Stone pitching
2.3	Floor Protection & Type	-
2.4	Is the Bridge Located in back water (Marine) or chemical affected water body	No back water
3. APPROACHES		
3.1	Type of Approach	Embankment
3.2	Material of Approach	Soil
3.3	Approach Geometrics (Straight/Curvilinear etc.)	Straight
3.4	If Approaches having any Span then provide Span details	No spans in approaches
3.5	Pavement surface (Check unevenness settlement, cracking, potholes etc.)	Cracking is observed
3.6	Sideslopes (Check pitched or un-pitched, Condition of pitching/turfing, any signs of slope failure etc.)	Un-pitched and no slope failure
3.7	Erosion of Embankment by rain cuts or any other damage to Embankment.	No erosion of embankment by rain cuts.
3.8	Approach slab (Check, settlement, cracks, movement etc.)	No settlement, cracks, movements
3.9	Retaining walls Type	-
3.10	Retaining wall condition (Check subsidence, tilting, condition of weep-holes, guard-stone and railing etc.)	-
3.11	Silt and Debris (Check Accumulation of silt and debris on submersible approaches in cutting and embankment.)	Accumulation of silt, debris & vegetation observed
4. PROTECTION WORKS		
4.1	Type (Mention whether guide-bund or protection around abutments or spurs.)	Not present
4.2	Layout, cross section profile (Check damage to the layout and the general cross section are in order.)	No damage to the layout
4.3	Slope pitching, apron, and toe walls (Check for proper slope, thickness of pitching in the slope, erosion of toe wall and indicating the nature of damage if any etc.)	Pitching, apron damage & erosion of toe wall observed
4.4	Floor Protection works (Condition if impervious floor, flexible apron, curtain walls and indicate nature of damage if any etc.)	No floor protection
4.5	Scour (Check any abnormal scour noticed.)	scouring is noticed
4.6	Reserve store material	No

5. WATERWAY			
5.1	Check presence of obstruction in flow and its impact on flow, island formation, Vegetation growth etc.		-
5.2	Flow pattern (Check any abnormal change in Meandering inflow and erosion of banks)		No change in meandering in flow
5.3	Maximum Flood Level observed during the year and mark the same on the pier / abutment both on the U/s and D/s (Local enquiry if necessary)		-
5.4	Afflux from U / sand D / s (Check signs of abnormal Afflux from U / sand D / s water mark on piers if any)		-
5.5	Check of erosion of bank		Yes
6. FOUNDATION			
6.1	Type (Main bridge and approach spans if any)		Not visible
6.2	Material		Not visible
6.3	Condition of Foundation (Check Settlement, abnormal Scour, Tilting, if any etc)		Not visible
6.4	Floating bodies, boulders etc (Check damage due to impact of floating bodies, boulders etc)		Not visible
6.5	Seepage, vehicle impact etc (For sub-ways report seepage, vehicle impact, if any damage to the foundations etc.)		Not visible
6.6	Check cracking, disintegration, decay, erosion, Cavitation etc.,		Not visible
7. SUBSTRUCTURE			
7.1	Abutment (A1 & A2)	A1	A2
7.1.1	Type	Wall type	Wall type
7.1.2	Material	RCC	RCC
7.1.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed S	-	-
7.1.4	Efficiency of drainage of the backfill behind abutments (Check fu	Weep holes present	Weep holes present
7.1.5	Maximum Depth of Abutment Foundation	-	-
7.1.6	Abutment Width	-	-
7.1.7	Abutment Thickness	-	-
7.2	Pier		
7.2.1	Type	Wall Type	
7.2.2	Material	RCC	
7.2.3	Condition (Crack, Settlement, Scour, Tilting, Rusting in exposed S	-	
7.2.4	Maximum Depth of Pier Foundation	-	
7.2.5	Pier Width	-	
7.2.6	Pier Thickness	1.1 m	
8. FOR SUBWAYS			
8.1	Check condition of side retaining wall like cracking, disintegration and seepage, if any		Not applicable
8.2	Check large excavations done in the road below in the vicinity of flyover or road over bridge or viaduct		Not applicable
8.3	Check damage to protective measures to pier and abutments (For viaducts, Flyover and R.O.Bs.		Not applicable
8.4	Check damages to protective coating or paint.		Not applicable

9. BEARING & PEDESTAL			
S. No.	Particulars	Bearing	Pedestal
9.1	No. per Abutment	2	2
9.2	No. per Pier	4	4
9.3	Type	NA	NA
9.4	Material	NA	NA
9.5	General condition (Check rusting, cleanliness, seizing of plates silting, accumulations of dirt in case of submersible bridges)	NA	NA
9.6	Functioning (Check excessive movement, tilting, jumping off guides)	NA	NA
9.7	Check Condition of Pads (oxidation, creep, Flattening, Bulging, splitting & displacement any)	NA	NA
9.8	Check for general cleanness	NA	NA
9.9	Check any signs of distress cracking, spalling, disintegration & any excessive shifting	NA	NA
9.10	Check loss of shape	NA	NA
9.11	Check cracks if any supporting members such as pier cap, abutment, Pedestal etc.,	NA	NA
9.12	Condition of D/s stoppers (For submergible Bridges)	NA	NA
10. SUPERSTRUCTURE			
10.1	Total number of Spans & Arrangement	5x21	
10.2	Type of Span (T-beam, slab/box-girder etc.)	PSC Girder	
10.3	Structural System (Simply supported/continuous/Continuous overhang/balance cantilever etc.)	Continuous	
10.4	Type of Material (RCC/PSC/Steel/Timber/Masonry etc)	RCC/PSC	
10.5	Check spalling disintegration or honeycombing, (special attention: to be given at points of bearings)	No spalling disintegration or honey combing	
10.6	Check cracks (Pattern, location, explains preferably by photograph and plotting on sketch. A map of crackings should be produced. The size and distribution of cracks and their penetration should be noted)	No cracks observed	
10.7	Check exposed reinforcement, if any	No reinforcement exposed	
10.8	Check wear of deck surface	Wear of deck surface is in Fair condition	
10.9	Check scaling (This is gradual and continuous loss of surface mortar and aggregate over irregular areas.)	No scaling observed	
10.10	Check surface stains and rust stains along with the locations	No surface stains and rust stains	
10.11	Check leaching (Effects are most usually evident on the soffits of decks)	-	
10.12	Check corrosion of reinforcements, sheathing and tendon if visible	-	
10.13	Check leakage (Leakage of water can take place through concrete decks, construction joints or thin component sections of the deck viz., kerbs, etc.)	-	
10.14	Check damages if any due to moving vehicle	-	
10.15	Check Condition of articulation (Cracks, exposed reinforcement if any)	No articulation	
10.16	Check excessive vibrations, if any	No vibrations on bridge observed	
10.17	Check excessive deflections (sag) or loss of camber if any at same point each time	Not applicable	
10. SUPERSTRUCTURE			
10.18	Check cracks, if any, around anchorage zone for prestressed concrete members	Not applicable	

10.19	Check excessive deflection (sag) at central hinge, tip, of cantilever for cantilever bridge	Not applicable
10.20	In box girders, the interior faces of flanges and webs need to be examined for signs of cracking and report excessive accumulation of water or debris. Interior diaphragms will also require examination, particularly for any signs of cracking at their junction to the webs	-
10.21	Check accumulation of slit and debris on surface of deck (for submersible bridges)	Not applicable
10.22	Check peeling off of protective coat or paint	No paint
10.23	Check steel members	-
10.24	Check condition of protective system	Good
10.25	Check corrosion, if any	-
10.26	Check excessive vibrations, if any	Not applicable
10.27	Check alignment of members	-
10.28	Check condition for Steel Superstructure (Adequacy, looseness of rivets, bolts or worn-out welds, especially on connection of stringer to cross girders, cross girder to main girders, gusset or splices, condition of hinges, splices, etc.)	Not applicable
10.29	Check excessive loss of camber and excessive deflections and deformations, if any	Not applicable
10.3	Check buckling, kinking, warping and waviness	Not applicable
10.31	Check apparent fracture if any	Not applicable
10.32	Check excessive wear (such as in pins in joints of truss) and their locations requiring close monitoring	Not applicable
10.33	Check conditions inside the closed members	Not applicable
10.34	Check masonry arches	Not applicable
10.35	Check condition of joints mortar, pointing, masonry, etc.	Not applicable
10.36	Check profile, report flattening by observing rise of the arch at centre and quarter points	Not applicable
10.37	Check cracks (indicate location, pattern, extent, depth; explain by sketches)	Not applicable
10.38	Check drainage of spandrel fillings (check bulging of spandrel walls, if any)	Not applicable
10.39	Check growth of vegetation	Growth of vegetation observed
10.4	Check all cast iron/wrought iron components	Not applicable
10.41	In case of steel bridges (Corrosion/painting/loose rivet joints)	Not applicable
10.42	In case of masonry bridges (Pointing/joints mortar and bulging of spandrel)	Not applicable
10.43	Vegetation (Yes/No)	Yes

11. EXPANSION JOINT		
11.1	Type	Strip seal
11.2	Condition i.e. Misalignment of Joints, Debris, Accumulation etc.	NA
11.3	Functioning i.e. Cracks in wearing course, existence of normal gap, excessive noise, etc.	Minor cracks on wearing course observed
11.4	Sealing material i.e. For neoprene sealing material, check for splitting, oxidation, creep, flattening, bulging and for bitumen filler, check hardening, cracking, etc.	NA
11.5	Check secureness of the joints	Not visible
11.6	Top sliding plate i.e. check corrosion, damage to welds, etc.	Not applicable
11.7	Locking of joints i.e. Check locking of joints especially for finger type expansion joints.	NA
11.8	Check for debris in joints	Debris observed in joints
11.9	Report rattling, if any	No rattling
11.10	Check drainage from expansion joint	No drainage from expansion joint
11.11	Check alignment and clearance	Proper alignment and clearance
12. WEARING COAT		
12.1	Material	Bituminous
12.2	Surface Condition i.e. Cracks/ potholes/ Bulges, spalling, disintegration, etc.	Cracks observed in wearing course
12.3	Check Evidence of wear (Tell talerings check for thickness against actual thickness, check data of last inspection)	NA
12.4	Compare additional thickness with design thickness with reference to kerb Height	NA
13. DRAINAGE SPOUTS AND VEST HOLES		
13.1	Check clogging, deterioration and damage, if any	NA
13.2	Check the projection of the spout on the underside (see whether structural members are being affected)	Not affected
13.3	Check adequacies thereof	Sufficient
13.4	For subways report about adequacy of drainage and pumping arrangements etc.	Not applicable
13.5	For submersible bridges, report on functioning	Not applicable
13.6	Report absence of Drainage Spouts	No drainage spouts absence
13.7	Check choking of drainage holes provided in the bottom booms	NA
14. HAND RAILS & PARAPETS WALLS		
14.1	Check General Condition (Check expansion Gaps and Missing parts if)	No expansion gaps observed
14.2	Check Damage due to collision	No damage due to collision
14.3	Check alignment (Report any abruptness in profile)	Good
15. FOOT PATHS		
15.1	Check general condition (Damaged due to mounting of vehicles)	NA
15.2	Check missing footpath slabs	NA
15.3	Cleanliness of ducts along footpaths	NA

16. UTILITIES		
16.1	Check leakage of water and sewage pipes	NA
16.2	Check any damage by telephone and electric cables.	NA
16.3	Check condition of lighting facilities	No lighting facilities
16.4	Check damages due to any other utilities	No damage due to utilities
17. BRIDGE NUMBER		
17.1	Check condition of painting	Fair Condition
18. ENVIRONMENT		
18.1	Check for signs of aggressiveness	No
19. AESTHETICS		
19.1	Check any visual intrusion, hoardings, vegetation on structural	No
19.2	Check Whether all actions for maintenance and recommended	NA
20. RECOMMENDATION		
20.1	Recommendation for testing YES or NO	NO - Bridge requires localized repairs

PHOTOGRAPHS



Picture-1: Cracks on road



Picture-2: Weep holes present



Picture-3: Toe wall observed



Picture-4: Bridge



Picture-5: Observed flood level on pier



Picture-6: Vegetation observed

ANNEXURE 9 NDT RESULTS

S. No.	Chainage	Locat ion
1	659	SpanIII(Center-1)-LHS
2	659	SpanIII(Center-2)-LHS
3	659	SpanIII(Center-3)-LHS
4	659	SpanIV(Center-1)-LHS
5	659	SpanIV(Center-2)-LHS
6	653	Span II- LHS
7	653	Span II- LHS
8	645	Span II- LHS
9	645	Span II- LHS
10	640	SpanMid.(2)-RHS
11	639	SpanIII-RHS

Table1.SummaryofNDTconductedonStructures

S. No.	Chainage	Locat ion	Rebound Hammer Analysis		
			Direct ion of testing	Average Rebound Index Value	Compressive Strength(M pa)
1	659	SpanIII(Center-1)-LHS	Upward	35	26
2	659	SpanIII(Center-2)-LHS	Upward	11	N/A
3	659	SpanIII(Center-3)-LHS	Upward	32	21
4	659	SpanIV(Center-1)-LHS	Upward	63	62
5	659	SpanIV(Center-2)-LHS	Upward	65	62
6	653	Span II- LHS	Upward	47	47
7	653	Span II- LHS	Upward	54	61
8	645	Span II- LHS	Upward	62	62
9	645	Span II- LHS	Upward	61	62
10	640	SpanMid.(2)-RHS	Upward	62	62
11	639	SpanIII-RHS	Upward	52	57
Carbonation			Yes(Note:Carbonatedconcretegivesand overestimatethestrengthwhichinextreme cases can be up t o 50 percent)		
Surface Condit ion			Dry		
Type of Aggregat e			Crushed Stone Aggregat e		
Type of Cement used			OPC-43		

Table2.ResultsofNDTbyreboundhammer



Technical Due Diligence Report of NH27 (NH14) Abu road -
Swaroopganj (Stretch1).Annexure Non-Destructive
Testing



Sr. No.	Ch.	Locations	Mode of Test	Time	Spacing	Pulse velocity before corrections	Correction due to wet condition	Correction due to temp. of concrete	Direct	Indirect	Remarks
1	659	Span III (Center) LHS	Indirect	110.9	400	3.61	1.02	1.02	3.61	3.79	Good
2	659	Span III (Center)	Indirect	146.4	400	2.73	1.02	1.02	2.73	2.87	Doubtful
3	659	Span III LHS	Indirect	153.4	400	2.61	1.02	1.02	2.61	2.74	Doubtful
4	659	Span IV (1) LHS	Indirect	142.9	400	2.80	1.02	1.02	2.80	2.94	Doubtful
5	659	Span IV (2) LHS	Indirect	110.4	400	3.62	1.02	1.02	3.62	3.80	Good
6	653	Span II (1) LHS	Indirect	112.9	400	3.54	1.02	1.02	3.54	3.72	Good
7	653	Span II (2) LHS	Indirect	100.4	400	3.98	1.02	1.02	3.98	4.18	Good
8	645	Span II Slab (1)	Indirect	98.4	400	4.07	1.02	1.02	4.07	4.27	Good
9	645	Span IV LHS	Indirect	123.4	400	3.24	1.02	1.02	3.24	3.40	Medium
10	640	Span Mid. (1) RHS	Indirect	131.4	400	3.04	1.02	1.02	3.04	3.20	Medium

Table 3. Results of NDT by ultrasonic pulse velocity

S. No.	Ch. (Km)	Type of Structure	Side	Span No./Pier	No of samples on			Remarks
					UPV	RHT	Carbonation	
1	639	Major bridge	RHS	III	1	1	-	Overall structure is in good condition
2	640	Major bridge	RHS	II	1	1	-	Overall structure is in good condition
3	645	Major bridge	LHS	II	2	2	-	Overall structure is in good condition
4	653	Major bridge	LHS	II	2	2	-	Overall structure is in good condition
5	659	Major bridge	LHS	II (central)	2	1	3	UPV reading is doubtful. Rebound hammer gives strength of 26 Mpa and below. Pressure grouting is recommended to achieve proper strength
				III	1	2	1	UPV reading is doubtful. Rebound hammer gives strength of 21 Mpa and below. Pressure grouting is recommended to achieve proper strength
				IV	2	2	1	UPV reading is doubtful. Rebound hammer gives strength of 62 Mpa and below. Pressure grouting is recommended to achieve proper strength

Table 4. Summary of NDT conducted on structures



ANNEXURE 10 TRAFFIC PROJECTIONS

	ESTIMATED TRAFFIC FOR 2018/19 (Vehicle Type)																				
	2-wheel	3-wheel	Car/Jeep	Mini LCV	Minibus	Bus	LCV-4 tyre	LCV-6 tyre	2 axle Truck	3 axle Truck	MAV	OS (6+ axle)	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	Animal Drw.	Hand Cart	Exempted V	TOTAL
ADT	3,592	396	4,321	496	58	501	72	617	524	1,109	3,473	1	19	68	15	8	1	0	0	54	15,325
Seasonal Factors	1.11	1.01	0.92	0.77	0.96	0.96	0.77	0.77	0.86	0.86	1.16	1.17	1.17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
AADT (Vehicles)	3,987	400	3,975	382	56	481	55	475	451	954	4,029	1	22	68	15	8	1	0	0	54	15,414
PCU Factors	0.5	1.0	1.0	1.5	1.5	3.0	1.5	1.5	3.0	3.0	4.5	4.5	4.5	4.5	1.5	0.5	2.0	4.0	3.0	1.0	
AADT (PCUs)	1,994	400	3,975	573	84	1,443	83	713	1,352	2,861	18,129	5	100	306	23	4	2	0	0	54	32,100

	Tollable
ADT	11,191
Seasonal Factors	
AADT (Vehicles)	10,881
PCU Factors	
AADT (PCUs)	29,318

TRAFFIC GROWTH RATES UNDAVARIYA																				
Year	2-wheel	3-wheel	Car/Jeep	Mini LCV	Minibus	Bus	LCV-4 tyre	LCV-6 tyre	2 axle Truck	3 axle Truck	MAV	OS (6+ axle)	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	Animal Drw.	Hand Cart	Exempted V
2019	8.0%	2.0%	5.1%	6.0%	2.9%	2.9%	6.0%	6.0%	-1.1%	-1.6%	6.7%	6.7%	6.7%	3.0%	3.0%	2.0%	1.0%	1.0%	0.0%	5.0%
2020	8.0%	2.0%	5.5%	6.4%	3.1%	3.1%	6.4%	6.4%	-1.2%	-1.7%	7.1%	7.1%	7.1%	3.0%	3.0%	2.0%	1.0%	1.0%	0.0%	5.0%
2021	8.0%	2.0%	5.6%	6.5%	3.1%	3.1%	6.5%	6.5%	-1.2%	-1.7%	7.2%	7.2%	7.2%	3.0%	3.0%	2.0%	1.0%	1.0%	0.0%	5.0%
2022	8.0%	2.0%	5.7%	6.6%	3.2%	3.2%	6.6%	6.6%	-1.2%	-1.7%	7.4%	7.4%	7.4%	3.0%	3.0%	2.0%	1.0%	1.0%	0.0%	5.0%
2023	8.0%	2.0%	5.6%	6.5%	3.1%	3.1%	6.5%	6.5%	-1.9%	-2.4%	7.2%	7.2%	7.2%	3.0%	3.0%	2.0%	1.0%	1.0%	0.0%	5.0%
2024	7.0%	1.8%	5.6%	6.5%	3.2%	3.2%	6.5%	6.5%	-1.9%	-2.5%	7.3%	7.3%	7.3%	2.8%	2.8%	1.0%	0.0%	0.5%	0.0%	4.5%
2025	7.0%	1.8%	5.5%	6.4%	3.1%	3.1%	6.4%	6.4%	-11.9%	-12.4%	-2.8%	-2.8%	-2.8%	2.8%	2.8%	1.0%	0.0%	0.5%	0.0%	4.5%
2026	7.0%	1.8%	5.4%	6.4%	3.1%	3.1%	6.4%	6.4%	-11.9%	-22.4%	-12.9%	-12.9%	-12.9%	2.8%	2.8%	1.0%	0.0%	0.5%	0.0%	4.5%
2027	7.0%	1.8%	5.4%	6.3%	3.0%	3.0%	6.3%	6.3%	-1.9%	-2.4%	7.0%	7.0%	7.0%	2.8%	2.8%	1.0%	0.0%	0.5%	0.0%	4.5%
2028	7.0%	1.8%	5.1%	6.0%	2.9%	2.9%	6.0%	6.0%	-2.5%	-3.0%	6.7%	6.7%	6.7%	2.8%	2.8%	1.0%	0.0%	0.5%	0.0%	4.5%
2029	6.0%	1.6%	5.1%	5.9%	2.9%	2.9%	5.9%	5.9%	-2.4%	-2.9%	6.6%	6.6%	6.6%	2.6%	2.6%	0.5%	0.0%	0.0%	0.0%	4.0%
2030	6.0%	1.6%	5.0%	5.8%	2.8%	2.8%	5.8%	5.8%	-2.4%	-2.9%	6.5%	6.5%	6.5%	2.6%	2.6%	0.5%	0.0%	0.0%	0.0%	4.0%
2031	6.0%	1.6%	4.9%	5.8%	2.8%	2.8%	5.8%	5.8%	-2.4%	-2.8%	6.4%	6.4%	6.4%	2.6%	2.6%	0.5%	0.0%	0.0%	0.0%	4.0%
2032	6.0%	1.6%	4.9%	5.7%	2.7%	2.7%	5.7%	5.7%	-2.3%	-2.8%	6.3%	6.3%	6.3%	2.6%	2.6%	0.5%	0.0%	0.0%	0.0%	4.0%
2033	6.0%	1.6%	4.6%	5.4%	2.6%	2.6%	5.4%	5.4%	-2.9%	-3.3%	6.0%	6.0%	6.0%	2.6%	2.6%	0.5%	0.0%	0.0%	0.0%	4.0%
2034	5.0%	1.4%	4.6%	5.3%	2.6%	2.6%	5.3%	5.3%	-2.9%	-3.3%	6.0%	6.0%	6.0%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	3.5%
2035	5.0%	1.4%	4.5%	5.3%	2.5%	2.5%	5.3%	5.3%	-2.8%	-3.2%	5.9%	5.9%	5.9%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	3.5%
2036	5.0%	1.4%	4.4%	5.2%	2.5%	2.5%	5.2%	5.2%	-2.8%	-3.2%	5.8%	5.8%	5.8%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	3.5%
2037	5.0%	1.4%	4.4%	5.1%	2.5%	2.5%	5.1%	5.1%	-2.7%	-3.1%	5.7%	5.7%	5.7%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	3.5%
2038	5.0%	1.4%	4.3%	5.0%	2.4%	2.4%	5.0%	5.0%	-2.7%	-3.1%	5.6%	5.6%	5.6%	2.4%	2.4%	0.0%	0.0%	0.0%	0.0%	3.5%
2039	4.0%	1.2%	4.1%	4.8%	2.3%	2.3%	4.8%	4.8%	-3.2%	-3.5%	5.3%	5.3%	5.3%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	3.0%
2040	4.0%	1.2%	4.0%	4.7%	2.3%	2.3%	4.7%	4.7%	-3.1%	-3.5%	5.3%	5.3%	5.3%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	3.0%
2041	4.0%	1.2%	4.0%	4.6%	2.2%	2.2%	4.6%	4.6%	-3.1%	-3.4%	5.2%	5.2%	5.2%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	3.0%
2042	4.0%	1.2%	3.9%	4.6%	2.2%	2.2%	4.6%	4.6%	-3.0%	-3.4%	5.1%	5.1%	5.1%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	3.0%
2043	4.0%	1.2%	3.8%	4.5%	2.2%	2.2%	4.5%	4.5%	-3.0%	-3.3%	5.0%	5.0%	5.0%	2.2%	2.2%	0.0%	0.0%	0.0%	0.0%	3.0%
2044	3.0%	1.0%	3.8%	4.4%	2.1%	2.1%	4.4%	4.4%	-2.9%	-3.3%	4.9%	4.9%	4.9%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	2.5%
2045	3.0%	1.0%	3.6%	4.2%	2.0%	2.0%	4.2%	4.2%	-3.3%	-3.6%	4.7%	4.7%	4.7%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	2.5%
2046	3.0%	1.0%	3.5%	4.1%	2.0%	2.0%	4.1%	4.1%	-3.2%	-3.6%	4.6%	4.6%	4.6%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	2.5%
2047	3.0%	1.0%	3.5%	4.0%	2.0%	2.0%	4.0%	4.0%	-3.2%	-3.5%	4.5%	4.5%	4.5%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	2.5%
2048	3.0%	1.0%	3.4%	4.0%	1.9%	1.9%	4.0%	4.0%	-3.1%	-3.4%	4.4%	4.4%	4.4%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	2.5%

PROJECTED AADT (Vehicles) UNDAVARIYA																					
Year	2-wheel	3-wheel	Car/Jeep	Mini LCV	Minibus	Bus	LCV-4 tyre	LCV-6 tyre	2 axle Truck	3 axle Truck	MAV	OS (6+ axle)	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	Animal Drw.	Hand Cart	Exempted V	Total
2019	4306	408	4,179	405	57	495	59	504	446	939	4,298	1	24	70	15	8	1	0	0	57	16,271
2020	4651	416	4,407	431	59	510	63	536	441	923	4,603	1	25	72	16	8	1	0	0	60	17,223
2021	5023	424	4,652	458	61	526	67	570	435	907	4,937	1	27	74	16	8	1	0	0	63	18,252
2022	5424	433	4,916	489	63	543	71	608	430	892	5,302	2	29	77	17	9	1	0	0	66	19,370
2023	5858	442	5,189	521	65	560	76	648	422	870	5,686	2	31	79	17	9	1	0	0	69	20,543
2024	6268	450	5,479	555	67	578	81	690	414	849	6,100	2	34	81	18	9	1	0	0	72	21,745
2025	6707	458	5,781	590	69	596	86	734	365	743	5,928	2	33	83	18	9	1	0	0	75	22,278
2026	7177	466	6,096	628	71	614	91	781	321	577	5,163	1	28	86	19	9	1	0	0	79	22,207
2027	7679	474	6,423	667	73	632	97	830	315	563	5,524	2	30	88	19	9	1	0	0	82	23,510
2028	8217	483	6,753	707	75	651	103	880	308	546	5,894	2	33	91	20	9	1	0	0	86	24,856
2029	8710	491	7,095	749	77	669	109	932	300	530	6,283	2	35	93	20	9	1	0	0	89	26,194
2030	9232	498	7,449	793	80	688	115	986	293	515	6,692	2	37	95	21	9	1	0	0	93	27,600
2031	9786	506	7,816	838	82	707	122	1,043	286	501	7,121	2	39	98	22	9	1	0	0	97	29,076
2032	10373	514	8,195	886	84	727	129	1,102	279	487	7,572	2	42	100	22	9	1	0	0	100	30,625
2033	10996	523	8,575	934	86	746	136	1,162	271	470	8,030	2	44	103	23	10	1	0	0	104	32,215
2034	11546	530	8,967	984	89	765	143	1,224	263	455	8,508	2	47	105	23	10	1	0	0	108	33,769
2035	12123	537	9,371	1,035	91	784	150	1,288	256	440	9,007	3	50	108	24	10	1	0	0	112	35,390
2036	12729	545	9,786	1,089	93	804	158	1,355	249	426	9,528	3	53	110	24	10	1	0	0	116	37,078
2037	13365	553	10,213	1,144	95	824	166	1,424	242	413	10,070	3	56	113	25	10	1	0	0	120	38,836
2038	14034	560	10,652	1,202	98	844	174	1,495	236	400	10,633	3	59	116	26	10	1	0	0	124	40,666
2039	14595	567	11,089	1,259	100	863	183	1,567	228	386	11,202	3	62	118	26	10	1	0	0	128	42,387
2040	15179	574	11,536	1,319	102	883	191	1,640	221	372	11,790	3	65	121	27	10	1	0	0	132	44,167
2041	15786	581	11,994	1,380	105	903	200	1,716	214	360	12,400	4	68	124	27	10	1	0	0	136	46,008
2042	16417	588	12,462	1,443	107	923	209	1,795	208	348	13,031	4	72	126	28	10	1	0	0	140	47,909
2043	17074	595	12,939	1,507	109	943	219	1,875	202	336	13,682	4	75	129	28	10	1	0	0	144	49,872
2044	17586	601	13,427	1,574	111	963	228	1,957	196	325	14,354	4	79	132	29	10	1	0	0	147	51,725
2045	18114	607	13,909	1,640	114	982	238	2,040	189	313	15,025	4	83	134	30	10	1	0	0	151	53,584
2046	18657	613	14,399	1,707	116	1,002	248	2,123	183	302	15,716	5	87	137	30	10	1	0	0	155	55,490
2047	19217	619	14,898	1,776	118	1,021	258	2,209	177	291	16,424	5	91	140	31	10	1	0	0	159	57,445
2048	19794	625	15,404	1,846	120	1,041	268	2,297	172	281	17,152	5	95	143	31	10	1	0	0	163	59,447

Projected AADT Tollable Undavariya												
Year	Car/Jeep	Mini LCV	Minibus	Bus	LCV-4 tyre	LCV-6 tyre	2 axle Truck	3 axle Truck	MAV	OS (6+ axle)	HCM/EME	Total
2019	4,179	405	57	495	59	504	446	939	4,298	1	24	11,406
2020	4,407	431	59	510	63	536	441	923	4,603	1	25	11,999
2021	4,652	458	61	526	67	570	435	907	4,937	1	27	12,642
2022	4,916	489	63	543	71	608	430	892	5,302	2	29	13,344
2023	5,189	521	65	560	76	648	422	870	5,686	2	31	14,068
2024	5,479	555	67	578	81	690	414	849	6,100	2	34	14,846
2025	5,781	590	69	596	86	734	365	743	5,928	2	33	14,926
2026	6,096	628	71	614	91	781	321	577	5,163	1	28	14,371
2027	6,423	667	73	632	97	830	315	563	5,524	2	30	15,157
2028	6,753	707	75	651	103	880	308	546	5,894	2	33	15,950
2029	7,095	749	77	669	109	932	300	530	6,283	2	35	16,781
2030	7,449	793	80	688	115	986	293	515	6,692	2	37	17,650
2031	7,816	838	82	707	122	1,043	286	501	7,121	2	39	18,557
2032	8,195	886	84	727	129	1,102	279	487	7,572	2	42	19,504
2033	8,575	934	86	746	136	1,162	271	470	8,030	2	44	20,456
2034	8,967	984	89	765	143	1,224	263	455	8,508	2	47	21,446
2035	9,371	1,035	91	784	150	1,288	256	440	9,007	3	50	22,475
2036	9,786	1,089	93	804	158	1,355	249	426	9,528	3	53	23,543
2037	10,213	1,144	95	824	166	1,424	242	413	10,070	3	56	24,650
2038	10,652	1,202	98	844	174	1,495	236	400	10,633	3	59	25,796
2039	11,089	1,259	100	863	183	1,567	228	386	11,202	3	62	26,942
2040	11,536	1,319	102	883	191	1,640	221	372	11,790	3	65	28,124
2041	11,994	1,380	105	903	200	1,716	214	360	12,400	4	68	29,344
2042	12,462	1,443	107	923	209	1,795	208	348	13,031	4	72	30,599
2043	12,939	1,507	109	943	219	1,875	202	336	13,682	4	75	31,891
2044	13,427	1,574	111	963	228	1,957	196	325	14,354	4	79	33,219
2045	13,909	1,640	114	982	238	2,040	189	313	15,025	4	83	34,537
2047	14,898	1,776	118	1,021	258	2,209	177	291	16,424	5	91	37,269
2048	15,404	1,846	120	1,041	268	2,297	172	281	17,152	5	95	38,681

Technical Due Diligence Report of NH27 (NH14) Abu road - Swaroopganj (Stretch 1)) Annexure Traffic Projections

Projected AADT (PCUs) Undavariya																					
Year	2-wheel	3-wheel	Car/Jeep	Mini LCV	Minibus	Bus	LCV-4 tyre	LCV-6 tyre	2 axle Truck	3 axle Truck	MAV	OS (6+ axle)	HCM/EME	Tr.+Trailer	Tractor	Cycle	Rickshaw	Animal Drw.	Hand Cart	Exempted V	Total
2019	2,153	408	4,179	607	86	1,485	88	755	1,337	2,816	19,341	6	107	315	23	4	2	0	0	57	33,770
2020	2,325	416	4,407	646	89	1,530	94	803	1,322	2,769	20,716	6	114	325	24	4	2	0	0	60	35,652
2021	2,511	424	4,652	688	91	1,578	100	856	1,306	2,722	22,214	6	123	334	25	4	2	0	0	63	37,700
2022	2,712	433	4,916	733	94	1,629	106	912	1,291	2,675	23,858	7	132	344	25	4	2	0	0	66	39,940
2023	2,929	442	5,189	781	97	1,680	113	971	1,266	2,610	25,585	7	141	355	26	4	2	0	0	69	42,268
2024	3,134	450	5,479	832	100	1,733	121	1,035	1,242	2,546	27,449	8	151	365	27	4	2	0	0	72	44,749
2025	3,354	458	5,781	885	103	1,787	129	1,101	1,094	2,229	26,676	8	147	375	28	5	2	0	0	75	44,237
2026	3,588	466	6,096	942	107	1,842	137	1,171	964	1,730	23,233	7	128	385	28	5	2	0	0	79	40,909
2027	3,840	474	6,423	1,001	110	1,897	145	1,245	946	1,689	24,858	7	137	396	29	5	2	0	0	82	43,287
2028	4,108	483	6,753	1,061	113	1,952	154	1,320	923	1,639	26,522	8	146	407	30	5	2	0	0	86	45,712
2029	4,355	491	7,095	1,123	116	2,008	163	1,398	900	1,591	28,273	8	156	418	31	5	2	0	0	89	48,222
2030	4,616	498	7,449	1,189	120	2,065	173	1,479	878	1,546	30,114	9	166	429	32	5	2	0	0	93	50,861
2031	4,893	506	7,816	1,257	123	2,122	183	1,564	858	1,502	32,047	9	177	440	32	5	2	0	0	97	53,632
2032	5,187	514	8,195	1,329	126	2,180	193	1,653	837	1,460	34,074	10	188	451	33	5	2	0	0	100	56,538
2033	5,498	523	8,575	1,401	130	2,237	203	1,742	813	1,411	36,134	10	199	463	34	5	2	0	0	104	59,485
2034	5,773	530	8,967	1,475	133	2,295	214	1,835	790	1,365	38,286	11	211	474	35	5	2	0	0	108	62,510
2035	6,061	537	9,371	1,553	136	2,353	225	1,932	768	1,321	40,532	12	224	486	36	5	2	0	0	112	65,665
2036	6,364	545	9,786	1,633	140	2,412	237	2,032	747	1,278	42,874	12	237	497	37	5	2	0	0	116	68,954
2037	6,683	553	10,213	1,717	143	2,472	249	2,135	726	1,238	45,313	13	250	509	37	5	2	0	0	120	72,379
2038	7,017	560	10,652	1,803	147	2,532	262	2,243	707	1,200	47,850	14	264	521	38	5	2	0	0	124	75,940
2039	7,298	567	11,089	1,889	150	2,590	274	2,350	685	1,158	50,407	15	278	533	39	5	2	0	0	128	79,456
2040	7,589	574	11,536	1,978	153	2,649	287	2,461	663	1,117	53,057	15	293	545	40	5	2	0	0	132	83,097
2041	7,893	581	11,994	2,070	157	2,708	300	2,575	643	1,079	55,801	16	308	556	41	5	2	0	0	136	86,864
2042	8,209	588	12,462	2,164	160	2,768	314	2,692	624	1,043	58,638	17	324	569	42	5	2	0	0	140	90,758
2043	8,537	595	12,939	2,261	164	2,828	328	2,812	605	1,008	61,568	18	340	581	43	5	2	0	0	144	94,778
2044	8,793	601	13,427	2,360	167	2,888	343	2,936	588	975	64,592	19	356	593	44	5	2	0	0	147	98,836
2045	9,057	607	13,909	2,459	171	2,946	357	3,059	568	940	67,614	20	373	605	44	5	2	0	0	151	102,887
2046	9,329	613	14,399	2,561	174	3,005	372	3,185	550	906	70,720	21	390	617	45	5	2	0	0	155	107,048
2047	9,609	619	14,898	2,664	177	3,064	387	3,314	532	874	73,910	21	408	629	46	5	2	0	0	159	111,318
2048	9,897	625	15,404	2,770	181	3,123	402	3,445	516	844	77,182	22	426	642	47	5	2	0	0	163	115,694

Projected AADT Tollable (PCUs) Undavariya												
Year	Car/Jeep	Mini LCV	Minibus	Bus	LCV-4 tyre	LCV-6 tyre	2 axle Truck	3 axle Truck	MAV	OS (6+ axle)	HCM/EME	Total
2019	4,179	607	86	1,485	88	755	1,337	2,816	19,341	6	107	30,808
2020	4,407	646	89	1,530	94	803	1,322	2,769	20,716	6	114	32,496
2021	4,652	688	91	1,578	100	856	1,306	2,722	22,214	6	123	34,336
2022	4,916	733	94	1,629	106	912	1,291	2,675	23,858	7	132	36,353
2023	5,189	781	97	1,680	113	971	1,266	2,610	25,585	7	141	38,441
2024	5,479	832	100	1,733	121	1,035	1,242	2,546	27,449	8	151	40,695
2025	5,781	885	103	1,787	129	1,101	1,094	2,229	26,676	8	147	39,941
2026	6,096	942	107	1,842	137	1,171	964	1,730	23,233	7	128	36,355
2027	6,423	1,001	110	1,897	145	1,245	946	1,689	24,858	7	137	38,459
2028	6,753	1,061	113	1,952	154	1,320	923	1,639	26,522	8	146	40,591
2029	7,095	1,123	116	2,008	163	1,398	900	1,591	28,273	8	156	42,832
2030	7,449	1,189	120	2,065	173	1,479	878	1,546	30,114	9	166	45,187
2031	7,816	1,257	123	2,122	183	1,564	858	1,502	32,047	9	177	47,657
2032	8,195	1,329	126	2,180	193	1,653	837	1,460	34,074	10	188	50,245
2033	8,575	1,401	130	2,237	203	1,742	813	1,411	36,134	10	199	52,856
2034	8,967	1,475	133	2,295	214	1,835	790	1,365	38,286	11	211	55,583
2035	9,371	1,553	136	2,353	225	1,932	768	1,321	40,532	12	224	58,426
2036	9,786	1,633	140	2,412	237	2,032	747	1,278	42,874	12	237	61,389
2037	10,213	1,717	143	2,472	249	2,135	726	1,238	45,313	13	250	64,470
2038	10,652	1,803	147	2,532	262	2,243	707	1,200	47,850	14	264	67,673
2039	11,089	1,889	150	2,590	274	2,350	685	1,158	50,407	15	278	70,884
2040	11,536	1,978	153	2,649	287	2,461	663	1,117	53,057	15	293	74,210
2041	11,994	2,070	157	2,708	300	2,575	643	1,079	55,801	16	308	77,650
2042	12,462	2,164	160	2,768	314	2,692	624	1,043	58,638	17	324	81,204
2043	12,939	2,261	164	2,828	328	2,812	605	1,008	61,568	18	340	84,872
2044	13,427	2,360	167	2,888	343	2,936	588	975	64,592	19	356	88,651
2045	13,909	2,459	171	2,946	357	3,059	568	940	67,614	20	373	92,416
2047	14,898	2,664	177	3,064	387	3,314	532	874	73,910	21	408	100,249
2048	15,404	2,770	181	3,123	402	3,445	516	844	77,182	22	426	104,314