

Tender No. NHIT/FY2026-27/RFE/Bridge Repair & Rehabilitation

Request for Empanelment ("RFE") issued by National Highways Infra Trust (NHIT) for Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT.

BID SUMMARY		
(i)	Last date and time for receipt of Bidding Documents	02 November 2026 up to 17:00 Hour.
(ii)	Date and Time of Opening of Technical Bids	02 November 2026 at 17:30 Hour.
(iii)	Place of Opening of Bids	Unit No.: 324, 3rd Floor, D21 - Corporate Park, Sector 21, Dwarka-110077, New Delhi.

Note: - Bids will be opened in the presence of bidders who choose to attend as above.

National Highways Infra Trust

Unit No.: 324, 3rd Floor, D21 - Corporate Park,
Sector-21, Dwarka -110077, Delhi
Email: tender@nhit.co.in
Date: 23-10-2026

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DISCLAIMER

The information contained in this Request for Empanelment ("RFE") or subsequently provided to Bidder(s), whether verbally or in documentary or any other form by or on behalf of "SPVs under NHIT" by persons authorized to do so, is provided to the interested parties on the terms and conditions set out in this RFE and such other terms and conditions subject to which such information is provided.

This RFE is not an agreement and is neither an offer nor an invitation by NHIT to interested parties who submit their quote (henceforth "Bidders") in response to this RFE. The purpose of this RFE is to provide Bidders with information that may be useful to them in preparing and submitting their Proposals (**"Proposal"**) for **Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT.**

NHIT makes no representation or warranty and shall have no liability to any person or Bidder under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this RFE or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the RFE and any assessment, assumption, statement or information contained herein or deemed to form part of this RFE or arising in any way from this process.

A Bidder must warrant that all the information provided by it to NHIT at the time of application & subsequently, is true to the best of its knowledge and belief and specially warrants that it has duly complied with the provisions of laws applicable to it. Bidder indemnifies NHIT from any liabilities arising out of error or default or negligence or contravention in regard to any of the applicable laws, including, but not limited to, submission of statutory forms & other such documents.

The issue of this RFE does not imply that NHIT is bound to select any Bidder(s) for any project/work/ services / transaction. NHIT may accept or reject any Empanelment in its discretion and may ask for any additional information or vary its requirements, add to or amend the terms, procedure and protocol set out in RFE for bona fide reasons, which will be notified to all the Bidders invited to tender. Further NHIT hereby reserves the right to annul the process at any time prior to issuance of Letter of Award/Empanelment/Work Order without incurring any liability towards the Bidders.

The Bidders shall bear all costs associated with or relating to the preparation and submission of its Empanelment including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by NHIT, or any other costs incurred regarding or relating to its Bid. All such costs and expenses will remain with the Bidder and NHIT shall not be liable in any manner for the same or for any other costs or expenses incurred by a Bidders in preparation or submission of the Bid, regardless of the conduct or outcome of this RFE and the related processes.

SECTION 1. NOTICE INVITING TENDER

- 1.1 NHIT invites Bids from eligible parties for Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT.
- 1.2 Agency/Firm will be empanelled after technically qualifying criteria as mentioned under section 4 as described in this RFE and in accordance with the practices of NHIT.
- 1.3 The RFE includes the following documents:

Section 1	– Notice Inviting Tender
Section 2	– Instructions to Bidders
Section 3	– Scope of Works
Section 4	– Form of Technical Proposal
Section 5	– Undertaking
Annexure I	– List of Project Sites

1.4 Brief Description of Bidding Process

- 1.4.1 NHIT has adopted single stage evaluation process for selection of the Bidder(s) for award of the work: the Bid by the Bidders shall be submitted in physical form in the prescribed format (To clarify, the documents should be serially numbered and hard/spiral bound) in the manner and before the date and time specified herein.
 - 1.4.2 After the submission of bids, each of the Bidders may be invited to make a presentation (if required) of their proposal to "NHIT". The date and time of presentations would be intimated to Bidders separately by email. The Presentation shall be made through either video-conferencing facility or in person meeting at "NHIT" office.
 - 1.4.3 Only those Bidders whose Bids are found to be responsive and meeting the Minimum Eligibility Criteria (hereinafter referred to as Qualified Bidders) in terms of this RFE, shall be eligible to be empanelled vendor. The bidders may send their authorized representatives along with an authorization letter on the letter head of the bidder for participation in the opening of the bid. The date and time of opening of Bids of such Bidders, will be intimated to them separately by NHIT through email or uploaded on NHIT website (<https://nhit.co.in/procurement-tender/>). The Bids will be opened physically at the location provided in this document. Only one representative of the Bidder shall be allowed to attend the opening of the Bids.
 - 1.4.4 The proposal of each bidder shall be opened and evaluated
- 1.5 Any queries or requests for additional information concerning the RFE shall be submitted in writing and/or e-mail to the officer designated below. The envelope / email communication shall clearly bear the following identification/title: "Queries/ Request for Additional Information: **Request for Empanelment ("RFE") issued by NHIT for Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT**

1.6 Address for Communication:

Shri Sandeep Khosa – GM(Procurement),
NHIT Western Projects Private Limited, SPV under NHIT
Unit No.: 324, 3rd Floor, D21 – Corporate Park,
Sector-21, Dwarka, Delhi – 110077.
E mail: tender@nhit.co.in

1.7 Schedule of Bidding Process:

The NHIT shall endeavour to adhere to the following schedule: Any changes to the following schedule shall be informed to the Bidders through Website or email communication.

S. No.	Description of Events	Timeline
1.	Name of Assignment	Request for Empanelment ("RFE") issued by National Highways Infra Trust (NHIT) for Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT
2.	Date of issue of RFE	23 October 2026
3.	Last date for receiving queries from bidders	27 October 2026
4.	Pre-Bid Queries	No pre-bid meeting. The bidders must submit their queries through email at tender@nhit.co.in which will be replied at NHIT website / through email.
5.	NHIT's response to queries latest by	29 October 2026
6.	Bid due date (Last date for bid submission)	02 November 2026 up to 17:00 Hour
7.	Opening of Technical Bids	02 November 2026 at 17:30 Hour Corporate Office: Unit No.: 324, 3rd Floor, D21 - Corporate Park, Sector-21, Dwarka, New Delhi-110077

SECTION 2 – INSTRUCTIONS TO BIDDERS

2.1 Introduction

About the company: Please refer to our website www.nhit.co.in

2.2 Empanelment

National Highways Infra Trust (NHIT) on behalf of SPVs under NHIT seeks Proposals for empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT as per scope of work given in Section 3 – Scope of Work of the RFE document.

2.3 Clarification and Amendment of RFE Documents

- 2.3.1 Bidders may request clarifications on any of the RFE documents up to the time mentioned in Section 1. Any request for clarification must be sent in writing NHIT address indicated in the RFE or by e-mail to tender@nhit.co.in NHIT will respond in writing, or by e-mail/ uploading responses on website or will send written copies of the response (including an explanation of the query but without identifying the source of inquiry) to all Bidders. Should NHIT deem it necessary to amend the RFE as a result of clarification, it shall do so following the established procedure and inform the Bidders of the same through written communication or by uploading it on the website of NHIT.
- 2.3.2 At any time before the submission of the Bids, NHIT shall have the right to amend the RFE by issuing an addendum/ amendment in writing or by standard electronic means. The addendum/ amendment shall be uploaded to the website of www.nhit.co.in which will be binding on all Bidders. To give Bidders reasonable time for considering the addendum/ amendment in their Bids, NHIT may, if the addendum/ amendment is substantial, at its discretion, extend the deadline for the submission of Bids.
- 2.3.3 It will be the responsibility of the Bidders to keep track of any uploaded addendum/ amendment before submission of the Bid.

2.4 Submission of Empanelment

The Empanelment shall be submitted as indicated below:

- 2.4.1 Sealed Envelope containing the Proposal of the Bidder. The proposal should be in the manner and format as prescribed in RFE Section 4 – Form of Technical Bid. Please note that proposals with any conditionality will be summarily rejected.
- 2.4.2 Your proposal (i.e. the aforesaid sealed envelopes marked as “Bid – Proposal **“Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT”**” should reach the undersigned, latest by date/time mentioned in the Section 1 – Notice inviting Tender, in hard copies/in original and shall remain valid for 120 days thereafter. The proposal should be signed by the authorized signatory of your entity. No proposal will be entertained after the due time and date, as stated above. NHIT shall not be responsible for any delay whatsoever in nature. The proposals received after the due time and date will be summarily rejected.
- 2.4.3 NHIT reserves the right to accept or reject any or all the offers received without assigning any reason. For any clarification, you may feel free to contact the undersigned.

2.5 Modification/Substitution/Withdrawal of Bids

- 2.5.1 The Bidder may substitute or withdraw its bid after submission prior to the Bid due date. No Bid shall be allowed to be substituted or withdrawn by the Bidder on or after the Bid due date.
- 2.5.2 Any alteration/modification in the Bid or additional information supplied subsequent to the Bid Due Date, unless the same has been expressly sought for by NHIT, shall be disregarded.

- 2.5.3 Partial modification of the Bid is not allowed. The Bidder will have to submit the revised bid again in a sealed envelope, as per Clause 2.4 above, mentioning "Revised Bid" on the top of the sealed envelope and the original bid envelope will be returned to the Bidder. No Bid may be modified after the Bid Due Date. Withdrawal or modification of Bids between the Bid Due Date and Expiration of Bid validity shall result in disqualification from the bidding process.

2.6 Opening and Evaluation of the Bids

- 2.6.1 The Bids will be opened after the due date at the time prescribed in the RFE document in the presence of the Bidders who choose to attend. NHIT will subsequently examine and evaluate the Bids in accordance with the provisions set out.
- 2.6.2 After the submission of technical bids, each of the Bidders shall be invited for making presentation (If required) of their proposal to NHIT. The date and time of presentations would be intimated to Bidders separately by NHIT through email. The Presentation shall be made either through video-conferencing facility or in person meeting at NHIT office.
- 2.6.3 Prior to evaluation of the Bids, the NHIT shall determine whether each Bid is responsive to the requirements of this RFE.
- 2.6.4 The Bid of prima-facie non-responsive Bidders shall not be evaluated.
- 2.6.5 To assist in the examination, evaluation, and comparison of Bids, NHIT may, at its discretion, ask any Bidder for clarification of its Bid. The request for clarification and the response shall be in writing or by email, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by NHIT in the evaluation of the Bids.
- 2.6.6 The Bidders would be evaluated on the criteria mentioned in Section 4 of this RFE and shortlisted for the purpose of empanelment.
- 2.6.7 Except in case any clarification is asked by NHIT, no Bidder shall contact NHIT on any matter relating to its Bid from the time of the Bid opening to the time the contract is awarded. If any Bidder wishes to bring additional information to the notice of NHIT, it should do so in writing at the address prescribed in the Notice Inviting Tender.

2.7 Prior to evaluation of the Bids, the NHIT shall determine whether each Bid is responsive to the requirements of this RFE document. A Bid will be declared non-responsive in case:

- 2.7.1 If a Bidder submits more than one Bid against this RFE.
- 2.7.2 The physical bid submissions are incomplete/ inadequate to the requirements of the RFE Documents.
- 2.7.3 Documents are submitted loose. (To clarify, the documents should be serially numbered or to be submitted in bounded form).
- 2.7.4 If in case the Power of Attorney or the Authority Letter is not provided.
- 2.7.5 If a Bidder submits a conditional Bid or makes changes to the terms and conditions given in this RFE document.
- 2.7.6 Failure to comply with all the requirements of RFE document by a Bidder.
- 2.7.7 If the Bid is not submitted in the formats prescribed in the RFE document.
- 2.7.8 If any requisite document/ certificate is not in the prescribed format the same shall not be considered while evaluating the bids and the same may lead to Bid being declared as non- responsive.
- 2.7.9 If the envelope containing physical submission is not sealed and marked as prescribed in the RFE document.
- 2.7.10 A Bid valid for a period of time shorter than prescribed in the RFE document.

2.8 Conflict of Interest:

- 2.8.1 Bidders at all times shall provide professional, objective, and impartial advice and at all times hold the NHIT Entities interest paramount, strictly avoid conflicts with other assignments or their own corporate interests and act without any consideration for future work. No two Bidders can have the same constituents or any such arrangement pursuant to which any third party is in a position to have access to confidential information of each other.

2.8.2 NDA clause to be signed between NHIT and the Agency/firm post release of the LOE, if required by NHIT.

2.9 Fraud and Corruption:

- 2.9.1 Bidders would be required to observe the highest standard of ethics during the selection and execution of such work. NHIT defines:
 - 2.9.1.1 "Corrupt practice" means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official in the selection process or in contract execution; and
 - 2.9.1.2 "Fraudulent practice" means a misrepresentation of facts in order to influence a selection process or the execution of a contract to the detriment of the NHIT and includes collusive practices among bidders (prior to or after submission of proposals) and to deprive the NHIT of the benefits of free and open competition.
- 2.9.2 NHIT will reject a proposal for Empanelment/Selection if it determines that the bidder recommended for Empanelment has engaged in corrupt or fraudulent activities in competing for the work in question.
- 2.9.3 NHIT will declare a bidder ineligible, either indefinitely or for a stated period of time, to be engaged if at any time determines that the bidder has engaged in corrupt or fraudulent practices in the bidding process for Empanelment for the subject work.
- 2.9.4 The bidder declared ineligible for corrupt and fraudulent practices by NHIT in accordance with the above paras shall not be eligible for selection.

2.10 Consortium of Bidders is not allowed

To be clarified, Bidder must be a single entity (natural person or a private entity), and not a group of entities (the "Joint Venture") coming together to implement the project. Bids from Joint ventures consortium, combination or any sort of arrangement between two or more than two entities, including Sub-Contracting, are not permitted.

2.11 Empanelment Period

NHIT proposes to empanel Agencies/firms for a period of 2 Year. The Empanelment may be further extended for a period of 1 Year by NHIT/SPVs under NHIT subject to satisfactory delivery of services by Agency/firm and approval from Competent Authority.

2.12 Termination

Upon finding deficiencies in quality of service/works, NHIT will notify the Agency/firm for rectification. Agency/firm will be given 7 days for rectification in deficiencies in case of nonresponse beyond 10 days, Termination notice may be issued with 10 days of notice.

2.13 Minimum Eligibility Criteria of Qualified Bidders

Eligibility Criteria To be considered for selection by the NHIT, the bidders should meet the following criteria:

- 2.13.1 The Bidder should be having minimum 05 years' experience in Rehabilitation and Repair works on National/State Highways Projects, Proof of the same shall be attached with bidding documents.
- 2.13.2 The Bidder should have completed minimum 03 Projects in undertaking structural strengthening of piers/Girders/Pedestals using Jacketing/Carbon fibre wrapping Or Experience and Capability in Advanced Upgradation Technologies for Modification of Central Hinge Bearings.
- 2.13.3. The Bidder should be having minimum 05 years' Experience and Capabilities in replacement of bearings.
- 2.13.4. The Bidder/ Company should have cumulative revenue/turnover of a minimum of Rs 5 Crore during the last three financial years ending 31/03/2024, 31/03/2025 and 31/03/2026. Certified copies of Financial Statements or certificate of turnover from Statutory Auditor / Chartered Accountant of the Bidder to be submitted along with the bid.
- 2.13.5. The Bidder shall not be an associate of the Sponsor i.e., NHAI, or NHIT or IDBI Trusteeship Services Limited.

- 2.13.6. The bidder should have positive net worth as per the last three years audited financial report. – Certificate from the Statutory Auditor/ Chartered Accountant.
- 2.13.7. **Legal Entity:** The bidder should be a Legal Entity registered under the Companies Act, 2013 or the Companies Act, 1956 or a Limited Liability Partnership (LLP) registered under the LLP Act, 2008 or Indian Partnership Act 1932.
- 2.13.8. **Blacklisting:** The bidder should not be debarred/ blacklisted by any Government Agency/ NHIT/Entities of NHIT/PSU in India as on date of submission of the Bid.
- 2.13.9. **Legal:** The bidder should not be subjected to any legal action for any cause in any legal jurisdiction in the last five years which would materially affect its ability to perform under this RFE.

2.14 Tax Payment – GST Payment Clause: The bidder must have a valid GST Registration and PAN in India. In the case of payment to a GST registered supplier, GST amount as claimed in the invoices by the consultant/contractor/Agency/Firm in terms of provisions mentioned in the Contract Agreement /Purchase Order may be paid along with their invoices subject to:

- 2.14.1 The GST portion that would be released would be proportionate to the amount of work certified as due for payment.
- 2.14.2 If the GST for any previous invoice is not reflected or reflected incorrectly in GSTR-2B after the due date of filling Return under GST Act is over, then for further payments the GST portion will be withheld till the previous GST amount is reflected accurately in GSTR-2B and position to the extent as depicted above is rectified.
- 2.14.3 However, the GST portion for the final invoice will be withheld till the GST of all invoices including the final invoice are accurately reflected in the GSTR-2B.
- 2.14.4 If a consultant/contractor/Agency/Firm abandons their work before completion, the unpaid GST portion of all invoices raised by them shall be withheld until the GST portion for the said invoices are reflected accurately in GSTR-2B.

2.15 Dis-Qualification Criteria:

NHIT may at its sole discretion and at any time during the evaluation of Empanelment, disqualify any respondent, if the respondent:

- 2.15.1 Submitted the Empanelment documents after the bid due date.
- 2.15.2 Made misleading or false representations in the forms, statements and attachments submitted in proof of the eligibility requirements.
- 2.15.3 Failed to provide related clarifications, when sought.
- 2.15.4 Respondent or its directors declared ineligible, debarred by CPSU/ SPSU/ Government companies/ Government organizations/NHIT/Entities of NHIT/ regulatory authorities for corrupt and fraudulent practices or blacklisted.
- 2.15.5 Bidders who submit their bid as JV other than as provided in this document, to meet eligibility criteria will not be considered as qualified bidders. Such, JV bidder will be considered ineligible and summarily rejected.
- 2.15.6 The Bidder had any dispute with NHIT Entities or defaulted in services/works of NHIT.

2.16 Technical Evaluation Criteria:

- 2.16.1 Evaluation shall be based on the Bid submitted by the Bidders as per Section 4 – Form of Technical Proposal.
- 2.16.2 The evaluation of the Technical Proposals shall be carried out with a maximum score of 100 as per the methodology mentioned in Section 4 Form of Technical Proposal. Where Total technical score total would be computed under Section 4.
- 2.16.3 The Technical Proposal shall be submitted in physical form along with all supporting documentation/ information as mentioned along with the criteria.
- 2.16.4 The presentation need not be included in the Technical Proposal. The Presentation shall be made as per schedule communicated by NHIT and a copy of presentation to be submitted on email at the time of

presentation (if required). The Bidders would be evaluated on the criteria mentioned in Section – 4 based on their Proposals received and shortlisted for the purpose of empanelment.

2.17 Financial Proposal:

Bidders need not to include any Financial Proposal as part of their Bid, Financial Proposals will be called separately from the empanelled bidders on as and when required basis from the SPVs under NHIT in Madhya Pradesh (MP).

2.18 Procedure for Empanelment of Agency/s:

- 2.18.1 Post qualification of the minimum eligibility criteria, the bidder(s) will be selected under the Quality Based Selection method as described in this section and in accordance with the practices of NHIT.
- 2.18.2 NHIT proposed to empanel Four Agencies/Firms. NHIT reserves the right to finalize the number of Agency/Firm to be empanelled at its discretion.
- 2.18.3 Bidder who scores minimum 70 marks as per Technical Criteria mentioned in Section 4 of this RFE, will be considered Technical Qualified Bidders and will be eligible for Empanelment.
- 2.18.4 NHIT retains the authority to determine the award of projects offered to Agency/Firm.

2.19 Payment Schedule:

- 2.19.1 Payment shall be made monthly on submission of the Tax Invoice, duly approved by Project Manager.
- 2.19.2 GST for all payments would be released after submission of proof of payment of GST.

2.20 Documents to be submitted along with the Bid

- 2.20.1 Either power of attorney or an authority letter from Partner / Board / Managing Committee of the Bidder entity should be provided for authentication of the authorized signatory signing the Bid document.
- 2.20.2 Bid in the form provided in the RFE duly signed by the authorized representative of the bidder on all pages.
- 2.20.3 Detailed profile of the Bidder certified by Authorized Signatory of the Bidder.
- 2.20.4 Documents in support of the claims of Bidder regarding eligibility/ experience duly signed by the authorized representative of the bidder on all pages. NHIT may ask for 3rd party certificates from the Bidder(s), at a later stage.
- 2.20.5 Undertaking in the format provided in the RFE duly signed by the authorized representative of the bidder on all pages.
- 2.20.6 Company profile including Registration certificate, GST Certificate and MSME Certificate if applicable.
- 2.20.7 Experience Certificate self-attested along with copy of Work order/Purchase Orders.

2.21 Financial Bids / Fees

Financial bids will be called from empanelled bidders as per requirements of SPVs under NHIT in Madhya Pradesh (MP).

2.22 Key Terms and Conditions of Empanelment

NHIT reserves the right to curtail or extend the validity period of the empanelled Agency/firm.

2.23 Commencement of Supply: Within 15 days of issuance of LOA/Work Order by NHIT.

2.24 MSME Agency/Firm:

Bidder shall confirm if they are/are not registered as Micro Enterprise/ Small Enterprise/ Medium Enterprise. The registered Bidder shall submit Registration no. along with Registration Certificate issued.

The bidder shall also confirm that any change in Status of their organization under the above Act shall be duly informed by NHIT. Any failure on their part in informing them about the changed status shall be the sole responsibility of Bidder.

2.25 Safety & Work Practice:

N.A.

2.26 Indemnification:

The Agency shall hold the NHIT/SPVs under NHIT harmless and shall indemnify the same against all claims, penalties, fines, losses, damages, costs and proceedings arising from the breach or contravention of any laws, rules and regulations referred to in this order.

2.27 Anti-Bribery & Corruption (ABC) Policy:

It is our policy to conduct all our business in an honest and ethical manner. We take a zero tolerance approach to Bribery and Corruption and are committed to acting professionally, fairly and with integrity in all our business dealings and relationships wherever we operate and implementing and enforcing effective systems to counter bribery. Requested to report improper demands from the NHIT Employees. You may address the same through email at whistleblow@nhit.co.in.

2.28 Resolutions of Disputes:

Any dispute arising out of the RFE, which cannot be amicably settled between the parties, shall be referred to arbitration in accordance with the Arbitration and Conciliation Act, 1996 through a panel of three arbitrators, with each of NHIT and the remaining disputing party(s) appointing one arbitrator and the two arbitrators so appointed appointing a third arbitrator. Provided that in the event that any disputing parties fail to appoint an arbitrator within 15 days from the dispute being referred to arbitration, the other parties shall be at liberty to appoint an arbitrator for such disputing party(s) and such appointment shall be final and binding on the other disputing parties. The venue of the arbitration shall be at New Delhi.

2.29 Force Majeure

A Force Majeure (FM) means extraordinary events or circumstance beyond human control such as an event described as an act of God (like a natural calamity) or events such as a war, strike, riots, crimes (but not including negligence or wrong-doing, predictable/seasonal rain and any other events specifically excluded in the clause). In the case of a FM, the contract frees both parties (NHIT & the Agency/Firm) from contractual liability or obligation when prevented by such events from fulfilling their obligations under the contract. However, this does not excuse a party's non-performance entirely, but only suspends it for the duration of the FM. The parties have to give notice of FM as soon as it occurs, and it cannot be claimed ex-post facto. If the performance in whole or in part or any obligation under this contract is prevented or delayed by any reason of FM for a period exceeding 90 (Ninety) days, NHIT may at its option terminate the contract without any financial repercussion on the other side.

Notwithstanding the punitive provisions contained in the contract for delay or breach of contract, the Agency/Firm would not be liable for imposition of any such sanction so long as the delay and/or failure of the supplier in fulfilling its obligations under the contract is the result of an event covered in the FM clause.

2.30 Governing Law and Jurisdiction

This RFE and the subsequent agreement between the parties shall be interpreted by and shall be governed and construed in accordance with the laws of India. The Courts at New Delhi, India shall have sole jurisdiction over all matters arising out of or relating to this agreement.

2.31 Ethics & integrity:

The selected agency/firm is/are expected to maintain a high level of professional ethics and will not act in any manner, which is detrimental to NHIT's Interest.

2.32 Matter of Confidentiality:

Each agency/firm Agency/firm will maintain confidentiality on matters disclosed.

2.33 LOA/LoE/WO Acknowledgement:

After Empanelment Letter of Empanelment/LOA/WO will be issued to successful bidder. As a token of acceptance, you are requested to acknowledge the receipt of this letter with official seal & sign form the authorized signatory along with all Annexures (if any) - within 3 working days and initiate the process for the signing of the Agreement.

2.34 Right of Removal:

NHIT will have the right to remove any selected Agency/firm from the selection list without assigning any reason whatsoever and without any cost & compensation therefore NHIT also reserves the right to replace/remove/ Empanel any new agency/firm as the Agency/firm for an ongoing or future Requirements at any stage.

2.35 GENERAL TERMS AND CONDITIONS:

2.35.1 The agency/firm is solely responsible for ensuring the timely submission of their Bids at our office.

2.35.2 The agency/firm shall not sublet, subcontract, transfer or assign the package and should offer Terms with 100% Carrying Capacity.

2.35.3 The undersigned reserve the right to reject any or all bids without assigning any reason or whatsoever.

2.35.4 Bidders are advised to visit site before submission of Bids.

2.36 GENERAL INFORMATION

2.36.1 Profile of the Agency/Firm with full particulars of the constitution, ownership, and business activities of the prospective Agency/Firm shall be provided along with the Bid/Empanelment.

2.36.2 Commitment(s) which shall act either as a constraint or as a conflicting interest in the proposed assignment (if any) shall be provided along with the Bid/Empanelment.

2.36.3 The Bidder shall visit the site before submission of Bid/Proposal.

SECTION 3 – SCOPE OF WORKS

Scope of Work and Technical Specifications for Comprehensive Bridge Rehabilitation & Strengthening

This document outlines the scope of work and technical provisions for the **rehabilitation, strengthening, and upgrading of existing bridge structures** under this contract. The objective is to restore the structural integrity, durability, and serviceability of the bridges through systematic repairs, replacement of deteriorated components, and preventive measures against further deterioration.

The Contractor is expected to have conducted a detailed assessment of the site prior to bidding and shall be deemed to have acquainted themselves with the condition of the bridge components, site accessibility, traffic diversion constraints, working height limitations, and safety hazards. **No claims arising from inadequate understanding of site conditions will be entertained during execution.**

The scope of work includes, but is not limited to:

- Repair and rehabilitation of superstructure, substructure, and foundation elements.
- Replacement or maintenance of bearings and expansion joints.
- Crack repair using grouting and sealing techniques.
- Shotcreting and surface treatment of distressed concrete.
- Application of protective coatings and waterproofing systems.
- Drainage spout/downpipe repair or replacement.
- Restoration of approach slabs where applicable.

All works shall conform to **the latest revision of the MoRTH Specifications for Road and Bridge Works, relevant IRC codes** (such as IRC:SP:74 , IRC SP40 & IRC:SP:80), and sound engineering practice. All necessary labour, materials, equipment, safety arrangements, and environmental safeguards shall be arranged by the Contractor.

Each item in this document shall be read alongside the Bill of Quantities (BOQ), which includes item codes, units of measurement, and payment basis. In case of any conflict, the BoQ shall prevail for contractual interpretation, while this document will serve as the execution and quality reference.

The Contractor is responsible for completing the works with due diligence, quality assurance, safety compliance, and within the prescribed timelines to the satisfaction of the Engineer-in-Charge.

B. Road Works (Typically for Approaches / Deck Slab Overlay)

Scope of Activity

B1. Clearing and Grubbing Debris Around Structures and Vegetation

Reference Clause: MoRTH Section 201 (Clearing and Grubbing)

Scope of Work:

This item includes the clearing and grubbing of debris, vegetation, and plant growth accumulated around structures such as RE panels, retaining walls, abutments, and medians. The work involves the removal of grass, bushes, shrubs, saplings, and trees up to 300 mm girth, including root stumps, without damaging the structure or adjoining facilities. All unserviceable materials shall be disposed of in an approved manner and serviceable materials, if any, shall be stacked for reuse or auction. The entire operation shall be done considering safety, environmental, and aesthetic aspects of the corridor, strictly following Clause 201 of MoRTH Specifications and instructions of the Engineer-in-Charge.

Methodology:

1. **Site Assessment and Demarcation:**
 - Identify and mark vegetation and debris to be removed.
 - Demarcate safe zones to prevent damage to structural elements or utility lines.
2. **Vegetation Removal:**
 - Cut and uproot grass, shrubs, saplings, and trees ≤ 300 mm girth using hand tools or mechanized cutters.
 - Root removal to be done carefully to avoid disturbing structural foundations.
 - Remove any encroaching plantation or waste deposited over RE panels or near walls.
3. **Debris and Waste Removal:**
 - Collect and segregate debris for disposal or reuse.
 - Load unserviceable debris into trucks and transport to approved dump yards.
 - Stack any salvageable material as per Engineer's direction.
4. **Cleaning and Finishing:**
 - Level and compact the cleared area with manual ramming if necessary.
 - Apply herbicide or anti-vegetative chemical (if approved) to prevent regrowth.
5. **Safety Measures:**
 - Workers must wear PPE including gloves, safety boots, and reflective jackets.
 - Erect barricades and display warning signs when work is near traffic zones.
 - Dispose biodegradable and non-biodegradable waste as per local pollution control norms.

Materials:

- Hand tools (spades, sickles, crowbars)
- Mechanized bush cutters/chainsaws
- Bags for segregation of reusable waste
- PPE: gloves, boots, masks, safety vests

Indicative Equipment Involved:

- Tractor with trolley or dumper for waste transport
- Chainsaws or mechanical cutters for trees/saplings
- Herbicide spray equipment (if required)
- Manual tools for root extraction

Measurement:

- Area in square meters (Sqm) cleaned and grubbed, measured on the plan area around the structure.
- Tree/sapling removal may be measured separately in numbers (Nos) as per girth, if required.

Safety and Quality Assurance:

- Ensure minimal disturbance to adjacent infrastructure.
- Regular supervision to ensure roots are fully extracted.
- Waste disposal records to be maintained.

B. Road Works (Typically for Approaches / Deck Slab Overlay)

Scope of Activity

- Follow MoRTH Clause 201 for specifications and workmanship quality.
- Obtain clearance from Engineer-in-Charge before and after execution.

B2. Approach Slab Mud Jacking/Mud Grouting (Lifting slab/Void Filling Beneath Slab by Pressure Grouting)

Reference Clause: MoRTH Section 2800 (Repair of Structures) — Clause 2806: Grouting, and as directed by Engineer-in-Charge

Scope of Work:

This item includes all activities related to the stabilization and re-levelling of settled approach slabs of bridges or culverts by pressure grouting (mud jacking). The process involves drilling holes through the slab, injecting a controlled cementitious grout or mortar mix (or polymer-modified grout) under pressure to fill voids, restore support, and re-establish bearing beneath the slab. This method helps eliminate settlement and prevent further differential movement between the approach slab and the bridge deck.

Methodology:

1. Preliminary Inspection and Marking:

- Identify depressions, cracks, or gaps between the approach slab and adjacent pavement/structure.
- Mark the grid pattern for drilling injection holes (typically at 1.0 to 1.5 m centres or as per site condition).

2. Drilling of Injection Holes:

- Drill holes of 25–50 mm diameter through the approach slab to reach the voids beneath (depth: 0.5–1.0 m or as encountered).
- Ensure dust is cleaned from the drilled holes for effective bonding.

3. Preparation of Grout/Mortar Mix:

- Prepare a cement-sand slurry mix in 1:1 or 1:2 ratio or use PMC grout depending on the extent of void and structural requirement.
- Add non-shrink or flow-improving admixtures as required.
- Maintain grout viscosity suitable for pumping and effective filling without creating uplift.

4. Grouting Process:

- Insert grout nipples into the holes and seal them with suitable fixing compound.
- Pump the grout using mechanical/manual grouting pumps at a pressure of 3–5 kg/cm².
- Monitor the uplift or resistance during pumping. Stop when voids are filled or grout appears at adjacent holes.
- Sequentially inject grout in other holes based on set grid and monitor behaviour.

5. Finishing Works:

- Remove grout nipples after curing (if temporary).
- Seal holes with non-shrink grout or polymer-modified mortar.
- Restore surface level by proper trowelling and curing.

Materials:

- OPC Cement (IS: 269/IS: 12269)
- Clean fine sand (zone II)
- Water (potable quality)
- Non-shrink admixture (CICO NSPGC or equivalent)
- Polymer additive (e.g., Tapcrete-151 or equivalent)
- Grout nipples and sealant

B. Road Works (Typically for Approaches / Deck Slab Overlay)
Scope of Activity

Indicative Equipment:

- Rotary drill machine
- Mechanical/manual grout pump
- Grout mixing drums with stirrers
- Measuring equipment for pressure and flow
- PPE: helmets, gloves, gumboots, eye protection, safety harness (if needed)

Measurement:

- Measured in **Square Metres (Sqm)** of approach slab area treated, based on actual area covered by mud jacking treatment.
- Rate includes drilling, material, grouting, sealing, and surface restoration.

Safety & Quality Assurance:

- Ensure proper PPE is worn during drilling and grouting.
- Use barricading and caution signage during work near traffic or open drop.
- Test pump pressure and material mix before injection.
- Record pressure and volume injected per hole to ensure consistency.
- Monitor slab uplift or rebound to prevent over-lifting or cracking.

B3. Subgrade Construction with Material from Borrow Pits

The Contractor shall carry out the construction of subgrade using approved earth sourced from borrow areas in accordance with MoRTH Clause 305 and relevant IRC guidelines. The subgrade forms the bottom-most structural layer of the pavement and is crucial for supporting the overlying layers by providing adequate strength, uniform support, and proper drainage. The borrow earth shall meet the specified requirements for gradation, plasticity, and strength, and be free from organic matter or harmful substances.

Before placing the material, the formation shall be dressed, levelled, and approved by the Engineer. The earth shall be laid in layers not exceeding 250 mm (loose), uniformly spread and moisture-conditioned to within $\pm 2\%$ of the Optimum Moisture Content (OMC), and compacted to not less than 97% of Maximum Dry Density (MDD) as per IS:2720 (Part 8). Earthen shoulders, if any, shall be compacted to 95% MDD. Cross-fall, slope, and line levels shall be maintained throughout the surface to ensure proper drainage and pavement performance.

All loose, weak, or segregated areas shall be corrected by scarifying and recompacting. The finished surface shall be dense, stable, and conform to the drawings and approved levels.

Indicative equipment includes:

- Excavators for borrow pit operations
- Tippers/dumpers for material transport
- Graders/dozers for levelling and dressing
- Water tankers with sprinklers
- Vibratory rollers (8–10T) for compaction
- Field density testing equipment (core cutter/sand replacement)
- Camber boards, templates, and levels

C. Concrete Repair & Surface Rehabilitation Works

Scope of Activity

C1. Removal of damaged concrete (manual/mechanical)

The Contractor shall carry out the **systematic removal of damaged, deteriorated, or delaminated concrete** from structural elements such as girders, piers, abutments, deck slabs, or crash barriers, in accordance with **MoRTH Clause 1700 & Clause 2800** and, where applicable, **Clause 2700**. This activity is intended to restore structural integrity by ensuring that only sound concrete remains prior to repair or retrofitting measures.

The extent of damaged concrete shall be established by **visual inspection, hammer sounding, or Non-Destructive Testing (NDT)** methods such as Rebound Hammer or Ultrasonic Pulse Velocity (UPV), subject to approval by the Engineer-in-Charge. Concrete removal shall be carried out carefully, avoiding damage to adjacent sound concrete or embedded reinforcement.

Manual methods using chisels, hammers, and hand breakers shall be employed where delicate removals are needed. For larger or deeper removals, **mechanical means such as electric/pneumatic breakers or hydro-demolition** may be adopted, depending on location, accessibility, and impact on surrounding structure. Reinforcement bars, if exposed or corroded, shall be preserved intact or marked for repair as per further instructions.

The resulting surface shall be free of laitance, dust, loose particles, and shall have an irregular, rough profile suitable for bonding with repair materials. All debris generated shall be collected, transported, and **disposed of safely and legally at an approved location** as per **MoRTH Clause 112**.

Indicative equipment includes:

- **Chisels, hammers, and crowbars** for manual removal
- **Electric or pneumatic concrete breakers**
- **Hydro-demolition equipment (if required)**
- **Wire brushes and surface cleaners**
- **Dust extraction/vacuum units**
- **Waste collection bins and disposal tippers**
- **PPE kits for safety compliance**

C. Concrete Repair & Surface Rehabilitation Works

Scope of Activity

C2. Surface preparation of exposed concrete area – water jet/sand blasting

The Contractor shall carry out **surface preparation of exposed concrete areas** by means of **high-pressure water jetting or sand blasting**, as required, to ensure an adequately rough and clean surface for the application of subsequent repair materials in accordance with **MoRTH Clause 1700 & Clause 2800**. This activity is critical for achieving proper mechanical bond between the substrate and patch repair systems such as polymer-modified mortar (PMM), epoxy mortar, or micro-concreting.

All prepared surfaces must be **free from laitance, loose concrete particles, dust, grease, oil, efflorescence, old coatings, and any deleterious substances** that may inhibit bonding. Water jetting shall be done using **high-pressure pumps (typically 350–500 bar or as directed by Engineer-in-Charge)** to remove weak surface layers without damaging sound concrete. For locations requiring aggressive profiling or rust removal from embedded steel, **abrasive blasting with sand or grit** may be employed.

Post surface preparation, the Contractor shall ensure that **reinforcement bars are fully exposed and rust-free** if embedded steel is revealed, and that the **surface is maintained in Saturated Surface Dry (SSD) condition**, wherever required by the repair system manufacturer or specification.

The method of preparation shall be approved in advance and demonstrated through a **mock-up** or sample area for the satisfaction of the Engineer-in-Charge. All waste materials, water, and abrasive media shall be **collected and disposed of in an environmentally safe manner**, conforming to local environmental regulations and **MoRTH Clause 112**.

Indicative equipment includes:

- **High-pressure water jetting machine (350–500 bar)**
- **Air compressor with sand blasting gun and grit/sand media**
- **Surface vacuum or blowers for cleaning**
- **Buckets, hand brushes, and SSD maintenance tools**
- **Protective screens, PPEs, and environmental safety enclosures**

C. Concrete Repair & Surface Rehabilitation Works

Scope of Activity

C3. Repair of damage concrete surface using Polymer Modified Mortar (PMM MORTAR) up to 50mm thickness

The Contractor shall carry out **patch repair works using Polymer Modified Mortar (PMM)** at all locations where damaged, honeycombed, spalled, or delaminated concrete has been removed, as per the direction of the Engineer-in-Charge and in accordance with **MoRTH Clause 1700 & Clause 2800**. The objective is to reinstate the structural integrity, geometry, and surface finish of concrete members by replacing deteriorated sections with a durable, bonded repair material.

Prior to application, the substrate shall be thoroughly **cleaned and prepared** using high-pressure water jetting or sand blasting (as described in Item C2), ensuring a **roughened and dust-free surface**. The **corroded reinforcement bars shall be cleaned**, treated with approved anti-corrosive coating (refer Item D2), and any **additional rebars shall be fixed** as per approved structural drawings.

Polymer Modified Mortar shall consist of **cement, graded sand, water, and polymer additive** in proportions recommended by the manufacturer and approved by the Engineer. The PMM shall be **mixed mechanically** using slow-speed mixers to achieve a homogenous and workable mix. The repair shall be placed manually or with trowels in layers, maintaining good compaction, proper bonding, and profile matching. For large areas or deeper patches, **formwork and layering** shall be adopted as per good repair practices.

The **final surface shall be finished smooth or textured** as required, and the repair shall be **cured using curing compounds or moist curing methods**, maintaining continuous curing for at least 7 days or as specified by the product manufacturer.

Indicative equipment includes:

- **Mechanical chisel or breaker for concrete removal**
- **Low-speed mortar mixer (with paddle attachment)**
- **Trowels and finishing tools**
- **High-pressure water jet / sand blaster**
- **Hand tools for mortar application and profiling**
- **Measuring scales and gauges for depth and finish monitoring**

C. Concrete Repair & Surface Rehabilitation Works

Scope of Activity

C4. Repair using Epoxy mortar

The Contractor shall undertake **epoxy mortar repair works** for restoring localized spalled, cracked, or honeycombed concrete sections, particularly in structural zones where high bond strength and chemical resistance are essential. All works shall be executed in strict compliance with **MoRTH Clause 1700 & Clause 2800** and as directed by the Engineer-in-Charge, using pre-approved materials conforming to relevant standards and technical specifications.

The **damaged concrete shall be removed** by mechanical means (using breakers, chisels, or saw cutting) to expose sound concrete with well-defined edges and sufficient depth for effective anchorage. All **loose particles, laitance, oil, or contaminants** shall be removed using **compressed air**, high-pressure water jet, or **abrasive blasting techniques** to achieve a clean, slightly roughened surface for superior bonding.

Exposed reinforcement shall be **cleaned of corrosion**, treated with approved anti-corrosion protective coating, and supplemented with new rebars where required (refer Items D1 to D3). The **epoxy mortar** shall consist of a **two- or three-component system** made of epoxy resin, hardener, and properly graded fillers, mixed in specified ratios using **slow-speed mixers** until a uniform consistency is achieved.

The prepared epoxy mortar shall be **placed manually or with trowels**, compacted into place, and finished to match the adjoining profile. Care shall be taken to ensure that the **substrate is dry and at a permissible temperature range** as recommended by the manufacturer to prevent curing issues. The mortar shall be allowed to cure as per manufacturer's specifications, ensuring **no disturbance, water ingress, or vibration during setting time**.

Indicative equipment includes:

- **Electric or pneumatic breakers and chisels**
- **Low-speed drill-type epoxy mortar mixers**
- **Hand trowels and finishing tools**
- **Compressed air blowers or vacuum cleaners**
- **Surface temperature and moisture meters**
- **Protective gear and epoxy-safe applicators**

C. Concrete Repair & Surface Rehabilitation Works

Scope of Activity

C5. Micro-concreting (flowable repair concrete)

The Contractor shall execute **micro-concreting works** to restore damaged or deficient structural concrete sections, particularly where conventional placement is impractical or inadequate. This activity shall conform to the provisions of **MoRTH Clause 1700 & Clause 2800**, with all operations executed using only approved, high-performance flowable micro-concrete materials having requisite compressive strength, flowability, shrinkage-compensation, and bond characteristics.

The **damaged concrete shall first be removed** to a pre-defined depth and boundary using manual/mechanical tools to expose sound concrete. The substrate shall then be **cleaned of dust, debris, grease, or laitance** using pressurized air/water jet and suitably prepared for receiving micro-concrete. Any exposed reinforcement shall be cleaned, treated with anti-corrosive coating, and augmented if necessary.

Formwork shall be designed to be **leakproof, stable, and rigid** to retain the flowable mix without deformation. A **bond coat or epoxy primer** shall be applied to vertical and soffit surfaces if specified by the product manufacturer. The **micro-concrete mix**, either ready-to-use or site-batched using non-metallic aggregates and cementitious grout additives, shall be prepared as per the product datasheet and placed by **gravity flow or pumping**, ensuring complete filling of voids and crevices. Vibrators shall not be used.

The surface shall be **finished flush with adjacent concrete**, and protected from premature drying, vibration, or impact. Curing shall be carried out using **approved curing compounds** or wet hessian cloths for the specified duration to ensure crack-free setting and strength gain.

Indicative equipment includes:

- **Chipping hammers and electric breakers**
- **Air/water jet cleaning system**
- **Mortar mixers or paddle mixers (low speed)**
- **Leakproof formwork with injection ports (if required)**
- **Gravity or pressure-based pumping system**
- **Measuring gauges and flow cone apparatus**
- **Curing compound sprayers**

C. Concrete Repair & Surface Rehabilitation Works

Scope of Activity

C6. Surface crack filling (Epoxy/PMM)

The Contractor shall carry out **surface crack treatment works** involving identification, cleaning, and sealing of visible surface cracks using **Epoxy Resin** or **Polymer Modified Mortar (PMM)** depending on the structural nature of cracks and as directed by the Engineer-in-Charge. All materials, procedures, and quality control shall be strictly in line with **MoRTH Clause 1700 & Clause 2800** and relevant manufacturer specifications.

The work shall commence with the **visual inspection and mapping** of all surface cracks to classify them as either **structural or non-structural**, and to determine the crack width and depth. **Hairline cracks (<0.5 mm)** shall typically be treated using **low-viscosity epoxy resin**, while **wider surface cracks (>0.5 mm)** or surface irregularities may be repaired using suitably formulated **PMM paste**.

All cracks shall be cleaned thoroughly using **compressed air**, wire brush, or vacuum to remove dust, loose particles, oil, or any contaminants. For epoxy injection, **V-grooves** may be cut along the crack path to improve anchorage where directed. The selected repair compound shall be **injected, brushed, or trowel-applied** depending on the system adopted. Epoxy resin shall be mixed in correct proportions and applied within its pot life.

In the case of PMM application, the surface shall be kept SSD (Saturated Surface Dry) before applying the PMM paste in layers not exceeding the specified thickness. The finished surface shall be **feather-edged with the parent concrete** and left undisturbed during the setting period. Proper **curing or sealing** shall be done as per product recommendation.

Indicative equipment includes:

- **Air compressor or vacuum blower**
- **Crack width measuring gauge**
- **Epoxy injection gun (manual or electric)**
- **Hand tools for trowelling PMM**
- **Surface preparation tools (wire brush, grinder, etc.)**
- **Mixing paddle for epoxy/PMM**

D. Rebar Treatment & Steel Repair

Scope of Activity

D1. Removal of corroded steel & rust cleaning

The **Contractor** shall execute the removal of **corroded steel** and **rust cleaning** as part of the structural repair work. This operation shall be carried out with the objective of preparing the steel reinforcement for the application of protective coatings, epoxy bonding agents, or other corrosion inhibitors. The removal of corroded steel and rust shall be conducted in accordance with **MoRTH Clause 1600, Clause 1700 & Clause 2800** and the technical specifications provided by the manufacturer of the repair materials.

The **steel surface preparation** shall be done by **mechanical cleaning methods** such as **abrasive blasting, wire brushing, or grinding**, as necessary, to completely remove rust, loose particles, and corrosion. The surface shall be free from all traces of dirt, oil, grease, or any other contaminants before applying any corrosion protection treatment.

In case of heavy corrosion, **abrasive blasting** using **sandblasting equipment** may be employed to achieve the desired surface cleanliness and roughness. The **minimum level of cleaning** required shall meet the **SSPC-SP6** (Commercial Blast Cleaning) standard or as specified by the Engineer-in-Charge.

Once the corrosion has been removed, the **exposed steel reinforcement** shall be thoroughly examined to identify any pitting or significant damage. In case of excessive damage, **steel replacement** or **augmentation** may be required. The cleaned steel reinforcement shall then be coated with an **anti-corrosive primer** or **zinc-rich epoxy coating** to protect it from future corrosion.

Indicative equipment includes:

- **Abrasive blasting machine (sandblasting)**
- **Wire brush**
- **Angle grinder**
- **Handheld power tools for rust removal**
- **Vacuum cleaner or air compressor** for dust and debris removal
- **Coating applicators (spray guns, brushes, etc.)**

D. Rebar Treatment & Steel Repair

Scope of Activity

D2. Anti-corrosive coating for rebars (Zinc-rich, etc.)

The **Contractor** shall apply an **anti-corrosive coating** to the **exposed steel reinforcement** to prevent further corrosion and ensure the longevity of the structural repair. The coating shall be **zinc-rich, epoxy-based**, or as specified by the Engineer-in-Charge and shall comply with the requirements stipulated in **MoRTH Clause 1600, Clause 1700 & Clause 2800**.

The surface preparation, as detailed in **D1**, must be completed before the application of the anti-corrosive coating. After the surface preparation and cleaning, the exposed steel shall be **treated with a protective coating**. The coating material must be formulated to provide an **effective barrier** against **moisture, oxygen, and other corrosive agents** that may lead to further degradation of the steel reinforcement.

The **zinc-rich epoxy coating** shall be applied in accordance with the manufacturer's instructions. Typically, it consists of a **two-component system** (primer and finish coat). The primer shall contain a high percentage of zinc, which acts as a sacrificial anode to protect the underlying steel, while the topcoat provides the necessary **mechanical protection** and **adhesion**.

The **dry film thickness (DFT)** of the coating must be verified after application, ensuring that it meets the required specifications and is free of defects such as **pinholes** or **bubbles**. The **minimum DFT** typically ranges from **80 to 120 microns**, depending on the type of coating material specified. Coating thickness shall be measured using **non-destructive testing equipment** such as a **wet film thickness gauge** or **dry film thickness gauge**.

The **contractor** must ensure that the coating is applied under suitable environmental conditions, i.e., temperature and humidity, in accordance with the manufacturer's recommendations. The application shall be carried out using either **spraying, brush application, or roller application**, depending on accessibility and surface configuration.

The **cured anti-corrosive coating** shall provide continuous protection to the rebars and prevent any future corrosion in the reinforced concrete element. Any damage to the coating during construction or after installation must be repaired immediately to maintain the integrity of the protection system.

Indicative equipment includes:

- **Airless spray machine** for coating application
- **Brushes and rollers**
- **Wet film thickness gauge**
- **Protective PPE (Personal Protective Equipment)**
- **Zinc-rich epoxy-based primer and topcoat**
- **Dust control systems (vacuum, air compressor)**

D. Rebar Treatment & Steel Repair

Scope of Activity

D3. Fixing new rebars / anchorage with epoxy grout

The **Contractor** shall fix **new rebars** or **anchorage** using **epoxy grout** as per the project requirements and **MoRTH Clause 1600, Clause 1700 & Clause 2800**. This is typically carried out when additional or replacement steel reinforcement is required in structural repair works. The epoxy grout serves as a bonding agent to secure the rebars in place, ensuring the **structural integrity** and **load transfer** between the existing and new reinforcement.

Before starting the installation of the new rebars or anchorage, the **existing concrete surface** must be **prepared** by cleaning the substrate to remove all **dust, dirt, oil, grease, and other contaminants** that could interfere with the bonding process. Surface preparation shall be carried out using methods such as **abrasive blasting** or **water jetting**, ensuring a **clean, rough surface** to improve bonding.

The **epoxy grout** shall be mixed in strict accordance with the manufacturer's instructions, ensuring the proper ratio of resin and hardener. The **grout** shall be applied using **appropriate tools** and techniques, ensuring thorough penetration and uniform distribution around the rebars or anchorage points. Special attention should be paid to areas where the rebars or anchorage meet the **concrete surface** to avoid air pockets or voids, which may compromise the structural integrity.

Once the **epoxy grout** is applied and the new rebars are in position, they must be kept in place until the **grout has fully cured**. The curing time for the epoxy grout shall be in accordance with the manufacturer's guidelines, but typically it should not be less than **24 to 48 hours** before any loading or stress is applied.

The **Contractor** shall ensure that the **epoxy grout** used is of high quality, **compatible with the type of concrete**, and **suitable for the environmental conditions** (e.g., humidity, temperature). The **epoxy grout** should have high **bond strength, impact resistance**, and be resistant to **chemical attack**, ensuring the longevity of the reinforcement system.

The **Contractor** must also verify the **alignment and positioning of the new rebars** and **ensure proper coverage** of the grout around the rebars. The **finished surface** must be **smooth** and free from defects such as **cracking** or **voids**, which could compromise the bond between the grout and the surrounding concrete.

Indicative equipment includes:

- **Epoxy grout mixing equipment** (e.g., paddle mixer)
- **Injection pumps** (for filling grout into anchorages)
- **Rebar bender and cutter**
- **Drilling machines** (for drilling holes for the new rebars)
- **Surface preparation tools** (abrasive blasters, wire brushes, etc.)
- **Measuring and alignment tools** (laser levels, spirit levels)
- **Protective PPE (Personal Protective Equipment)**

D. Rebar Treatment & Steel Repair

Scope of Activity

D4. Rebar augmentation / replacement

The **Contractor** shall carry out the **augmentation or replacement of rebars** as per the **design requirements** and **MoRTH Clause 1600, Clause 1700 & Clause 2800**. Rebar augmentation or replacement is typically required in cases where the existing reinforcement has been **damaged, corroded, or insufficient** for the desired load-carrying capacity of the structure. This procedure is essential for **restoring the structural integrity** of the affected part of the structure and ensuring it meets the **required strength** as per the design specifications.

The **Contractor** shall first conduct a **detailed inspection** of the damaged area to assess the **extent of rebar damage** and determine the **quantity of replacement reinforcement** required. The **existing concrete** shall be **removed** to expose the damaged or insufficient rebars, using **mechanical methods** such as **concrete cutting or grinding**, ensuring that the remaining concrete surface is not compromised.

Once the damaged area is cleared, the **new reinforcement** shall be installed in accordance with the **approved design**. The **new rebars** shall be properly **aligned, positioned, and secured** to the surrounding structure. The **Contractor** shall ensure that the replacement rebars match the size and grade specified in the design and that they provide adequate **cover** as per the relevant **design codes**.

If the new rebars are **longer than the existing ones**, the Contractor shall **splice or anchor** them properly using **mechanical couplers or epoxy grout** as necessary to ensure a **continuous bond** with the existing reinforcement. All splicing and anchoring shall be carried out in accordance with **IRC: 112 and MoRTH specifications**, ensuring no compromise on the load-carrying capacity.

Once the new rebars are in place, they shall be properly **tied, secured, and supported** using **wire ties, clamps, or other appropriate methods** to prevent **displacement** during subsequent concrete placement. The **Contractor** shall ensure that there is no **overlapping of reinforcement** in critical load-carrying zones unless explicitly permitted by the design.

After the **rebar installation**, the **Contractor** shall proceed with **concrete pouring** around the new reinforcement, ensuring that the newly placed concrete adheres to the specified **mix design and compaction requirements**. The **new concrete** shall be **cured** properly, and the **Contractor** shall verify the **quality of the bonding** between the new and old concrete.

Indicative equipment includes:

- **Concrete cutters / diamond saws**
- **Rebar bender and cutter**
- **Mechanical couplers** (if splicing is required)
- **Epoxy injection equipment** (for rebar anchorage)
- **Rebar tying tools**
- **Concrete mixers** (if new concrete is required)
- **Vibrators** (for compaction of newly placed concrete)
- **Surface preparation tools** (grinders, abrasive blasters)
- **Protective PPE** (Personal Protective Equipment)

E. Injection Grouting Works

Scope of Activity

E1. Providing and Inserting Steel Pipe NRV Nipples for Pressure Injection Grouting

Reference Clause: MoRTH Section 2800 (Structural Concrete Repairs), IS 9103 (Concrete Admixtures), and as per manufacturer's specification for epoxy/PMC grouting

Scope of Work:

This item involves supplying, drilling, fixing, and subsequently removing/sealing steel pipe NRV nipples of 12 mm diameter into structural concrete or similar substrates to facilitate pressure injection grouting using PMC or Epoxy materials. The holes shall be drilled in the range of 16 to 25 mm diameter to a depth between 50 mm and 150 mm at 300 mm c/c (or as directed). NRV Nipples are to be inserted securely with approved fixing compound ensuring a leak-tight fit for injection grouting. After grouting is completed and material has set, NRV nipples shall be cut/removed and holes sealed flush with epoxy mortar or approved sealing compound as directed by the Engineer-in-Charge.

Methodology:

1. **Surface Preparation and Marking:**
 - Identify and mark locations for insertion of nipples as per grouting plan and spacing.
 - Clean surface of dust, oil, loose materials to ensure proper bonding.
2. **Drilling of Holes:**
 - Drill holes of 16–25 mm diameter, 50–150 mm deep, at 300 mm c/c (or as required).
 - Ensure no reinforcement bars are damaged during drilling.
3. **Insertion of Nipples:**
 - Insert 12 mm steel pipe nipples into drilled holes using an approved fixing compound.
 - Ensure tight fitting to prevent leakage during injection.
 - Let the compound cure as per manufacturer's recommendation.
4. **Grouting:**
 - Perform injection grouting using PMC/Epoxy material under pressure through the nipples.
 - Grout until refusal or until flow is seen from adjacent ports, indicating saturation.
5. **Post-Grouting Removal and Sealing:**
 - After curing of grout, carefully cut/remove nipples flush with surface.
 - Seal all holes with epoxy mortar or compatible sealing material as instructed.

Materials:

- 12 mm dia steel pipe NRV nipples (cut to required length)
- Fixing compound: Approved chemical anchoring adhesive or epoxy putty
- Grout: PMC or epoxy injection compound as per specification
- Sealing compound for post-grouting closure
- Water or solvent for surface cleaning

Indicative Equipment Involved:

- Rotary hammer drills or core drills with depth control
- Air compressor or electric grouting machine with pressure gauge
- Grout mixing tools
- Hand tools for insertion and cutting of nipples
- PPE for chemical handling

Measurement:

- Measured in Number of nipples (Nos) inserted, used, and sealed as per actual executed quantity.

E. Injection Grouting Works

Scope of Activity

Safety and Quality Assurance:

- Use of safety gloves, goggles, and chemical-resistant PPE mandatory.
- Ensure proper ventilation when working with epoxy or PMC materials.
- Verify anchorage of each nipple and perform test injection where required.
- Ensure no voids or leakage during injection – check using flow monitoring.
- Holes must be sealed flush to avoid trip hazards or water ingress after grouting.

E2. Low-pressure cementitious grouting

The **Contractor** shall carry out **low-pressure cementitious grouting** for the repair and sealing of cracks, voids, and other structural defects in concrete as per the **MoRTH Clause 1700 & Clause 2800** and the relevant **IRC specifications**. Low-pressure cementitious grouting is typically used in **non-structural repairs** and for **sealing active water leaks in concrete structures**. It involves the injection of a **cement-based grout** under **low pressure** to **fill voids, cracks, or honeycombing** in concrete.

Prior to the application of grout, the **Contractor** shall thoroughly inspect the damaged or cracked areas. **Surface preparation** shall include **cleaning** the cracks or voids using **compressed air** or **water** to remove any loose debris, dust, or contaminants. In cases where the cracks are dry, the **Contractor** shall pre-wet the crack area to ensure better grout penetration.

The **grouting system** shall be prepared using a **cementitious grout mix**, formulated with **water, cement**, and suitable **additives** to ensure optimal **flowability** and **adhesion**. The grout mix shall be designed to meet the specific requirements for **crack filling, waterproofing, and structural repair** as per the relevant **MoRTH specifications**.

The **grouting procedure** involves injecting the grout into the **cracks or voids** under **low pressure**, ensuring that it fills all gaps effectively without causing damage to the surrounding structure. The **Contractor** shall monitor the **pressure levels** during the injection process to avoid over-pressurization, which could lead to further structural damage. The grout shall be injected using appropriate equipment, such as **injection pumps** or **manual pumps**, depending on the size and location of the cracks.

Once the grouting is completed, the **Contractor** shall **seal the injection ports** and allow the grout to **cure** fully. Any excess grout on the surface of the concrete shall be **removed** and the surface shall be **smoothed** as required. If the grouting is intended for **waterproofing**, the **Contractor** shall perform **water testing** after the grout has set to verify the effectiveness of the seal.

Indicative equipment includes:

- **Injection pumps** (manual or powered)
- **Grouting equipment** (piping, injectors)
- **Cementitious grout mix preparation units**
- **Compressor or air-blower**
- **Surface preparation tools** (abrasive grinders, wire brushes)
- **Water or air pressure testing devices**
- **Protective PPE** (gloves, safety glasses, etc.)

E3. Providing and Injecting Polymer Cement Grouting (PMC Grout)

E. Injection Grouting Works

Scope of Activity

Reference Clause: MoRTH Section 2806 (Polymer Modified Cementitious Grouting), IS 1343 (Prestressed Concrete – relevant for pressure grouting), IS 9103 (Concrete Admixtures)

Scope of Work:

This item involves preparing and injecting Polymer Cement Grout (PMC) composed of cement blended with 10% polymer by weight (such as Tapcrete-151 or its equivalent) and a non-shrink admixture (0.5%–1% by weight of cement, such as Cico NSPGC or equivalent), into pre-identified cracks, voids, or honeycombed zones in structural elements. The injection shall be done at a minimum pressure of 4 kg/sq.cm using approved grouting equipment as per the Engineer-in-Charge's direction. The work shall conform to MoRTH Clause 2806 to ensure monolithic structural restoration and durability.

Methodology:

1. **Surface & Crack Preparation:**
 - Clean the surface to expose cracks and voids clearly.
 - Seal all cracks except for the injection ports using epoxy paste to avoid leakage during grouting.
2. **Hole Drilling and NRV Nipple Fixing (if not pre-fixed):**
 - Drill holes to access voids where required.
 - Fix nipples or injection ports using suitable fixing compound.
3. **Grout Mixing:**
 - Mix Ordinary Portland Cement (OPC) with 10% polymer (by weight of cement), and add 0.5% to 1% non-shrink compound.
 - Use clean potable water. Maintain Water-Cement ratio as per material supplier's specification for desired flowability and strength.
 - Mix uniformly using a mechanical agitator to avoid lumps and air entrapment.
4. **Grouting Procedure:**
 - Inject the prepared PMC grout using a pump capable of maintaining a steady pressure of minimum 4 kg/sq.cm.
 - Inject progressively until grout refusal or until it flows from adjacent ports, indicating saturation.
 - Plug outlet ports as injection proceeds.
5. **Post-Grouting:**
 - Allow curing of the grout for the prescribed time.
 - Cut/remove nipples and seal ports flush using epoxy mortar or compatible filler.
 - Maintain curing as per standard protocol.

Materials:

- OPC (43 or 53 grade)
- Polymer Additive: Tapcrete-151 or equivalent (10% by weight of cement)
- Non-shrink Admixture: Cico NSPGC or equivalent (0.5–1% by weight of cement)
- Clean potable water
- Sealing compound for surface crack closing
- Compatible epoxy or sealing compound for post-grouting closure

Indicative Equipment Involved:

- Grout mixer with mechanical stirrer
- Grout injection pump with minimum 4 kg/sq.cm pressure rating
- Pressure gauge, injection pipes, and NRV nipples
- PPE including gloves, safety goggles, face mask
- Surface preparation tools (wire brush, chisel, grinder)

E. Injection Grouting Works

Scope of Activity

Measurement:

- Measured in **litres (Ltr)** of polymer cement grout injected based on the actual quantity consumed in the work.

Safety and Quality Assurance:

- PPE use mandatory for workers handling chemical admixtures and pressurised injection.
- Trial mix to be conducted before start to confirm flow, setting time, and stability.
- Maintain records of pressure, volume, and location for each injection point.
- Work must comply with MoRTH Clause 2806, ensuring no leakage, good bond, and restoration of monolithicity.

E4. Epoxy injection grouting (for structural cracks)

The **Contractor** shall carry out **epoxy injection grouting** for the **repair of structural cracks** in concrete structures as per **MoRTH Clause 1700 & Clause 2800** and **IRC guidelines**. Epoxy grouting is a highly effective method for **restoring structural integrity** in **load-bearing concrete elements** by **filling cracks, voids, and honeycombing** caused by shrinkage, settlement, or structural stresses.

Before applying the **epoxy grout**, the **Contractor** shall thoroughly assess the extent of the **structural damage** and **prepare the cracks** or voids. Surface preparation involves **cleaning** the cracks with **compressed air** or **water**, ensuring the removal of dust, debris, grease, or any foreign material that could affect the bond strength. In case of wet cracks, the **Contractor** shall ensure the area is **dried** or pre-treated to enhance the epoxy adhesion.

The **epoxy grout** mix shall be prepared in accordance with the manufacturer's guidelines and shall be a two-component system consisting of **epoxy resin** and **hardener**. The mixture shall be designed for **high bonding strength, low viscosity, and high durability** to effectively fill the structural cracks and resist both **physical and chemical stresses**. The **Contractor** shall ensure that the grout mix is **free from air pockets** and is mixed to the **correct ratio** to achieve the desired properties.

The **epoxy injection** shall be performed under **high pressure** to force the epoxy grout into the cracks. The grout shall be injected through pre-drilled injection ports located at **strategic points** along the crack line. The **Contractor** shall ensure that the **pressure** used during injection is **controlled** to avoid damaging the surrounding concrete structure. **Pressure gauges** and **flow meters** shall be used to monitor and regulate the **injection process**.

After the epoxy grout has been injected, the **Contractor** shall seal the injection ports and allow the epoxy to **cure** as per the manufacturer's recommendations. Curing shall typically take **12 to 48 hours** depending on the ambient temperature and humidity. Once cured, the **Contractor** shall **clean** the surface and remove any excess epoxy that might have seeped out of the cracks.

The **Contractor** shall conduct a **structural integrity test** to verify that the crack has been successfully sealed, and the strength of the repaired area meets the specified requirements. If required, the **Contractor** shall carry out additional **load testing** to ensure the **restoration of load-carrying capacity**.

Indicative equipment includes:

- Injection pumps** (manual or powered)
- Epoxy resin and hardener mixing units**
- Injection ports and valves**

E. Injection Grouting Works Scope of Activity
• Pressure gauges and flow meters • Injection nozzles and tubing • Surface preparation tools (abrasive tools, wire brushes) • Protective PPE (gloves, safety glasses, respiratory protection)
<u>E5. PU injection grouting (non-structural/waterproofing)</u> The Contractor shall carry out Polyurethane (PU) injection grouting as a non-structural repair method primarily aimed at waterproofing and sealing cracks, voids, and gaps within the concrete structures. The PU grouting process is highly effective for hydraulic sealing applications, especially in foundations, basements, tunnels, and other areas where water penetration needs to be controlled or eliminated. The Contractor shall adhere to MoRTH Clause 1700 & Clause 2800 and relevant IRC guidelines for executing this work. Before starting the PU grouting process, the Contractor shall carefully assess the cracks, joints, or voids to be treated. Surface preparation involves cleaning the cracks or gaps from any dust, debris, or foreign matter, using compressed air, water jetting, or any other approved method. Any active water flow within the cracks must be stopped, and the Contractor shall ensure that the area is dried before proceeding with the application. The PU grout shall consist of a single-component or two-component system, depending on the type of grout used. The Contractor shall ensure the selected PU grout is designed for waterproofing purposes and is compatible with the structure's intended use and environmental conditions. The grout should possess low viscosity to penetrate deeply into the cracks and expand upon contact with water, forming a flexible and durable seal. The Contractor shall drill injection ports at the crack or void's most strategic locations, ensuring effective injection of the PU grout. The injection process will involve low-pressure injection to ensure that the grout thoroughly fills the cracks and voids. The Contractor shall regulate the injection pressure carefully to avoid damaging the surrounding concrete and ensure complete filling of all voids. Upon injection, the PU grout will react with the moisture present in the crack, causing it to expand and cure, effectively sealing the area and preventing future water ingress. After the grout has cured, the Contractor shall remove any residual excess grout from the surface and ensure that the area is restored to its original condition. Once the curing process is completed, the Contractor shall inspect the work and conduct necessary tests to ensure the area is properly sealed and that no further water penetration occurs. The Contractor shall carry out a visual inspection and may also use water tests to confirm the effectiveness of the waterproofing treatment. Indicative equipment includes: • Injection pumps (manual or powered) • PU resin and hardener mixing units • Injection ports and nozzles • Pressure gauges • PPE (gloves, safety glasses, respirators) • Surface preparation tools (abrasive tools, wire brushes) • Waterproofing testing kits (if required)
<u>E6. Microfine/chemical grouting</u>

E. Injection Grouting Works Scope of Activity

The **Contractor** shall carry out **Microfine Grouting** or **Chemical Grouting** for sealing **cracks, voids, or injections** in **concrete structures** where **high penetration** and **waterproofing** are required. This method is particularly effective in structures like **foundations, dams, tunnels, and water treatment plants**. The **Contractor** shall ensure compliance with **MoRTH Clause 1700 & Clause 2800** and **IRC guidelines** for the execution of this work.

Microfine grouting involves the injection of **finely micronized cementitious materials** mixed with water and specific **chemical additives** to penetrate minute cracks and voids in the concrete. The **chemical grouting** uses materials that react chemically with the surrounding water or moisture in the substrate to form a **gel-like substance**, which effectively fills the voids and **seals** any leaks or cracks.

Before commencing work, the **Contractor** shall conduct a **site survey** to assess the **extent of damage** and the nature of the cracks or voids. The **Contractor** shall then carry out **surface preparation**, including **cleaning** the cracks, voids, and surrounding areas of any debris, dirt, oils, or contaminants, using **high-pressure air** or **water** to ensure that the grouting material adheres properly.

Microfine grout consists of **micronized cement** combined with **chemical accelerators** to ensure quick setting and **low viscosity** for deep penetration. The **Contractor** shall mix the grout materials strictly as per the manufacturer's recommendations to achieve the required **consistency** and **performance** standards.

The **grouting process** begins with the installation of **injection ports** at strategic points along the cracks or voids. The **Contractor** shall use **low-pressure injection pumps** to inject the grouting material into the cracks. The **Contractor** must ensure that the grout completely fills all voids and cracks while **avoiding excessive pressure** that could damage the surrounding concrete or structures.

Once injected, the **Microfine grout** will **penetrate deeply** into the cracks, and upon curing, it will bond with the concrete to **seal** and **reinforce** the structure. The **Contractor** shall monitor the curing process and ensure that the grout sets properly, forming a **permanent seal** that prevents water infiltration.

The **Contractor** shall perform necessary **post-application checks**, including **water leakage tests** and **visual inspections**, to ensure the success of the grouting and confirm that no further leaks or cracks remain in the treated areas.

Indicative equipment includes:

- **Grouting pumps (manual or powered)**
- **Microfine cementitious grout**
- **Chemical additives (accelerators, retarders)**
- **Injection nozzles and ports**
- **Pressure gauges**
- **High-pressure air or water cleaning equipment**
- **Surface preparation tools** (wire brushes, grinders)
- **Waterproofing testing kits** (if required)

F. Structural Strengthening Measures

Scope of Activity

F1. Jacketing of beams/columns/Piers with concrete

The **Contractor** shall carry out **jacketing of beams, columns and piers with concrete** as part of the structural strengthening and rehabilitation works. This process is aimed at restoring the **strength, ductility, and serviceability** of deteriorated or damaged structural elements, ensuring they meet the required **load-carrying capacity**. The work shall be executed in strict accordance with **MoRTH Clause 1700 & Clause 2800** and relevant **IRC guidelines**.

Jacketing involves the application of a **reinforced concrete layer** around an existing beam or column to **increase its strength** and **enhance its structural performance**. The **Contractor** shall first carry out an **assessment** of the existing structure to identify the degree of damage, reinforcement corrosion, and areas requiring strengthening.

The work shall begin with **surface preparation**, where the **Contractor** will **remove** any damaged or loose concrete, expose the **reinforcement bars** (rebars), and **clean** them thoroughly using wire brushes, sandblasting, or high-pressure water jets. All **corroded rebars** shall be cleaned of rust and any debris. If necessary, the rebars shall be treated with **anti-corrosive coatings** (such as **zinc-rich paints** or **epoxy coatings**) as per **MoRTH specifications**.

After surface preparation, the **Contractor** shall install **additional reinforcement** in the form of **rebars**, which may include **vertical stirrups, longitudinal bars, and spirals**, ensuring adequate spacing and anchorage in accordance with design specifications. The **reinforcement details** shall conform to the **IS 3370** (Concrete Structures) and **IRC SP: 84** for **reinforced concrete work**.

Once the reinforcement is in place, the **Contractor** shall **mix the concrete** in the required proportions, typically using **Grade M30 or higher** concrete, and shall place it around the reinforcement to form the **jacketing layer**. The **concrete mix** shall be designed to provide **adequate durability** and **strength** in line with the structural design requirements. The use of **self-compacting concrete (SCC)** or **high-strength concrete** may be considered, depending on the specifications and the conditions of the structure.

The **concrete placement** shall be done carefully, avoiding any air pockets or voids. The **Contractor** shall ensure proper **compaction** through **vibrators** or **manual tamping** to ensure that the concrete fully envelopes the reinforcement and forms a strong bond with the existing substrate.

After placing the concrete, the **Contractor** shall **cure** the jacketing using **curing compounds** or **water curing** methods as prescribed in **MoRTH Clause 2800** to ensure that the concrete achieves its designed strength and durability. The curing process shall be maintained for a minimum of **7 days** or as specified in the design documents.

The **Contractor** shall then conduct a thorough **inspection** of the completed jacketing work, ensuring that the concrete is properly bonded, there are no visible cracks, and that the structural performance is as expected. Any defects in the jacketing layer shall be rectified before proceeding further.

Indicative equipment includes:

- **Concrete mixers (manual or powered)**
- **Vibration equipment for compaction (needle vibrators, internal vibrators)**
- **Rebar bending and cutting machines**
- **Concrete placement tools (shovels, rakes)**

F. Structural Strengthening Measures

Scope of Activity

- **Water curing equipment (if applicable)**
- **Anti-corrosive coating materials**
- **Surface preparation tools (wire brushes, sandblasting equipment)**
- **Curing compounds or water sprayers**

F2. Carbon Fibre Reinforced Polymer (CFRP) wrapping

The work includes the strengthening of structural elements using **Carbon Fibre Reinforced Polymer (CFRP) wrapping** as per the guidelines outlined in **IS 1343:2012** (Code of Practice for Prestressed Concrete) or **ACI 440.2R-17** (Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures). The scope involves surface preparation, application of CFRP sheets, and ensuring proper bonding of the system with the existing structure. The wrapping shall be installed as per the manufacturer's recommendations and in strict compliance with the relevant design calculations and specifications.

Materials:

The CFRP material shall be of the highest quality, conforming to **IS 1343:2012**, and shall be designed for structural strengthening in accordance with the **ACI 440.2R-17** guidelines. The material must be certified for structural applications and meet the standards for tensile strength, durability, and moisture resistance.

Methodology:

1. **Surface Preparation:** The surface of the concrete to be strengthened shall be cleaned, free from dirt, dust, oil, or any other contaminants that could hinder the bond between the CFRP and the substrate. Surface preparation may include grinding or sandblasting as required.
2. **Application of CFRP Sheets:** The CFRP sheets shall be carefully applied using a polymer matrix adhesive to bond the sheets to the concrete. The application must be carried out by trained personnel, and the correct amount of resin must be applied to ensure proper bonding.
3. **Curing and Final Inspection:** After application, the system must be allowed to cure fully according to the manufacturer's specifications. Final inspection shall be done to ensure proper alignment and bonding, and any defects shall be corrected before final approval.

Testing and Quality Assurance:

The CFRP wrapping system must be tested in accordance with the **ASTM D3039** standards for tensile properties. Inspection and testing shall be conducted on-site to confirm the proper installation and bonding strength of the CFRP material.

Safety Requirements:

Proper safety measures should be followed during the installation of CFRP, including the use of personal protective equipment (PPE) such as gloves, goggles, and respirators to prevent any exposure to harmful chemicals or dust.

Indicative Equipment Includes:

- **Surface Preparation Equipment:**
 - **Handheld power grinders or diamond grinders** – for grinding and smoothing the surface to ensure proper bonding of CFRP sheets.
 - **Sandblasting machines** – to prepare the concrete surface by removing contaminants and roughening it for better adhesion.
- **Application Equipment:**
 - **Resin mixing machines** – to mix the polymer matrix adhesive in the required proportions.

F. Structural Strengthening Measures

Scope of Activity

- **Brushes/rollers** – for applying the resin to the surface.
- **CFRP lamination tools** – for accurately laying down and adhering the CFRP sheets.
- **Resin pumps** – for applying epoxy-based adhesives for the CFRP.
- **Curing and Monitoring Equipment:**
 - **Moisture content monitoring devices** – to monitor the curing process and ensure proper bonding of the CFRP materials.
 - **Infrared thermometers** – for checking the temperature during the curing process.

Note:

The contractor is expected to provide all necessary equipment for the proper execution of the work, as indicated above. The equipment should be in good working condition, and all activities shall be performed in compliance with the relevant safety standards.

F3. External steel plate bonding

The work involves strengthening the structural elements by bonding **external steel plates** (also referred to as "external steel plate bonding") to the concrete surfaces. This technique is used to enhance the load-carrying capacity of beams, columns, slabs, and other structural members where additional strength is required. The bonding shall be done in accordance with the guidelines of **IS 1343:2012** (Code of Practice for Prestressed Concrete), **ACI 318** (Building Code Requirements for Structural Concrete), and the **ACI 440.2R-17** (Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures), along with relevant industry standards for steel-to-concrete bonding.

The scope includes the following tasks:

1. Surface preparation of the concrete elements to ensure adequate bonding between the steel plate and the concrete.
2. Cleaning and surface preparation of the steel plates.
3. Application of adhesive materials to bond the steel plate to the concrete structure.
4. Proper alignment, positioning, and clamping of the steel plates during the bonding process.
5. Final inspection to ensure the integrity of the bonded system.

Materials:

- **Steel Plates:** The steel plates used for bonding shall be of high-strength, corrosion-resistant steel, such as **Fe 415** or **Fe 500** grade. The thickness and size of the steel plate will be as per the design requirements.
- **Adhesives:** The adhesive materials shall be epoxy-based structural adhesives that are specifically designed for bonding steel to concrete. These adhesives must comply with **IS 9103** for construction chemical products, ensuring durability and strength under varying environmental conditions.
- **Surface Preparation Materials:** These include grinding tools, sandblasting equipment, and primers as required for the preparation of the concrete and steel surfaces to facilitate a strong bond.

Methodology:

1. **Surface Preparation:**
 - a. **Concrete Surface:** The concrete surface shall be cleaned and roughened to ensure proper bonding of the adhesive. All contaminants, dust, oil, and loose particles must be removed by sandblasting or mechanical means to expose a sound surface for bonding.
 - b. **Steel Surface:** The steel plate shall be cleaned, free from rust, oil, or any other contaminants. Grinding or sandblasting should be used to prepare the steel surface for better adhesion.
2. **Application of Adhesive:**

The prepared surfaces of both the steel plate and the concrete shall be coated with the epoxy-based adhesive. The adhesive shall be applied using a trowel, brush, or spray method, ensuring uniform

F. Structural Strengthening Measures

Scope of Activity

thickness.

3. **Positioning and Clamping:**

The steel plate should be accurately aligned with the concrete surface and then clamped to ensure continuous contact during the curing period. Proper alignment is essential to prevent any shifting or misplacement of the steel plate, which could affect the structural performance.

4. **Curing:**

After placement and clamping, the adhesive shall be allowed to cure as per the manufacturer's instructions. Curing time should be strictly adhered to ensure that the bonding achieves the desired strength. The contractor must monitor the curing process to ensure that the adhesive has properly set before subjecting the structure to any loads.

5. **Final Inspection:**

Once the adhesive has cured, the bonded steel plate shall be visually inspected for proper placement, alignment, and secure adhesion. Non-destructive testing (such as ultrasonic testing) may be required to check the integrity of the bond.

Testing and Quality Assurance:

- Bond integrity and adhesion strength shall be tested as per the guidelines in **IS 9103** and other relevant standards.
- Non-destructive testing methods such as ultrasonic testing or pull-off testing may be employed to ensure the effectiveness of the bond between the steel plate and the concrete.

Safety Requirements:

- The contractor shall adhere to all safety guidelines for the handling and application of epoxy-based adhesives, including the use of personal protective equipment (PPE) such as gloves, safety goggles, and respiratory protection.
- Proper ventilation should be maintained while applying adhesives to avoid inhalation of fumes.

Indicative Equipment Includes:

- **Surface Preparation Equipment:**
 - **Power grinders or sandblasting machines** – for cleaning and roughening the concrete surface.
 - **Steel grinders or wire brushes** – to remove rust and contaminants from the steel plate surface.
- **Application Equipment:**
 - **Trowels, brushes, or rollers** – for spreading the adhesive on both the steel plate and concrete surface.
 - **Glue dispensing machines** – for precise application of adhesive.
- **Clamping and Positioning Equipment:**
 - **Steel clamps or hydraulic presses** – to ensure proper bonding and alignment of the steel plate with the concrete surface during curing.
 - **Alignment jigs** – for precise positioning of the steel plates.
- **Curing Equipment:**
 - **Infrared thermometers** – to monitor temperature during the curing process to ensure optimal adhesive bonding.

Note:

The contractor is responsible for ensuring that all equipment is in proper working condition. The contractor should also provide the required technical manpower to perform the work according to the specifications and within the defined time frame.

F. Structural Strengthening Measures

Scope of Activity

F4. Steel jacketing / confinement

Scope of Work:

Steel jacketing or confinement involves wrapping or encasing structural members such as beams, columns, and walls with steel plates or sections to enhance the structural capacity and protect them from further deterioration. This technique is primarily used to restore the load-bearing capacity of structural elements in cases where concrete deterioration, corrosion, or other factors have led to a reduction in strength. Steel jacketing is commonly employed for the repair and strengthening of columns, beams, or structural members as per the **IRC:SP:80** (Guidelines for Strengthening of Concrete Structures) and **IS 3370** (Code of Practice for Concrete Structures for the Storage of Liquids).

The work involves the following tasks:

1. **Surface preparation** of the concrete member to ensure the proper adhesion of steel plates or jackets.
2. **Cutting, shaping, and installation** of steel plates or structural steel sections to cover the concrete member.
3. **Welding, bolting, or riveting** of the steel plates to ensure a secure and permanent installation.
4. **Surface finishing** to ensure proper sealing and prevention of moisture ingress.

Materials:

- **Steel Plates / Sections:**

Steel plates or structural steel sections (angles, channels, I-beams, etc.) used for jacketing should conform to **IS 2062** (Hot Rolled Medium and High Tensile Structural Steel). The steel should have a minimum yield strength of **250 MPa** for mild steel or **415 MPa** for high-strength steel, as per the design requirements.

- **Welding and Fastening Materials:**

- **Weldable steel electrodes** conforming to **IS 814** (Specification for Covered Electrodes for Manual Metal Arc Welding).
- **Bolts, nuts, and washers** should conform to **IS 1367** for high-strength fasteners.

- **Surface Preparation Materials:**

Surface preparation shall be done using sandblasting, wire brushing, or mechanical means to remove all dirt, oil, grease, and corrosion from the concrete and steel surfaces.

- **Epoxy-based Adhesive (if applicable):**

For bonding steel plates to concrete, an epoxy-based adhesive, conforming to **IS 9103**, shall be used. The adhesive should be suitable for the specific environment and ensure long-term bonding.

Methodology:

1. **Surface Preparation:**

- **Concrete Surface:** The surface of the concrete member shall be cleaned to remove dirt, debris, oils, and any other contaminants using abrasive blasting or other suitable methods. Any exposed reinforcement shall be cleaned of rust, and the surface should be roughened to promote adhesion.
- **Steel Surface:** The steel plates or sections shall be cleaned by sandblasting or wire brushing to remove mill scale, rust, oil, and dirt. The surface should be prepared to ensure a smooth bonding between the steel and the concrete.

2. **Steel Plate / Section Installation:**

- The steel plates or sections shall be carefully measured, cut, and shaped to the size and dimensions as per the design drawings.
- These plates shall be aligned with the concrete member and secured using welding, bolting, or riveting, as required. The joints between steel plates shall be tightly fitted to avoid any gaps that

F. Structural Strengthening Measures

Scope of Activity

could weaken the bond.

3. **Welding / Bolting:**

- **Welding:** The steel plates shall be welded using appropriate welding methods. All welds should comply with **IS 816** (Code of Practice for Use of Structural Steel in Overhead Line Towers) and **IS 9595** (Code of Practice for Arc Welding of Structural Steel). Welds should be free from cracks, undercuts, or any discontinuities.
- **Bolting:** If bolted connections are used, the bolts should be high-strength, corrosion-resistant bolts, and fastened in accordance with **IS 1367**. The bolted connections should be designed to ensure that the steel jacket remains securely in place under service loads.

4. **Sealing and Finishing:**

- Once the steel plates are installed and secured, the joints between plates shall be sealed with appropriate **epoxy sealants** to prevent water ingress.
- The finished steel jacket shall be coated with a corrosion-resistant primer or paint to enhance durability, especially if the structure is exposed to aggressive environmental conditions. The coating material should conform to **IS 1477** (Code of Practice for Painting of Ferrous Metals) and should be applied in multiple coats for long-lasting protection.

5. **Inspection and Testing:**

- The bonded steel jacket shall be inspected for proper alignment, secure fastening, and correct placement. Non-destructive testing methods such as ultrasonic testing or magnetic particle testing may be employed to ensure the integrity of the welds or bolted connections.
- A visual inspection shall be conducted to check for any visible defects or improper installation of the steel jacket.

Testing and Quality Assurance:

- All welds shall be tested as per **IS 816** to ensure their strength and durability.
- If bolted connections are used, torque testing should be conducted on the bolts to ensure that they are tightened to the required specifications.
- A visual and ultrasonic inspection of the steel jacket shall be conducted to confirm the integrity and completeness of the work.

Safety Requirements:

- Adequate safety measures shall be adopted while handling heavy steel plates and during the welding or bolting process. The contractor shall ensure that the workers are trained and equipped with the necessary personal protective equipment (PPE) such as welding helmets, gloves, and safety boots.
- The use of proper lifting equipment such as cranes, hoists, or mechanical lifts is mandatory for handling large steel plates or structural sections.

Indicative Equipment Includes:

- **Surface Preparation Equipment:**
 - **Sandblasting machines** or **grinders** for cleaning concrete and steel surfaces.
 - **Wire brushes** for cleaning rust and contaminants from steel surfaces.
- **Welding Equipment:**
 - **Arc welding machines** for welding the steel plates to the concrete surface.
 - **Welding electrodes** conforming to **IS 814**.
- **Cutting Equipment:**
 - **Plasma cutters** or **cutting torches** for cutting steel plates to the required size.
 - **Angle grinders** for edge finishing and preparation of steel plates.
- **Lifting Equipment:**

F. Structural Strengthening Measures

Scope of Activity

- **Cranes, hoists, or winches** for lifting and positioning heavy steel plates or sections.
- **Hydraulic jacks** for precise positioning of large steel sections.
- **Bolting and Fastening Equipment:**
 - **Torque wrenches** for tightening bolts to the specified torque.
 - **Riveting tools** (if applicable) for fastening steel sections together.
- **Safety Equipment:**
 - **Personal Protective Equipment (PPE):** Welding helmets, gloves, face shields, and fire-resistant clothing for workers.
 - **Lifting slings** and **chains** for safe handling of heavy steel components.

Note:

The contractor is responsible for ensuring that all equipment used is in proper working condition and complies with the safety standards. The contractor shall also ensure that all personnel are adequately trained to handle the equipment and perform the work as per the required quality standards.

Relevant MoRTH / IRC Specifications:

- **MoRTH Specification:** IRC SP: 74 – Guidelines for Repair and Rehabilitation of Concrete Bridges (This standard includes provisions for the application of steel jacketing for bridge structures).
- **IS 800:2007** – Code of Practice for General Construction in Steel: Provides guidelines for the design and construction of steel structures, including steel jacketing techniques.
- **IS 15988:2013** – Guidelines for Seismic Evaluation and Strengthening of Existing Reinforced Concrete Buildings: Offers guidance on strengthening techniques, including steel jacketing, for structures subjected to seismic forces.
- **IS 456:2000** – Code of Practice for Plain and Reinforced Concrete: Outlines the design and application of jacketing for reinforced concrete elements.
- **ACI 440.2R-17** – Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures: Provides complementary guidance on strengthening concrete structures, including the use of steel jacketing.

F5. Providing and Fixing MS Lining Plate for Steel Plate Jacketing

Reference Clauses: MoRTH Section 2600 (if applicable), IRC: SP:37, IRC:112, and IS:2062 for MS Plates

Work Type: Structural Strengthening / Rehabilitation of Bridge Piers, Columns, or Beams

Scope of Work:

This item involves the supply, fabrication, and fixing of Mild Steel (MS) lining plates as part of **steel plate jacketing** for strengthening deteriorated or deficient structural members such as bridge piers, columns, or beams. The MS plates shall be fabricated as per the approved design and drawing, conforming to IS:2062 Grade-B or higher. The work includes surface preparation, fitting, tack welding, fillet welding, bolt fixing (if specified), and corrosion protection of the plates after installation.

Methodology:

1. **Surface Preparation of Existing Structure:**
 - Remove any deteriorated concrete, rust, paint, or loose particles from the surface of the pier/column using sandblasting, wire brushing, or mechanical grinding.
 - Clean the surface thoroughly and level it where uneven.
 - Ensure the surface is dry and free of oil, dust, or grease.

F. Structural Strengthening Measures

Scope of Activity

2. **Fabrication of MS Plates:**
 - Cut the MS plates as per the approved structural design to match the profile of the member to be jacketed.
 - Drill holes or prepare slots if bolted connections are included.
 - Ensure all edges are properly chamfered and burr-free.
3. **Fitting and Fixing of MS Plates:**
 - Position the MS plates around the member and temporarily fix them using clamps or tack welds.
 - Use appropriate lifting equipment where necessary.
 - Ensure correct alignment and flush joints between plates.
4. **Welding and Fastening:**
 - Perform full fillet welding or stitch welding along all joints, vertical and horizontal, as per design.
 - Where bolts are specified, use high-strength bolts and apply epoxy mortar or grout around them.
 - Provide adequate ventilation and fire protection during welding work.
5. **Injection Grouting (if required):**
 - In case of gaps between the jacket and existing concrete, inject non-shrink grout or polymer-modified mortar to fill the void.
 - Ensure complete filling without air pockets using pressure grouting.
6. **Corrosion Protection:**
 - After welding and grinding, clean the entire surface of the MS plates.
 - Apply **primer coat** of zinc-rich epoxy and **two coats of epoxy-based paint** or equivalent anti-corrosive coating as approved by the Engineer.
 - Paint should be applied as per manufacturer's recommendations and only under suitable weather conditions.

Materials:

- MS Plates (IS:2062 Grade B or better)
- High-strength bolts/nuts/washers (if used)
- Epoxy grout / non-shrink grout (if grouting is required)
- Zinc-rich primer and epoxy paint for corrosion protection
- Welding rods conforming to IS:814 (E6013 or as specified)

Indicative Equipment Involved:

- Welding machine and accessories
- Cutting torches or plasma cutters
- Grinding and surface preparation tools
- Grouting equipment (for voids)
- Lifting and rigging equipment
- PPE for welding and cutting works

Measurement:

- Measured in **square metres (Sqm)** of MS plate surface area fixed in position, including all cuts, laps, overlaps, welding, fasteners, and coatings.

Safety and Quality Assurance:

- All welding to be done by certified welders.
- Use appropriate PPE: welding shields, gloves, safety harness (if working at height).
- Ensure continuous supervision and NDT testing of welds (DPT or ultrasonic if critical).
- Maintain material test certificates (MTCs) for MS plates.
- Record of epoxy coating DFT (dry film thickness) to be maintained.

Expansion Joint Works

Scope of Activity

G1. Removal of damaged expansion joint

The contractor shall carry out the removal of damaged, worn-out, or deteriorated expansion joints from the designated locations as per the project requirements. The scope includes the complete removal of the existing joint materials, including seals, asphalt, and any other associated components, while ensuring that the surrounding structure (deck, bridge, or slab) is not damaged in the process. The contractor shall ensure that the removal is performed in a manner that minimizes disruption to the structure and facilitates a smooth transition for the installation of new expansion joint materials. Proper disposal of the removed materials shall be done in accordance with environmental guidelines.

The contractor shall take all necessary precautions during the removal process to ensure the safety of workers, the protection of the surrounding infrastructure, and the prevention of any unnecessary damage to the structural elements. The work shall be executed in compliance with all relevant specifications and standards.

Relevant MoRTH / IRC Specifications:

- **MoRTH Specification:** IRC SP: 73 – Guidelines for Design and Construction of Expansion Joints for Bridges (This guideline includes the design, removal, and installation processes for expansion joints in bridge structures).
- **MoRTH Clause 2600** – Expansion Joints for Bridges (This clause provides specific requirements for the removal and installation of expansion joints on bridges and similar structures).
- **IRC 83 Part II** – Guidelines for Highway and Bridge Expansion Joints (This code provides detailed provisions for the design and removal of expansion joints in roadways and bridges).
- **IS 12118:1987** – Code of Practice for the Installation of Joint Fillers for Roadways and Bridges (This standard addresses the removal of expansion joints and the installation of new fillers).

Materials:

1. **Sealant Material:** The existing sealant materials such as bituminous or rubber-based sealants shall be identified and removed according to the applicable specifications for expansion joint removal.
2. **Asphalt or Bituminous Materials:** If the expansion joint involves asphaltic materials, they should be removed carefully without damaging the surrounding road surface.
3. **Waste Disposal:** All removed materials, including sealants and asphalt, shall be disposed of at approved disposal sites in compliance with environmental norms and regulations.

Execution:

1. **Site Preparation:** The area around the expansion joint shall be cordoned off for safety and to prevent any accidents during the removal process. Proper signage and barricading shall be provided as per MoRTH guidelines.
2. **Removal Process:** The damaged expansion joint material shall be carefully removed using appropriate tools and equipment. Special care shall be taken to avoid causing damage to the adjoining concrete or pavement.
3. **Debris Disposal:** All debris and waste material from the removed expansion joint shall be collected and disposed of as per the project's waste disposal plan and local environmental guidelines.
4. **Cleaning and Inspection:** After removal, the surface of the deck or slab shall be thoroughly cleaned to remove any residual debris, dust, or contaminants to ensure a clean surface for the installation of the new expansion joint.
5. **Safety Measures:** All safety precautions shall be implemented during the removal process, including the use of appropriate personal protective equipment (PPE) and ensuring that workers are trained in safe handling procedures.

Expansion Joint Works Scope of Activity
Indicative Equipment Includes (for site execution): • Hydraulic or Pneumatic Tools: For cutting and removing old expansion joint materials. • Angle Grinders / Concrete Cutters: For cutting through damaged concrete or asphalt sections adjacent to the joint. • Excavators / Backhoes: For removing larger segments of damaged joints or sections that need to be lifted. • Waste Disposal Bins: For the collection and removal of debris. • Hand Tools: Hammers, chisels, and other manual tools for detailed removal work.
<u>G2. Groove cutting and cleaning</u> The contractor shall carry out groove cutting and cleaning at the specified locations as per the project requirements for the proper installation of new expansion joints. This work includes cutting grooves of the specified dimensions (depth, width, and length) into the existing concrete or asphalt surface to prepare it for the installation of the new expansion joint systems. The cutting shall be done in a precise manner to ensure that the joint material will fit seamlessly, ensuring effective load transfer and minimal maintenance in the future. After groove cutting, the contractor shall thoroughly clean the grooves to remove any debris, dust, dirt, oil, or any other contaminants that may interfere with the proper bonding of the joint material. The cleaning shall ensure that the groove surface is free from all foreign materials, which might prevent the effective adhesion of the joint system to the substrate. The contractor must ensure that the work is completed in a safe manner, maintaining all necessary precautions and complying with the relevant specifications, guidelines, and standards. Relevant MoRTH / IRC Specifications: • MoRTH Clause 2600 – Expansion Joints for Bridges (This clause outlines the requirements for preparing and cutting grooves in bridge decks and roadways for the installation of expansion joints). • IRC SP: 73 – Guidelines for the Design and Construction of Expansion Joints for Bridges (This guideline specifies the process and technical requirements for cutting and cleaning grooves for expansion joints). • IS 12118:1987 – Code of Practice for the Installation of Joint Fillers for Roadways and Bridges (This standard provides guidance on the necessary preparation of grooves for expansion joint filler installation). • IRC 83 Part II – Guidelines for Highway and Bridge Expansion Joints (This code includes provisions for the proper treatment and preparation of grooves for effective joint installation). Materials: 1. Groove Cutting Tools: Diamond-blade saws or other suitable tools for cutting grooves into the concrete or asphalt. 2. Cleaning Agents: Suitable solvents or cleaning agents for the removal of oils, greases, or other contaminants from the groove surfaces. 3. Cleaning Equipment: Air compressors, wire brushes, or specialized cleaning equipment to ensure the grooves are free of debris. 4. Sealant Material: High-quality sealants or fillers as per the approved specifications to be used for filling grooves once they are cut and cleaned. Execution: 1. Site Preparation: ○ The work area shall be marked and cordoned off for safety, with appropriate

Expansion Joint Works Scope of Activity	
	barricades and signage installed as per MoRTH guidelines. - Proper traffic management and safety protocols should be in place if the work is carried out on live roadways or bridges. 2. Groove Cutting: - The groove shall be cut using diamond blade saws or suitable equipment, ensuring precise dimensions according to the design requirements. - Care shall be taken to avoid damaging the surrounding concrete or pavement while cutting the groove. The groove shall be cut to the required depth, width, and length as per the project drawings or specifications. - The cutting operation shall be carried out with appropriate dust control measures, including water spraying or vacuum systems, to minimize airborne particles and maintain a clean work environment. 3. Cleaning of Grooves: - After cutting, the grooves shall be thoroughly cleaned using air compressors, wire brushes, and other appropriate tools. - If necessary, cleaning agents may be applied to remove any oils, greases, or residues from the groove surface. - The cleaned groove shall then be dried and inspected for any remaining contamination before the installation of the joint sealant. 4. Inspection and Quality Control: - The groove dimensions and cleanliness shall be checked against the design requirements. Any deviations from the required dimensions shall be rectified before proceeding with the next step. - The contractor shall ensure that the groove surfaces are smooth, clean, and free from any defects or contamination that might affect the performance of the expansion joint. 5. Safety Measures: - All workers shall use appropriate personal protective equipment (PPE), including goggles, gloves, and ear protection, during the cutting and cleaning operations. - Adequate measures shall be taken to ensure that the surrounding infrastructure is protected from damage during the cutting process. - Proper ventilation shall be provided if any chemicals or solvents are used for cleaning. Indicative Equipment Includes (for site execution): Diamond Blade Saw / Concrete Cutter: For precise cutting of the grooves to required dimensions. Air Compressor: For cleaning the grooves and removing debris. Wire Brushes / Hand Tools: For manual cleaning of the groove surfaces. Cleaning Solvents: For removing any contaminants from the grooves. Vacuum Systems / Water Spraying Equipment: For dust control during cutting. PPE: Safety gear for workers, including protective gloves, goggles, and ear protection.
<u>G3. Fixing of strip seal / compression seal joint</u> The contractor shall carry out the fixing of strip seal or compression seal joints at specified locations as per the project requirements. This task includes the preparation, installation, and proper sealing of the expansion joint system, ensuring smooth operation and effective protection against weathering, traffic-induced stress, and environmental elements. The work will be executed by	

Expansion Joint Works

Scope of Activity

following the manufacturer's instructions and relevant standards for the specified joint type.

The contractor shall ensure that the joint system, whether strip seal or compression seal, is securely and accurately fixed in place. The installation process includes placing the joint components into the pre-prepared grooves or slots, ensuring that they are aligned correctly and function optimally in both compression and tension.

The contractor shall also ensure that the proper bonding material, such as adhesives or sealants, is used according to the manufacturer's specifications. All components shall be checked for dimensional accuracy and compliance with design requirements before proceeding with the installation.

Relevant MoRTH / IRC Specifications:

- **MoRTH Clause 2600** – Expansion Joints for Bridges (This clause outlines the requirements for the installation and fixing of expansion joints, including strip seal and compression seal systems).
- **IRC SP: 73** – Guidelines for the Design and Construction of Expansion Joints for Bridges (This guideline specifies the correct installation techniques for various types of expansion joints, including strip seal and compression seal joints).
- **IRC 83 Part II** – Guidelines for Highway and Bridge Expansion Joints (This code includes the application and installation of compression and strip seal joints for bridge expansion joints).
- **IS 12118:1987** – Code of Practice for the Installation of Joint Fillers for Roadways and Bridges (This standard provides guidance on the correct installation of joint fillers, which is a component of the strip seal or compression seal system).
- **ASTM D5329-19** – Standard Guide for Installation of Compression Seal Joints (Relevant for the installation of compression seal joints, providing detailed steps and requirements).
- **EN 14188-5:2013** – Asphalt and Bituminous Materials for Expansion Joints (Provides standards for the use of bituminous and elastomeric sealants in expansion joints).

Materials:

1. **Strip Seal / Compression Seal Components:** High-quality pre-manufactured rubber strips or compression seals, as per the project specifications.
2. **Bonding Adhesive/Sealant:** Sealants or adhesives compatible with the rubber components and the substrate, ensuring strong bonding and weatherproofing.
3. **Backing Material:** Suitable backing material to support the sealant, such as foam, to ensure proper compression and expansion.
4. **Cleaning Agents:** Solvents or cleaning agents for preparing the surface before installation.

Execution:

1. **Site Preparation:**
 - The work area shall be cleaned and marked as per the project requirements.
 - All expansion joints and adjacent surfaces must be free from debris, dirt, dust, and moisture to ensure proper bonding and effective sealing.
 - Temporary barricades or safety signs shall be placed to ensure safe working conditions around live roadways or bridges.
2. **Groove Preparation:**
 - The grooves or slots in the pavement or bridge deck shall be checked to ensure they meet the design dimensions, including width, depth, and length.

Expansion Joint Works Scope of Activity	
○ If necessary, the contractor shall carry out any additional groove cutting, cleaning, or preparation work to ensure that the joint system fits correctly and securely. 3. Fixing of Strip Seal / Compression Seal Joint: ○ The contractor shall install the strip seal or compression seal joint in the prepared groove, ensuring that the seal is properly aligned. ○ The seal shall be positioned in a way that ensures its compression and expansion abilities are maintained throughout its service life. ○ The bonding adhesive or sealant shall be applied as per the manufacturer's guidelines, ensuring uniform distribution along the surface of the joint. ○ The seal shall be pressed into place, ensuring that it fits snugly and is adequately compressed for optimal sealing performance. ○ The contractor shall also ensure that any backing material is positioned as required, providing additional support to the sealant. 4. Inspection and Quality Control: ○ After the joint is installed, the contractor shall inspect the alignment, compression, and overall installation to ensure compliance with the design requirements and specifications. ○ The joint shall be checked for any air pockets, improper alignment, or insufficient compression. Any defects shall be rectified before proceeding with the completion of the work. ○ The contractor shall also check the sealant's bonding quality to ensure that the adhesive or sealant is properly cured and providing a strong bond. 5. Safety Measures: ○ All workers shall use appropriate personal protective equipment (PPE), including gloves, goggles, and safety shoes, during the installation process. ○ Proper traffic management and safety protocols must be in place if the work is carried out on live roadways or bridges. ○ The contractor shall ensure that adequate ventilation and dust control measures are taken if any adhesives or sealants are used during the process.	Indicative Equipment Includes (for site execution): ● Rubber Strip Seal / Compression Seal Materials: High-quality pre-manufactured joint materials for installation. ● Sealant and Adhesive Applicators: Equipment for applying adhesives or sealants to the joint surfaces. ● Cleaning Tools (Wire Brushes / Air Compressors): For cleaning grooves and ensuring proper surface preparation before installation. ● Backer Rods / Foam Materials: To ensure proper compression and expansion capabilities for the seal. ● Measuring and Alignment Tools: For accurate fitting and alignment of the joint. ● PPE (Personal Protective Equipment): Safety gear, including gloves, goggles, and safety footwear.
<u>G4. Providing and Fixing New Expansion Joint – Filler Type</u> Reference Clause: MoRTH Section 2600 – <i>Expansion Joints</i> (Clause 2602 to 2607), IRC: SP:69, and as directed by the Engineer-in-Charge	

Expansion Joint Works Scope of Activity
Scope of Work: This item includes all works related to the removal of damaged or deteriorated expansion joints (if any) and the provision and installation of new filler-type expansion joints across bridge deck joints. The filler-type joint is intended to accommodate thermal expansion and contraction, vehicular load movements, and structural deflections while ensuring a watertight seal and continuity of the wearing surface. The scope includes surface preparation, installation of compressible filler board, edge protection angles, sealants, primer, and protective coating. The work shall be executed in accordance with MoRTH specifications and approved drawings. Methodology: 1. Site Preparation: • Mark the exact location of the expansion joint as per approved drawings. • Remove existing damaged joint materials, debris, or concrete (if applicable) using appropriate cutting or chiselling tools. • Clean the joint gap thoroughly, ensuring it is free from dust, grease, loose particles, and moisture. 2. Installation of Filler Board: • Insert a pre-moulded compressible filler board (such as bitumen impregnated fibreboard or closed-cell polymer board) of the specified thickness and depth into the joint gap. • Ensure the filler board is continuous along the length and tightly fits the joint to avoid movement or displacement. 3. Fixing of Edge Protection (if specified): • Provide mild steel or galvanized edge angles on either side of the joint gap, properly aligned and anchored using bolts/dowels embedded in epoxy grout. • Weld or mechanically fix the angle sections to ensure a neat and protected edge for the bituminous or concrete wearing surface. 4. Sealant Application: • Apply a compatible primer on the vertical faces of the joint groove. • Install backer rod (compressible foam) if required to control the depth of the sealant. • Pour polysulphide or elastomeric sealant using a sealant gun, ensuring it adheres well and remains slightly concave to accommodate expansion/contraction. 5. Surface Restoration: • Restore the wearing course (bituminous or cement concrete) adjacent to the joint using approved material. • Finish the surface flush with the deck to ensure smooth passage for traffic. Materials: • Pre-moulded compressible filler board (bitumen impregnated, polymer type, or as specified) • Elastomeric / polysulphide sealant conforming to IS:12118 • Primer compatible with sealant • MS or GI edge angles (if required) • Backer rod (PE foam) • Fasteners, epoxy grout (for angle anchorage) Indicative Equipment: • Angle grinders/cutters

Expansion Joint Works Scope of Activity
• Drilling machine for dowel fixing • Sealant gun and primer applicator • Grouting tools • PPE for site workers (gloves, eye protection, safety shoes) Measurement: • Measured in running metres (RM) of expansion joint fixed as per approved drawing. • Rate to include complete material supply, surface preparation, fixing, sealing, anchoring, and surface reinstatement. Safety & Quality Assurance: • Ensure joints are placed accurately and securely with no obstruction to expansion. • All sealants and filler boards must be as per approved make and test-certified. • Ensure adequate curing of sealant before opening to traffic. • Provide barricading during work and ensure joint edges are chamfered or protected. • Maintain joint width uniformity throughout and ensure watertightness is achieved.
<u>G5. Pourable sealant fixing in joints</u> The contractor shall carry out the fixing of pourable sealant in the joints of the specified locations as per the project requirements. The work involves cleaning, preparation, and application of pourable sealant to fill the joint gaps, providing an effective seal against environmental factors, water penetration, and other potential stresses. The contractor shall ensure that the sealant is applied correctly, adhering to the design specifications and manufacturer's instructions, and providing a long-lasting and durable solution for the joint. The contractor shall ensure that the joint is properly cleaned and all loose debris, contaminants, and moisture are removed before the sealant is poured. The pourable sealant shall be mixed, applied, and cured according to the manufacturer's specifications, ensuring its effectiveness over the long term in various environmental conditions. Relevant MoRTH / IRC Specifications: • MoRTH Clause 2600 – Expansion Joints for Bridges (This clause outlines the installation and sealing of expansion joints, which may include pourable sealant in specific applications). • IRC SP 73 – Guidelines for the Design and Construction of Expansion Joints for Bridges (This guideline includes provisions for the installation of pourable sealants in bridge joints). • IS 12118:1987 – Code of Practice for the Installation of Joint Fillers for Roadways and Bridges (This standard includes installation guidelines for sealants and fillers, which are a part of the pourable sealant fixing process). • ASTM D6690-17 – Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements (This standard specifies the use of hot-applied pourable sealants for concrete and asphalt joints). • EN 14188-5:2013 – Asphalt and Bituminous Materials for Expansion Joints (This European standard specifies pourable sealants and their application in expansion joints). Materials: 1. Pourable Sealant: High-quality, polymer-modified bitumen or elastomeric-based sealant, as per the project specifications. The sealant must be compatible with the materials of the joint and provide resistance to environmental factors such as temperature fluctuations, UV rays,

Expansion Joint Works Scope of Activity	
	and moisture. Cleaning Agents: Suitable solvents or cleaners to ensure that the joint surfaces are free of dust, debris, and moisture before applying the sealant. Backing Material (Optional): Suitable foam backer rods or similar materials to support the sealant and ensure proper compression and expansion capabilities, if required. Adhesive (If required): For bonding the sealant to the substrate, depending on the type of joint and surface. Execution: Site Preparation: - The contractor shall ensure that the joint surfaces are clean, dry, and free from contaminants. Cleaning should be done using wire brushes, air compressors, or vacuum systems to remove dust, dirt, and moisture. - The contractor shall verify that the joint dimensions (width, depth) are in accordance with the design requirements. Any excess materials or irregularities in the joint shall be removed prior to sealant application. - Temporary barriers or covers shall be placed to protect the joint from contamination during the installation process, especially if work is performed on active roadways or bridge decks. Mixing of Sealant (If Applicable): - If the sealant requires mixing before application, the contractor shall ensure that the sealant is mixed according to the manufacturer's instructions to ensure proper consistency and performance. - The sealant must be thoroughly blended to ensure uniform distribution of all components and prevent any separation or inconsistency during curing. Application of Pourable Sealant: - The contractor shall pour the sealant into the joint, ensuring that it completely fills the joint cavity and that there is no air entrapment. - For hot-applied sealants, the contractor shall use proper heating equipment to bring the sealant to the required temperature before application. - The sealant must be applied evenly and should slightly overfill the joint to account for shrinkage during curing. - The contractor shall ensure that the sealant is applied in layers if necessary, especially for joints with deeper cavities, ensuring each layer is fully cured before applying the next. Finishing and Curing: - After pouring, the sealant shall be leveled and smoothed to a uniform surface, ensuring that the sealant is flush with the joint edges. - The contractor shall allow the sealant to cure as per the manufacturer's instructions, ensuring that the joint is fully sealed and waterproof. - Curing times will vary depending on the type of sealant used and environmental conditions (temperature, humidity). The contractor shall ensure that no traffic or loads are applied to the joint until the sealant has fully cured. Inspection and Quality Control: - The contractor shall inspect the installed sealant to ensure that it has been applied correctly, fills the joint completely, and is free from defects such as air pockets, cracks, or improper curing. - The contractor shall also inspect the surrounding joint surfaces for any imperfections

Expansion Joint Works Scope of Activity
or contamination that could affect the bonding or performance of the sealant. ○ Any defects or issues identified during inspection shall be rectified immediately. 6. Safety Measures: ○ All personnel shall wear appropriate personal protective equipment (PPE), including gloves, goggles, and safety boots, while handling hot sealants or sealant-related chemicals. ○ Safety barriers, cones, and warning signs must be used to demarcate the work area, especially if work is conducted near live roadways or bridges. Indicative Equipment Includes (for site execution): • Sealant Dispensers (Manual or Automated): For accurate and controlled application of the pourable sealant. • Heating Equipment (For Hot-Applied Sealant): To heat the sealant to the required temperature for application. • Cleaning Tools (Wire Brushes / Air Compressors): For cleaning the joint surfaces before sealant application. • Backer Rods / Foam Materials (If Required): To ensure proper sealant compression and expansion. • Measuring Equipment: For checking joint dimensions and sealant level. • PPE (Personal Protective Equipment): Gloves, goggles, and safety footwear for the protection of workers.
<u>G6. Elastomeric concrete in joint chamber</u> The contractor shall carry out the installation of elastomeric concrete in the joint chambers as per the project requirements. Elastomeric concrete is a specialized type of concrete designed to provide enhanced flexibility and durability in high-stress areas such as expansion joints and bridge deck chambers. The work includes surface preparation, mixing, placing, compacting, and curing of elastomeric concrete in the designated joint chambers. The primary purpose of using elastomeric concrete is to ensure a strong, flexible, and durable joint system that accommodates movement and reduces the risk of joint failure. The elastomeric concrete shall be applied in strict accordance with the project specifications, ensuring that it meets the required mechanical properties, bonding capabilities, and durability standards. Relevant MoRTH / IRC Specifications: • MoRTH Clause 2600 – Expansion Joints for Bridges (This clause provides general guidelines for the installation and sealing of expansion joints, which include the use of elastomeric concrete in certain applications). • IRC SP 73 – Guidelines for the Design and Construction of Expansion Joints for Bridges (This IRC guideline includes specifications for the use of elastomeric concrete in joint chambers for bridges). • IRC SP 79 – Guidelines for Strengthening and Rehabilitation of Bridges (Elastomeric concrete can be part of strengthening applications, particularly in joint chambers). • IS 13311-2:1992 – Non-Destructive Testing of Concrete: Part 2 – Ultrasonic Pulse Velocity (This standard may be used to assess the integrity of elastomeric concrete post-application). • IS 456:2000 – Code of Practice for Plain and Reinforced Concrete (General guidelines for the mixing and placement of concrete, applicable for elastomeric concrete). • ASTM C309-18 – Standard Specification for Liquid Membrane-Forming Compounds for Curing

Expansion Joint Works	
Scope of Activity	
Concrete (Relevant when considering curing compounds for elastomeric concrete).	
• ACI 548.2R-13 – Guide for the Use of Fiber-Reinforced Concrete (For fiber-reinforced elastomeric concrete applications, if applicable).	
Materials:	
1. Elastomeric Concrete: A specially formulated concrete mixture containing elastomeric resins, polymer modifiers, and appropriate aggregates. The concrete must exhibit the required flexibility, tensile strength, and resistance to environmental degradation, ensuring the durability of the joint system. 2. Aggregates: Well-graded aggregates with the appropriate size and grading as per the specifications, ensuring proper mix consistency and bond strength. 3. Polymer/Elastomeric Additives: Materials such as rubber or polymer compounds that are added to the concrete mix to enhance its flexibility, reduce cracking, and improve its durability under dynamic loads. 4. Water: Clean, potable water shall be used for mixing the concrete. 5. Curing Compounds (If Applicable): Suitable curing agents that will be used to maintain proper hydration and strength gain in the elastomeric concrete.	
Execution:	
1. Site Preparation: ○ The contractor shall ensure that the joint chamber surfaces are clean, free from any debris, dust, oil, grease, or other contaminants that could affect the bond between the elastomeric concrete and the joint surfaces. ○ The chamber should be adequately dried (if needed) before the application of elastomeric concrete. ○ Any loose or deteriorated concrete within the joint chamber must be removed and replaced, ensuring a sound substrate for the new elastomeric concrete. 2. Mixing of Elastomeric Concrete: ○ The elastomeric concrete shall be mixed in accordance with the manufacturer's specifications and project requirements, ensuring proper proportions of cement, polymer additives, aggregates, and water. ○ The contractor shall ensure that the mix is homogeneous and free from air pockets. ○ If fiber reinforcement is part of the design, it shall be added to the mixture as per the specifications, ensuring even distribution throughout the concrete. 3. Placement of Elastomeric Concrete: ○ The elastomeric concrete shall be placed in the joint chamber as a continuous pour, ensuring complete filling of the cavity without leaving gaps or voids. ○ The contractor shall use mechanical vibrators or hand tools (depending on the size of the chamber) to ensure proper compaction and consolidation of the concrete. ○ The joint chamber should be filled completely to the required level, with any excess concrete removed or levelled to match the finished surface. 4. Curing: ○ The elastomeric concrete shall be cured immediately after placement to ensure proper hydration and strength development. The contractor shall use water-based curing methods or curing compounds as per the manufacturer's recommendations. ○ Curing time and conditions shall be monitored closely, with the contractor ensuring that the curing process is completed without interruption for the required duration to ensure maximum strength and durability.	

Expansion Joint Works Scope of Activity	
5. Finishing:	○ The surface of the elastomeric concrete should be finished to the specified texture and smoothness. ○ The contractor shall ensure that the final surface is flush with the surrounding deck or joint surfaces and that no cracks or irregularities are present after the curing process.
6. Inspection and Quality Control:	○ The contractor shall inspect the completed elastomeric concrete to ensure that it meets the required thickness, surface finish, and bond strength. ○ Any defects, such as air pockets, cracks, or inconsistencies in the surface, must be rectified immediately. ○ The contractor shall also test the compressive strength of the elastomeric concrete, ensuring that it meets the specified strength requirements before the joint chamber is opened to traffic or further use.
Indicative Equipment Includes (for site execution): • Concrete Mixers: For thorough mixing of elastomeric concrete. • Vibration Equipment (Mechanical/Hand Vibrators): For proper compaction and consolidation of the poured elastomeric concrete. • Finishing Tools (Trowels/Floaters): For smoothing and leveling the concrete surface. • Curing Equipment (Sprayers/Water Tanks): For ensuring proper curing of the elastomeric concrete. • Cleaning Tools (Wire Brushes/Blowers): For cleaning the joint chamber surfaces before application. • PPE (Personal Protective Equipment): Gloves, goggles, and safety boots to protect workers during concrete placement and curing.	

H. Bearing Replacement Works

Scope of Activity

H1. Lifting of girders (hydraulic jacking)

Refer MoRTH clause 1400, Clause 2000, Clause 2200

The contractor shall undertake the safe and effective lifting of girders using **hydraulic jacking** methods to facilitate the replacement of bearings or other structural interventions. This operation involves raising the girder to a predetermined height to provide sufficient clearance for bearing replacement while maintaining structural integrity throughout the process. The method must comply with the relevant safety, technical, and environmental standards.

The **hydraulic jacking** system should be capable of lifting the girder uniformly without introducing any differential stresses that may affect the structure's alignment or stability. It must be equipped with precise lifting equipment such as synchronized hydraulic jacks and load cells to monitor and control the applied force. The lifting operation should be performed under the supervision of qualified engineers and according to the guidelines provided by the manufacturer of the hydraulic equipment.

The contractor shall ensure that all necessary safety measures are in place, including barricading the work area, providing appropriate personal protective equipment (PPE) to workers, and ensuring proper signaling and communication systems are established. A comprehensive risk assessment and method statement must be provided prior to commencing the work.

Materials & Equipment:

- **Hydraulic Jacks:** Capable of safely lifting the girder to the required height.
- **Synchronized Jacking System:** Ensures uniform lifting to avoid angular displacement.
- **Load Cells & Sensors:** To measure and control the load during lifting.
- **Steel Lifting Beams and Spreader Bars:** To distribute the lifting force evenly across the girder.
- **Temporary Supports:** To stabilize the girder during the lifting and bearing replacement process.

Procedure:

1. **Pre-Lifting Inspection:** Ensure that the girder, lifting points, and hydraulic jacking equipment are structurally sound and safe for operation.
2. **Positioning of Hydraulic Jacks:** Place the hydraulic jacks under the girder at designated lifting points, ensuring that they are symmetrically aligned to prevent any misalignment during the lifting process.
3. **Lifting Process:** Gradually raise the girder using the synchronized hydraulic jacks. Continuously monitor the load applied to each jack using load cells. Ensure that the girder is raised uniformly and avoid any sudden movements or jerks.
4. **Height Adjustment:** Maintain the girder at the required height, ensuring it remains stable and properly aligned.
5. **Post-Lifting Inspection:** Once the girder is lifted to the specified height, inspect the temporary support systems and ensure that the girder remains secure before proceeding with the bearing replacement.

Safety and Quality Considerations:

- Ensure the lifting procedure is conducted in compliance with relevant **IS codes, MoRTH guidelines, and IRC standards**.
- The lifting equipment and procedure should be reviewed and approved by a structural engineer.
- The contractor must maintain **adequate monitoring systems** to track and control the lifting operation.
- All equipment used should be regularly inspected and certified for safe use.

Testing and Measurement:

- Verification of the **lifting capacity** and performance of the hydraulic jacks.
- Ensure that the **height of lifting** is measured accurately to meet the required clearance for bearing replacement.

H2. Dismantling of old bearing

H. Bearing Replacement Works

Scope of Activity

Refer MoRTH Clause 2000 & Clause 2200

The contractor shall undertake the dismantling and removal of the **old bearings** from the bridge structure. The scope includes the complete removal of all existing bearings, along with any associated components such as anchor bolts, base plates, and other materials connected to the bearing system. The work must be executed in a manner that minimizes any impact on the structural integrity of the bridge, ensuring no damage to surrounding elements like girders, supports, or the deck.

Prior to dismantling, the contractor shall assess the condition of the bearings and surrounding areas to develop a strategy for safe removal. The method of dismantling should be chosen to avoid causing any damage to the foundation, substructure, or any part of the structure that is to remain intact.

Materials & Equipment:

- i. **Wrenches & Torque Tools:** To remove bolts and nuts without damaging the surrounding structure.
- ii. **Cutting Equipment:** In case of the need to cut through any corroded or damaged components.
- iii. **Lifting Cranes or Hydraulic Jacks:** For removing large or heavy bearing components.
- iv. **Hoisting Slings & Supports:** To handle the bearings and ensure safe removal.
- v. **Personal Protective Equipment (PPE):** Including helmets, gloves, and fall protection for workers involved in dismantling operations.

Procedure:

1. **Preparation & Safety Measures:**
 - o Secure the work area, setting up barriers and safety zones to prevent unauthorized access.
 - o Perform a safety check to ensure all workers have appropriate PPE and that all equipment is in good working order.
 - o Check the structural stability of the area around the bearing, and ensure temporary supports are in place if necessary.
2. **Disconnection of Bearings:**
 - o Remove any anchor bolts, nuts, and washers securing the old bearings to the bridge structure.
 - o Use appropriate **tools** such as wrenches, impact drivers, or cutting tools to disconnect the bearings without damaging surrounding components.
3. **Removal of Bearings:**

The **removal of bearings** is a critical operation that requires careful planning and execution to avoid any structural damage and ensure the safety of personnel and equipment. The method used will depend on the type, size, and condition of the existing bearings.

Step-by-Step Procedure for Bearing Removal:

- i. **Preparation for Lifting:**
 - o Before starting the lifting operation, ensure that all **surrounding structural elements** (such as girders, bridge deck, and substructure) are adequately supported with temporary supports or **shoring**. This prevents any unwanted movement of the structure during the bearing removal process.
 - o Confirm that the **bearing pedestal area** is clean, free from debris, and any obstacles that might hinder the lifting operation.
- ii. **Disconnection from Supporting Structure:**
 - o **Anchor Bolts:** First, remove the **anchor bolts** or other fastening mechanisms securing the bearing to the pedestal or structural base. Use appropriate **wrenches, impact drivers, or torque tools** to

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Scope of Activity

unscrew the bolts. Ensure that no bolts are left loosely attached, as they could create hazards during the lift.

- **Isolation of the Bearing:** If the bearing is fixed in place due to corrosion or adhesion, it may be necessary to apply a **cutting tool** (such as a **grinder** or **diamond cutter**) to release any hardened material or bond. This should be done carefully to avoid damaging the bearing pedestal or nearby structures.

iii. **Lifting and Extraction of the Bearing:**

- Once the bearing is disconnected, **hydraulic jacks** or **lifting cranes** (depending on the bearing size and location) should be used to gently lift the bearing off its base. The lifting must be performed **symmetrically** and **gradually** to ensure the load is evenly distributed.
- **Lifting Slings and Hoists:** If using cranes, **lifting slings** should be properly secured around the bearing, ensuring that the slings are positioned correctly to avoid any slippage. Always check the **lifting angle** to ensure stability during the lift.
- **Hydraulic Jacks:** If using hydraulic jacks, ensure that the lifting points are strong and stable. The jacks should be placed on firm, level ground, and the bearing should be raised slowly and steadily to avoid any sudden shifts or stresses on the structure.

iv. **Handling of Bearings:**

- As the bearing is lifted, care must be taken to **avoid sudden impacts or shocks** that might cause damage to the bearing, surrounding components, or the structure itself.
- **Large bearings:** For large, heavy bearings, **multiple lifting points** may be necessary to ensure balanced lifting. It is important to coordinate the lifting operation with all involved parties to ensure the lifting equipment works in unison.
- **Fragile bearings:** If the bearing is fragile or has been deteriorated due to environmental factors (e.g., corrosion), extra care should be taken to avoid any crushing, bending, or distortion during the lifting process.

v. **Transporting the Bearing for Disposal:**

- Once the bearing has been lifted, it should be carefully moved from the bridge structure. Depending on its size and weight, **heavy-duty trolleys** or **flatbed trucks** may be used to transport it to the disposal site.
- Ensure that the bearing is securely fastened during transport and does not shift, potentially damaging nearby infrastructure or causing an accident.

vi. **Final Inspection and Documentation:**

- After removal, inspect the **bearing pedestal** and the surrounding areas to assess any **wear and tear** caused by the removal process. Check for **abrasions, scratches, or damage to the substrate** that might need repair before installing new bearings.
- Document the **removal process**, including any unusual issues encountered (such as corrosion or damage) and corrective actions taken. This documentation should be used for future reference when installing the new bearings.

4. **Disposal of Removed Components:**

- Safely transport and dispose of the old bearings and associated components as per local environmental regulations and standards.

5. **Site Clean-Up & Final Inspection:**

- Clean the bearing pedestal and surrounding areas to remove any debris or residue that may affect the installation of the new bearings.
- Ensure that the site is clear and ready for the installation of new bearings.

Safety and Quality Considerations:

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Scope of Activity	
vii.	All dismantling operations should be conducted in compliance with relevant MoRTH guidelines and IRC standards .
viii.	Work should be performed by skilled personnel under the supervision of a qualified engineer.
ix.	Prior to starting the dismantling, ensure that the bridge's structural integrity is confirmed to avoid accidental damage.
x.	Maintain clear communication and coordination between all workers involved in the operation to avoid accidents.
Testing and Measurement:	
xi.	Verification of Structural Integrity: Ensure that the bridge's substructure is unaffected by the removal of bearings.
xii.	Quality Inspection: The condition of the bearing pedestal and surrounding areas should be inspected to confirm that it is suitable for receiving new bearings.
<u>H3. Cleaning of bearing pedestal & epoxy levelling pad</u>	
Refer MoRTH Clause 2000 & Clause 2200	
This item involves thorough cleaning and preparation of the bearing pedestal surface after removal of the existing bearing, followed by the application of an epoxy-based levelling pad to ensure a uniform and stable surface for the new bearing installation. Detailed Description: Surface Cleaning of Bearing Pedestal: - The concrete pedestal surface shall be cleaned of all loose particles, dust, debris, grease, old mortar, or adhesive materials by wire brushing, air blasting, or grit blasting, as required. - Any residual adhesive or deteriorated epoxy from previous bearing installation shall be completely removed to expose the bare concrete surface. The surface should be dry, sound, and free from laitance. - In case of damage to the concrete surface, minor surface repairs may be carried out using a suitable polymer-modified mortar or repair concrete as per the approved methodology. Surface Preparation for Epoxy Application: - The cleaned surface shall be checked for level and evenness. Any undulations exceeding the permissible tolerance (typically ± 1 mm over the bearing seating area) shall be corrected before applying epoxy. - Prior to epoxy application, the surface should be blown with compressed air to remove any remaining fine dust. Application of Epoxy Levelling Pad: - A two-component epoxy resin system, conforming to ASTM C881 or equivalent approved standard, shall be used. The material should be non-shrink, high-strength, and with excellent bond properties to both concrete and steel. - The epoxy shall be mixed as per the manufacturer's instructions and applied uniformly over the pedestal surface using a trowel or screed to achieve a level, smooth, and even layer. - The thickness of the epoxy pad should typically be in the range of 3 mm to 10 mm, or as recommended by the bearing manufacturer and the structural design. - The epoxy layer shall be allowed to cure as per specified time, maintaining proper ambient temperature and avoiding any movement or loading on the area. Quality Checks:	

H. Bearing Replacement Works Scope of Activity
○ After curing, the surface shall be checked with a spirit level or precision straight edge to confirm that it is truly horizontal and suitable for bearing installation. ○ Adhesion and compressive strength tests of epoxy samples (as per the technical specification) may be conducted, if required. Indicative Equipment Involved: • Wire brushes and scrapers • Air compressor and air blowers • Grinders or scarifiers (for tough adhesion removal) • Mixing tools for epoxy resin • Trowels and levelling tools • Protective gear for workers (PPE, gloves, goggles)
<u>H4. Fixing of POT/PTFE/Elastomeric bearing</u> Refer MoRTH Clause 2000 & Clause 2200 This item includes the precise positioning and installation of POT, PTFE, or Elastomeric bearings over the prepared pedestal and under the girder, ensuring proper alignment, anchorage, and seating in accordance with MoRTH specifications and manufacturer's instructions. The process is to be executed after pedestal preparation and immediately prior to girder lowering. Detailed Description: 1. Inspection & Pre-Installation Checks: ○ Bearings shall be inspected for physical damage, dimensional accuracy, and compliance with the approved drawings, technical specifications, and manufacturer's data sheet. ○ Bearing type (POT, PTFE, or Elastomeric) shall match the design requirement for the particular location and structure. ○ Identification marks such as bearing number, location code, and orientation arrow shall be verified before installation. 2. Surface Preparation: ○ The epoxy levelling pad (installed as per H3) should be checked for level, cleanliness, and full curing. ○ A thin layer of approved epoxy adhesive or grout may be applied just before setting the bearing to ensure uniform contact and bonding. 3. Setting and Positioning of Bearing: ○ The bearing shall be carefully lowered into its designated location using crane, chain pulley, or manual guiding, ensuring precise alignment in both longitudinal and transverse axes. ○ Orientation of the bearing shall match the direction of movement or restraint, as per the structure's design. ○ Bearings shall be placed such that the centre of rotation and load transfer aligns with the girder's centreline and pedestal centreline. 4. Fixing and Anchoring: ○ For POT and PTFE bearings, anchor bolts shall be inserted into preformed pockets or sleeves and grouted using non-shrink grout as per manufacturer's specification. ○ For Elastomeric bearings, which are usually unanchored, anti-skid pads or recesses in the pedestal may be provided to restrict movement during service. 5. Gap and Clearance Checks:

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Scope of Activity	
	- o Ensure specified horizontal and vertical clearances around the bearing and ensure there is no constraint on movement. - o Use feeler gauges and spirit levels to confirm level placement and even contact pressure.
6.	Grouting of Anchor Pockets (if applicable): - o Pockets for anchor bolts or holding-down bolts shall be grouted using non-shrink, flowable grout conforming to IS 4031 / ASTM C1107. - o Curing of grout shall be ensured as per manufacturer's recommendation.
7.	Final Inspection & Documentation: - o Post-installation, conduct visual alignment check and verify with the approved checklist. - o Manufacturer's installation certificate and inspection report shall be recorded and submitted. - o Bearing rotation or movement (if expected) shall be checked under trial loading, if specified.
Applicable Codes and Standards: • MoRTH Section 2200 • IRC:83 Part II – <i>Specifications for POT/PTFE Bearings</i> • IRC:83 Part I – <i>For Elastomeric Bearings</i> • IS 2062 – <i>For structural steel parts used in bearings</i> • ASTM D4014 – <i>Standard for Elastomeric Bearings</i> • IS 10270 – <i>For POT/PTFE type bearings</i>	
Indicative Equipment Involved: • Chain pulley blocks / cranes • Levelling instruments (spirit levels, laser levels) • Epoxy adhesive tools • Grouting pumps or mixers • Steel wedges / bearing jigs • Lifting platforms / scaffolding • Torque wrench for tightening anchor bolts	
H5. Lowering of girders post replacement Refer MoRTH Clause 1400, Clause 2000, Clause 2200 This item includes the controlled lowering of bridge girders after successful placement of new bearings. The work shall be executed using appropriate hydraulic jacks or lifting mechanisms, ensuring uniform transfer of loads onto the newly fixed bearings without inducing eccentric stresses, misalignments, or undue shocks to the structure. Detailed Description: 1. Pre-Lowering Checks: - o Ensure that the new bearings are securely fixed, grouted, aligned, and fully cured where applicable. - o All temporary supports, scaffolds, or falsework should be cleared from the girder line. - o Confirm that bearing anchor bolts (if any) are tightened as per torque specifications and that manufacturer's guidelines are followed. 2. Hydraulic System Verification: - o Check for synchronization of hydraulic jacks, pressure settings, oil levels, hoses, and control valves. - o Perform a dry run or partial load test to verify that the lowering mechanism is responding uniformly and safely. 3. Lowering Operation:	

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- Lowering shall be carried out **gradually and uniformly** from both ends or multiple points as required, not exceeding **5 mm per stage** to prevent tilting or rotational stress on the girders.
- **Communication** among the operating team must be coordinated throughout the lowering to avoid differential settlement.
- 4. **Load Transfer and Monitoring:**
 - Use **dial gauges, load cells, or displacement meters** to monitor load transfer and settlement at each step.
 - Ensure that the full structural dead load is **properly transferred to the new bearings** with no excessive tilt or gap.
- 5. **Post-Lowering Inspection:**
 - Conduct a **visual inspection of the bearings** to ensure there is no movement, cracking of grout, or displacement.
 - All jacks and lifting equipment must be **safely removed** after confirming that the structure is fully stable on the bearings.
- 6. **Documentation & Records:**
 - Maintain a **stage-wise logbook** of jack pressures, lowering sequence, time, and observations.
 - A final **as-built bearing placement report** and **load transfer confirmation certificate** shall be submitted by the contractor.

Indicative Equipment Involved:

- Hydraulic jacks with pressure gauge & synchronized control
- Load monitoring gauges (dial gauges / load cells)
- Steel wedges / safety supports
- Torque wrenches and alignment tools
- Communication devices (intercoms / walkie-talkies)

I. Crack & Joint Treatments Scope of Activity

II. Groove cutting & PU sealant filling

Reference Clause: MoRTH Section 2600 (Joints in Concrete Pavement) and relevant practices from IRC:57 and IRC:15 as applicable

Scope of Work:

This item includes cutting of a neat, uniform groove over construction joints, cracks, or predetermined locations on concrete bridge decks or approach slabs, followed by cleaning, priming, and filling with high-performance Polyurethane (PU) sealant to ensure durable watertight joints. The work is intended to accommodate limited joint movement, prevent ingress of water, chlorides, and other contaminants, and preserve the durability and service life of the deck surface.

Methodology:

1. **Surface Marking and Layout:**

Marking of groove alignment shall be done precisely using chalk or chalk line, ensuring it aligns with the joint layout plan or visible cracks to be sealed.

2. **Groove Cutting:**

- Use a **mechanized diamond-blade cutter** to cut a straight groove, typically **10–20 mm wide and 20–25 mm deep**, or as directed by the Engineer-in-Charge.
- The groove edges shall be sharp, with no chipping or spalling.
- Depth and width shall be checked using a steel scale or depth gauge at regular intervals.

3. **Cleaning of Groove:**

- After cutting, clean the groove thoroughly using **compressed air (minimum 100 psi)** and a wire brush.
- Remove all loose particles, laitance, moisture, grease, or any foreign matter.
- If the surface is damp, allow adequate time for drying or use a **hot air blower**.

4. **Primer Application:**

- Apply a **compatible primer** recommended by the PU sealant manufacturer, using a brush or low-pressure spray.
- Allow the primer to cure as per product data sheet (typically 30–60 minutes) before sealant application.
- Do not allow traffic or dust accumulation after priming.

5. **Backer Rod Placement (if required):**

- A **closed-cell polyethylene backer rod** shall be inserted to the desired depth to provide a firm base and control the depth of sealant.
- Diameter of backer rod shall be 20–25% larger than the groove width to ensure snug fit.

6. **PU Sealant Application:**

- Use a **hand-held or pneumatic sealant gun** to fill the groove with cold-applied, **self-leveling polyurethane sealant**.
- The sealant shall conform to **ASTM C920 / BS EN 14188-2**, with movement capability of $\pm 25\%$ minimum, and excellent UV and chemical resistance.
- The sealant shall be applied slightly convex to allow for shrinkage.
- Tooling (if needed) must be done within the sealant's open time to ensure proper adhesion and finish.

7. **Curing and Protection:**

- Allow sealant to cure undisturbed for minimum 24 hours or as per manufacturer's recommendation.
- Traffic shall not be allowed until full curing is achieved.

Materials:

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• PU Sealant: Cold-applied, self-levelling, moisture-cured, with elongation > 600% • Primer: Manufacturer-recommended • Backer Rod: Closed-cell polyethylene, compressible • All materials shall be from approved vendors and supported by manufacturer's datasheets and test certificates. Indicative Equipment Involved: • Concrete groove cutting machine (diamond blade) • Air compressor with nozzle • Sealant gun (manual or pneumatic) • Hot air blower (if required) • Wire brushes, hand tools, PPE kits Measurement: • Measurement shall be in Running Metres (RM) of completed and sealed groove, conforming to the specified width and depth, accepted by the Engineer. Safety and Quality Assurance: • Operatives shall wear protective gear including gloves, goggles, and masks. • Proper signage, barricading, and caution tape shall be used to restrict access during cutting and curing. • Work shall comply with MoRTH Clause III (Safety Precautions) and IS:962 for quality workmanship. • Quality checks shall include width, depth, adhesion test (ASTM C794), and visual inspection for continuity, smoothness, and voids.
<u>12. V-groove cutting and crack stitching</u> Reference Clause: MoRTH Section 2800 (Repair of Structures), aligned with IRC:SP:80 and IRC:SP:74 guidelines on structural crack repair and durability enhancement. Scope of Work: This item covers the work of addressing active and dormant cracks in concrete elements of bridge structures through V-groove cutting followed by stitching using steel staples or stitching bars, bonded with structural epoxy. The activity is intended to arrest further propagation of cracks, restore structural continuity, and enhance long-term durability of concrete components such as decks, girders, crash barriers, or piers. Methodology: Crack Identification and Marking: ○ Conduct a detailed crack mapping survey using crack width measurement tools (crack comparator) to record crack width, depth, and orientation. ○ Only structural cracks (typically >0.3 mm wide or showing signs of movement) are to be treated under this item. ○ Mark crack lines clearly on the concrete surface for groove preparation. V-Groove Cutting: ○ Use a handheld or mechanized angle grinder fitted with a diamond wheel to cut a V-shaped groove along the marked crack. ○ The groove shall be approximately 10–15 mm wide and 12–20 mm deep, depending on

I. Crack & Joint Treatments Scope of Activity

crack depth and extent, as directed by the Engineer.

- The cut should expose clean, sound concrete surfaces free of laitance or dust.

3. Drilling for Stitching Bars:

- Drill **horizontal or slightly inclined holes (typically 8–12 mm dia)** at regular intervals (typically every 300–500 mm along the crack line), crossing the crack perpendicularly.
- The embedment length on each side of the crack shall be as per design, usually 50–75 mm minimum.

4. Surface and Hole Cleaning:

- Clean the groove and drilled holes thoroughly using **compressed air and brushes** to remove dust, slurry, and moisture.
- Ensure the substrate is dry and free from oil or contaminants before epoxy application.

5. Epoxy Application and Stitching Bar Fixing:

- Prepare and apply **structural-grade epoxy resin (as per ASTM C881 Type IV/V or equivalent IS standard)** to the groove and inside the drilled holes.
- Insert pre-bent stitching bars or **U-shaped mild steel bars (8–12 mm dia)** into the holes with full contact bonding using epoxy.
- Fill the remaining groove flush with structural epoxy mortar or paste, ensuring no voids remain.

6. Finishing and Curing:

- Tool the surface smoothly and allow curing as per manufacturer's recommendations.
- Protect the area from vibration, moisture, and direct sunlight during the curing period.

Materials:

- Stitching Bars: Mild steel or stainless steel U-bars of 8–12 mm diameter, rust-free and of specified shape.
- Structural Epoxy: Two-part epoxy adhesive conforming to ASTM C881 / IS 9103 for bonding and filling.
- Cleaning Agents: Acetone or suitable degreaser if required for pre-cleaning.

Indicative Equipment Involved:

- Angle grinder with diamond blade
- Electric rotary drill with masonry bits
- Compressed air blower
- Hand tools: brushes, trowels, putty knives
- PPE kit, measuring gauges, epoxy dispensers

Measurement:

- Measured in **Running Metres (RM)** of crack line treated, including groove cutting, bar insertion, epoxy filling, and finishing, accepted by the Engineer.

Safety and Quality Assurance:

- Workers shall wear gloves, eye protection, and masks during epoxy handling and grinding operations.
- Area shall be cordoned off with signage as per Clause III of MoRTH.
- Crack width and depth shall be recorded pre- and post-repair.
- Core samples or pull-out tests may be conducted at random locations for quality validation.
- All epoxy and bar placement shall be supervised by an experienced technician.

I. Crack & Joint Treatments

Scope of Activity

I3. Installation of glass fibre mesh for crack control

Reference Clause: MoRTH Section 2800 (Repair of Structures); aligned with IRC:SP:80 and IRC:SP:74 guidelines for crack mitigation and surface strengthening.

Scope of Work:

This item involves surface preparation and application of **alkali-resistant glass fibre mesh** embedded in polymer-modified mortar or cementitious overlay to control microcracks and arrest further surface deterioration of concrete elements such as decks, crash barriers, parapets, or substructure faces. The process enhances tensile resistance across potential crack zones and ensures long-term surface durability under thermal and shrinkage stresses.

Methodology:

1. Surface Preparation:

- Clean the designated concrete surface to remove all loose particles, dirt, laitance, oil, and any previous coating using **wire brushing and compressed air or water jetting**.
- Repair minor defects (such as honeycombs, minor cracks) using polymer mortar before mesh installation.
- Ensure the surface is sound, slightly rough (minimum surface profile of CSP 3–4), and moist but not wet at the time of application.

2. Primer / Bond Coat Application:

- Where specified or recommended by the product manufacturer, apply a **bonding primer or slurry coat** (typically cement + polymer + water) to improve adhesion between substrate and mortar.

3. Mortar Base Layer Application:

- Apply a **first coat of polymer-modified cementitious mortar**, 2–4 mm thick using a trowel or spatula.
- The mortar shall be prepared using approved polymer admixtures conforming to ASTM C881 or IS 2645 standards.
- Ensure even spreading without air pockets.

4. Glass Fibre Mesh Embedding:

- Immediately after the base coat, embed the **alkali-resistant glass fibre mesh (typically 45–60 gsm with 5x5 mm grid size)** into the wet mortar.
- The mesh shall be gently pressed into the mortar ensuring full contact and no wrinkles, overlaps, or voids.
- Where overlaps are unavoidable, provide a minimum **50 mm overlap** in both directions.

5. Second Coat and Finishing:

- Apply a second coat of polymer mortar (1.5–3 mm) to fully encapsulate the mesh and create a smooth finish.
- Total thickness of the finished layer shall generally be **5–8 mm**, or as directed.
- Surface should be finished with a steel trowel for uniformity.

6. Curing:

- Begin moist curing after initial set for a minimum of 3–5 days, unless a **curing compound** (as per MoRTH 2800) is applied.
- Protect from rapid drying, rain, or physical damage during curing.

Materials:

- **Glass Fibre Mesh:** Alkali-resistant, woven, 45–60 gsm, approved by the Engineer.
- **Polymer Modified Mortar:** Blend of OPC, graded sand, and approved polymer (SBR or Acrylic)

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with water–cement ratio <0.45. • Bonding agent or slurry coat as specified. Indicative Equipment Involved: • Power grinder and wire brush for surface cleaning • Trowels, spatulas, and mixing paddles • Water sprayer or compressed air blower • Mortar mixing drums or mechanical mixers • PPE kits, scaffoldings for vertical/hard-to-access surfaces Measurement: • Measured in Square Metres (Sqm) of finished surface area with mesh fully embedded, cured, and accepted by the Engineer. Safety and Quality Assurance: • Use of gloves, goggles, and masks is mandatory during surface preparation and mortar mixing. • All scaffolding must comply with IS:3696 for working at heights. • Material certifications for mesh and polymer must be submitted before use. • Test patches may be conducted for bond strength, finish, and mesh placement uniformity. • Surface shall be visually inspected for wrinkles, detachment, or air gaps post-application.

Shotcreting / Guniting Works

Scope of Activity

J1. Preparatory Work for Shotcreting (Surface Preparation and Reinforcement Fixing)

Reference Clause: MoRTH Section 2800 (Repair of Structures); aligned with IRC: SP:80 and IRC:SP:74 guidelines on rehabilitation of concrete structures using shotcrete/gunite.

Scope of Work:

This item includes thorough surface preparation of deteriorated concrete elements and fixing of reinforcement mesh or dowel bars prior to application of shotcrete/gunite. The aim is to ensure effective bonding of the shotcrete layer with the existing substrate and provide necessary reinforcement to restore the structural integrity of components such as girders, piers, abutments, retaining walls, or crash barriers.

Methodology:

1. **Surface Preparation:**
 - Remove all unsound, loose, cracked, or delaminated concrete using **chisels, electric hammers, or hydro-demolition**, as per Engineer's direction.
 - All rusted or exposed rebars must be cleaned using **wire brushing, sandblasting, or mechanical tools** to remove corrosion products, followed by application of **anti-corrosion primer**.
 - Substrate shall be prepared to a rough surface profile (minimum CSP 5-7), free from dust, laitance, oil, or contaminants.
2. **Substrate Cleaning:**
 - After chipping and preparation, thoroughly clean the surface using **compressed air** or high-pressure water jet (≥ 2000 psi).
 - Remove standing water and ensure saturated surface dry (SSD) condition before reinforcement or shotcrete placement.
3. **Fixing of Reinforcement Mesh / Dowels (if specified):**
 - Fix **welded wire mesh (typically 6-8 mm dia at 100-150 mm c/c)** using stainless steel tie wires or welded studs.
 - Maintain a minimum **cover of 20-25 mm** behind the mesh using spacers or plastic chairs.
 - Dowels or rebars (8-16 mm dia) may be anchored into pre-drilled holes using **epoxy resin or grout** where structural enhancement is required.
 - The fixing system shall ensure no displacement during shotcreting.
4. **Final Inspection Before Shotcreting:**
 - The prepared surface and fixed reinforcement shall be inspected and approved by the Engineer before any shotcrete application.
 - Surface must be pre-wetted in advance and brought to SSD condition prior to placing shotcrete.

Materials:

- Welded wire mesh of required diameter and spacing (IS 1566 / IS 432)
- Anchoring rebars / dowels (Fe500D as per IS 1786)
- Anti-corrosion primer for rebars (zinc-rich epoxy or equivalent)
- Polymer bonding agent or slurry coat if required
- Anchoring grout / epoxy (conforming to ASTM C881 / IS 9103)

Indicative Equipment Involved:

- Light-duty demolition hammers or chisels
- Needle scalers or scarifiers
- Rebar cleaning tools (wire brushes, grinders)
- Air compressor or water jetting pump
- Drilling machine with rotary bits
- Mesh tying tools and scaffolding

Shotcreting / Guniting Works	Scope of Activity
- PPE kits and safety harnesses Measurement: - Measured in Square Metres (Sqm) of surface prepared and reinforcement mesh fixed, ready for shotcreting and accepted by the Engineer. Safety and Quality Assurance: - All demolition or chipping work shall be carried out with proper PPE including face shield, ear protection, and safety goggles. - Fall protection shall be ensured for work at height using scaffolds and lifelines per IS:3696. - Mesh and bars shall be cut, bent, and fixed as per bar bending schedule and approved shop drawings. - All materials must carry valid test certificates. - Bond pull-off or adhesion tests may be carried out to check surface suitability.	
<u>J2. Shotcrete application (wet/dry mix)</u> Reference Clause: MoRTH Section 2800 (Repair of Structures); aligned with IRC:SP:80, IRC:SP:74 and IS 9012 (Recommended Practice for Shotcreting) Scope of Work: This item includes the application of shotcrete using wet or dry mix methods over prepared concrete surfaces for structural rehabilitation or protective overlay. Shotcreting shall be used for strengthening, restoring cross-section, arresting progressive deterioration, or providing a durable overlay on concrete elements such as girders, piers, abutments, and retaining walls. Methodology: Pre-Application Preparation: - Ensure the substrate is properly prepared, clean, sound, and in Saturated Surface Dry (SSD) condition as per Item J1. - Reinforcement mesh or dowels (if specified) shall be fixed and inspected prior to shotcrete application. - All utilities, inserts, joints, and boundary elements shall be masked or protected from rebound and over-spray. Material Preparation: For Wet Mix Method: - Prepare the shotcrete mix with cement, graded sand, coarse aggregates (≤ 10 mm), water, and admixtures in a controlled batching plant. - Mix shall conform to the specified design grade (typically M25–M40), with water-cement ratio ≤ 0.45 and slump of 60–80 mm. - Use of polymer admixtures, silica fume, or steel fibres is permitted as per structural requirement. For Dry Mix Method: - Cement and aggregates shall be pre-mixed and fed into the shotcrete machine dry; water is added only at the nozzle during application. - Used primarily for patch repairs or where water availability is limited. Shotcrete Application: - Apply shotcrete using a rotary or piston pump (wet mix) or guniting machine (dry mix) with compressed air, ensuring a uniform pressure of 5–7 bars.	

Shotcreting / Guniting Works	Scope of Activity
	- Nozzle shall be held at approximately right angles (75°–90°) to the surface, at a distance of 0.5–1.0 metres. - Apply in multiple passes (lift thickness 20–40 mm), especially on vertical or overhead surfaces to avoid sagging or rebound. - Ensure minimum rebound and reapplication over previous layers only after initial set. 4. Finishing & Surface Tolerance: - Screed or trowel the final surface to desired finish (rough/textured/smooth as required). - Minimum thickness as per design; typically 25–75 mm in single/multiple layers. 5. Curing: - Initiate curing after initial setting using moist burlap, water fogging, or curing compound for a minimum of 7 days. - For polymer-modified or fibre-reinforced shotcrete, curing shall follow the manufacturer's recommendation and MoRTH 2800 guidelines.
Materials: - OPC 43/53 grade (IS 269 / IS 12269) - Graded fine and coarse aggregates (IS 383) - Water conforming to IS 456 - Admixtures: Plasticizers, polymers, accelerators as per IS 9103 / ASTM C494 - Fibre reinforcement if specified (steel / polypropylene, as per ASTM C1116)	
Indicative Equipment Involved: - Shotcrete pump / guniting machine with compressor - Transit mixer or on-site batching plant - Nozzle assembly with water injection (for dry mix) - Vibrating screeds, trowels - Water curing system / curing compound sprayers - PPE including shotcrete shields, gloves, goggles, and ear protection	
Measurement: - Measured in Cubic Metres (Cum) of shotcrete applied and accepted as per design thickness and surface area. - Measurement shall be based on approved drawings or actual thickness verified by depth pins or core samples.	
Safety and Quality Assurance: - Operators shall wear full PPE, including face shields and protective clothing due to rebound and high-velocity projection. - Scaffolding and fall protection to conform with IS:3696. - Rebound material shall not be reused. - Trial panels shall be prepared for mix approval and nozzleman proficiency before execution. - In-situ core testing or rebound hammer tests (as per IS 13311) may be conducted to check compressive strength. - Minimum 3–5 test cores per 100 sqm shall be extracted, if directed by Engineer.	

K. Surface Protection and Coatings	Scope of Activity
<u>K1. Anti-carbonation / waterproof coatings</u> Reference Clause: MoRTH Section 2800 (Repair of Structures); aligned with IRC:SP:80 and IS 14177 (Waterproofing of Concrete Structures) Scope of Work: This item covers the application of anti-carbonation and waterproof coatings over concrete surfaces, particularly on exposed elements like facades, beams, columns, and other structures vulnerable to carbonation, water ingress, and environmental degradation. These coatings help in extending the service life of the structure by preventing moisture-related deterioration and reinforcing the surface against carbonation-induced corrosion. Methodology: 1. Surface Preparation: ○ Ensure that the surface to be treated is thoroughly cleaned by removing all dirt, oil, dust, grease, and any contaminants using high-pressure water jetting, sandblasting, or mechanical cleaning methods. ○ If surface deterioration or scaling is observed, carry out light abrasive treatment to expose a clean, sound surface. ○ Moisture content on the surface should be reduced to SSD (Saturated Surface Dry) condition before application. 2. Coating Application: ○ Anti-carbonation Coating: ▪ Apply a breathable anti-carbonation coating that allows moisture vapor to escape while preventing carbon dioxide from penetrating the concrete. ▪ The coating shall be applied in two coats, with the second coat applied after the first has dried, ensuring uniform coverage without runs. ▪ Follow the manufacturer's recommendation for curing time between coats (typically 4–6 hours). ○ Waterproofing Coating: ▪ Apply waterproofing coating using brush, roller, or spray as per the manufacturer's guidelines. ▪ The coating shall be continuous, without gaps or voids, and should form an impermeable barrier to prevent water penetration. ▪ Multiple coats may be applied depending on the required thickness (usually 2–3 coats). 3. Curing: ○ Allow the coating to cure as per the manufacturer's recommended time (typically 7 days), avoiding any traffic or exposure during this period. ○ Ensure the coatings are not subjected to mechanical damage or heavy weather conditions until curing is complete. Materials: • Anti-carbonation Coating: Water-based, breathable, and high-durability anti-carbonation coating (IS 14177 / manufacturer-specific specifications). • Waterproofing Coating: Cementitious or polymer-based waterproofing products (IS 2645 / IS 9103). • Additives (if required): Accelerators, pigments, or thickeners as per product specifications. Indicative Equipment Involved: • High-pressure water jetting pump	

K. Surface Protection and Coatings

Scope of Activity

- Sandblasting machine
- Roller, brush, or spray equipment for coating application
- Scaffolding (for working at height)
- PPE, including gloves, goggles, and face shields
- Curing equipment (plastic sheets, misting system, etc.)

Measurement:

- Measured in **Square Metres (Sqm)** of surface area treated and accepted by the Engineer, as per approved drawings or site measurement.
- The measurement will include all applied coats as per the agreed scope.

Safety and Quality Assurance:

- Personnel involved in surface cleaning, preparation, and coating application must wear the appropriate PPE including gloves, safety goggles, respirators (if required), and protective clothing.
- During surface preparation, ensure that the work area is barricaded to avoid exposure to dust or debris.
- Only certified, approved waterproofing and anti-carbonation coatings with valid test certificates should be used.
- Application shall be in accordance with the manufacturer's instructions and MoRTH standards for coating thickness and application techniques.
- Performance of the coating shall be verified by **adhesion tests** and **water penetration tests** at random spots.
- Coating will be tested for its **thickness, uniformity, and cure time** by the Engineer.

K2. Silane/Siloxane-based water repellent

Reference Clause: MoRTH Section 2800 (Repair of Structures); aligned with IS 9103 (Waterproofing of Concrete Structures)

Scope of Work:

This item covers the application of **Silane/Siloxane-based water repellent** treatment to concrete and masonry surfaces to enhance their resistance to water penetration. These treatments form a hydrophobic layer on the surface, preventing moisture ingress while maintaining the substrate's ability to breathe, thus protecting the structure from weathering, freeze-thaw damage, and carbonation-related corrosion.

Methodology:

- Surface Preparation:**
 - Clean the surface thoroughly by **pressure washing, abrasive blasting**, or using **mechanical cleaning** methods to remove any dirt, oil, grease, and other contaminants.
 - Ensure the surface is in a **Saturated Surface Dry (SSD)** condition, and free from any loose particles or damaged concrete.
 - If the surface shows signs of previous water damage or efflorescence, appropriate remedial treatment should be done before the application.
- Application Process:**
 - **Silane/Siloxane Treatment:**
 - The water repellent solution is typically supplied as a ready-to-use liquid. It is applied by **brush, roller, or low-pressure spray** (to ensure even coverage).
 - The treatment should be applied uniformly across the surface, ensuring that the coating does not leave streaks or gaps.

K. Surface Protection and Coatings

Scope of Activity

- The application should cover the entire surface to form a continuous, hydrophobic barrier.
- If multiple coats are needed, apply subsequent coats after the first one has dried (generally 1–2 hours, depending on temperature and humidity).

3. Curing and Drying:

- Allow the treated surface to cure for **48–72 hours** before subjecting it to any moisture or exposure to heavy traffic.
- Ensure the treated surface is not exposed to rain or high moisture during the curing period.

4. Post-Application Inspection:

- Inspect the treated surface for uniformity and to ensure that no area has been missed.
- Perform a **water drop test** to ensure the surface is effectively repelling water. If any section fails, reapply the water repellent as necessary.

Materials:

- **Silane/Siloxane-based Water Repellent Solution:** Conforming to IS 9103 and manufacturer specifications.
- **Solvent (if required for thinning):** Conforming to applicable standards for coatings.
- **Additives (optional):** For enhanced performance under extreme weather conditions, certain additives or boosters may be incorporated as per the manufacturer's instructions.

Indicative Equipment Involved:

- Pressure washing equipment
- Abrasive blasting machines
- Spray equipment (airless sprayers or low-pressure sprayers)
- Brushes and rollers for manual application
- PPE including gloves, goggles, and face masks to avoid inhalation of fumes
- Scaffolding (for working at height)

Measurement:

- Measured in **Square Metres (Sqm)** of surface area treated with Silane/Siloxane-based water repellent, based on approved drawings or actual field measurements.
- Measurement shall be made for the total area covered by the water repellent treatment, including multiple coats if applicable.

Safety and Quality Assurance:

- Personnel applying the water repellent treatment shall wear appropriate **PPE**, including gloves, face shields, and protective clothing.
- Ensure proper ventilation in enclosed areas during the application of solvents or chemicals.
- Manufacturer's specifications must be adhered to for the **drying time, coverage rate, and environmental conditions** (temperature, humidity) during the application.
- Ensure that the surface is **uniformly treated**, with no missed patches or inconsistencies.
- A **water drop test** should be conducted on random spots to check for proper water repellency post-application.

K3. Elastomeric acrylic coatings

Reference Clause: MoRTH Section 2800 (Repair of Structures); aligned with IS 1661 (Code of Practice for Application of Coatings to Concrete Surfaces) and IS 11957 (Acrylic Coatings for Concrete)

K. Surface Protection and Coatings

Scope of Activity

Scope of Work:

This item involves the application of **elastomeric acrylic coatings** to concrete surfaces to provide a flexible, durable, and waterproof protective layer. These coatings are designed to bridge small cracks and offer excellent resistance to weathering, UV degradation, and water ingress, making them ideal for use on external concrete surfaces, including façades, beams, and columns.

Methodology:

1. **Surface Preparation:**
 - Clean the surface thoroughly to remove **dust, dirt, grease, oil, and other contaminants** using pressure washing or abrasive cleaning methods.
 - Repair any visible cracks or damages on the concrete surface using appropriate **crack fillers** or **patching compounds**.
 - Ensure that the surface is in a **Saturated Surface Dry (SSD)** condition before applying the coating.
2. **Primer Application:**
 - Apply a **bonding primer** suitable for acrylic coatings, following the manufacturer's instructions.
 - The primer should be applied evenly, ensuring full coverage across the surface. Allow the primer to cure for the specified time (typically 4–6 hours) before proceeding with the coating.
3. **Coating Application:**
 - **Elastomeric Coating:**
 - Apply the elastomeric acrylic coating using **brush, roller, or spray** (depending on the surface and accessibility).
 - The coating should be applied in **two coats**, with the second coat applied after the first coat has dried (usually 4–6 hours).
 - Ensure a uniform, crack-bridging film with no pinholes or voids. The coating must be applied at the specified **wet film thickness** (usually 200–300 microns per coat).
4. **Curing and Drying:**
 - Allow the coating to cure as per the manufacturer's specifications (typically 7–10 days).
 - During the curing period, the surface should be protected from heavy traffic, rain, or mechanical damage.
 - Avoid any exposure to moisture or excessive UV light until the coating is fully cured.
5. **Post-Application Inspection:**
 - Conduct a thorough inspection of the coated surface to ensure uniformity, proper adhesion, and coverage.
 - Check the cured surface for **flexibility, crack-bridging properties, and water resistance**.

Materials:

- **Elastomeric Acrylic Coating:** Conforming to IS 11957 and manufacturer-specific formulations.
- **Bonding Primer:** Acrylic or epoxy-based primer suitable for use with elastomeric coatings.
- **Crack Filler:** Non-shrinking, flexible crack filler material for pre-repair of cracks.

Indicative Equipment Involved:

- Pressure washing or sandblasting equipment for surface preparation
- Brushes, rollers, or spray equipment for application
- Scaffolding for elevated areas
- PPE including gloves, goggles, and face masks to avoid inhalation of fumes
- Curing sheets or protective covers (if needed)

Measurement:

K. Surface Protection and Coatings	Scope of Activity
	- Measured in Square Metres (Sqm) of surface area covered by the elastomeric acrylic coating, based on actual site measurement or approved drawings. - Measurement shall be taken after the full application of all coats, as per the specified thickness. Safety and Quality Assurance: - Workers applying the coating should wear appropriate PPE, including gloves, face shields, and respiratory protection if required. - Ensure proper ventilation during the application of solvents or acrylic-based coatings, particularly in confined spaces. - All materials used must meet the relevant BIS and MoRTH standards for quality and durability. - The coating should be checked for flexibility and adhesion strength using standard test methods. - During curing, the work area must be barricaded to prevent unauthorized access and protect the surface from potential damage.

L. Drainage Spouts

Scope of Activity

L1. Providing and Replacing Drainage Spout Assembly

Reference Clause: MoRTH Section 2705 (Drainage Spouts for Bridge Decks)

Scope of Work:

This item includes all charges for providing, replacing, and installing drainage spout assemblies on bridge decks as per approved drawings and MoRTH Clause 2705. The work involves removal of damaged or non-functional spouts (if applicable), cleaning of deck scuppers, supply and installation of new drainage spout assembly including pipes, hoppers, collars, anti-clogging mesh, and sealing works. The objective is to ensure quick and uninterrupted drainage of rainwater from the bridge deck to prevent water accumulation, deterioration of wearing course, or corrosion of reinforcement.

Methodology:

1. **Survey and Preparation:**

- Identify locations of existing or proposed drainage spouts as per structural drawings.
- Mark locations and inspect deck scupper openings for blockages or damage.
- Ensure that the number, spacing, and placement of spouts meet the drainage design intent.

2. **Dismantling of Existing Spout Assembly (if applicable):**

- Carefully cut or unfasten existing damaged spouts using mechanical tools.
- Remove the entire spout assembly including mesh, pipe, and collar.
- Clean the scupper opening with wire brushes or compressed air.

3. **Surface Preparation:**

- Remove loose mortar or concrete around the opening.
- Prepare the contact surface by chiselling and cleaning to receive new components.
- Ensure that the opening slope allows free water flow without backflow or clogging.

4. **Installation of New Spout Assembly:**

- Insert GI or SS pipe (as per design, typically 100 mm to 150 mm diameter) through the scupper hole.
- Fix the hopper or funnel at the inlet side of the pipe, flush with the deck level.
- Attach the anti-clogging stainless steel mesh or HDPE filter inside the hopper to prevent debris ingress.
- Provide anchorage collars or brackets to support the spout and ensure rigidity.
- If spout is to be grouted, apply polymer-modified mortar or epoxy grout around the pipe where it passes through the slab.
- Seal all joints with weatherproof and leakproof sealant to avoid water leakage to the substructure.

5. **Finishing and Water Testing:**

- Apply finishing mortar to ensure smooth transition between deck and installed spout.
- Pour water from the deck to test flow through the spout, ensuring no leakage or backpressure.
- Make corrections if the water does not drain properly.

6. **Disposal of Debris:**

- Collect and dispose dismantled material and debris away from the site as per environmental guidelines.
- Ensure no blockage or waste is left near bridge piers or slopes.

Materials:

- GI or SS pipe (diameter as per design, corrosion-resistant)
- Stainless steel/HDPE mesh for clog protection
- Grout: Polymer modified mortar or epoxy grout
- Hopper and collar assembly (as per standard drawing)
- Weatherproof sealant (PU or epoxy-based)
- Fasteners, support brackets, and mounting hardware

L. Drainage Spouts Scope of Activity
Indicative Equipment Involved: • Angle grinder/cutting machine • Grouting tools and mixing pans • Wire brushes, blowers or compressed air for cleaning • Measuring tape and alignment tools • PPE for workers (gloves, helmets, face shield, boots) Measurement: • Measured in number of assemblies (Each/No.) provided or replaced and made functional. • Includes dismantling (if any), cleaning, and complete installation including testing. Safety and Quality Assurance: • Use only corrosion-resistant materials for durability. • Ensure all fixings are rigid to prevent detachment due to water flow or vibration. • Workers to use fall protection if working at deck edges. • Ensure no tools or debris fall through openings during dismantling or installation. • Testing of each installed spout to ensure proper drainage before approval. • Follow all safety protocols under MoRTH Clause 111 for working on live traffic bridges.
<u>L2. Providing / Replacing Missing or Damaged Down Take Pipes</u> Reference Clause: MoRTH Section 2705 (Drainage Spouts and Down Take Pipes for Bridge Decks) Scope of Work: This item includes all operations for providing and fixing new down take pipes or replacing damaged or missing ones, as per approved drawings and MoRTH specifications Clause 2705. The work involves removal of existing broken pipes (if any), surface preparation, alignment and fixing of new pipes, ensuring a continuous drainage path from the deck-level drainage spouts to the discharge point. The objective is to ensure effective drainage and avoid water accumulation on structural components such as piers, abutments, or bearings. Methodology: Site Assessment and Marking: • Identify all locations with missing or damaged down take pipes. • Cross-check with the drainage layout and structural drawings to confirm pipe sizes and anchorage design. Dismantling of Damaged Pipes (if applicable): • Cut and remove broken or corroded pipes using mechanical tools. • Remove all clamps, fasteners, and sealants associated with the old pipe. • Clean the mounting surface thoroughly to prepare for new installation. Surface Preparation: • Clean and remove loose concrete or rust from the mounting zones. • Repair damaged mounting areas using polymer mortar or non-shrink grout, if needed. Supply and Fixing of Down Take Pipe: • Use corrosion-resistant GI/SS/UPVC pipes of required diameter (typically 100 mm to 150 mm). • Cut the pipe to length and align it vertically from the spout outlet to the designated discharge level. • Fix the pipe using stainless steel brackets/clamps anchored with expansion bolts at regular intervals (usually 1.0 to 1.5 m). • Ensure the pipe connection to the spout is watertight using rubber gaskets or sealant.

L. Drainage Spouts Scope of Activity
• Provide bell mouth or shoe at the outlet end to direct water away from the bridge substructure. 5. Sealing and Finishing: • Seal joints with approved weatherproof sealant. • Paint GI pipes with two coats of epoxy-based anti-corrosive paint, if applicable. • Ensure all components are aligned, secured, and allow free flow of water. 6. Water Testing and Quality Check: • Pour water from the deck to verify proper drainage through the newly installed pipe. • Check for leakages, loose fixings, or blockages. • Rectify defects before final approval. Materials: • GI/SS/UPVC down take pipe of approved make and diameter • Clamps, anchors, and fixing hardware • Weatherproof sealant (PU or epoxy) • Epoxy primer and anti-corrosive paint (if using GI pipes) • Rubber gaskets or connectors Indicative Equipment Involved: • Cutting/grinding tools • Drill machine and anchor bolt kit • Measuring tape, plumb bob or laser level • Water hose for testing • PPE kits (gloves, helmets, harness for elevated work) Measurement: • Measured in running metres (RM) of pipe length provided and installed in position. • Includes all accessories, dismantling (if applicable), and full functional testing. Safety and Quality Assurance: • Ensure all fixing points are strong enough to bear the pipe's weight with water load. • Use scaffolding or suspended platforms for safe working at heights (in line with IS 3696). • Ensure pipes do not interfere with bearings or expansion joints. • Conduct load and water flow tests before acceptance. • Follow MoRTH Section III for safety compliance during elevated work.
<u>L3. Providing and Fixing Missing Mild Steel (MS) Grating at Drainage Spouts</u> Reference Clause: MoRTH Section 2705 (Drainage Spouts and Down Take Pipes for Bridge Decks) and IS 2062 for MS material Scope of Work: This item includes fabrication, supply, and fixing of missing MS gratings over drainage spout openings to prevent debris, stones, and other objects from entering and blocking the down take pipes. The grating is an essential component to ensure smooth drainage and longevity of the bridge drainage system. The work involves measuring the opening, preparing the grating, applying corrosion protection, and securely fixing it in place with approved anchoring arrangements. Methodology: 1. Site Inspection and Measurement: • Identify all spouts without gratings. • Measure the opening dimensions of each drainage outlet precisely.

L. Drainage Spouts

Scope of Activity

- Record shape and depth for custom fabrication if needed.
- 2. **Fabrication of Grating:**
 - Fabricate MS bar grating using IS 2062 Grade steel, bars typically spaced at 20–40 mm centres.
 - The grating should be capable of withstanding incidental foot loads and debris impact.
 - Provide welded frame, if required, to support the grating.
- 3. **Surface Treatment:**
 - Clean and apply one coat of zinc chromate primer followed by two coats of epoxy-based anti-corrosive paint.
- 4. • Alternatively, provide hot-dip galvanization as per IS 4759 (recommended in corrosive/humid environments).
- 5. **Fixing the Grating:**
 - Place the fabricated grating over the drainage spout securely.
 - Fix using stainless steel bolts or welding onto existing frames or embedded metal inserts.
 - Ensure it is flush with the deck surface or slightly recessed to avoid tripping hazards.
- 6. **Testing and Finishing:**
 - Pour water to ensure drainage is not impeded.
 - Ensure the grating is rigid and doesn't rattle or move.

Materials:

- MS Flat/Bar Sections (IS 2062 compliant)
- Epoxy or zinc primer and anti-corrosive paint (or galvanization)
- Anchoring bolts, fasteners, or welding rods
- Cutting, grinding, and measuring tools

Indicative Equipment:

- Welding set (if welding used)
- Hand tools (wrench, drill, grinder)
- Measuring tape and clamps
- PPE for cutting/welding work

Measurement:

- Measured **per number (each)** of MS grating fabricated and fixed in place.
- Includes all fittings, anchorage, painting, and site preparation.

Safety & Quality Assurance:

- Ensure sharp edges of the grating are ground smooth to prevent injury.
- All welds and bolts must be rust-proof and tightly secured.
- Paint/galvanize to prevent long-term corrosion.
- Conduct a functional water test and physical inspection after installation.

M. General / Supporting Activities

Scope of Activity

M1. Barricading and safety signage

Reference Clause: MoRTH Section 111 (General Requirements for Traffic Safety); IRC 67-2022 (Code of Practice for Road Signs)

Scope of Work:

This item involves the installation, maintenance, and removal of **barricades** and **safety signage** to ensure safety at the worksite during bridge maintenance activities. The purpose of this is to warn, inform, and guide traffic and pedestrians, preventing accidents and ensuring smooth movement around the work zone. The installation shall adhere to **MoRTH and IRC standards**, ensuring proper visibility, reflectivity, and structural integrity.

Methodology:

1. Barricade Installation:

- **Materials:** Barricades shall be made of **reflective tape, plastic/metal panels**, and **warning lights**. Depending on the traffic and area, **type I, type II**, or **type III** barricades (as defined by MoRTH and IRC guidelines) shall be used.
- **Location:** Barricades should be installed at critical points such as the beginning and end of the work zone, **on both sides of traffic lanes**, and at intersections if necessary.
- **Placement:** Barricades should be placed at a distance of **5-10 meters** from the work area to give enough warning to approaching vehicles. The **clearance** between the barricade and any part of the work zone should be at least **1.5 meters**.
- Ensure that the barricades are visible both during the **daytime** and **nighttime**, by using appropriate **reflective materials** and **lighting**.

2. Safety Signage:

- **Type of Signs:** Safety signs should include **warning signs, directional signs**, and **informational signs**. These should be made of **reflective, high-visibility materials** and placed at locations where drivers and pedestrians can clearly see them.
- **Placement:**
 - Warning signs (e.g., "Men at Work", "Slow Down") should be placed at **100 meters before** the work zone.
 - Directional signs (e.g., "Detour", "Right Turn Only") should be placed at appropriate points to guide traffic smoothly around the work area.
 - Signs should be installed on **stand-alone poles** or **mounted on barricades**, ensuring that they are **clear of traffic** and **visible from all directions**.

3. Nighttime Operations:

- During nighttime operations, ensure that **flashing lights** or **LED signal boards** are installed alongside the barricades and signs to improve visibility.
- For night signage, use **high-intensity reflective tapes** and **LED lights** to ensure that the signs are clearly visible from a distance.

4. Maintenance and Monitoring:

- **Regular checks** should be conducted to ensure that the barricades and signs remain upright, undamaged, and visible at all times.
- Barricades and signs must be **repositioned or replaced** immediately if they are damaged or obstructed due to weather or work activities.

5. Removal of Barricades and Signs:

- Once the maintenance work is completed, remove all barricades and signs promptly to restore the traffic flow.
- Ensure that removal is done in a safe manner, following traffic control procedures, and ensuring no traffic hazards remain.

M. General / Supporting Activities

Scope of Activity

Materials:

- **Barricades:** Reflective panels, metal or plastic frames, high-visibility materials (orange/white), reflective sheeting, warning lights.
- **Safety Signage:** Reflective vinyl sheets, metal/wooden poles, LED lights for nighttime visibility, and mounting accessories.
- **Warning Lights:** Solar-powered or battery-operated lights for placement on barricades or at critical points.

Indicative Equipment Involved:

- Traffic cones and barriers
- Flashing LED or solar lights
- Signs and signposts
- Drilling equipment (for pole installation)
- Manual or motorized lifting equipment for large signage
- PPE including **helmets, gloves, high-visibility vests, and safety shoes.**

Measurement:

- Measured in **Linear Metres (Lm)** of barricading (distance along the road covered by barricades).
- **Unit of Measurement for Signs:** Each sign installed (each unit).
- Measurement should account for **barricades used for the duration of the work**, including both temporary and permanent signage installations.

Safety and Quality Assurance:

- Ensure all personnel involved in the installation and removal of barricades wear appropriate **PPE** (helmet, high-visibility clothing, gloves).
- The **reflectivity** of signs must meet MoRTH specifications for nighttime visibility, and the installation of **flashing lights** or **LED signals** must be done as per guidelines.
- Barricades and signs should be checked regularly during work for **stability, reflectivity, and visibility.**
- Compliance with **IRC-67-2022** must be ensured, ensuring that the signage is visible, placed at the correct distance, and meets the required dimensions.

M2. Scaffolding / suspended platforms

Reference Clause: MoRTH Section 111 (General Requirements for Traffic Safety) and IS 3696 (Code of Practice for Scaffolds and Scaffolding)

Scope of Work:

This item involves the provision, installation, and maintenance of **scaffolding** or **suspended platforms** to facilitate safe access for workers performing maintenance or repair work on bridges and elevated structures. The scaffolding shall be designed, constructed, and maintained in accordance with the relevant standards and the structural requirements of the project. This includes the necessary safety measures to protect the workers and pedestrians in and around the work zone.

Methodology:

1. Scaffolding Design and Planning:

- The design of the scaffolding or suspended platforms must be **site-specific** and in line with the dimensions and load-bearing capacity of the work zone.
- Scaffolding shall be designed by qualified engineers to ensure **stability, adequate load-bearing**

M. General / Supporting Activities

Scope of Activity

capacity, and **accessibility** to workers and materials.

- The scaffolding design must include **safety rails, toe boards**, and **platform decking** to ensure the safety of workers at height.

2. Installation of Scaffolding / Suspended Platforms:

○ Scaffolding Installation:

- Erect scaffolding according to the approved design, ensuring that the base is level and secure, and the structure is **properly braced** to prevent any swaying or shifting.
- Ensure that the scaffolding is free from defects and that all connections are secure, with **metal clips or couplers** used to fix the components.
- **Vertical and horizontal tie-ins** must be provided at intervals according to the height of the structure to prevent lateral movement.

○ Suspended Platforms:

- Install **suspended platforms** using a combination of **ropes, pulleys, and counterweights** as per the design.
- Platforms should be equipped with safety guardrails, **safety harness points**, and **non-slip surfaces** for worker safety.
- Ensure that the platform is securely anchored and tested for load-bearing capacity before use.

3. Inspection and Maintenance:

○ Pre-Use Inspection:

- Conduct a thorough inspection before use, ensuring that all **bracing, securing components, and guardrails** are in place and that the scaffold is **stable**.
- Any **defective parts** such as broken pins, damaged planks, or weakened ties must be replaced immediately.

○ Routine Inspection:

- Scaffolding and suspended platforms should be inspected regularly during use, particularly after any weather events, such as **strong winds or rain**.
- Check for the integrity of all components and ensure **safe access** for workers at all times.

○ Post-Use Inspection:

- After completing the work, dismantle the scaffold or suspended platform carefully, checking for any damage that may have occurred during use.
- Ensure that the dismantling process is done in a controlled and safe manner to prevent accidents.

4. Safety Measures:

- **PPE:** All workers using the scaffolding or platform must wear appropriate **fall protection gear** such as **harnesses, lifelines, helmets**, and **non-slip footwear**.
- **Barrier Protection:** For scaffolds near live traffic or pedestrian zones, install **temporary barriers or netting** to prevent falling objects from causing injury.
- Ensure that scaffolding is **not overloaded**, and weight limits should be clearly marked and adhered to at all times.

5. Dismantling:

- Dismantle scaffolding or suspended platforms after use by reversing the installation process, ensuring safety protocols are followed.
- The dismantling process should be conducted from **top to bottom** in a controlled manner to avoid any falling debris or components.

Materials:

- **Scaffolding Materials:** Steel pipes, couplers, planks, nuts, bolts, ties, and braces.

M. General / Supporting Activities Scope of Activity
• Suspended Platform Components: Ropes, pulleys, counterweights, steel beams, non-slip decking, guardrails. • Safety Gear: Harnesses, ropes, helmets, non-slip footwear, and other fall protection gear. Indicative Equipment Involved: • Scaffolding tools for installation (wrenches, levels, etc.) • Crane or manual hoists for lifting materials to elevated work areas • Ropes, pulleys, and counterweights for suspended platforms • Lifting equipment for transporting materials to the work zone • PPE for workers, including fall arrest systems, helmets, gloves, and safety shoes Measurement: • Measured in Square Metres (Sqm) of scaffold or platform area provided and maintained, based on the actual area covered by scaffolding or suspended platform during the project. • Measurement for Suspended Platforms: Measured by the length of the platform and the area covered, not the number of platforms installed. Safety and Quality Assurance: • Ensure compliance with MoRTH and IS 3696 standards for scaffolding design, installation, and maintenance. • Scaffolding must be designed and constructed to withstand wind loads, live loads, and dead loads. • Only qualified personnel should install, inspect, and maintain scaffolding and suspended platforms. • Use of safety nets, fall arrest systems, and barriers is mandatory around scaffoldings or platforms located near open or high-traffic areas.
<u>M3. Curing using curing compounds</u> Reference Clause: MoRTH Section 2800 (Curing of Concrete) Scope of Work: This item involves the application of curing compounds to freshly laid concrete surfaces to ensure proper hydration and strength development. Curing is a crucial process for maintaining moisture in concrete, preventing early drying, and promoting proper cement hydration. The curing compounds should be applied in accordance with MoRTH and BIS standards to enhance the quality and durability of the concrete. Methodology: 1. Preparation of Surface: ○ Ensure that the concrete surface to be cured is clean, free from dust, debris, or any contaminants that could affect the bonding of the curing compound. ○ The concrete should have reached the initial set stage before the application of the curing compound. 2. Application of Curing Compound: ○ Selection of Curing Compound: ▪ The curing compound should be water-based, non-toxic, and non-flammable, with a white pigmented or clear type to ensure uniform coverage. The compound must be compatible with the specific type of concrete used. ▪ Examples of acceptable curing compounds include water-based films, acrylic-based curing agents, or membrane-forming agents that comply with relevant BIS standards such as IS 9103 (Specifications for Curing Compounds).

M. General / Supporting Activities	
Scope of Activity	
○ Method of Application: ▪ Apply the curing compound using sprayers, brushes, or rollers depending on the area and surface type. For large areas, mechanical sprayers should be used for uniform coverage. ▪ Ensure uniform application over the entire surface, covering all exposed areas. The recommended coverage rate is typically 4-5 square meters per litre of curing compound. ▪ The curing compound must be applied immediately after the concrete surface has reached the initial set and while the surface is still moist. 3. Post-Application: ○ Once applied, the curing compound will form a continuous film over the concrete surface, retaining moisture and preventing evaporation. ○ Allow the curing compound to cure for a minimum period of 7 days or as per the specific project requirement. The curing duration may vary depending on the concrete grade, ambient temperature, and humidity conditions. 4. Environmental Conditions: ○ Avoid applying curing compounds during rainy or windy weather, as these conditions may reduce the effectiveness of the compound. ○ For high-temperature conditions, additional measures such as using wet burlap or polyethylene sheets in conjunction with the curing compound may be recommended to prevent rapid evaporation. Materials: • Curing Compounds: Water-based curing compounds, white pigmented or clear types, non-toxic, and suitable for the concrete mix used. • Sprayers, Brushes, and Rollers for applying the curing compound to ensure uniform coverage. Indicative Equipment Involved: • Sprayers (manual or mechanical) for applying the curing compound • Rollers and brushes for smaller areas or detailing • Protective gear (gloves, goggles, and masks) for workers handling chemicals. Measurement: • Measured in Square Metres (Sqm) of surface area treated with the curing compound. • The measurement is based on the area where the compound is applied, ensuring uniform coverage. Safety and Quality Assurance: • Ensure that the curing compound complies with BIS IS 9103 for curing materials. • Follow proper handling and application procedures as specified by the manufacturer of the curing compound. • Ensure that PPE (Personal Protective Equipment) such as gloves, goggles, and protective clothing is worn during the handling and application of the curing compound. • The curing compound must be applied as per the recommended coverage rate to ensure effective curing.	
M4. Concrete cutting / coring	
Reference Clause: MoRTH Section 2800 (Concrete Cutting and Coring)	

M. General / Supporting Activities

Scope of Activity

Scope of Work:

This item involves the **cutting** and **coring** of concrete surfaces as part of bridge maintenance activities. Concrete cutting may be necessary for repairs, modifications, or the installation of structural elements such as reinforcement or expansion joints. Coring is often used to extract samples for testing or for creating holes for services like ducts or pipes. The work must be performed with precision to avoid damaging the structural integrity of the concrete, while adhering to relevant safety, quality, and environmental standards.

Methodology:

1. Surface Preparation:

- Inspect the concrete surface to identify the cutting or coring location. The area should be free from debris, loose particles, and any other material that might interfere with the cutting or coring process.
- Mark the cutting or coring line with appropriate tools, such as **chalk lines** or **laser markers**, to ensure accuracy.

2. Concrete Cutting:

○ Selection of Cutting Method:

- The cutting method depends on the thickness of the concrete and the required precision. **Diamond cutting blades** are preferred for most applications due to their precision and ability to cut through reinforced concrete.
- For smaller cuts or openings, **circular saws** or **abrasive cutting tools** may be used.

○ Cutting Process:

- Ensure that the cutting is done using appropriate **wet or dry cutting methods**. Wet cutting is preferred for controlling dust and cooling the blade.
- Use **water-fed cutting equipment** for wet cutting to minimize dust, prevent overheating of the blade, and improve cutting efficiency.
- Maintain consistent speed and pressure to ensure clean, straight cuts without damaging the concrete or reinforcing steel.

3. Concrete Coring:

○ Selection of Coring Method:

- **Diamond core drills** are typically used for coring operations, as they provide smooth, clean holes for services or testing purposes.
- Select the appropriate **diameter** and **depth** of the core based on the requirements of the project (e.g., hole size for pipes, cables, or testing).

○ Coring Process:

- Install the **diamond core drill** securely and ensure the alignment is correct before beginning.
- Apply **water** to the drill bit to reduce friction and cooling, ensuring the longevity of the core bit.
- **Cores** should be extracted carefully without disturbing the surrounding concrete.
- After extraction, the cores should be **stored safely** for later analysis or testing as required.

4. Post-Work Procedures:

○ Debris Removal:

- After the cutting or coring process, clean the area of any concrete dust, chips, or debris. This ensures that the work zone remains safe and ready for further operations.

○ Inspection of Work:

- Inspect the cut or core to verify its alignment, depth, and quality. Ensure the work meets the specified requirements and that no damage has occurred to surrounding concrete.

M. General / Supporting Activities
Scope of Activity

or reinforcement.

5. Safety Measures:

- **Dust Control:** For dry cutting, use **vacuum systems** or **water-fed tools** to minimize dust emissions. Dust control is essential for worker safety and environmental protection.
- **Personal Protective Equipment (PPE):** Workers should wear **face shields, ear protection, dust masks, gloves, and safety boots** to protect from debris and noise.
- **Safety Barriers:** Erect **barriers** around the work area to prevent access by unauthorized personnel, as concrete cutting can create sharp debris and dust.

Materials:

- **Diamond Cutting Blades** for concrete
- **Core Drills** with diamond bits for coring operations
- **Water** for wet cutting
- **Vacuum Systems** for dust control (if required)
- **Reinforcement Cutting Tools** for cutting through steel bars when necessary

Indicative Equipment Involved:

- **Concrete Cutting Machines** (diamond saws, abrasive cutters, etc.)
- **Diamond Core Drills**
- **Water Supply Systems** (for wet cutting)
- **Vacuum Systems** (for dust extraction)
- **Personal Protective Equipment (PPE)**

Measurement:

- **Concrete Cutting:** Measured in **Linear Metres (Lm)** of concrete cut, based on the length of the cut made, including any variations in depth.
- **Concrete Coring:** Measured in **Number of Cores** taken, or **Linear Metres (Lm)** for core length, depending on the project requirements.

Safety and Quality Assurance:

- Ensure that cutting and coring operations comply with **MoRTH** and **BIS** standards for equipment safety and quality.
- Conduct a **pre-work inspection** of cutting equipment to ensure that it is in good working condition.
- Ensure that workers are adequately trained in **safe operation** of the cutting and coring equipment.
- Follow all **environmental guidelines** for dust control and waste disposal.

M5. Controlled demolition of RCC

Reference Clause: MoRTH Section 202 (Demolition of Concrete)

Scope of Work:

This item involves the **controlled demolition of reinforced cement concrete (RCC)** structures or components to facilitate repairs, modifications, or the complete removal of sections as part of bridge maintenance activities. The demolition process must be executed with precision to ensure the safety of surrounding structures, personnel, and the environment. The method of demolition should be chosen based on the nature of the structure and the scale of work, ensuring minimal disturbance to the remaining structure and surroundings.

Methodology:

1. **Preparation of Site:**

M. General / Supporting Activities

Scope of Activity

- **Inspection and Assessment:**
 - Perform a thorough **inspection** of the RCC structure to be demolished. Assess the structural integrity and identify any potential hazards.
 - Mark the area to be demolished and set up safety barriers to restrict access to unauthorized personnel.
- **Documentation:**
 - Prepare detailed **demolition plans**, including safety procedures, equipment details, and methodology, to be approved by the relevant authorities before starting work.
- 2. **Safety Measures:**
 - Erect **scaffolding, protective barriers, and safety nets** around the demolition area to prevent debris from falling and to protect workers and passersby.
 - Ensure that **warning signs** and **safety signage** are clearly visible to alert workers and the public of the ongoing demolition.
 - Workers should wear full **PPE**, including **helmet, safety boots, gloves, eye protection, and hearing protection**.
- 3. **Demolition Process:**
 - **Mechanical Demolition:**
 - Use **hydraulic breakers, excavators, or crushers** for large-scale concrete demolition. These machines should be equipped with proper attachments for effective demolition without causing excessive vibration or damage to adjacent structures.
 - **Manual Demolition:**
 - For smaller or delicate areas, use **manual tools** such as **jackhammers** or **cutting torches** to break up the concrete. Manual demolition allows for more controlled and precise removal.
 - **Controlled Explosive Demolition (if applicable):**
 - In cases where mechanical methods are impractical, **controlled explosive demolition** may be used. This method involves strategically placing explosives in pre-drilled holes in the concrete to safely bring down the structure. This should only be performed under strict supervision and with detailed planning to ensure safety.
- 4. **Removal and Disposal of Debris:**
 - After demolition, **remove all debris** from the site immediately. The debris should be sorted for recycling, especially **rebar and concrete** materials that can be reused.
 - **Disposal of waste** should follow local environmental regulations, ensuring that any hazardous material, such as **asbestos**, is handled according to safety protocols.
 - Dispose of non-recyclable materials in accordance with **local waste management** policies.
- 5. **Post-Demolition Inspection:**
 - Inspect the remaining structure after demolition to ensure that it is stable and safe for further work. Remove any residual debris or materials that may obstruct further construction or maintenance activities.
 - Ensure that the demolition site is cleared of any hazardous materials and that the area is safe for workers to begin subsequent tasks.

Materials:

- **Explosives** (if controlled explosive demolition is used)
- **Cutting Tools** (saws, jackhammers, etc.)
- **Mechanical Equipment** (excavators, hydraulic breakers, crushers)
- **Recycling Containers** for sorting and disposing of concrete, steel, and other debris.

Indicative Equipment Involved:

M. General / Supporting Activities Scope of Activity
• Excavators with hydraulic breakers or crushers for mechanical demolition • Jackhammers, cutting torches, and diamond saws for manual demolition • Explosives for controlled explosive demolition (if applicable) • Scaffolding, protective barriers, and safety nets for safety • Waste removal equipment such as dumps trucks or cranes for lifting debris Measurement: • Controlled Demolition of RCC: Measured in Cubic Metres (Cum) of concrete demolished, based on the volume of RCC removed. • Measurement is taken based on the depth, width, and height of the demolished area or structure, as per the approved demolition plan. Safety and Quality Assurance: • Adhere to MoRTH guidelines and BIS standards for demolition works to ensure the safety of workers and nearby structures. • Conduct a risk assessment and ensure all safety measures are in place before commencing the work. • Demolition activities should be supervised by experienced personnel to avoid accidents and ensure adherence to the specified methodology. • Ensure that all waste is disposed of in compliance with environmental and regulatory requirements.

- All costs towards transport, handling, hoisting, storage, watch and ward for all the materials procured for use in the Works, including all the equipment, labour, machinery, tools and tackles required for the Works and other Works related to horticulture as per needs from time to time shall be included in the Quoted Price and no extra claim on account of these charges will be entertained.
- Bidders may be asked to quote for Supply & Fixing of Road Studs jointly or separately depending on requirements at the time of sharing RFQ with Empaneled Vendors.
- Please refer to our website for present location of our Projects, however these may increase during period of empanelment.
- All costs regarding transport and handling of all the materials procured for use in the Works, including all the equipment, labor, machinery, tools and tackles required for supplying the safety items shall be included in the Quoted Price and no extra claim on account of these charges will be entertained.

SECTION 4 – FORM OF TECHNICAL PROPOSAL

(On the letter head of the bidder)

To,

Shri Sandeep Khosa, GM (Procurement)

NHIT Western Projects Private Limited, SPV under NHIT

Unit No.: 324, 3rd Floor, D21 – Corporate Park, Sector-21,

Dwarka, New Delhi-110077.

E mail: tender@nhit.co.in

Sub: Request for Empanelment (“RFE”) issued by National Highways Infra Trust (NHIT) for Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT

Section A: General Information

- I. Profile of the organization with full particulars of the constitution, ownership and business activities of the prospective Agency/Firm.
- II. Commitment(s) which shall act either as a constraint or as a conflicting interest in the proposed assignment (if any).

Section B: Technical Information

Sr. No.	Evaluation criteria & scoring guidance	Maximum Points
1	Minimum 05 Years’ Experience in Similar works:	25
	05 Years to less than 10 Years: 15 Marks	
	10 Years to less than 15 Years: 20 Marks	
	15 Years and more: 25 Marks	
2	Cumulative Turnover for Last Three years:	25
	5 Crore to less than 10 Crore: 15 Marks	
	10 Crore to less than 15 Crore: 20 Marks	
	15 Crore or more: 25 Marks	
3	Manpower Requirements – Minimum 10 Employees	25
	10 Employees to 20 Employees – 15 Marks	
	21 Employees to 30 Employees – 20 Marks	
	31 or More Employees – 25 Marks	
	Proof of the same shall be submitted as part of Bid	
4A	Number of Projects in last 5 years – Min. 03 Projects (Refer 2.13.2 Clause of Section 2)	25
	03 to 05 Projects – 15 Marks	
	06 to 08 Projects – 20 Marks	
	More than 08 Projects – 25 Marks	
	OR	
4B	Experience and Capability in Advanced Upgradation Technologies for Modification of Central Hinge Bearings	

Less than 01 completed CHB replacement/ upgradation projects - Not Eligible	
a) 01 to 03 completed projects - 15 Marks	
b) 03 to 05 completed projects - 20 Marks	
c) More than 05 completed projects - 25 Marks	
TOTAL	100

• **Minimum Qualifying marks shall be 70 marks.**

We accept all the terms & conditions mentioned in the RFE. In the event of any contradiction in the terms and conditions mentioned in the RFE and our proposal/ offer to NHIT's decision shall prevail.

Name & Signature of Bidder's

Authorized Signatory

Date

SECTION 5 – UNDERTAKING
(On the letter head of the bidder)

From <Name & Address and Complete contact details of the bidder> To

To,

Shri Sandeep Khosa, GM (Procurement)

NHIT Western Projects Private Limited, SPV under NHIT

Unit No.: 324, 3rd Floor, D21 – Corporate Park, Sector-21,

Dwarka, Delhi:110077, India.

E mail: tender@nhit.co.in

Sub: Request for Empanelment (“RFE”) issued by National Highways Infra Trust (NHIT) for Empanelment of additional Agencies/Firms for Bridge Repair & Rehabilitation works at Project sites under SPVs of NHIT .

We undertake that: -

- 5.1 The Empanelment submitted hereunder shall remain valid for a period of at least 120 days from the last date for submission of the Empanelment.
- 5.2 No other fees/cost/ expenses/taxes/levies shall be payable by NHIT or any of its associated entities for the Services rendered by Agency/firm except as mentioned in Financial Empanelment as mentioned in the RFE.
- 5.3 The Bidder has not been banned/ blacklisted/ de-listed/ disqualified/ debarred by any organization/ government agency/NHIT/Entities of NHIT/ quasi-government agency/ PSU to participate in their tenders for Empanelment. We further certify that there is no investigation pending against us or the CMD/CEO/Directors of our Company and no action has been initiated against us/ our Directors by CVC/ RBI or any other government/ statutory agency regarding any financial irregularities.
- 5.4 The Bidder does not have any conflict of interest, which is prejudicial to the scope of work. Further, the bidder will ensure that no such business or professional activities will be carried out by it, which may affect the interest of NHIT.
- 5.5 The Bidder has adequate infrastructure, personnel, resources to carry out the required Services and are eligible for acting as Agency/firm. The Bidder has understood the scope of work properly and shall comply with the terms of Empanelment.
- 5.6 No bankruptcy/ liquidation proceedings have been initiated against the Bidder by any entity/ government agency/ quasi-government agency/ PSU and there is no material case/ proceeding against the Bidder/ its directors that is likely to have significant impact on its business as selected Bidder/ empanelled Agency/firm or on its deliverables pursuant to this Bid/RFE.
- 5.7 All the information submitted as part of the Bid is true and correct.

We accept all the terms & conditions mentioned in the RFE. In the event of any contradiction in the terms and conditions mentioned in the RFE and our Empanelment/ offer to NHIT, the NHIT’s decision shall prevail.

Name & Signature and Contact Details of Bidder’s Authorized Signatory

Date: