Haryana Rail Infrastructure Development Corporation Ltd

(A Joint Venture Govt. of Haryana and Ministry of Railways)
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Tender No.: HORC/HRIDC/C-5/2023 Date 03.01.2024

Reference: Specific Procurement Notice dated 03.11.2022.
E-tender No.: 2023_HBC_327530_1

CORRIGENDUM No. 2

Name of Work: Contract Package C-5: Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for:

(i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942;

(ii) Design & Construction of viaduct from km 20.942 to km 24.844;

(iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and

(iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844.

The E-tender No. 2023_HBC_327530_1 for the above-mentioned work was published on 08.11.2023.

Final Tender Document is hereby issued vide Corrigendum No. 2 incorporating all the modifications carried out vide Corrigendum No. 1 dated 20.12.2023. Also, it is brought out to the notice of Tenderers that in the Final Tender Document, the amount in Column No. 6 of Table for Schedule 'C': General Electrical Services under Clause 7, Appendix B to Financial Part: Price Schedules, has been modified to remove minor rounding off errors in multiplication of Unit Rate and Quantity. Final Tender Document issued on 03.01.2024 supersedes previously issued Tender Document dated 08.11.2023.

Tenderers are advised to download Final Tender Document issued vide Corrigendum No. 2 dated 03.01.2024 on e-procurement portal of Govt. of Haryana (https://etenders.hry.nic.in) and submit their Tenders based on the requirements of Final Tender Document. In order to facilitate Tenderers with high quality of drawings, Section VII-8: Tender Drawings and Documents is available for downloading in Active Tender section on HRIDC website (http://www.hridc.co.in/active-tender.php). Section VII-8: Tender Drawings and Documents uploaded on HRIDC website for Package C-5 shall be deemed to form part of Final Tender Document.

In case of any discrepancy noticed at any stage i.e. evaluation of Tenders, Award of Tender, execution of work or final payment of the Contract, the contents of Final Tender Document shall supersede previously issued Tender Document dated 08.11.2023 and Corrigendum No. 1.

--SD--
Chief Project Manager/South,
Haryana Rail InfrastructureDevelopment Corporation Limited Plot No 143, 5th Floor, RailTel Tower,Sector-44, Gurugram, Haryana-122003

Final Tender Document for Works

(Two-Envelope Tendering Process Without Prequalification)

Procurement of:

Contract Package C-5: Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for:

(i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942;

(ii) Design & Construction of viaduct from km 20.942 to km 24.844;

(iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and

(iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844.

Tender No: HORC/HRIDC/C-5/2023

Contract title: Composite Works Contract (Civil, Viaduct, Ballast less Track, General Electrical Services and other Works) on EPC basis (C-5)

Project: Haryana Orbital Rail Corridor Project

Loan No.: Under Process

Project No.: 000741

Employer: Haryana Orbital Rail Corporation Limited

Country: INDIA

Issued on: *03.01.2024*

Summary

Specific Procurement Notice (SPN)

PART 1 – Tendering Procedures

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Section I - Instructions to Tenderers (ITT)

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Section I - Instructions to Tenderers (ITT)

A. General

1. Scope of Tender

1.1 In connection with the Specific Procurement Notice (SPN) indicated in the **Tender Data Sheet (TDS)**, the Employer, as specified in the **TDS**, issues this Tender Document for the provision of Works on EPC basis as specified in Section VII, Employer's Requirements. The name, identification, and number of lots (contracts) of this tender are specified in the **TDS.**

1.2 Throughout this Tender Document:

(a) the term "in writing" means communicated in written form (e.g., by mail, e-mail, fax, including, if specified in the **TDS**, distributed or received through electronic-procurement system used by the Employer) with proof of receipt;

(b) if the context so requires, "singular" means "plural' and vice versa;

(c) "Day" means calendar day, unless otherwise specified as a "Business Day." A Business Day is any day that is a working day of the Recipient. It excludes the Recipient's official public holidays;

(d) "ESHS" means environmental, social, health and safety; and

(e) the word "tender" is synonymous with "bid" and "tenderer" with "bidder", and the words "tender documents" with "bidding documents".

2. Source of Funds

2.1 The Recipient specified in the **TDS** has received or has applied for financing (hereinafter called "funds") from the Asian Infrastructure Investment Bank (hereinafter called ("AIIB" or "the Bank") in an amount specified in the **TDS**, toward the project named in the **TDS**. The Recipient intends to apply a portion of the funds to eligible payments under the contract(s) for which this Tender Document is issued.

2.2 Payment by the Bank will be made only at the request of the Recipient and upon approval by the Bank, and will be subject, in all respects, to the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, equipment, plant, or materials, if such payment or import is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of

the United Nations. No party other than the Recipient shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Prohibited Practices

3.1 The Bank requires compliance with the Bank's Policy on Prohibited Practices as set forth in Section VI.

3.2 In further pursuance of this policy, Tenderers shall permit and shall cause their agents (whether declared or not), subcontractors, sub-consultants, service providers, suppliers, and their personnel, to permit the Bank to inspect all accounts, records and other documents relating to any prequalification process, tender submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Tenderers

4.1 A Tenderer may be a firm that is a private entity, a state-owned enterprise or institution subject to ITT 4.6 or any combination of such entities in the form of a joint venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Tendering process and, in the event the JV is awarded the Contract, during contract execution. Unless specified in the **TDS**, there is no limit on the number of members in a JV.

4.2 A Tenderer shall not have a conflict of interest. Any Tenderer found to have a conflict of interest shall be disqualified. A Tenderer may be considered to have a conflict of interest for the purpose of this Tendering process, if the Tenderer:

a) directly or indirectly controls, is controlled by or is under common control with another Tenderer; or
b) receives or has received any direct or indirect subsidy from another Tenderer; or
c) has the same legal representative as another Tenderer; or
d) has a relationship with another Tenderer, directly or through common third parties, that puts it in a position to influence the Tender of another Tenderer, or influence the decisions of the Employer regarding this Tendering process; or
e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Works that are the subject of the Tender; or
f) or any of its affiliates has been hired (or is proposed to be hired) by the Employer or Recipient as Engineer for the Contract implementation; or

g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the TDS ITT 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

h) has a close business or family relationship with a professional staff of the Recipient (or of the project implementing agency, or of any other beneficiary of the Bank's financing, or of any other party representing or acting on behalf of the Recipient) who: (i) are directly or indirectly involved in the preparation of the Tender Document or specification of the Contract, and/or the Tender evaluation process of such Contract; or (ii) would be involved in the implementation or supervision of such Contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the Tendering process and execution of the Contract; or

i) is an affiliate of the Recipient, or of a procurement agent engaged by the Recipient, unless the Recipient demonstrates to the satisfaction of the Bank that there is no significant degree of common ownership, influence or control between the Recipient on the one hand, and the Recipient's agent and the affiliate on the other.

4.3 A firm that is a Tenderer (either individually or as a JV member) shall not participate in more than one Tender, except for permitted alternative Tenders. Such participation shall result in the disqualification of all Tenders in which the firm is involved. However, this does not limit: (a) the inclusion of the same Subcontractor in more than one Tender for the same contract; or (b) the ability of one Tenderer to be a Subcontractor in another Tender for the same contract.

4.4 A Tenderer may have the nationality of any country, subject to the restrictions pursuant to ITT 4.8. A Tenderer shall be deemed to have the nationality of a country if the Tenderer is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or sub-consultants for any part of the Contract including related Services.

4.5 A Tenderer that has been declared, and remains, as at the relevant date, ineligible pursuant to the Bank's Policy on Prohibited Practices as described in Section VI, shall be ineligible to be prequalified for,

tender for, propose for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified in the **TDS**.

4.6 Tenderers that are state-owned enterprises or institutions in the Employer's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are carrying-out or are established for a business purpose, and are operating on a commercial basis; (ii) are financially and managerially autonomous; (iii) are not controlled by the government on day-to-day management; and (iv) are not under the supervision of the Employer or its procuring agency.

4.7 A Tenderer shall not be under suspension from Tendering by the Employer as the result of the operation of a Tender–Securing or Proposal-Securing Declaration.

4.8 Firms and individuals may be ineligible if so indicated in Section V and (a) as a matter of law or official regulations, the Recipient's country prohibits commercial relations with the firm or individual's country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Recipient's country prohibits any import of goods or contracting of works or services from the firm or individual's country, or any payments to any country, person, or entity in that country. When the Works are implemented across jurisdictional boundaries (and more than one country is a Recipient, and is involved in the procurement), then exclusion of a firm or individual on the basis of ITT 4.8 (a) above by any country may be applied to that procurement across other countries involved, if the Bank and the Recipients involved in the procurement agree.

4.9 A Tenderer shall provide such documentary evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.10 A firm that is under a sanction of debarment by the Recipient from being awarded a contract is eligible to participate in this procurement, unless the Bank, at the Recipient's request, is satisfied that the debarment; (a) relates to fraud or corruption or other prohibited practices, and (b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Materials,

5.1 The materials, equipment and services to be supplied under the Contract and financed by the Bank may have their origin in any

Equipment, and Services

country subject to the restrictions specified in Section V, Eligible Countries, and all expenditures under the Contract will not contravene such restrictions. At the Employer's request, Tenderers may be required to provide evidence of the origin of materials, equipment and services.

B. Contents of Tender Document

6. Sections of Tender Document

6.1 The Tender Document consists of Parts 1, 2 and 3, includes all the sections specified below, and should be read in conjunction with any Addenda issued in accordance with ITT 8.

PART 1 Tendering Procedures

- Section I - Instructions to Tenderers (ITT)
- Section II - Tender Data Sheet (TDS)
- Section III - Evaluation and Qualification Criteria
- Section IV - Tender Forms
- Section V - Eligible Countries
- Section VI - Prohibited Practices

PART 2 Employer's Requirements

Section VII - Employer's Requirements

PART 3 Conditions of Contract and Contract Forms

- Section VIII - General Conditions of Contract (GCC)
- Section IX - Particular Conditions of Contract (PCC)
- Section X - Contract Forms

6.2 The Specific Procurement Notice issued by the Employer is not part of the Tender Document.

6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the Tender Document, responses to requests for clarification, the minutes of the pre-Tender meeting (if any), or Addenda to the Tender Document in accordance with ITT 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.

6.4 The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document and to furnish with its Tender all information and documentation as is required by the Tender Document.

7. Clarification of Tender

7.1 A Tenderer requiring any clarification of the Tender Document shall contact the Employer in writing at the Employer's address specified

Document, Site Visit, Pre-Tender Meeting

in the **TDS** or raise its enquiries during the pre-Tender meeting if provided for in accordance with ITT 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received no later than two days prior to Pre-Tender meeting. The Employer shall forward copies of its response to all Tenderers who have acquired the Tender Document in accordance with ITT 6.3, including a description of the inquiry but without identifying its source. If so, specified in the **TDS**, the Employer shall also promptly publish its response at the web page identified in the **TDS**. Should the clarification result in changes to the essential elements of the Tender Document, the Employer shall amend the Tender Document following the procedure under ITT 8 and ITT 22.2.

7.2 The Tenderer is advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Tenderer's own expense.

7.3 The Tenderer and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Tenderer, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 If so specified in the **TDS**, the Tenderer's designated representative is invited to attend a pre-Tender meeting and/or a Site of Works visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Tenderer is requested to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.6 Minutes of the pre-Tender meeting, if applicable, including the text of the questions asked by Tenderers, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Tenderers who have acquired the Tender Document in accordance with ITT 6.3. If so, specified in the **TDS,** the Employer shall also promptly publish the Minutes of the pre-Tender meeting at the web page identified in the **TDS**. Any modification to the Tender Document that may become necessary as a result of the pre-Tender meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to ITT 8 and not through the minutes of the pre-Tender meeting. Nonattendance at the pre-Tender meeting will not be a cause for disqualification of a Tenderer.

8. Amendment of Tender Document

8.1 At any time prior to the deadline for submission of Tenders, the Employer may amend the Tender Document by issuing addenda.

8.2 Any addendum issued shall be part of the Tender Document and shall be communicated in writing to all who have obtained the Tender Document from the Employer in accordance with ITT 6.3. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITT 7.1.

8.3 To give Tenderers reasonable time in which to take an addendum into account in preparing their Tenders, the Employer may, at its discretion, extend the deadline for the submission of Tenders, pursuant to ITT 22.2.

C. Preparation of Tenders

9. Cost of Tendering

9.1 The Tenderer shall bear all costs associated with the preparation and submission of its Tender, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Tendering process.

10. Language of Tender

10.1 The Tender, as well as all correspondence and documents relating to the Tender exchanged by the Tenderer and the Employer, shall be written in the language specified in the **TDS**. Supporting documents and printed literature that are part of the Tender may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the **TDS**, in which case, for purposes of interpretation of the Tender, such translation shall govern.

11. Documents Comprising the Tender

11.1 The Tender shall comprise two Parts, namely the Technical Part and the Financial Part. These two Parts shall be submitted simultaneously in two separate sealed envelopes (two-envelope tendering process). One envelope shall contain only information relating to the Technical Part and the other, only information relating to the Financial Part. These two envelopes shall be enclosed in a separate sealed outer envelope marked "ORIGINAL TENDER".

11.2 The Technical Part shall contain the following:

(a) Letter of Tender – Technical Part: prepared in accordance with ITT 12;

(b) Tender Security or Tender-Securing Declaration: in accordance with ITT 19.1;

(c) Alternative Tender – Technical Part: if permissible, in accordance with ITT 13;

(d) Authorization: written confirmation authorizing the signatory of the Tender to commit the Tenderer, in accordance with ITT 20.3;

(e) Eligibility: documentary evidence in accordance with ITT17.1 establishing the Tenderer's eligibility to tender;

(f) Qualifications: documentary evidence in accordance with ITT 17.2 establishing the Tenderer's qualifications to perform the Contract if its Tender is accepted;

(g) Conformity: a technical proposal in accordance with ITT 16;

(h) Any other document required in the **TDS**.

11.3 The Financial Part shall contain the following:

(a) Letter of Tender – Financial Part: prepared in accordance with ITT 12 and ITT 14;

(b) Price Schedule: completed in accordance with ITT 12 and ITT 14;

(c) Alternative Tender - Financial Part: if permissible in accordance with ITT 13; and

(d) Any other document required in the **TDS**.

11.4 The Technical Part shall not include any information related to the Tender price. Where material financial information related to the Tender price is contained in the Technical Part, the Tender shall be declared non-responsive.

11.5 In addition to the requirements under ITT 11.2, Tenders submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Tender shall be signed by all members and submitted with the Tender, together with a copy of the proposed Agreement.

11.6 The Tenderer shall furnish in the Letter of Tender – Financial Part information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Tender.

12. Letter of Tender and Schedules

12.1 The Letter of Tender – Technical Part, the Letter of Tender – Financial Part, Schedules and all documents listed under ITT 11 including the Price Schedule, shall be prepared using the relevant forms furnished in Section IV, Tender Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITT 20.3. All blank spaces shall be filled in with the information requested.

13. Alternative Tenders

13.1 Unless otherwise specified in the **TDS**, alternative Tenders shall not be considered.

13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included in the **TDS**, and the method of evaluating different alternative times for completion will be described in Section III, Evaluation and Qualification Criteria.

13.3 Except as provided under ITT 13.4 below, Tenderers wishing to offer technical alternatives to the requirements of the Tender Document must first price the Employer's design as described in the Tender Document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the Tenderer with the Most Advantageous Tender conforming to the basic technical requirements shall be considered by the Employer.

13.4 When specified in the **TDS**, Tenderers are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be identified in the **TDS** and described in Section VII, Employer's Requirements. The method for their evaluation will be stipulated in Section III, Evaluation and Qualification Criteria.

14. Tender Prices and Discounts

14.1 The prices and discounts (including any price reduction) quoted by the Tenderer in the Letter of Tender – Financial Part and in the Price Schedule shall conform to the requirements specified below.

14.2 Unless otherwise specified in the TDS, Tenderers shall quote for the entire Works on a "single responsibility" basis such that the total lump sum Tender price, subject to any adjustments, in accordance with the Contract, covers all the Contractor's obligations mentioned in or to be reasonably inferred from the Tendering document for complete execution of the Works on EPC basis. This includes all requirements under the Contractor's responsibilities for design, construction, procurement, erection, installation, subcontracting (if any), testing, pre-commissioning and commissioning (as applicable) of the Works and, where so required by the Tendering document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Tendering document, all in accordance with the requirements of the General Conditions.

Tenderers shall give a breakdown of the prices in the manner and detail called for in the Schedule of Rates and prices (if any) included in Section IV, Tender Forms. These will not in any way limit the Tenderers' single point total responsibility for the complete Scope of Work and for all contractual responsibilities/ obligations as stated in the Tendering Document.

14.3 The price to be quoted in the Letter of Tender – Financial Part, in accordance with ITT 12.1, shall be the total price of the Tender, excluding any discounts offered.

14.4 The Tenderer shall quote any discounts and the methodology for their application in the Letter of Tender – Financial Part, in accordance with ITT 12.1.

14.5 Unless otherwise specified in the **TDS** and the Conditions of Contract, the rates and prices quoted by the Tenderer are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract. In such a case, the Tenderer shall furnish the indices and weightings for the price adjustment formulae in the Table of Adjustment Data in Section IV, Tender Forms, and the Employer may require the Tenderer to justify its proposed indices and weightings.

14.6 If so specified in ITT 1.1, Tenders are being invited for individual lots (contracts) or for any combination of lots (packages). Tenderers wishing to offer discounts for the award of more than one Contract shall specify in their Tender the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITT 14.4, provided the Tenders for all lots (contracts) are opened at the same time. If, however, rated criteria are used in accordance with ITT 30.2, discounts on condition of award of more than one Contract shall not be used for Tender evaluation purpose.

14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of Tenders, shall be included in the rates and prices and the total Tender Price submitted by the Tenderer.

15. Currencies of Tender and Payment

15.1 The currency (ies) of the Tender and the currency (ies) of payments shall be the same and shall be as specified in the **TDS.**

15.2 Tenderers may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Table of Adjustment Data in the Appendix to Tender in Section IV, Tender Forms, are reasonable, in which case a detailed breakdown of the foreign currency requirements shall be provided by Tenderers.

16. Documents Comprising the Technical Proposal

16.1 The Tenderer shall furnish a technical proposal in the Technical Part of the Tender including a statement of work methods, equipment, personnel, schedules and any other information as stipulated in Section IV, Tender Forms, in sufficient detail to demonstrate the

adequacy of the Tenderer's proposal to meet the Employer's requirements and the completion time.

17. Documents Establishing the Eligibility and Qualifications of the Tenderer

17.1 To establish Tenderer's eligibility in accordance with ITT 4, Tenderers shall complete the Letter of Tender – Technical Part, included in Section IV, Tender Forms.

17.2 In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract, the Tenderer shall provide the information requested in the corresponding information sheets included in Section IV, Tender Forms.

17.3 If provisions for development of domestic industry (such as a margin of domestic preference) apply as specified in accordance with ITT 38.1, domestic Tenderers, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITT 38.1.

18. Period of Validity of Tenders

18.1. Tenders shall remain valid for the Tender Validity period specified in the **TDS**. The Tender Validity period starts from the date fixed for the Tender submission deadline (as prescribed by the Employer in accordance with ITT 22). A Tender valid for a shorter period shall be rejected by the Employer as nonresponsive.

18.2. In exceptional circumstances, prior to the expiration of the Tender validity period, the Employer may request Tenderers to extend the period of validity of their Tenders. The request and the responses shall be made in writing. If a Tender Security is requested in accordance with ITT 19, it shall also be extended for a corresponding period. A Tenderer may refuse the request without forfeiting its Tender security. A Tenderer granting the request shall not be required or permitted to modify its Tender, except as provided in ITT 18.3.

18.3. If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Tender validity period, the Contract price shall be determined as follows:

(a) in the case of fixed price contracts, the Contract price shall be the Tender price adjusted by the factor specified in the **TDS**;

(b) in the case of adjustable price contracts, no adjustment shall be made; or

(c) in any case, Tender evaluation shall be based on the Tender price without taking into consideration the applicable correction from those indicated above.

19. Tender Security

19.1 The Tenderer shall furnish as part of the Technical Part of its Tender, either a Tender Security or a Tender-Securing Declaration, as specified in the **TDS**, in original form and, in the case of a Tender Security, in the amount and currency, or in the case of a Tender-Securing Declaration, for the period of ineligibility, as specified in the **TDS**.

19.2 A Tender-Securing Declaration shall use the form included in Section IV, Tender Forms.

19.3 If a Tender Security is specified pursuant to ITT 19.1, the Tender Security shall be a demand guarantee in any of the following forms at the Tenderer's option:

(a) an unconditional guarantee issued by a bank;

(b) an irrevocable letter of credit;

(c) a cashier's or certified check; or

(d) another security specified in the **TDS**,

from a reputable source from an eligible country. In the case of a bank guarantee, the Tender Security shall be submitted either using the Tender Security Form included in Section IV, Tender Forms, or in another substantially similar format approved by the Employer prior to Tender submission. The Tender Security shall be valid for twenty-eight (28) days beyond the original validity period of the Tender, or beyond any period of extension if requested under ITT 18.2.

19.4 If a Tender Security or Tender-Securing Declaration is specified pursuant to ITT 19.1, any Tender not accompanied by a substantially responsive Tender Security or Tender-Securing Declaration shall be rejected by the Employer as non-responsive.

19.5 If a Tender Security is specified pursuant to ITT 19.1, the Tender Security of unsuccessful Tenderers shall be returned as promptly as possible upon the successful Tenderer's signing the Contract and furnishing the Performance Security pursuant to ITT 50.

19.6 The Tender Security of the successful Tenderer shall be returned as promptly as possible once the successful Tenderer has signed the Contract and furnished the required Performance Security.

19.7 The Tender Security may be forfeited, or the Tender-Securing Declaration executed:

(a) if a Tenderer withdraws its Tender during the period of Tender validity specified by the Tenderer on the Letter of Tender, or any extension thereto provided by the Tenderer; or

(b) if the successful Tenderer fails to:

(i) sign the Contract in accordance with ITT 49; or

(ii) furnish a Performance Security in accordance with ITT 50.

19.8 The Tender Security or the Tender-Securing Declaration of a JV shall be in the name of the JV that submits the Tender. If the JV has not been legally constituted into a legally enforceable JV at the time of Tendering, the Tender Security or the Tender-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITT 4.1 and ITT 11.5.

20. Format and Signing of Tender

20.1 The Tenderer shall prepare one original set of the Technical Part of the Tender and one original set of the Financial Part of the Tender as described in ITT 11 and ITT 21, and clearly mark them "ORIGINAL". Alternative Tenders, if permitted in accordance with ITT 13, shall be clearly marked "ALTERNATIVE." In addition, the Tenderer shall submit copies of the Tender, in the number specified in the **TDS** and clearly mark them "COPY". In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 Tenderers shall mark as "CONFIDENTIAL" all information in their Tenders which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive information.

20.3 The original and all copies of the Tender shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Tenderer. This authorization shall consist of a written confirmation as specified in the **TDS** and shall be attached to the Tender. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Tender where entries or amendments have been made shall be signed or initialed by the person signing the Tender.

20.4 In case the Tenderer is a JV, the Tender shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

20.5 Any amendments such as inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Tender.

D. Submission of Tenders

21. Sealing and Marking of Tenders

21.1 Tenderers may submit their Tenders by mail or by hand. If so specified in the TDS, Tenderers shall have the option of submitting their

Tenders electronically. Procedures for submission, sealing, and marking are as follows:

(a) Tenderers submitting Tenders by mail or by hand shall enclose the original Technical Part of the Tender, the original Financial Part of the Tender, and the respective copies of the Tender, including Alternative Tenders if permitted in accordance with ITT 13, in separate sealed envelopes. The envelopes shall be duly marked as "ORIGINALTECHNICAL PART", "ORIGINAL-FINANCIAL PART", "COPY-TECHNICAL PART", "COPY-FINANCIAL PART", "ALTERNATIVE-ORIGINAL-TECHNCIAL PART", "ALTERNATIVE-ORIGINAL-FINANCIAL PART", "ALTERNATIVE-COPY-TECHNCIAL PART", and "ALTERNATIVE-COPY-FINANCIAL PART". These envelopes shall then be enclosed in one single package. The rest of the procedure shall be in accordance with ITT 21.2 through ITT 21.5.

(b) Tenderers submitting Tenders electronically shall follow the electronic tender submission procedures specified in the **TDS**.

21.2 The inner and outer envelopes shall:

(a) bear the name and address of the Tenderer;

(b) be addressed to the Employer in accordance with ITT 22.1; and

(c) bear the specific identification of this Tendering process specified in accordance with TDS ITT 1.1.

21.3 The outer envelopes and the inner envelopes containing the Technical Part of Tender shall bear a warning not to open before the time and date for the opening of Technical Part of Tender, in accordance with ITT 25.1.

21.4 The inner envelopes containing the Financial Part of Tender shall bear a warning not to open until advised by the Employer in accordance with ITT34.

21.5 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Tender.

22. Deadline for Submission of Tenders

22.1 Tenders must be received by the Employer at the address and no later than the date and time specified in the **TDS**.

22.2 The Employer may, at its discretion, extend the deadline for the submission of Tenders by amending the Tender Document in accordance with ITT 8, in which case all rights and obligations of the Employer and Tenderers previously subject to the deadline shall thereafter be subject to the deadline as extended.

23. Late Tenders

23.1 The Employer shall not consider any Tender that arrives after the deadline for submission of Tenders, in accordance with ITT 22. Any Tender received by the Employer after the deadline for submission of Tenders shall be declared late, rejected, and returned unopened to the Tenderer.

24. Withdrawal, Substitution, and Modification of Tenders

24.1 A Tenderer may withdraw, substitute, or modify its Tender after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITT 20.3 (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Tender must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITT 20 and ITT 21 (except that withdrawals notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL", "SUBSTITUTION", "MODIFICATION"; and

(b) received by the Employer prior to the deadline prescribed for submission of Tenders, in accordance with ITT 22.

24.2 Tenders requested to be withdrawn in accordance with ITT 24.1 shall be returned unopened to the Tenderers.

24.3 No Tender may be withdrawn, substituted, or modified in the interval between the deadline for submission of Tenders and the expiration of the period of Tender validity specified by the Tenderer on the Letter of Tender or any extension thereof.

E. Public Opening of Technical Parts of Tenders

25. Technical Part Opening

25.1 Except in the cases specified in ITT 23 and ITT 24.2, the Employer shall publicly open and read out in accordance with this ITT all Tenders received by the deadline, at the date, time and place specified in the **TDS**, in the presence of Tenderers' designated representatives and anyone who chooses to attend. Any specific electronic Tender opening procedures required if electronic Tendering is permitted in accordance with ITT 21.1, shall be as specified in the **TDS**.

25.2 First, envelopes marked "Withdrawal" shall be opened and read out and the envelope with the corresponding Tender shall not be opened, but returned to the Tenderer. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Tender opening.

25.3 Next, envelopes marked "Substitution" shall be opened and read out and exchanged with the corresponding Tender being substituted, and the substituted Tender shall not be opened, but returned to the Tenderer. No Tender substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Tender opening.

25.4 Next, envelopes marked "Modification" shall be opened and read out with the corresponding Tender. No Tender modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Tender opening.

25.5 Next, all remaining envelopes marked "TECHNICAL PART" shall be opened one at a time. All envelopes marked "FINANCIAL PART" shall remain sealed, and kept by the Employer in safe custody until they are opened, at a later public opening, following the evaluation of the Technical Part of the Tenders. On opening the envelopes marked "TECHNICAL PART" the Employer shall read out: the name of the Tender, the presence or the absence of a Tender Security, or Tender-Securing Declaration, if required, and whether there is a modification; and Alternative Tender - Technical Part; and any other details as the Employer may consider appropriate.

25.6 Only Technical Parts of Tenders and Technical Parts of Alternative Tenders that are opened and read out at Tender opening shall be considered further for evaluation. The Letter of Tender – Technical Part and the separate sealed envelopes marked "FINANCIAL PART" are to be initialed by representatives of the Employer attending Tender opening in the manner specified in the **TDS**.

25.7 At the tender opening the Employer shall neither discuss the merits of any Tender nor reject any Tender (except for late Tenders, in accordance with ITT 23.1).

25.8 The Employer shall prepare a record of the Technical Part of Tender opening that shall include, as a minimum:

(a) the name of the Tenderer and whether there is a withdrawal, substitution, or modification;

(b) the receipt of envelopes marked "FINANCIAL PART;

(c) the presence or absence of a Tender Security or Tender-Securing Declaration, if one was required any alternative Tenders; and

(d) if applicable, any Alternative Tender – Technical Part.

25.9 The Tenderers' representatives who are present shall be requested to sign the record. The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record. A copy of

the record shall be distributed to all Tenderers who submitted Tenders in time and posted online when electronic Tendering is permitted.

F. Evaluation of Tenders – General Provisions

26. Confidentiality

26.1 Information relating to the evaluation of Tenders and recommendation of contract award shall not be disclosed to Tenderers or any other persons not officially concerned with the Tendering process until information on Intention to Award the Contract is transmitted to all Tenderers in accordance with ITT 45.

26.2 Any attempt by a Tenderer to influence the Employer in the evaluation of the Tenders or Contract award decisions may result in the rejection of its Tender.

26.3 Notwithstanding ITT 26.2, from the time of Tender opening to the time of Contract award, if a Tenderer wishes to contact the Employer on any matter related to the Tendering process, it shall do so in writing.

27. Clarification of Tenders

27.1 To assist in the examination, evaluation, and comparison of the Tenders, and qualification of the Tenderers, the Employer may, at its discretion, ask any Tenderer for a clarification of its Tender, allowing a reasonable time for response. Any clarification submitted by a Tenderer that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease, in the prices or substance of the Tender shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders, in accordance with ITT 36.

27.2 If a Tenderer does not provide clarifications of its Tender by the date and time set in the Employer's request for clarification, its Tender may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of Tenders, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the Tender Document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Tender Document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Tender Document.

29. Nonmaterial Nonconformities

29.1 Provided that a Tender is substantially responsive, the Employer may waive any nonconformities in the Tender.

29.2 Provided that a Tender is substantially responsive, the Employer may request that the Tenderer submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities or omissions in the Tender related to documentation requirements. Requesting information or documentation on such nonconformities or omissions shall not be related to any aspect of the price of the Tender. Failure of the Tenderer to comply with the request may result in the rejection of its Tender.

29.3 Provided that a Tender is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Tender Price. To this effect, the Tender Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component in the manner specified in the **TDS**.

G. Evaluation of Technical Parts of Tenders

30. Evaluation of Technical Parts

30.1 In evaluating the Technical Parts of each Tender, the Employer shall use the criteria and methodologies listed in this ITT and Section III, Evaluation and Qualification Criteria. No other evaluation criteria or methodologies shall be permitted.

30.2 If specified in the **TDS**, the Employer's evaluation will be carried out by applying rated criteria that take into account technical factors, in addition to cost factors. An Evaluated Tender Score will be calculated for each responsive Tender using the formula specified in Section III, Evaluation and Qualification Criteria. The scores to be given to technical factors and sub-factors are specified in the **TDS**. The weights to be given to the cost and the total technical score are specified in the **TDS**.

31. Determination of Responsiveness

31.1 The Employer's determination of a Tender's responsiveness is to be based on the contents of the Tender itself, as defined in ITT 11.

31.2 A substantially responsive Tender is one that meets the requirements of the Tender Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the Tender Document, the Employer's rights or the Tenderer's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Tenderers presenting substantially responsive Tenders.

31.3 The Employer shall examine the technical aspects of the Tender submitted in accordance with ITT 16, in particular, to confirm that all requirements of Section VII, Employer's Requirements have been met without any material deviation, reservation or omission.

31.4 If a Tender is not substantially responsive to the requirements of the Tender Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

32. Qualification of the Tenderers

32.1 The Employer shall determine to its satisfaction whether the eligible Tenderers that have submitted substantially responsive Tender - Technical Parts meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

32.2 The determination shall be based upon an examination of the documentary evidence of the Tenderer's qualifications submitted by the Tenderer, pursuant to ITT 17. The determination shall not take into consideration the qualifications of other firms such as the Tenderer's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in ITT 33.3), or any other firm(s) different from the Tenderer.

32.3 If a Tenderer does not meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria, its Tender shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

32.4 Only Tenders that are both substantially responsive to the Tender Document, and meet all Qualification Criteria shall have their envelopes marked "FINANCIAL PART" opened at the second public opening.

33. Subcontractors

33.1 Unless otherwise stated in the **TDS**, the Employer does not intend to execute any specific elements of the Works by subcontractors selected in advance by the Employer.

33.2 Tenderers may propose subcontracting up to the percentage of total value of contracts or the volume of works as specified in the **TDS**.

Subcontractors proposed by the Tenderer shall be fully qualified for their parts of the Works.

33.3 The subcontractor's qualifications shall not be used by the Tenderer to qualify for the Works unless their specialized parts of the Works were previously designated by the Employer in the **TDS** as can be met by subcontractors referred to hereafter as 'Specialized Subcontractors', in which case, the qualifications of the Specialized Subcontractors proposed by the Tenderer may be added to the qualifications of the Tenderer.

H. Public Opening of Financial Parts of Tenders

34. Public Opening of Financial Parts

34.1 Following the completion of the evaluation of the Technical Parts of the Tenders, and the Bank has issued its no objection (if applicable), the Employer shall notify in writing those Tenderers whose Tenders were considered non-responsive to the Tender Document or failed to meet the Qualification Criteria, advising them of the following information:

(a) the grounds on which their Technical Part of Tender failed to meet the requirements of the Tender Document;

(b) their envelopes marked "FINANCIAL PART" will be returned to them unopened after the completion of the selection process and the signing of the Contract; and

(c) notify them of the date, time and location of the public opening of the envelopes marked "FINANCIAL PART".

34.2 The Employer shall, simultaneously, notify in writing those Tenderers whose Tenders - Technical Parts have been evaluated as substantially responsive to the Tender Document and met all Qualifying Criteria, advising them of the following information:

(a) their Tender has been evaluated as substantially responsive to the Tender Document and met the Qualification Criteria;

(b) When rated criteria are used, the evaluated technical scores;

(c) their envelope marked "FINANCIAL PART" will be opened at the public opening of the Financial Parts; and

(d) notify them of the date, time and location of the second public opening of the envelopes marked "FINANCIAL PART" as specified in the **TDS**.

34.3 The opening date should allow Tenderers sufficient time to make arrangements for attending the opening. The Financial Part of the

Tender shall be opened publicly in the presence of Tenderers' designated representatives and anyone who chooses to attend.

34.4 At this public opening the Financial Parts will be opened by the Employer in the presence of Tenderers, or their designated representatives and anyone else who chooses to attend. Tenderers who met the Qualification Criteria and whose Tenders were evaluated as substantially responsive will have their envelopes marked "FINANCIAL PART" opened at the second public opening. Each of these envelopes marked "FINANCIAL PART" shall be inspected to confirm that they have remained sealed and unopened. These envelopes shall then be opened by the Employer. The Employer shall read out the names of each Tenderer, and the total Tender prices, per lot (contract) if applicable, including any discounts and Alternative Tender - Financial Part, and any other details as the Employer may consider appropriate.

34.5 Only envelopes of Financial Part of Tenders, Financial Parts of Alternative Tenders and discounts that are opened and read out at tender opening shall be considered further for evaluation. The Letter of Tender – Financial Part and the Priced Bill of Quantities are to be initialed by representatives of the Employer attending the tender opening in the manner specified in the **TDS**.

34.6 The Employer shall neither discuss the merits of any Tender nor reject any envelopes marked "FINANCIAL PART".

34.7 The Employer shall prepare a record of the Financial Part of the Tender opening that shall include, as a minimum:

(a) the name of the Tenderer whose Financial Part was opened;

(b) the Tender price, per lot (contract) if applicable, including any discounts; and

(c) if applicable, any Alternative Tender – Financial Part.

34.8 The Tenderers whose envelopes marked "FINANCIAL PART" have been opened or their representatives who are present shall be requested to sign the record. The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Tenderers.

I. Evaluation of Financial Parts of Tenders

35. Evaluation of Financial Parts

35.1 To evaluate the Financial Part, the Employer shall consider the following:

(a) the Tender price, excluding Provisional Sums and the provision, if any, for contingencies in the Price Schedule, but including Daywork items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITT 36.1;

(c) price adjustment due to discounts offered in accordance with ITT 14.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITT 37;

(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITT 29.3; and

(f) the additional evaluation factors are specified in the **TDS** and Section III, Evaluation and Qualification Criteria.

35.2 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Tender evaluation.

35.3 If this Tender Document allows Tenderers to quote separate prices for different lots (contracts), the methodology to determine the lowest evaluated cost of the contract combinations, including any discounts offered in the Letter of Tender – Financial Part, is specified in Section III, Evaluation and Qualification Criteria. If, however, rated criteria are used in accordance with ITT 30.2, discounts on condition of award of more than one contract shall not be used for Tender evaluation purpose.

36. Correction of Arithmetical Errors

36.1 If Tenders have been invited on single responsibility basis in terms of ITT 14, the Tenderer is deemed to have included all prices in the quoted lump sum Tender Price. Arithmetical corrections shall therefore not be made, except that where there is a discrepancy between the amount in words and the amount in figures, the amount in words shall prevail.

36.2 If Tenders have been invited to include any part of the Works to be paid according to quantity supplied or work done in terms of ITT 14, the Employer shall correct arithmetical errors only for the price for such part of the Works on the following basis:

(a) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly; and

(b) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related

to an arithmetic error, in which case the amount in figures shall prevail subject to (a) above.

36.3 Tenderers shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITT 36.1, shall result in the rejection of the Tender.

37. Conversion to Single Currency

37.1 For evaluation and comparison purposes, the currency(ies) of the Tender shall be converted into a single currency as specified in the **TDS**.

38. Provision for Development of Domestic Industry

38.1 Unless otherwise specified in the **TDS**, provision for development of domestic industry (such as a margin of preference for domestic Tenderers[1]) shall not apply.

39. Comparison of Tenders

39.1 The Employer shall compare the evaluated costs of all substantially responsive Tenders established in accordance with ITT 35.1 to determine the Tender that has the lowest evaluated cost.

39.2 If ITT 30.2 is applicable, the Employer shall evaluate the technical score and financial score of each tender and determine the Tender with the highest combined technical and financial score in accordance with TDS ITT 30.2.

40. Abnormally Low-Priced Tenders

40.1 An Abnormally Low-Priced Tender is one where the Tender price, in combination with other elements of the Tender, appears so low that it raises material concerns as to the capability of the Tenderer in regard to the Tenderer's ability to perform the Contract for the offered Tender Price.

40.2 In the event of identification of a potentially Abnormally Low-Priced Tender, the Employer shall seek written clarifications from the Tenderer, including detailed price analyses of its Tender price in relation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the Tender Document.

40.3 After examining the clarifications given and the detailed price analyses presented by the Tenderer, the Employer may as appropriate:

(a) accept the Tender, if the evidence provided satisfactorily accounts for the low tender price, in which case the Tender is not considered abnormally low; or

[1]An individual firm is considered a domestic Tenderer for purposes of the margin of preference if it is registered in the country of the Employer, has more than 50 percent ownership by nationals of the country of the Employer, and if it does not subcontract more than 10 percent of the contract price, excluding provisional sums, to foreign contractors. JVs are considered as domestic Tenderers and eligible for domestic preference only if the individual member firms are registered in the country of the Employer or have more than 50 percent ownership by nationals of the country of the Employer, and the JV shall be registered in the country of the Employer. The JV shall not subcontract more than 10 percent of the contract price, excluding provisional sums, to foreign firms. JVs between foreign and national firms will not be eligible for domestic preference.

(b) accept the Tender, but require that the amount of the Performance Security be increased at the expense of the Tenderer to a level sufficient to protect the Employer against financial loss. The amount of the Performance Security shall generally be not more than 20% of the Contract Price; or

(c) reject the Tender, if the evidence provided does not satisfactorily account for the low tender price and make a similar determination for the next ranked Tender, if required.

41. Unbalanced or Front-Loaded Tenders

41.1 If the Tender that is evaluated as the Most Advantageous Tender is, in the Employer's opinion, seriously unbalanced or front loaded, the Employer may require the Tenderer to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the Tender prices with the scope of works, proposed methodology, schedule and any other requirements of the Tender Document.

41.2 After the evaluation of the information and detailed price analyses presented by the Tenderer, the Employer may as appropriate:

(a) accept the Tender; or

(b) accept the Tender, but require that the total amount of the Performance Security be increased at the expense of the Tenderer to a level not exceeding 20% of the Contract Price; or

(c) reject the Tender and make a similar determination for the next ranked Tender.

42. Most Advantageous Tender

42.1 The Employer shall determine the Most Advantageous Tender. The Most Advantageous Tender is the Tender of the Tenderer that meets the Qualification Criteria and whose Tender has been determined to be substantially responsive to the Tender Documents and:

(a) when rated criteria are used, is the tender with the highest combined technical and financial score; or

(b) when rated criteria are not used, is the tender with the lowest evaluated cost.

43. Employer's Right to Accept Any Tender, and to Reject Any or All Tenders

43.1 The Employer reserves the right to accept or reject any Tender and to annul the Tendering process and reject all Tenders at any time prior to Contract Award, without thereby incurring any liability to Tenderers. In case of annulment, all Tenders submitted and specifically, Tender securities, shall be promptly returned to the Tenderers.

44. Standstill Period

44.1 The Contract shall not be awarded earlier than the expiry of the Standstill Period. The Standstill Period shall be ten (10) Business Days unless

extended in accordance with ITT 48. The Standstill Period commences the day after the date the Employer has transmitted to each Tenderer the Notification of Intention to Award the Contract. Where only one Tender is submitted, or if this contract is in response to an emergency situation recognized by the Bank, the Standstill Period shall not apply.

45. Notification of Intention to Award

45.1 The Employer shall send to each Tenderer the Notification of Intention to Award the Contract to the successful Tenderer. The Notification of Intention to Award shall contain, at a minimum, the following information:

(a) the name and address of the Tenderer submitting the successful Tender;

(b) the Contract price of the successful Tender;

(c) the names of all Tenderers who submitted Tenders, and their Tender prices as readout, and as evaluated, and when rated criteria are used, the evaluated technical and financial scores, and the combined total scores;

(d) a statement of the reason(s) the Tender (of the unsuccessful Tenderer to whom the notification is addressed) was unsuccessful, unless the price or score information in (c) above already reveals the reason;

(e) the expiry date of the Standstill Period; and

(f) instructions on how to request a debriefing and/or submit a complaint during the standstill period.

J. Award of Contract

46. Award Criteria

46.1 Subject to ITT 43, the Employer shall award the Contract to the successful Tenderer. This is the Tenderer whose Tender has been determined to be the Most Advantageous Tender.

47. Notification of Award

47.1 Prior to the expiry of the Tender Validity Period and upon expiry of the Standstill Period specified in ITT 43.1 or any extension thereof, and, upon satisfactorily addressing any complaint that has been filed within the Standstill Period, the Employer shall notify the successful Tenderer, in writing, that its Tender has been accepted. The notification of award (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution of the Contract (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

47.2 Within ten (10) Business Days after the date of transmission of the Letter of Acceptance, the Employer shall publish the Contract Award Notice which shall contain, at a minimum, the following information:

(a) name and address of the Employer;

(b) name and reference number of the contract being awarded, and the procurement method used;

(c) names of all Tenderers that submitted Tenders, and their Tender prices as read out at Tender opening, and as evaluated, and when rated criteria are used, the evaluated tender scores;

(d) names of all Tenderers whose Tenders were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor;

(e) the name of the successful Tenderer, the final total contract price, the contract duration and a summary of its scope; and

(f) successful Tenderer's Beneficial Ownership Disclosure Form, if specified in TDS ITT 49.1.

47.3 The Contract Award Notice shall be published on the Employer's website with free access if available, or in at least one newspaper of national circulation in the Employer's Country, or in the official gazette. The Employer shall also publish the contract award notice in UNDB online and AIIB website.

47.4 Until a formal Contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract.

48. Debriefing by the Employer

48.1 On receipt of the Employer's Notification of Intention to Award referred to in ITT 44.1, an unsuccessful Tenderer has three (3) Business Days to make a written request to the Employer for a debriefing. The Employer shall provide a debriefing to all unsuccessful Tenderers whose request is received within this deadline.

48.2 Where a request for debriefing is received within the deadline, the Employer shall provide a debriefing within five (5) Business Days, unless the Employer decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes place. The Employer shall promptly inform, by the quickest means available, all Tenderers of the extended standstill period.

48.3 Where a request for debriefing is received by the Employer later than the three (3)-Business Day deadline, the Employer should provide the

debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Contract Award Notice. Requests for debriefing received outside the three (3)-day deadline shall not lead to extension of the standstill period.

48.4 Debriefings of unsuccessful Tenderers may be done in writing or verbally. The Tenderer shall bear its own costs of attending such a debriefing meeting.

49. Signing of Contract

49.1 The Employer shall send to the successful Tenderer the Letter of Acceptance including the Contract Agreement, and, if specified in the **TDS**, a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form, if so requested, shall be submitted within eight (8) Business Days of receiving this request.

49.2 The successful Tenderer shall sign, date and return to the Employer, the Contract Agreement within twenty-eight (28) days of its receipt.

50. Performance Security

50.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Tenderer shall furnish the Performance Security in accordance with the General Conditions of Contract, subject to ITT 40.3 (b) and ITT 41.2 (b), using for that purpose the Performance Security Form included in Section X, Contract Forms, or another form acceptable to the Employer.

50.2 Failure of the successful Tenderer to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security. In that event the Employer may award the Contract to the Tenderer offering the next Most Advantageous Tender.

51. Procurement Related Complaint

51.1 The procedures for making a Procurement-related Complaint are as specified in the **TDS**.

Section II - Tender Data Sheet (TDS)

The following specific data for the Works to be procured shall complement, supplement, or amend the provisions in the Instructions to Tenderers (ITT). Whenever there is a conflict, the provisions herein shall prevail over those in ITT.

A. General	
ITT 1.1	The reference number of the SPN/Tender is: **HORC/HRIDC/C-5/2023** The Employer is*:* **Haryana Orbital Rail Corporation Limited (HORCL)** The name of the Tender is: **Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for: **Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for: (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844. The number and identification of lots (contracts) comprising this Tender is: **Contract Package (C-5)**
ITT 1.2(a)	**Electronic – Procurement System** The Employer shall use the following electronic-procurement system to manage this Tendering process: **eProcurement portal of Govt. of Haryana (**https://etenders.hry.nic.in**)**
ITT 2.1	The Recipient is: **Haryana Orbital Rail Corporation Limited (HORCL) through Government of Haryana** The Bank Loan : **Under process** Loan Amount: **USD 272 million** The name of the Project is: **Haryana Orbital Rail Corridor (HORC)**
ITT 4.1	Maximum number of members in the JV shall be: **Three (03)**

ITT 4.1	**Add the following after the last sentence of Clause 4.1** Highest shareholding member in the JV shall be the Lead member of JV. Minimum percentage share of each JV member shall be as specified in Sub-Clause 3.1.6 of Section III, EQC. No change in constitution or percentage share shall be permitted at any stage after the Tender submission, failing which the Tenderer shall be treated as non-responsive. Authorized Representative of JV shall be from Lead Member of JV.
ITT 4.4	**Add the following after the last sentence of Clause 4.4** In the event that the Contract is awarded to a foreign Tenderer or to a JV having foreign lead Member, such foreign Tenderer/foreign lead Member shall be required to set up a project office in India in accordance with applicable laws in India, and shall be required to submit a proof of having opened a project office in India along with statutory approvals, if any, prior to submitting any interim payment certificate in accordance with the Contract, failing which no payment shall be made to the Contractor by the Employer (in accordance with the Contract) until such requirement has been complied with by the foreign Contractor. The aforesaid condition of establishing a project office in India shall not be applicable in case the selected Tenderer is a joint venture between an Indian entity and a foreign entity where Indian Member is lead Member.
ITT 4.5	A list of debarred firms and individuals is available on the Bank's external website: https://www.aiib.org/debarment/
ITT 6.3	**Replace ITT 6.3 with the following:** The complete Tender Document can be viewed/ downloaded by the Tenderer from eProcurement portal of Govt. of Haryana https://etenders.hry.nic.in. The Employer is not responsible for the completeness of the Tender Document and their addenda, if they were not obtained directly from eProcurement portal of Govt. of Haryana https://etenders.hry.nic.in .
B. Contents of Tender Document	
ITT 7.1	For **Clarification of Tender purposes** only, the Employer's address is: **Attention:** Chief Project Manager /South **Street address:** Haryana Rail Infrastructure Development Corporation Limited (HRIDC), Plot no.143, Railtel Tower, Sector-44 **Floor:** 5th floor **City:** Gurugram **ZIP code:** 122003

	Country: India **Telephone:** +91 9729410447 **E-mail:** horc.etendering@gmail.com
ITT 7.2	**Add the following at the end of Para 7.2:** The Tenderer must obtain for themselves information related to site conditions, traffic, location, surroundings, climate, hydrology, meteorological conditions, weather data, availability of power, water, other utilities cumulative for construction, access and approach roads to the Site, handling and storage of materials, Waste disposal, applicable laws and regulations and any other matter considered relevant and necessary by them required for submitting their Tender and performance of all of its obligations in accordance with the requirements of Tender Documents. Site visit with the Employer's Representative will be conducted on the date and time specified below. **Date: 21.11.2023** **Time: 1100 hrs. IST** Tenderers who wish to participate in site visit shall send a request (giving details of the Company, its address, and the name, designation and email of the person attending the Site Visit) through email on the email id (i.e. horc.etendering@gmail.com) on or before **20.11.2023**. Tenderer's Representative who wish to participate in site visit on the given date should assemble at the location given below: Prithla Station (HORC), near by DFCC Connectivity Line Village-Prithla, District -Palwal, State- Haryana, Pin-121102 **Country:** India **For coordination regarding Site visit, Tenderers may contact:** Sh. Raju Solanki, Deputy General Manager /HRIDC **Telephone:** +91 6350475788 The costs of visiting the Site shall be at the Tenderer's own expense.

ITT 7.4

Replace the entire Sub-Clause 7.4 with the following:

A Pre-Tender Meeting will take place through online Video conferencing (VC) as well as offline in the Conference room of HRIDC office, Plot No 143, Railtel Tower, Sector-44, Gurugram, Haryana-122003 at the following date and time.

Date: 22.11.2023

Time: 11.00 hrs. IST

The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

The prospective Tenderers who wish to join the Pre-Tender Meeting through VC shall send a request (giving details of the Company, its address, and the name, designation and email of the person attending the VC) through email along with an editable soft copy (MS Word) of the queries raised by them on the email id (i.e. horc.etendering@gmail.com) so that a link for Video Conferencing can be sent by HRIDC. The Tenderers should use the following format for any Pre-Tender queries:

Query No.	**Reference to Tender Document (Clause/ Para No. & Page No.)**	**Brief Description of Clause/ Para No.**	**Query Raised**
1.			
2.			
3.			
4.			
5.			
etc.			

HRIDC will allow maximum of one email Id for one company to participate in the VC. Any request for VC received after the given date and time for sending the link for VC may not be entertained by HRIDC. Prospective Tenderers will be able to join the VC through the link provided to them on their Email ID.

ITT 7.5

Replace ITT 7.5 with the following:

The Tenderer is requested to submit any questions in writing, to reach the Employer not later than 2 days before the Pre-Tender Meeting.

ITT 7.6	**Replace ITT 7.6 with the following:** Minutes of the Pre-Tender Meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting will be uploaded on eProcurement portal, https://etenders.hry.nic.in. Any modification to the Tender Document that may in the sole discretion of the Employer become necessary as a result of the Pre-Tender meeting shall be made by the Employer exclusively through the use of an Addendum pursuant to ITT 8.
ITT 8.2	**Replace ITT 8.2 with the following:** Any addendum issued shall be part of the Tender Document and shall be uploaded on eProcurement portal, https://etenders.hry.nic.in. The onus is on the Tenderers to visit the eProcurement portal to see the Addenda/Corrigenda published by the Employer.
C. Preparation of Tenders	
ITT 10.1	The language of the Tender is: **English** All correspondence exchange shall be in **English** language. **Add the following at the end of Sub-Clause ITT 10.1** In case the Certificates/ documents other than Power of Attorney are in foreign language, the translation of the same shall be submitted in English language. The translation of Certificates / documents in foreign language shall be done by the licensed translator. Tenderer must submit copy of license issued by the competent authority in their country of origin. POA should be submitted in accordance with Sub-Clause ITT 20.
ITT 11.1	**Replace ITT 11.1 with the following:** The Tenderer shall submit their Tender online on eProcurement portal https://etenders.hry.nic.in as mentioned in para ITT 21. The Tender shall comprise two parts submitted simultaneously, one called the Technical Part containing the documents listed in ITT 11.2 and the other the Financial Part containing the documents listed in ITT 11.3**.** The Tenderer shall upload only the above-mentioned documents in its submission on eProcurement portal and is not required to upload Part 1, Part 2 and Part 3 of the Tender document issued by the Employer. The master copy of Tender Document published on eProcurement portal shall be available with HRIDC which shall be final and binding.

ITT 11.2	**Replace the entire Sub-Clause 11.2 with the following:** The Tenderer shall submit all the documents in its Technical Part as per the Checklist CL (A. Technical Part) given in Section III: Evaluation and Qualification Criteria.
ITT 11.3	**Replace the entire Sub-Clause 11.3 with the following** The Tenderer shall submit all the documents in its Financial Part as per the Checklist CL (B. Financial Part) given in Section III: Evaluation and Qualification Criteria
ITT 13.1	Alternative Tenders **shall not be** considered.
ITT 13.2	Alternative times for completion **shall not be** permitted.
ITT 13.4	Alternative technical solutions **shall not** be permitted**.**
ITT 14.2	**Replace ITT 14.2 with the following: -** The Tenderer shall quote the total lump sum price on "single responsibility basis" for Schedule 'A' in the prescribed place of Price Schedule in MS-Excel file. The Tenderer shall quote single percentage (%) Excess (+) or Less (-) on the estimated amount for Schedule 'B', Schedule 'C' and Schedule 'D' in the prescribed place of Price Schedule in MS-Excel file.
ITT 14.4	**Replace ITT 14.4 with the following: -** No discounts shall be quoted by the Tenderers.
ITT14.7	Replace **ITT 14.7 with the following:** All duties (except Custom Duty), taxes including Goods and Services Taxes (GST), royalties, fees, cess and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of Tenders, shall be included in the rates and prices and the total Tender Price submitted by the Tenderer. The Tenderer must take note of Sub-Clause 14.1, Part B-Specific Provisions, Section IX: Particular Conditions of Contract (PCC) for quoting rates and prices of their Tender.
ITT 15.1	The currency(ies) of the Tender and the payment currency(ies) shall be as described below: The prices shall be quoted by the Tenderer in the Price Schedule in Indian Rupees (**INR)** only. A Tenderer expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's Country (referred to as "the foreign currency requirements") shall indicate in the Appendix A to Financial Part - Table B, Section IV-Tender Forms the percentage(s) of the Tender Price (excluding Provisional Sums), needed

	by the Tenderer for the payment of such foreign currency requirements, limited to any three freely convertible currencies.
ITT 18.1	The Tender validity period shall be 180 days after the Tender submission deadline date.
ITT 19.1	The Tenderer shall furnish a Tender Security for an amount of **INR 10,000,000.00 (INR Ten Million only) or the equivalent amount in a freely convertible currency.** The rates of exchange for computing INR equivalent shall be the reference rate prevailing twenty-eight (28) days prior to the deadline of Tender submission. Exchange rates shall be taken from the sources specified in Note 1 (iii) given under Sub-Clause 3.4, Section III, EQC.
ITT 19.2	Not Applicable
ITT 19.3	**Replace the ITT 19.3 with the following:** The amount for Tender Security specified in ITT 19.1 above can be paid online by eligible Tenderers on eProcurement Portal in INR in favour of Haryana Rail Infrastructure Development Corporation Limited using the electronic payment gateway service or Tender Security can be submitted in the form of unconditional and irrevocable Bank Guarantee in INR or the equivalent amount in a freely convertible currency from the specified banks using the Tender Security Form included in Section IV, Tender Forms. The Bank Guarantee shall be issued from: (i) a scheduled bank (excluding co-operative banks) in India, or (ii) a Foreign Bank having arrangement with a nationalized bank or scheduled banks (excluding co-operative banks) in India; The scheduled bank issuing the bank guarantee shall be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the Bank Guarantee shall invariably be sent by the issuing bank to the Employer's Bank through SFMS and only after receipt of the same by the Employer's Bank, the bank guarantee shall become operative and acceptable to the Employer. Further, the bank guarantee in original form along with a copy of "MT760COV (in case of bank guarantee message)/ MT767COV (in case of bank guarantee amendment message) Report" sent by the concerned issuing bank sealed in an envelope shall be submitted to the Employer within ten (10) days of deadline of submission of Tender. The Issuing Bank shall send the SFMS to: Beneficiary: Haryana Rail Infrastructure Development Corporation Limited

	Bank Name: State Bank of India Account Number: 38848977231 Branch: SME Branch, Sector 8, Chandigarh IFSC Code: SBIN0011705 The Tender Security shall be valid for twenty-eight (28) days beyond the original validity period of the Tender, or beyond any period of extension if requested under ITT 18.2. In case the Tenderer has opted for Tender Security in the form of an unconditional Bank guarantee, the Tenderer shall upload the scanned copy of Bank Guarantee with the Tender. The original Bank Guarantee shall be delivered either by Registered Post/Speed Post/Courier or by hand within ten (10) days of deadline of submission of Tender at the address given below: **Chief Project Manager/South** Haryana Rail Infrastructure Development Corporation Limited, Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram, Haryana-122003 Non submission of scanned copy of Bank Guarantee with the Tender on eProcurement portal and/or no submission of original Bank Guarantee within the specified period shall lead to summary rejection of Tender. The details of the Original Bank Guarantee should match with the details available in the scanned copy and the data entered during Tender submission time, failing which the Tender shall be rejected. **Notes:** **1.** In case SFMS for the Bank Guarantee is not received by the Employer's Bank through SFMS, original copy of BG received in such a manner will be sent to the concerned Bank for its verification and only after its confirmation from the Bank, BG shall be acceptable by the Employer and Tender shall be evaluated . **2.** Option of Exemption from payment of EMD mentioned in the module of eProcurement portal is only for exemption of online payment of Tender Security to the Tenderers who wish to submit Tender Security in the form of Bank Guarantee.
ITT 20.1	**Replace ITT 20.1 with the following:** The Technical Part (comprising of documents specified in ITT 11.2) and Financial Part (comprising of documents specified in ITT 11.3) shall be submitted online on eProcurement portal of Government of Haryana (https://etenders.hry.nic.in**)** only in accordance with the requirements of the Tender Documents.

ITT 20.3	The written confirmation of authorization to sign on behalf of the Tenderer shall consist of: (a) In case of Private/Public Companies, a Power of Attorney from the Director of the Company who has been authorized by the Board of Directors through resolution to sign on behalf of the Company. Copy of Board Resolution shall also be submitted. In case of Foreign Members, Power of Attorney(s) and Board Resolution confirming authority on the persons issuing the Power of Attorney for such actions shall be submitted duly translated by licensed translator and duly notarized by the notary public of country of origin Where the Successful Tenderer is either a Foreign Entity or one of the Joint Venture Member is a Foreign Entity, such Foreign entity shall be required to submit all the documents either duly stamped by Indian Embassy/High Commission or Member Countries of Hague convention may submit these document with "Apostille" stamp before signing the Contract. (b) In case of Proprietory Tenderers, Power of Attorney by the Proprietor. (c) In case of Partnership firms, Power of Attorney duly signed by all the Partners. (d) In case of Limited Liability Partnership (LLP) firms, a Power of Attorney issued by the LLP in favour of the individual to sign the tender on behalf of the LLP and create liability against the LLP. (e) In case of Joint Venture, Power of Attorney duly signed by authorized representative of individual Member in favour of the Lead Member and Authorized representative of JV. (f) The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.
D. Submission of Tenders	
ITT 21	**Replace ITT 21 with the following:** 21.1 Tenderers shall upload their tender submission online on eProcurement portal (i.e. https://etenders.hry.nic.in) within the stipulated date and time as mentioned in ITT 22.1. The Tenderer shall ensure that they retain a copy of the receipt/ acknowledgement of their Tender submission which is generated by the system upon successful submission of Tender online.

21.2 Tenders sent telegraphically or through any other means of transmission except as mentioned above shall be treated as invalid and shall stand rejected.

21.3 No details about Financial Part shall be submitted/ disclosed directly or indirectly in the Technical Part failing which the Employer has the right to reject the Tender.

21.4 **Instructions for Online Tender Submission**

The Tenderers are required to submit soft copies of their Tenders electronically on the eProcurement portal of Government of Haryana i.e., https://etenders.hry.nic.in, using valid Digital Signature Certificates. The instructions given below are meant to assist the Tenderers in registering on the eProcurement Portal, prepare their Tenders in accordance with the requirements and submitting their Tenders online on the eProcurement Portal.

Registration:

i) Tenderers are required to enroll on the above-mentioned eProcurement portal by clicking on the link "**Online Bidder Enrollment**" on the Portal which is free of charge.
ii) As part of the enrolment process, the Tenderers will be required to choose a unique username and assign a password for their accounts.
iii) Tenderers are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the eProcurement Portal.

A. Obtaining a Digital Certificate:

i. The Tenders submitted online should be encrypted and signed electronically with a Digital Certificate to establish the identity of the Tenderer online. These Digital Certificates are issued by an Approved Certifying Authority, by the Controller of Certifying Authorities, Government of India.

ii. A Digital Certificate is issued upon receipt of mandatory identity (i.e. Applicant's PAN Card) and Address proofs and verification form duly attested by the Bank Manager / Postmaster / Gazetted Officer. Only upon the receipt of the required documents, a digital certificate can be issued. For more details please visit the website – https://etenders.hry.nic.in

iii. The Tenderers may obtain Class-II or III digital signature certificate from any Certifying Authority or Sub-certifying Authority authorized by the Controller of Certifying Authorities or may obtain information,

	application format and documents required for the issue of digital certificate. iv. The Tenderer must ensure that he/she comply by the online available important guidelines at the portal https://etenders.hry.nic.in for Digital Signature Certificate (DSC) including the e-Token carrying DSCs. For any queries related to e-tendering process (registration, online e-bid submission/withdrawal, uploading of documents), Tenderer may contact the below representative of NIC: **Mr. Anuj Mahajan** **E - mail:** amahajan@nic.in, eprocnichry@yahoo.com **Help Desk:** 0120-4001002, 0120-4200462, 0120-4001005, 0120-6277787, 0172-2700275. v. Tender for a particular tender must be submitted online using the digital certificate (Encryption & Signing), which is used to encrypt and sign the data during the stage of Tender preparation. In case, during the process of a particular tender, the user loses his digital certificate (due to virus attack, hardware problem, operating system or any other problem) he will not be able to submit the Tender online. Hence, the users are advised **to keep a backup of the certificate** and also keep the copies at safe place under proper security (for its use in case of emergencies). vi. In case of online tendering, if the digital certificate issued to the authorized user of a firm is used for signing and submitting a Tender, it will be considered equivalent to a no-objection certificate/power of attorney/lawful authorization to that User only for accessing eProcurement portal for online Tender submission on the portal. The firm has to authorize a specific individual through an authorization certificate signed by all partners to use the digital certificate as per Indian Information Technology Act 2000. Unless the certificates are revoked, it will be assumed to represent adequate authority of the user to Tender on behalf of the firm in the department tenders as per Information Technology Act 2000. The digital signature of this authorized user will be binding on the firm. vii. In case of any change in the authorization, it shall be the responsibility of management/ partners of the firm to inform the certifying authority about the change and to obtain the digital signatures of the new person/ user on behalf of the firm/ company. The procedure for application of a digital certificate however will remain the same for the new user.

viii. The same procedure holds true for the authorized users in a private/Public limited company. In this case, the authorization certificate will have to be signed by the directors of the company.

B. Purchase of Tender Document - Online

For purchasing the Tender Document online, Tender Document Fee is NIL. Tender Document can be downloaded free of cost from the eProcurement portal https://etenders.hry.nic.in .

C. Pre-requisites for online Tendering:

In order to operate on the electronic tender management system, a user's machine is required to be set up. A help file on system setup/Pre-requisite can be obtained from National Informatics Center or downloaded from the home page of the website - https://etenders.hry.nic.in the link for downloading required java applet & DC setup are also available on the Home page of the eProcurement Portal.

D. Online Viewing of Specific Procurement Notice (SPN):

The Tenderers can view the SPN and the time schedule (Key Dates) through the single portal eProcurement system on the Home Page at https://etenders.hry.nic.in

E. Downloading of Tender Documents:

The detailed Tender Document can be downloaded free of cost from the eProcurement portal https://etenders.hry.nic.in from **08.11.2023 (17:00 Hrs. IST) to 18.01.2024 (15:00 Hrs. IST.)**

F. Key Dates:

The Tenderers are strictly advised to follow dates and times as indicated in the online Specific Procurement Notice. The date and time shall be binding on all Tenderers. All online activities are time tracked and the system enforces time locks that ensure that no activity or transaction can take place outside the start and end dates and the time of the stage as defined in the online Specific Procurement Notice.

G. Online Payment of E-Service Fee & Tender Security:

The online payment for E-Service Fee and Tender Security in INR or equivalent amount in any other freely convertible foreign currency shall be made using the secure electronic payment gateway by Tenderers online directly through Debit Cards & Internet Banking accounts.

The secure electronic payments gateway is an online interface between Contractors and Debit card/online payment authorization networks.

For online payments guidelines, please refer to the Home page under tab "**Guidelines for hassle free Bid Submission**" of the eProcurement Portal of Government of Haryana, https://etenders.hry.nic.in

H. Offline Payment of Tender Security

For submission of the Tender Security in the form of BG (Tender Security offline Payment), System will direct Tenderer to the EMD details page (EMD Payment offline). Following Steps are to be followed:
Step 1: Select 'Yes' option where system asks "Are you submitting EMD through BG/ST or Exempted from EMD payment".
Step2: Select 'Percentage" option to choose EMD exemption type and insert 100% as exemption.
Step 3: Tenderer must upload scanned copy of Bank Guarantee as EMD exemption document on eProcurement Portal. After uploading the document, Tenderer must sign the document digitally.
Step 4: To confirm the details of payment, Tenderer must Select option "Confirm to pay"
Step 5: Tenderer must enter the details of BG as EMD fee detail on EMD offline payment page

Note: Option of Exemption from payment of EMD mentioned in the module of eProcurement portal is only for exemption of online payment of Tender Security to the Tenderers who wish to submit Tender Security in the form of Bank Guarantee.

I. **Preparation & Submission of online Applications/Tenders:**

i. Tender shall mandatorily be submitted online following the instruction appearing on the screen.

ii. **Scan copy of Documents to be submitted/uploaded for Technical Part under online PQQ/ Technical Envelope:**

	All documents shall be prepared and scanned in file formats PDF /JPEG/MS WORD format such that file size does not exceed 10 MB) and uploaded during the online submission of PQQ or Technical Envelope. **iii. FINANCIAL PART (MS-Excel File for quoting price and Pdf file for Letter of Tender-Financial Part and Appendix A and Appendix B to Letter of Tender- Financial Part) shall be submitted mandatorily online under Commercial Envelope and original not to be submitted manually.** ***NOTES:*** ***(A) Tenderers participating in online tenders shall check the validity of his/her Digital Signature Certificate before participating in the online Tenders at the portal*** https://etenders.hry.nic.in**.** ***(B) For help manual, please refer to the 'Home Page' of the*** **eProcurement** ***website at*** https://etenders.hry.nic.in.
ITT 22.1	**Replace ITT 22.1 with the following:** The Tender submission is through the eProcurement portal only (i.e. https://etenders.hry.nic.in) as specified in ITT 21.1 The Tenderer shall submit its Tender before expiry of the date and time for tender submission as specified herein. **The start date for Tender submission is:** Date: **11.01.2024** Time: **11.00 hrs. IST** **The deadline for Tender submission is:** Date: **18.01.2024** Time: **15.00 hrs. IST**
ITT 23.1	**Replace ITT 23.1 with the following:** Submission of Tenders shall be closed on eProcurement portal on the date & time of submission as prescribed in ITT 22.1 after which no Tender can be uploaded.

ITT 24	**Replace ITT 24 with the following:** 24.1 The Tenderer may modify, substitute or withdraw its e-Tender after submission prior to the deadline for submission of Tenders. For modification of e-Tender, Tenderer has to detach its old Tender from eProcurement portal (https://etenders.hry.nic.in) and upload/ resubmit digitally signed modified Tender. For withdrawal of Tender, Tenderer has to click on withdrawal icon at eProcurement portal and can withdraw its e-tender. Before withdrawal of a tender, it may specifically be noted that after withdrawal of a tender for any reason, Tenderer cannot re-submit e-tender again. 24.2 No Tender may be withdrawn, substituted, or modified in the interval between the deadline for submission of Tenders and the expiration of the period of Tender validity specified by the Tenderer on the Letter of Tender or any extension thereof.
E. Public Opening of Technical Parts of Tenders	
ITT 25	**Replace ITT 25 with the following:** 25.1 The Employer shall conduct the electronic opening of Technical Part on eProcurement portal on the date, time and place as specified below: **Street Address:** Haryana Rail Infrastructure Development Corporation Limited (HRIDC), Plot no.143, Railtel Tower, Sector-44 **Floor/ Room number:** 5th floor **City:** Gurugram **Zip code:** 122003 **Country:** INDIA Date: **18.01.2024** Time: **15.30 hrs IST** The opening of the Technical Part and subsequent details can be viewed by the Tenderers by logging on the eProcurement portal. Alternatively, any Tenderer who wish to attend the Technical Part opening can be present during the opening. The Tenderer's representatives who are present shall be requested to mark their attendance on the format available with the Employer. 25.2 The Financial Part submitted online on eProcurement portal will remain unopened in the eProcurement portal until the date and time of opening of Financial Part. The date and time of the opening of the Financial Part will be notified to all the Tenderers on eProcurement portal whose tender is found

	to be substantially responsive and qualified in technical evaluation as specified in ITT 34.2. 25.3 At the time of opening of Technical Part, the following shall be read out and recorded: (a) the name of the Tenderer; (b) the presence of a Tender Security; and (c) any other details as the Employer may consider appropriate. Only Technical Part read out and recorded at Tender opening shall be considered for evaluation. 25.4 The Employer shall prepare a record of the opening of Technical Part that shall include, as a minimum, the name of the Tenderer and the presence or absence of Tender Security. The Tenderer's representatives who are present shall be requested to sign the record available with the HRIDC. The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record. 25.5 At the tender opening the Employer shall neither discuss the merits of any Tender nor reject any Tender.
F. Evaluation of Tenders – General Provisions	
ITT 27	**Replace ITT 27 with the following:** 27.1 To assist in the examination, evaluation and comparison of the Tenders, the Employer may, at its discretion, ask any Tenderer for a clarification of its Tender in accordance with ITT Clause 29. Any clarification submitted by a Tenderer that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing and delivered to concerned Tenderers (by courier or e-mail through PDF attachment). The due date and time to respond to these queries will also be communicated. No change in the prices or substance of the Tender shall be sought, offered, or permitted, except to confirm the correction of errors discovered by the Employer in the evaluation of the Financial Part, in accordance with ITT Clause 35. 27.2 If a Tenderer does not provide clarifications of its Tender by the date and time set in the Employer's request for clarification, their Tender shall be evaluated as per the available information in the submitted Tender.

ITT 29.3	Not Applicable
G. Evaluation of Technical Parts of Tenders	
ITT 30.2	Not Applicable
ITT 32.4	**Replace ITT 32.4 with the following:** Only Tenders that are both substantially responsive to the Tender Document, and meet all Qualification Criteria, shall be notified on eProcurement portal for the public opening of "FINANCIAL PART".
ITT 33.1	Subcontractor is permitted for the activity specified in ITT 33.3.
ITT 33.2	Maximum allowable accumulated value of work to be subcontracted (as a percentage of the Accepted Contract Amount)- 30%
ITT 33.3	Specialist Subcontractors are permitted for the following activities: (i) Fabrication, assembly & launching of Open Web Girders (OWG) and **(ii)** Construction of Ballastless Track System
H. Public Opening of Financial Parts of Tenders	
ITT 34	**Replace ITT 34 with the following:** 34.1 Following the completion of the evaluation of the Technical Parts of the Tenders, and the Bank has issued its no objection (if applicable), the Employer shall notify in writing those Tenderers whose Tenders were considered non-responsive to the Tender Document or failed to meet the Qualification Criteria, advising them of the following information: (a) the grounds on which their Technical Part of Tender failed to meet the requirements of the Tender Document; (b) their "FINANCIAL PART" shall remain unopened on the eProcurement portal; (c) notify them of the date, time and location of the public opening of "FINANCIAL PART" on the eProcurement portal; 34.2 The Employer shall, simultaneously, notify in writing those Tenderers whose Tenders - Technical Parts have been evaluated as substantially responsive to the Tender Document and met all Qualifying Criteria, advising them of the following information:

	(a) their Tender has been evaluated as substantially responsive to the Tender Document requirements and met the Qualification Criteria; (b) their "FINANCIAL PART" on eProcurement portal will be opened at the public opening of the Financial Parts; and (c) notify them of the date, time and location of the public opening of the "FINANCIAL PART" as specified below: i. The Employer shall publish a notice of the public opening of the Financial Parts on eProcurement portal. ii. Any interested party who wishes to attend this public opening may contact: **For the attention:** Chief Project Manager Haryana Rail Infrastructure Development Corporation Limited **Email address:** horc.etendering@gmail.com 34.3 The "FINANCIAL PART" of Tenderers who met the Qualification Criteria and whose Tenders were evaluated as substantially responsive, will be opened on eProcurement portal. The Employer shall read out the names of each Tenderer, and the total Tender prices, including any discounts and any other details as the Employer may consider appropriate. 34.4 The Employer shall neither discuss with Tenderer's representative present, if any, the merits of any Tender nor reject any "FINANCIAL PART". 34.5 The Employer shall prepare a record of the Financial Part of the Tender opening that shall include, as a minimum: (a) the name of the Tenderer whose Financial Part was opened; (b) the Tender price; 34.6 The Tenderer's representatives who are present at the time of opening of Financial Part shall be requested to sign the record. The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record. A copy of the record (i.e. summary of rates quoted) can be viewed by all eligible Tenderers after opening of the Financial Part.
I. Evaluation of Financial Parts of Tenders	
ITT 37.1	The currency that shall be used for tender evaluation and comparison purposes is **Indian Rupees (INR) only.**

ITT 38.1	Provisions for development of domestic industry (such as a margin of domestic preference) shall not apply.
J. Award of Contract	
ITT 47.1	**Add the following to ITT 47.1** The Accepted Contract Amount shall be in **INR** only. However, the payments will be made in currencies as quoted by the Tenderer in Appendix A, Table B, Section IV-Tender Forms.
ITT 49.1	The successful Tenderer shall submit the Beneficial Ownership Disclosure Form.
ITT 51.1	The procedures for making a Procurement-related Complaint are detailed in the Bank's Procurement Instructions for Recipients (Annex IV). A Tenderer may make a Complaint in writing, to: **For the attention:** Chief Project Manager/South Haryana Rail Infrastructure Development Corporation Limited **Email address***:* *horc.etendering@gmail.com*

Section III. Evaluation and Qualification Criteria

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1. General Provisions

1.1 Evaluation Sequence

(a) Tenders will be evaluated through the following four stages:

(i) Stage 1: Evaluation of Administrative Requirements

(ii) Stage 2: Evaluation of Compliance with the Qualification Requirements

(iii) Stage 3: Technical Evaluation

(iv) Stage 4: Financial Evaluation

1.2 Clarification from Tenderers

(a) The Evaluation Team may request clarification(s) of any Tender in accordance with theprovisions of the Tender Documents (Part 1, Section-I: Instructions to Tenderers, Clause 27 and Clause 29).

(b) If clarification is required, the Evaluation Team will send written (Courier/email with PDF attachment) request(s) to the Authorized Representative for clarification(s), specifying the deadline for receipt of reply.

(c) Replies to the above request(s) shall be sent by Tenderer through Courier/e-mail with PDF attachments and the same shall be solely to clarify and/or elaborate the item(s) already included in the submitted Tenders for the purpose of evaluation in accordance with ITT 27.1 and ITT 29.

1.3 Tender Forms

(a) Tenderers should note that the information required to be inserted into the Tender Forms shall be comprehensive and detailed. The technical information shall be furnished in line with the requirements of Part 1, Part 2 and Part 3 of the Tender Documents.

(b) All Forms contained in the Tender Documents must be fully and properly completed and all the forms must be returned duly signed by Authorised Representative of the Tenderer, as they will be reviewed exactly as submitted and errors or omissions may count against the Tenderer.

(c) Any Tenderer who is found to have intentionally submitted false or inaccurate statements/information shall be disqualified from the Tendering process.

2. Stages of Evaluation

2.1 Stage 1: Evaluation of Administrative Requirements

A. General

(a) The Stage 1 Evaluation will consist of checking the Tenders to confirm whether they are substantially responsive to the administrative requirements of the Tender Documents.

(b) The following administrative items will be checked:

(i) Whether the Tender submission is in accordance with ITT 11.2;

(ii) Whether the Power of Attorney (POA) for the Tender signatory is in the correct form [Ref. ITT 20.3 and ITT 20.4]. If during technical evaluation stage, POA submitted by the Tenderer is not found in the correct format, Employer will send written (Courier/email with PDF attachment) request to the Authorized Representative for rectification of POA in accordance with format prescribed in Section IV, Tender Forms, specifying the deadline for receipt of Power of Attorney in correct form. If a tenderer does not provide the Power of Attorney in correct form within the stated date and time set in the Employer's request for correction of Power of Attorney, its Tender is liable to be rejected.

2.2 Stage 2: Evaluation of Compliance with the Qualification Requirements

A. General

Tenders will be reviewed to ascertain whether the Tender complies with all of the minimum requirements as stipulated in the Sub-Clause C. Qualification Criteria.

B. Check Items

The following requirements of the Instruction to Tenderers, Clauses 4, 11 & 17 will be checked to ensure compliance to the requirements of criteria given below:

(a) Eligibility

(i) Nationality: Form ELI-1.1(a), ELI-1.1(b), and Form ELI-1.2
(ii) Conflict Interest: Letter of Tender-Technical Part
(iii) Bank Eligibility: Letter of Tender -Technical Part
(iv) State-owned Enterprise or Institution of the Recipient country: Form ELI-1.1(a), ELI-1.1(b), and Form ELI-1.2, Letter of Tender -Technical Part
(v) United Nations resolution or Recipient's country law: Letter of Tender-Technical Part

(b) Historical Contract Non-Performance and Litigation

(i) History of Non-Performing Contracts: Form CON-1
(ii) Suspension Based on Execution of Tender- Securing Declaration by the Employer: Letter of Tender-Technical Part
(iii) Pending Litigation: Form CON-1
(iv) Declaration: Environmental, Social, Health, and Safety (ESHS) past performance: Form CON-2

(c) Financial Situation

(i) Financial Situation and Performance: Form FIN-3.3.1
(ii) Average Annual Construction Turnover: Form FIN-3.3.2
(iii) Bid capacity: Form FIN 3.3.4

(d) Financial Resources

(i) Financial Resources: Form FIN-3.3.3
(ii) Average Net Worth: Form FIN- 3.3.1

(e) Experience

(i) General Construction Experience: Form EXP-3.4.1
(ii) Specific Construction and Contract Management Experience: Form EXP-3.4.2(a)
(iii) Specific Construction Experience in Key Activities: Form EXP-3.4.2 (b)

3. Qualification Criteria

If the Tenderer fails to comply with any item of Qualification Criteria given below, the Tenderer shall be disqualified

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
3.1 Eligibility							
3.1.1	**Nationality**	Nationality in accordance with ITT 4.4	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Forms ELI – 1.1(a). 1.1 (b) and 1.2, with attachments
3.1.2	**Conflict of Interest**	No conflicts of interest in accordance with ITT 4.2	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Letter of Tender-Technical Part
3.1.3	**Bank Eligibility**	Not having been declared ineligible by the Bank, as described in ITT 4.5.	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Letter of Tender-Technical Part
3.1.4	**State-owned Enterprise or Institution of the Recipient country**	Meets conditions of ITT 4.6	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Letter of Tender-Technical Part
3.1.5	**United Nations resolution or Recipient's country law**	Not having been excluded as a result of prohibition in the Recipient's country laws or official regulations against commercial	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Letter of Tender-Technical Part

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		relations with the Tenderer's country, or by an act of compliance with UN Security Council resolution, both in accordance with ITT 4.8 and Section V.					
3.1.6	**Share of JV members**	The share of JV members shall not be less than the specified percentage	N/A	100%	30%	34%	Form ELI-1.3
3.2 Historical Contract Non-Performance							
3.2.1	**History of Non-Performing Contracts**	Non-performance of a contract[1] did not occur as a result of contractor default since 1st April 2018 till 28 days prior to deadline of Tender submission.	Must meet requirement	Must meet requirements	Must meet requirement[2]	Must meet requirement	Form CON-1
3.2.2	**Suspension Based on**	Not under suspension based on-execution of a	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Letter of Tender – Technical Part

[1] Nonperformance, as decided by the Employer, shall include all contracts terminated by the Employer where (a) nonperformance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the Contractor. Nonperformance shall not include contracts where Employer's decision was overruled by the dispute resolution mechanism. Nonperformance must be based on all information on fully settled disputes or litigation, i.e., dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Tenderer have been exhausted.

[2] This requirement also applies to contracts executed by the Tenderer as JV member.

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
	Execution of Tender-Securing Declaration by the Employer	Tender/Proposal Securing Declaration pursuant to ITT 4.7 and ITT 19.9					
3.2.3	**Pending Litigation**	Tenderer's financial position and prospective long-term profitability still sound according to criteria established in 3.3.1 (ii) below and assuming that all pending litigation and arbitration [3] will be resolved against the Tenderer	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Form CON-1
3.2.4	**Declaration: Litigation History**	Declare History of court/arbitral award decisions against the Tenderer since 1st April 2018 till 28 days prior to deadline of Tender submission.	Must make the declaration	N/A	Must make the declaration	Must make the declaration	Form CON-1

[3] Tenderer shall provide accurate information in the tender form CON-1 about any litigation and arbitration resulting from contracts completed or ongoing under its execution over the last five years since 1st April 2018 till 28 days prior to deadline of tender submission.

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
3.2.5	**Declaration: Environmental, Social, Health, and Safety (ESHS) past performance**	Declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social, or health, or safety requirements or safeguard in the past five years [4] preceding 28 days prior to deadline of Tender submission	Must make the declaration	N/A	Must make the declaration.	Must make the declaration	Form CON-2 ESHS Performance Declaration
3.3 Financial Situation and Performance							
3.3.1	**Financial Capabilities**	(i) The Tenderer shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means	Must meet requirement	Must meet requirement	Must meet at least 30% *[Thirty percentage]* of the requirement	Must meet at least 40% *[Forty percentage]* of the requirement	Form FIN-3.3.3 (Sources of Finance for the subject Contract)

[4] The Employer may use this information to seek further information or clarifications in carrying out its due diligence.

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		(independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as **INR 1000.00 million or the equivalent amount in a freely convertible currency (**for the subject contract **(i.e. C-5).**					
		(ii) The Tenderer must demonstrate the current soundness of its financial position and indicate its prospective long-term profitability. As a minimum, **a)** Average Net-Worth (Total Assets – Total Liabilities)* during the last three (03) financial years (FY: 2020-21, 2021-22 and 2022-23) should be **positive** and	Must meet requirement	Must meet requirement	Must meet requirement	Must meet the requirement	Form FIN-3.3.1

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		b) the Net-worth during the last financial year (FY 2022-23) should be **positive.** *Note: Amount in dispute against the Tenderer corresponding to all pending litigations and arbitration resulting from contracts completed or ongoing under its execution over the last five years, considering that these will be resolved against the Tenderer (as per Form CON-1 item 2 and 3), shall be subtracted from the average Net Worth calculated as per a) above.					
3.3.2	**Average Annual Construction Turnover**	Minimum average annual construction turnover of **INR 6000.00 million or the equivalent amount in**	Must meet requirement	Must meet requirement	Must meet at least 30% *[Thirty percentage]*	Must meet at least 40% *[Forty percentage]*	Form FIN-3.3.2

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		a freely convertible currency, calculated as total certified payments received for contracts in progress and/or completed within the last three financial years (FY: 2020-21, 2021-22 and 2022-23) divided by three.			of the requirement	of the requirement	
3.3.3	**Bid Capacity**	The Tenderer shall also demonstrate to the satisfaction of the Employer that it has adequate **Bid capacity** for the works currently in progress and future contract commitments. The **available Bid capacity** should be equal to or more **than INR 12000.00 million or the equivalent amount in a freely convertible currency.** The available Bid capacity will be	Must meet requirement	Must meet requirement	Must meet at least 30% *[Thirty percentage]* of requirement	Must meet at least 40% *[Forty percentage]* of the requirement	Form FIN – 3.3.2 & Form FIN- 3.3.4

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		calculated as per item no. 1 of Form FIN- 3.3.4.					
3.4 Experience							
3.4.1	**General Construction Experience**	Experience under construction contracts in the role of Prime Contractor, JV Member or Management Contractor or a Sub-Contractor starting 1st April 2016 till 28 days prior to deadline of Tender submission.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Form EXP-3.4.1
3.4.2 (a)	Specific Construction & Contract	Participation, as a Prime Contractor, Joint venture [5] Member or Management Contractor [6]	Must meet Requirement of (i) or (ii) or (iii)	Must meet Requirement of (i) or (ii) or (iii)	Must have the experience of executing at least one	Must have the experience of executing at least one	Form EXP-3.4.2(a)

[5] Value of completed work done by a Member in an earlier JV shall be reckoned as per the Note 2 given at the end of Sub-Clause 3.4.2 (a), Section III, EQC for purpose of satisfying his/her experience criteria mentioned in 3.4.2(a).

[6] A management contractor is a firm which takes on the role of contract management as a "general" contractor of sort could do. It does not normally perform directly the work(s) associated with the Contract. Rather, it manages the work of other Contractors/Sub-Contractors while bearing full responsibility for quality and timely performance of the contract. If the Tenderer or any of the JV member submits experience certificate as a Management Contractor then the documents issued by the Employer (owner of the work)/ concessionaire

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
	Management Experience	or Sub-Contractor [7] in at least **(**i) one "similar work"***** of minimum value of **INR 7200.00 million or the equivalent amount in a freely convertible currency**. *****"Similar work" for (i) above shall be any infrastructure work involving construction of Viaduct/Bridges and Earthwork in formation for			work of minimum value **INR 3600 million or the equivalent amount in a freely convertible currency** involving construction of Viaduct/ Bridges or Earthwork in formation for	work of minimum value **INR 3600 million or the equivalent amount in a freely convertible currency** involving construction of Viaduct/ Bridges or Earthwork in formation for	

in support of his being appointed as Management Contractor shall only be considered for evaluation and qualification purpose. In case the Tenderer fails to submit such document(s) issued by the Employer (owner of the work) / Concessionaire, the offer of the Tenderer shall be summarily rejected.

[7] If a tenderer has successfully completed a work as Sub-Contractor, the work experience certificate issued only by the Employer (owner of the work) / Concessionaire for such work to Sub-Contractor shall be considered for the purpose of fulfillment of credentials. Tenders submitted without this documentary proof shall be summarily rejected.

For example: Entity **'A'** is the owner of the work and awards a contract for execution of work to Contractor **'X'**. Thereafter, Contractor **'X'** sublets part of the work to Sub-Contractor **'Y'**. In this case, experience certificate of Sub-Contractor **'Y'** issued only by Entity **'A'** / Concessionaire shall be considered for the purpose of evaluation of the Tender. Experience certificate issued by Contractor **'X'** to Sub-Contractor **'Y'** shall not be considered and the offer submitted based on such certificate shall be summarily rejected.

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		"Railway Project"[8] / Road project. **OR** (ii) two "similar works"* each of minimum value of **INR 4800.00 million or the equivalent amount in a freely convertible currency**. *"Similar work" for (ii) shall be any infrastructure work in which both the works combined together involve construction of Viaduct/ Bridges and Earthwork in formation for "Railway Project"/ Road project. **OR** (iii) three "similar works"* each of minimum value of **INR 3600 . million or the**			"Railway Project"/ Road Project that has been successfully ***completed* or substantially completed** since 1st April 2016 till 28 days prior to deadline of Tender submission	"Railway Project"/ Road Project that has been successfully ***completed* or substantially completed** since 1st April 2016 till 28 days prior to deadline of Tender submission	

[8] Railway Project includes projects of Railway/ Metro Rail / Regional Rapid Transit System (RRTS) / High Speed Rail / Dedicated Freight Corridor (DFC).

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		equivalent amount in a freely convertible currency or more. "Similar work" for (iii) shall be any infrastructure work in which all the three works combined together involve construction of Viaduct/ Bridges and Earthwork in formation for "Railway Project"/ Road Project .The *Works* mentioned in (i) or (ii) or (iii) above must have been successfully **completed or substantially completed**[9] since 1st April 2016 till 28 days prior to deadline of Tender submission and that are similar to the proposed works.					

[9] Substantial completion shall be based on 80% or more of the original or revised value (whichever is lower) of works completed under the contract. Completion or substantial completion of work shall be based on completion/substantial completion certificate issued by the Employer (Owner of the Work) / Concessionaire.

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
3.4.2 (b)	**Specific Construction Experience in Key Activities**	Participation, as a Prime Contractor, Joint venture member or Management Contractor or Sub-Contractor in: (i) Construction of minimum **2.00 km** cumulative length [10] of viaducts / Bridges in **one** contract of infrastructure project in "Railway Project"/ Road Project. and	Must meet requirement of (i),(ii)and (iii)	Must meet requirement of (i),(ii)and (iii)	Must meet requirement of either (i) or (ii) or (iii)	Must meet requirement of either (i) or (ii) or (iii)	Form EXP-3.4.2 (b)(i), Form EXP-3.4.2 (b)(ii) and Form EXP-3.4.2 (b)(iii)

[10]. Evaluation of length of spans for multitrack/ multilanes bridges shall be done as under:

(a) In case of Railway bridges/Metro viaduct, accommodating multiple tracks, the length of span for each track shall be taken into consideration. In case of Road bridges accommodating multilanes, the credit for length of one span shall be given for every two lanes.

(b) The credit for multiple tracks/multilanes (exceeding two lanes) shall be given only if the number of tracks or number of lanes is specifically mentioned in the certificate of the Employer.

(c) For evaluation purpose, length of bridge will be measured from abutment to abutment of the bridge or the length of bridge certified in the Employer (Owner of the Work) / Concessionaire Certificate.

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		(ii) Execution of minimum equivalent length of **14,000 RM** Pile foundation (of minimum dia.**1000 mm**)/Well [11] foundation in **one** contract of infrastructure project in "Railway Project"/ Road Project , **AND** iii. Execution of Earthwork in formation for **1.0 million cum** in **one** contract of infrastructure project in "Railway Project"/ Road Project . The key activities mentioned in (i), (ii) and (iii) above should have					

[11] **Calculation of equivalent length (RM) of Pile/Well foundation:**

a) In case of Well foundation, depth of 1 RM Well foundation shall be considered equivalent to construction of 6 RM depth of Pile foundation (i.e., 1 RM Well foundation= 6 RM Pile foundation).

No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All Members Combined	Each Member	Lead Member	
		been executed in **completed / On going contract**[12] since 1st April 2016 till 28 days prior to deadline of Tender submission.					

[12] The Tenderer shall submit copy of completion certificate/experience certificate issued by the Employer (Owner of the Work) / Concessionaire clearly indicating the executed quantities of key activities.

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Notes:

1. Exchange Rate for Qualification Criteria

Wherever a Form in Section IV, Tender Forms, requires a Tenderer to state a monetary amount, Tenderers shall indicate the INR equivalent as indicated in the respective form using the rate of exchange determined as follows:

(i) For construction turnover or financial data required for each year – Exchange rate prevailing on the last day of the respective financial year.

(ii) Value of single contract - Exchange rate prevailing on the date of the Contract Award i.e. the date of issue of Letter of Acceptance.

(iii) Exchange rates shall be taken from reference rate published by the Reserve Bank of India (RBI) on its website https://www.rbi.org.in. In case the exchange rate of particular currency on given date is not available on RBI web site, it will be as per the web site https://www.fbil.org.in of Financial Benchmark India Private Limited (FBIL). Any error in determining the exchange rates may be corrected by the Employer. In the case, where a Tenderer is required to convert a monetary amount from a currency other than those currencies for which the RBI/FBIL reference rate is not published, the INR equivalent shall be worked out using the rate of exchange as published by the central bank of the country issuing the said currency. In case the exchange rate of that currency is not directly available in INR on the website of the central bank of the country issuing the said currency then the currency will be first converted to USD as per that web site and then converted from USD to INR as Per RBI or FBIL reference rates.

2. Value of completed work done by a Member in an earlier JV shall be reckoned only to the extent of the concerned member's share in that JV for purpose of satisfying his/her experience criteria mentioned in 3.4.2(a).

3. For past experience of a firm in earlier JV for specified key activity in Sub-Clause 3.4.2 (b) credit shall be given for execution of only the quantity of the specified key activity executed by the firm as part of a JV, duly certified by the Employer (owner of work)/ Concessionaire. If the Employer's (owner of work)/ Concessionaire's Certificate does not indicate the quantity of specified key activity executed by each member, in such a case credit for quantity of specified key activity shall be given as per following provisions in order of priority:

(i) As per details given in JV agreement forming part of the relevant Contract Agreement.

(ii) If JV agreement does not provide such details, then credit shall be given in proportion of the percentage share of the firm in that JV mentioned in the Employer's (owner of work)/ Concessionaire's Certificate/ JV Agreement.

4. *In case a JV quoting for the Tender has executed similar work specified in 3.4.2(a) and key activities specified in Sub-Clause 3.4.2 (b) with the same constitution of JV, the requirement specified to be met under Sub-Clause 3.4.2(a) and Sub-Clause 3.4.2(b) shall be considered to have been met treating the JV as a single entity for this purpose.*

5. *For Sub-Clause 3.3.2, Average Annual Construction Turnover, the Tenderer should submit actual construction turnover figures for the specified financial years. For Evaluation purposes the figures of previous years shall be updated @ 5% per year compounded annually based on Rupee value to bring them to the level of the last Financial Year specified in Sub-Clause 3.3.2. If the figure for turnover in an individual year is in a currency other than INR, then the same shall first be converted to INR based on the exchange rates derived as mentioned in Note 1 above and then the figures in INR shall be updated.*

6. *For Sub-Clause 3.4.2 (a) Specific Construction & Contract Management Experience,*

   The Tenderer should submit actual Value of Work completed/ substantially completed. Value of Work for Evaluation purposes shall be updated @ 5% per year compounded annually based on Rupee value to bring them to the price level of date of deadline for submission of Tenders. Updated value shall be calculated as per formula given below:-

   $$P = Qx\ [1.05]^{N/365}$$

   Where

   P = updated value of work on deadline for submission of Tenders.

   Q = value of work on the date of completion/substantial completion as indicated in the Employer's certificate.

   N = Number of days between date of completion and deadline for submission of Tenders.

4. Stage 3: Evaluation of Technical Proposal

A. Procedure for Evaluation of Technical Proposal

(a) The Stage 3 Evaluation will consist of checking the technical aspects of the Tenders to confirm whether they substantially conform to the requirements of theTender Document.

(b) In order to determine whether the Tender substantially conforms to the technical requirements of the Tender Document, the technical proposal shall broadly cover the following items in relevant Forms:

S. No.	Technical Evaluation Items	Relevant Forms
1.	Site Organization	Form TP-1, Technical Proposal, Section IV Tender Forms
2.	Outline Method Statement	Form TP-2, Technical Proposal, Section IV Tender Form
3.	Works Execution Programme	Form TP-3, Technical Proposal, Section IV Tender Form
4.	Contractors Representative and Key Personnel as per the list given in Table-1 below	Form PER-1 and PER-2, Section IV Tender Form
5.	Key Equipment as per the list given in Table-2 below	Form EQU, Section IV Tender Form

(i) Site Organization

The Tenderer must submit Site Organization in the Form TP-1 given in Section IV Tender Forms.

(ii) Outline Method Statement

The Tenderer must submit Outline Method Statement in the Form TP-2 given in Section IV Tender Forms.

(iii) Works Execution Programme

The Tenderer must submit Works Execution Programme in the Form TP-3 given in Section IV Tender Forms.

(iv) Contractor's Representative and Key Personnel

The Tenderer must demonstrate that it will have a suitably qualified Contractor's Representative and suitably qualified (and in adequate numbers) Key Personnel, as described in the Table below.

Table 1: Contractor's Representative and Key Personnel

S. No.	*Designation*	*Qualification*	*Minm. Nos. Required*	*Experience Level*
1.	Contractor's Representative/ Project Manager	Graduate in Civil Engineering	1	Minimum total experience of 10 years out of which, minimum 2 years as In-charge in projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.
2.	Deputy Project Manager (Viaduct)	Graduate/ Diploma in Civil Engineering	1	Minimum total experience of 06/08 years out of which minimum 03/05 years in relevant filed of projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.
3.	Planning Engineer	Graduate in Civil Engineering	1	Minimum total experience of 05 years out of which minimum 01 years in relevant field in planning of Infrastructure projects.
4.	Senior Quality Assurance /Quality Control Expert	Graduate / Diploma in Civil Engineering	1	Minimum total experience of 05/07 years out of which minimum 02/04 years in QA (Field) in Infrastructure Projects.

The Tenderer shall provide details of the Contractor's Representative and Key Personnel in the relevant Forms PER-1 and PER-2 in Section IV, Tender Forms

(v) Key Equipment

The Tenderer must demonstrate that it has the key equipment listed in the Table 2 below:

Table 2: Equipment

S. No.	Equipment Type	Minimum Numbers required
1.	Hydraulic Piling Rig	10
2.	Excavator	4
3.	Grader	2
4.	Dozer	2

The Tenderer shall provide details of the Equipment in the relevant Form EQU in Section IV, Tender Forms

Noncompliance, if any, with Contractor's Representative and Key Personnel (in sub-para iv above) and Key Equipment requirements (in sub-para v above) described in this Section shall not normally be a ground for tender rejection, and such noncompliance will be subject to clarification during tender evaluation and rectification prior to contract award.

(c) It is expected that the Tenderer visits the site and is fully aware of all the work requirements under this Tender and then prepares the Technical Part.

All Tenders which are found substantially responsive after Stage 3 evaluation will proceed to the next stage.

5. STAGE 4: Financial Evaluation

The activities in this Stage 4 will be in two (2) parts.

A. Evaluation of Compliance and Responsiveness

(a) Under this Stage the following items will be checked:

(i) Whether the Letter of Tender-Financial Part is compliant (i.e. does not include any alteration to the basic terms and does not constitute an alternative offer).

(ii) Whether Financial Part has not been altered and is correctly completed and signed.

B. Detailed Financial Evaluation

(a) After passing the above requirements, the Tender will then proceed for Financial Part evaluation in accordance with ITT 35.

(b) In principle, the lowest evaluated Tender resulting from 'A' above will move to next stage as per ITT "J. Award of Contract", described in ITT Clauses 46 to 50.

Checklist-CL

Checklist of submission of Documents/Forms online, duly filled

(Reference to TDS-ITT 11.2 & 11.3, Section II, Part 1)

A. TECHNICAL PART

S. No.	Requirement of Tender Document	Ref. Clause of Tender documents	Tenderer's Name:	
			Whether information submitted (Yes/No/N.A.)	Ref. Pg No. in the Technical Submittal
1.	Letter of Tender-Technical Part	ITT 11.2 (a) and Section IV		
2.	Technical Part signed by authorized representative of Single Entity/Joint Venture	ITT 20.3		
3.	Tender Security- Online Receipt or Scanned copy of Bank Guarantee	ITT 19.1, ITT 19.3 and Appendix E of Section IV		
4.	Form ELI – 1.1: (a) Tenderer Information Form (Single Entity)	ITT 17.1 and Appendix D of Section IV		
5.	Form ELI – 1.1: (b) Tenderer Information Form (JV)	ITT 17.1 and Appendix D of Section IV		
6.	Form ELI – 1.2: Tenderer's JV Member Information Form	ITT 17.1 and Appendix D of Section IV		
7.	Form ELI – 1.3: Joint Venture Agreement	ITT 17.1 and Appendix D of Section IV		
8.	Form ELI-1.4: Power of Attorney (POA) for Submitting Tender	ITT 20.3 and Appendix D of Section IV		
9.	Board Resolution in case of a Public/Private limited company/LLP	TDS ITT 20.3		
10.	Incorporation Certificate and Memorandum and Articles of Association (MOA & AOA) (in case of Private/Public Limited Company)	Note (iii) (d) of Form ELI 1.4		
11.	Incorporation Certificate and Limited Liability Membership Agreement in case of Limited Liability Membership firms.	Note (iii) (e) of Form ELI 1.4		
12.	Proprietorship Affidavit (in case the Tenderer is Proprietorship Tenderer)	Note (iii) (a) of Form ELI 1.4		
13.	Partnership Deed (in case the Tenderer is Partnership Firm)	Note (iii) (b) of Form ELI 1.4		
14.	Form ELI-1.5: Power of Attorney (POA) for Authorized Signatory of Joint venture (JV) Members	ITT 20.4		
15.	Form ELI-1.6: Power of Attorney to Lead Member and Authorised Representative of Joint venture (JV)	ITT 20.4		

S. No.	Requirement of Tender Document	Ref. Clause of Tender documents	Tenderer's Name:	
			Whether information submitted (Yes/No/N.A.)	Ref. Pg No. in the Technical Submittal
16.	In case of foreign tenderer, the Notarised POA/MOU/JV Agreement is notarised in the country of origin and stamped by Indian Embassy/ High Commission or Member Countries of Hague convention submitted these documents with "Apostille" stamp	Note (i) of Form ELI 1.4		
17.	Form CON - 1: Historical Contract Non-Performance, Pending Litigation and Litigation History	ITT 17.2 and Appendix D of Section IV		
18.	Form CON - 2: Environmental, Social, Health, and Safety Performance Declaration	ITT 17.2 and Appendix D of Section IV		
19.	Form FIN – 3.3.1: Financial Situation and Performance	ITT 17.2 and Appendix D of Section IV		
20.	Form FIN – 3.3.2: Average Annual Construction Turnover	ITT 17.2 and Appendix D of Section IV		
21.	Form FIN – 3.3.3: Financial Resources	ITT 17.2 and Appendix D of Section IV		
22.	Form FIN - 3.3.4: Bid Capacity	ITT 17.2 and Appendix D of Section IV		
23.	Form EXP – 3.4.1: General Construction Experience	ITT 17.2 and Appendix D of Section IV		
24.	Form EXP – 3.4.2(a): Specific Construction and Contract Management Experience	ITT 17.2 and Appendix D of Section IV		
25.	Form EXP – 3.4.2(b) (i): Specific Construction Experience in Key Activity (i)	ITT 17.2 and Appendix D of Section IV		
26.	Form EXP – 3.4.2(b) (ii): Specific Construction Experience in Key Activity(ii)	ITT 17.2 and Appendix D of Section IV		
27.	Form EXP – 3.4.2(b) (iii): Specific Construction Experience in Key Activity(iii)	ITT 17.2 and Appendix D of Section IV		
28.	Form TP-1: Site Organization	ITT 16.1 and Appendix A of Section IV		
29.	Form TP-2: Outline Method Statement	ITT 16.1 and Appendix A of Section IV		
30.	Form TP-3: Work Execution Programme	ITT 16.1 and Appendix A of Section IV		
31.	Form PER – 1: Proposed Personnel	ITT 16.1 and Appendix A of Section IV		

S. No.	Requirement of Tender Document	Ref. Clause of Tender documents	Tenderer's Name:	
			Whether information submitted (Yes/No/N.A.)	Ref. Pg No. in the Technical Submittal
32.	Form PER – 2: Resumé of Proposed Personnel	ITT 16.1 and Appendix A of Section IV		
33.	Form EQU: Equipment,	ITT 16.1 and Appendix A of Section IV		
34.	In case of Certificate/documents translated in English from Foreign Language, copy of license of licensed translator issued by the competent authority in their country of origin	ITT 10.1 of Section II		

Note:

(i) **The check list is indicative and not exhaustive. The Tenderer must go through the complete tender documents and submit the required documents accordingly.**

(ii) **If any of the above form or criteria is not applicable to the Tenderer, then they can simply indicate N.A. against the relevant column**

(iii) **All Tender Forms contained in the Tender Documents must be fully and properly completed and all the forms must be returned signed by Authorized Representative of the Tenderer.**

B. FINANCIAL PART

The Financial Part is provided in the Tender Documents in the form of MS-EXCEL file and PDF file. The Contract Price for the Works shall be quoted in the MS-EXCEL file provided in the eProcurement portal. The Tenderer shall download the MS-EXCEL file and after quoting their Contract Price, upload the completed MS-EXCEL file along with duly signed PDF documents of Financial Part mentioned in (a) below on eProcurement portal. The quoted Contract Price shall not be offered/quoted elsewhere in the Technical Part submission/ Tender submission. These prices shall include all costs associated with the contract including GST. The Tenderer shall complete the Financial Part in accordance with the instructions given in the Financial Part.

Following information are required to be submitted by Tenderers in their Financial Part**:**

(a) In PDF File

1. Letter of Tender – Financial Part
2. Appendix A to Financial part: Schedule of Adjustment Data
   Table A: Foreign Currency (FC)
   Table B: Summery of Payment Currencies
3. Appendix B to Financial Part: Price Schedules
   Contract Price comprises of the following Schedules:

Schedule	Description	Remarks
A	**Lump Sum component of Works**	Quoted the total lump sum price for Schedule 'A'

Schedule	Description	Remarks
BOQ Schedules (B, C and D)		
B	**Bridges, Retaining Wall & other civil Works**	
Sub-Schedule	**Description**	
B1	Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)	Quoted single percentage (%) Excess (+) or Less (-) on the estimated amount for each Sub-Schedules 'B1' to 'B8' of Schedule 'B' in the prescribed place of Price Schedule in MS-Excel file of Financial Part.
B2	Reinforcement (USSOR Based items)	
B3	RCC Works (NS item)	
B4	Bridge Works-Pile foundation (NS items)	
B5	Bridge Works-Steel Super Structure- Composite Girder (USSOR Based item)	
B6	Backfill Material (USSOR Based item)	
B7	Bridge Works-Precast Concrete Blocks (NS item)	
B8	Cement (USSOR Based items)	
B9	Formation Works (USSOR Based & NS items)	
B10	Bridge Works-Steel Super Structure - Miscellaneous (USSOR Based items)	
B11	Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)	
B12	Road and Building Works (DSR Based & NS items)	
B13	Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)	
B14	P Way Works-Ballastless Track, Rails & Special Sleepers (NS items)	
C	**General Electricals Services**	Quoted single percentage (%) Excess (+) or Less (-) on the estimated amount 'C' in the prescribed place of Price Schedule in MS-Excel file of Financial Part.
D	**Signalling & Telecommunication (S&T) Works**	Quoted single percentage (%) Excess (+) or Less (-) on the estimated amount 'D' in the prescribed place of Price Schedule in MS-Excel file of Financial Part.

(b) In MS-Excel File

Price Schedule for quoting Price for the Works against each Schedule.

I hereby confirm that:

(i) I have checked the above list with our submittal. I am also aware that if our Tender is not containing the above documents, the Employer has the right to reject our Tender.

(ii) All the pages of Tender submission are properly indexed and numbered.

Seal:
Date:
(Signature of Authorized representative of Tenderer)

Section IV - Tender Forms

Table of Forms

Letter of Tender – Technical Part

INSTRUCTIONS TO TENDERERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

The Tenderer must prepare this Letter of Tender on stationery with its letterhead clearly showing the Tenderer's complete name and business address.

Note: All italicized text is to help Tenderers in preparing this form.

Date of this Tender submission: [*insert date (as day, month and year) of Tender submission*]

Tender No.: HORC/HRIDC/C-5/2023

To:

Chief Project Manager/South
Haryana Rail Infrastructure Development Corporation Limited (HRIDC),
Plot no.143, 5th floor,
Railtel Tower, Sector-44
Gurugram – 122003
Tel: +91 9729410447

We, the undersigned, hereby submit our Tender, in two parts sealed separately, namely: (a) the Technical Part; and (b) the Financial Part.

In submitting our Tender, we declare that:

(a) **No Reservations:** We have examined and have no reservations to the Tender Document, including Addenda issued in accordance with ITT 8;

(b) **Eligibility:** We meet the eligibility requirements and have no conflict of interest in accordance with ITT 4;

(c) **Tender-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Tender-Securing or Proposal-Securing Declaration in the Employer's Country in accordance with ITT 4.7;

(d) **Conformity:** We offer to execute in conformity with the Tender Document and in accordance with the implementation and completion specified in the construction schedule, the following Works: *[insert a brief description of the Works];*

_____;

(e) **Tender Validity Period**: Our Tender shall be valid for the period specified in TDS 18.1 (as amended, if applicable) after the date fixed for the Tender submission deadline specified in TDS 22.1 (as amended, if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) **Performance Security** If our Tender is accepted, we commit to obtain a Performance Security in accordance with the Tender Document;

(g) **One Tender Per Tenderer:** We are not participating, as a Tenderer, either individually or as a Joint Venture member, in more than one Tender in this tendering process, and meet the requirements of ITT 4.3;

(h) **Suspension and Debarment**: We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment or any ineligibility imposed or recognized by the Bank. Further, we are not ineligible under the Employer's Country laws or official regulations or pursuant to a decision of the United Nations Security Council;

(i) **State-Owned Enterprise or Institution:** [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITT 4.6*];

(j) **Binding Contract:** We understand that this Tender, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(k) **Employer Not Bound to Accept**: We understand that you are not bound to accept the lowest evaluated cost Tender, the Most Advantageous Tender or any other Tender that you may receive;

(l) **Prohibited Practice**: We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Prohibited Practice; and

(m) **Inspection and Audit**: We agree to permit the Bank or its representative to inspect our accounts and records and other documents relating to the tender submission and to have them audited by auditors appointed by the Bank.

(n) We declare and certify that we have not made any misleading or false representation in the forms, statements and attachments in proof of the qualification requirements.

(o) We declare that the information and documents submitted along with the tender by us are correct and we are fully responsible for the correctness of the information and documents, submitted by us.

(p) [*select the appropriate option and delete* whichever *is not applicable*] [We declare and certify that financial data as per the balance sheets for last three financial years including that for the latest concluded financial year are being submitted] **OR** [We declare and

certify that balance sheet for the latest concluded financial year has not been finalized till date and that is why we are furnishing financial data for last three financial years ignoring the latest concluded financial year.]

(q) We undertake to provide the Key Equipment for execution of the work listed in Section III, Evaluation and Qualification Criteria in case the Contract is awarded to us.

(r) We undertake to provide the Contractor's Representative and Key Personnel for execution of the work listed in Section III, Evaluation and Qualification Criteria in case the Contract is awarded to us.

(s) I/we have downloaded the Tender Document/addenda/corrigenda/ clarifications along with the set of enclosures hosted on eProcurement portal as mentioned in Tender Document. I/We verified the content of the document from the website and there is no addition, no deletion or no alteration to the content of the Tender Document. In case of any discrepancy noticed at any stage i.e. evaluation of Tenders, execution of work or final payment of the Contract, the master copy of Tender Document available with HRIDC shall be final and binding upon me/us

Name of the Tenderer: * [*insert complete name of the Tenderer*]

Name of the person duly authorized to sign the Tender on behalf of the Tenderer: **[*insert complete name of person duly authorized to sign the Tender*]

Title of the person signing the Tender: [*insert complete title of the person sign*

ing the Tender]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*****: In the case of the Tender submitted by joint venture specify the name of the Joint Venture as Tenderer

**: Person signing the Tender shall have the power of attorney given by the Tenderer. The power of attorney shall be attached with the Letter of Tender.

Appendix A to Technical Part: Technical Proposal

[Ref. ITT Sub-Clause 16.1, Clause 4 of Section III, Evaluation and Qualification Criteria (EQC)]

1. Site Organization

2. Outline Method Statement

3. Work Execution Programme

Form TP-1

Site Organization

(To be submitted by the Tenderer)

Form TP-2

Outline Method Statement

(To be submitted by the Tenderer)

Form TP-3

Work Execution Programme

(To be submitted by the Tenderer)

Appendix B to Technical Part: Equipment

Form EQU: Equipment

The Tenderer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Tenderer.

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Tenderer.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Email
Agreements	Details of rental / lease / manufacture agreements specific to the project	

"We undertake to provide the Key Equipment for execution of the work listed in Section III, Evaluation and Qualification Criteria in case the Contract is awarded to us."

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…..

Appendix C to Technical Part: Key Personnel

Form PER-1

Tenderers should provide the names and details of the suitably qualified Contractor's Representative and Key Personnel to perform the Contract. The data on their experience should be supplied using the Form PER-2 below for each candidate.

Contractor' Representative and Key Personnel

1.	**Title of position:** Contractor's Representative/ Project Manager	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
2.	**Title of position:** *Deputy Project Manager (Viaduct)*	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
3.	**Title of position:** *Planning Engineer*	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
4.	**Title of position:** *Senior Quality Assurance /Quality Control Expert*	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]

	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]

"We undertake to provide the Contractor's Representative and Key Personnel for execution of the work listed in Section III, Evaluation and Qualification Criteria in case the Contract is awarded to us."

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…...

Form PER-2:
Resume and Declaration
Contractor's Representative and Key Personnel

Name of Tenderer

Position [*#1*]: [*title of position from Form PER-1*]		
Personnel information	**Name:**	**Date of birth:**
	Address:	**E-mail:**
	Professional qualifications:	
	Academic qualifications:	
	Language proficiency: *[language and levels of speaking, reading and writing skills]*	
Details		
	Address of employer:	
	Telephone:	**Contact (manager / personnel officer):**
	Fax:	
	Job title:	**Years with present employer:**

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

Project	**Role**	**Duration of involvement**	**Relevant experience**
[main project details]	*[role and responsibilities on the project]*	*[time in role]*	*[describe the experience relevant to this position]*

Declaration

I, the undersigned *[insert either "Contractor's Representative" or "Key Personnel" as applicable]*, certify that to the best of my knowledge and belief, the information contained in this Form PER-2 correctly describes myself, my qualifications and my experience.

I confirm that I am available as certified in the following table and throughout the expected time schedule for this position as provided in the Tender:

Commitment	**Details**
Commitment to duration of contract:	*[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]*
Time commitment:	*[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]*

I understand that any misrepresentation or omission in this Form may:

(a) be taken into consideration during Tender evaluation;

(b) result in my disqualification from participating in the Tender;

(c) result in my dismissal from the contract.

Name of Contractor's Representative or Key **Personnel: [*insert name*]**

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Tenderer:

Signature: _____

Date: (day month year): _____

Appendix D to Technical Part: Tenderer's Qualification

To establish its qualifications to perform the contract in accordance with Section III, Evaluation and Qualification Criteria the Tenderer shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI-1.1 (a)

Tenderer Information Form (Single Entity)

[Ref. ITT Sub-Clause 17.1]

Date: _____
Tender No. and title: _____
Page_____of _____pages

Tenderer's name
Tenderer's actual or intended country of registration: *[indicate country of Constitution]*
Tenderer's actual or intended year of incorporation:
Tenderer's legal address [in country of registration]:
Tenderer's authorized representative information Name: _____ Address: _____ Mobile number: _____ Telephone/Fax numbers: _____ E-mail address: _____
Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITT 4.4 ☐ In case of state-owned enterprise or institution, in accordance with ITT 4.6, documents establishing: • Operation on a commercial basis; • Financial and managerial autonomy; • Day-to-day management not controlled by the government; and • Not under the supervision of the Employer or its procuring agency.

Tenderer's Authorized Representative

Signature: ……..
Date: ……..……..
Company stamp: ……..…..

Form ELI-1.1 (b)

Tenderer Information Form (JV)

[Ref. ITT Sub-Clause 17.1]

Date: _____
Tender No. and title: _____
Page_____of _____pages

Tenderer's JV name
Name of each member of JV
Tenderer's actual or intended country of registration: *[indicate country of Constitution]*
Tenderer's actual or intended year of incorporation:
Tenderer's legal address [in country of registration]:
*Tenderer's authorized representative information Name: _____ Address: _____ Mobile number: _____ Telephone/Fax numbers: _____ E-mail address: _____
Attached are copies of original documents of ☐ In case of intended JV, letter of intent to form JV or JV agreement, in accordance with ITT 4.1

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…..

Note:

1. *Tenderer's Authorized Representative shall be from Lead Member of JV.

Form ELI-1.2

Tenderer's JV Member Information Form

[Ref. ITT Sub-Clause 17.1]
(To be completed for each member of Tenderer's JV)

Date: _____
TENDER No. and title: _____
Page _____ of _____ pages

Tenderer's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Mobile: _____ Telephone/Fax numbers: _____ E-mail address: _____
1.Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITT 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing operation on a commercial basis; financial and managerial autonomy; day-to-day management not controlled by the government; and not under the supervision of the Employer or its procuring agency, in accordance with ITT 4.6. 2. Included are the organizational chart, a list of Board of Directors in the **Attachment 1** given below, and the beneficial ownership [If required under TDS ITT 48.1, the successful Tenderer shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.]

Tenderer's Authorized Representative

Signature: ……..

Date: ……..

Company stamp: ……..…..

Attachment 1 to Form ELI-1.2

1. **Organizational chart,**

   (To be submitted by each JV member of the Tenderer)

2. **List of Board of Directors,**

   (To be submitted by each JV member of the Tenderer)

Form ELI-1.3

Joint Venture Agreement

[Ref. ITT Sub-Clause 4.1 and ITT Sub-Clause11.5]

The Members of the Joint Venture shall provide Joint Venture Agreement for Joint Venture Participation in the name of M/s……of which includes at least the followings: -

(i) M/s …….. having its registered office at …… (hereinafter referred to as ……) acting as the Lead Member of the first part;

And

(ii) M/s ……having its registered office at ……. (hereinafter referred to as `…….') in the capacity of a Joint Member of the other part;

And

(iii) M/s ……having its registered office at ……. (hereinafter referred to as `…….') in the capacity of a Joint Member of the other part.

The expressions of (i) ,…….. (ii) …….. (iii) …… (names of JV Members) shall wherever the context admits, mean and include their respective legal representatives, successors-in-interest and assigns and shall collectively be referred to as " the Parties" and individually as " the Party"

WHEREAS:

Haryana Rail Infrastructure Development Corporation Ltd. on behalf of Haryana Orbital Rail Corporation Ltd.[hereinafter referred to as "Employer"] has invited tenders for …… *"[Insert name of work]……"*

NOW, THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1. The following documents shall be deemed to form and be read and construed as an integral part of this JV agreement.
   i) Specific Procurement Notice, ii) Tender document, iii) Any Addendum/ Corrigendum issued by Haryana Rail Infrastructure Development Corporation Ltd.
   iv) The Tender submitted on our behalf jointly by the Lead Member/ authorised representative.
2. The `Parties' have studied the documents and have agreed to participate in submitting a tender jointly in the name of----------.
3. M/s ……shall be the lead Member of the JV for all intents and purpose and shall represent the Joint Venture in its dealing with the Employer. For the purpose of submission of tenders, the parties agree to nominate …….. as the Lead Member duly authorized to sign and submit all documents and subsequent

clarifications, if any, to the Employer. However, M/s …… shall not submit any such tenders, clarifications or commitments before securing the written clearance of the other Member which shall be expeditiously given by M/s……..……. and M/s……. to M/s…….

4. The 'Parties' have resolved that the distribution of share and responsibilities between the JV Members ~~i~~s as under:-

    a) Lead Member Name…….and share ……..% ;
    b) Joint Venture Member Name…….and share ……..% ;
    c) Joint Venture Member Name…….and share ……..% ;

5. JOINT AND SEVERAL RESPONSIBILITIES

The Parties undertake that they shall be jointly and severally liable to the Employer in the discharge of all the obligations and liabilities as per the contract with the Employer and for the performance of contract awarded to their JV.

6. ASSIGNMENT AND THIRD PARTIES

The parties shall co-operate throughout the entire period of this Joint Venture Agreement on the basis of exclusivity and neither of the Parties shall make arrangement or enter into agreement either directly or indirectly with any other party or group of parties on matters relating to the Project except with prior written consent of the other party and the Employer.

7. EXECUTIVE AUTHORITY

The said Joint Venture through its authorized representative shall receive instructions from the Employer. The management structure for the project shall be prepared by mutual consultations to enable completion of project to quality requirements within permitted cost and time.

8. PROPOSAL SUBMISSION

Each Party shall bear its own cost and expenses for preparation and submission of the tender *and all costs until conclusion of a contract with the Employer for the Project. Common expenses shall be shared by all the parties in the ratio of their actual participation.*

9. INDEMNITY

Each party hereby agrees to indemnify the other party against its respective parts in case of breach/default of the respective party of the contract works of any liabilities sustained by the Joint Venture.

10. For the execution of the respective portions of works, the parties shall make their own arrangements to bring the required finance, plants and equipment, materials, manpower and other resources.

11. DOCUMENTS & CONFIDENTIALITY

Each Party shall maintain in confidence and not use for any purpose related to the Project all commercial and technical information received or generated in the course of preparation and submission of the tender.

12. ARBITRATION

Any dispute, controversy or claim arising out of or relating to this Joint Venture agreement shall be settled in the first instance amicably between the parties. If an amicable settlement cannot be reached as above, it will be settled by JV in accordance with arbitral agreement mutually agreed by the parties. The venue of the arbitration shall be _____.

13. **VALIDITY**

This Joint Venture agreement shall remain in force till the occurrence of the earliest of any of the following, unless by mutual consent, the Parties agree in writing to extend the validity for a further period.

a. The Tender submitted by the Joint Venture is declared unsuccessful, or
b. Cancellation/ shelving of the Project by the Employer for any reasons prior to award of work
c. Execution of detailed JV agreement by the parties, setting out detailed terms after award of work by the Employer.

14. This Joint Venture agreement is drawn in ….. number of copies with equal legal strength and status. One copy is held by M/s …… and the other by M/s. ..... and M/s. ..... and a copy submitted with the tender.

15. This Joint Venture agreement shall be construed under the laws of India.

16. NOTICES BETWEEN JVMEMBERS

Notices shall be given in writing by fax confirmed by registered mail or commercial courier to the following fax numbers and addresses:

Lead Member.	Other Member	Other Member
……..	……	……
……	……	……
(Name & Address)	(Name & Address)	(Name & Address)

IN WITNESS WHEREOF THE PARTIES, have executed this MOU the day, month and year first before written

M/s……	M/s……	M/s……
……..……	……	……
(Seal)	(Seal)	(Seal)

Witness

1……..(Name & Address)

2…….. (Name & Address)

Form ELI-1.4

[Ref. ITT Sub-Clause 20.3]

Power of Attorney (POA) for Submitting Tender

(For Single Entity/Sole Tenderer only)

(*To be executed on non-judicial stamp paper of the appropriate value in accordance with relevant stamp Act. The stamp paper to be in the name of the company who is issuing the Power of Attorney*)

Know all men by these presents, we…..…….. (name and address of the registered office) do hereby constitute, appoint and authorise Mr/Ms…….. (name and residential address) who is presently employed with us and holding the position of ……..as our attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to our tender for the work of "**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844" including signing and submission of all documents and providing information/ responses to Haryana Rail Infrastructure Development Corporation Ltd (HRIDC), representing us in all matters before HRIDC, and generally dealing with HRIDC in all matters in connection with our tender for the said project.

We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

……. (Signature)
(Name, Title and address) of the **Person Accepting the POA.**

……. (Signature)
(Name, Title and address) of the **Person issuing the POA**

Notes:

i. The tenderer should submit the notarised Power of Attorney. In case of Foreign Members, Power of Attorney(s) and Board Resolution confirming authority on the persons issuing the Power of Attorney for such actions shall be submitted duly notarized by the notary public of country of origin and should be either stamped by Indian Embassy/High Commission or Member Countries of Hague convention may submit these document with "Apostille" stamp. Also, in case the documents are in foreign language the translation of the same shall be authenticated by Embassy/High Commission.

ii. The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.

iii. The tenderer should submit following additional document in support of the POA as case to case basis:

a) Proprietorship Affidavit in case of Proprietary Tenderer.
b) Partnership Deed in case of Partnership Firms.
c) Board Resolution in case of a Public/Private limited company/LLP.
d) Incorporation Certificate and Memorandum & Article of Association in case of a Public/Private limited company.
e) Incorporation Certificate and Limited Liability Membership Agreement in case of Limited Liability Membership firms.

Form ELI-1.5

Power of Attorney (POA) for Authorized Signatory of Joint Venture (JV) Members
[Ref. ITT Sub-Clause 20.4]
(To be submitted by Tenderer' each JV member)

POWER OF ATTORNEY*

(*To be executed on non-judicial stamp paper of the appropriate value in accordance with relevant stamp Act. The stamp paper to be in the name of the company who is issuing the Power of Attorney*)

Know all men by these presents, we…..…….. do hereby constitute, appoint and authorise Mr/Ms. …….. who is presently employed with us and holding the position of ……..as our attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to our tender for the work of "**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844" including signing and submission of all documents, withdrawal, substitution and modification of tender and providing information/ responses to Haryana Rail Infrastructure Development Corporation Ltd, representing us in all matters, dealing with Haryana Rail Infrastructure Development Corporation Ltd. in all matters in connection with our tender for the said project.

We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

Dated this the …… day of ……. 20..

(Signature of authorised Signatory in token of **Acceptance of POA**

……

(Signature and Name in Block letters of Signatory)

Seal of Company

Witness

Witness 1:	Witness 2:
Name:	Name:
Address:	Address:
Occupation:	Occupation:

**Notes:*

i) To be executed by all the Members individually, in case of a Joint Venture.

ii) The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.

Form ELI-1.6

Power of Attorney to Lead Member and Authorized Representative of Joint Venture (JV)

[Ref. ITT Sub-Clause 20.4]

(To be executed on non-judicial stamp paper of the appropriate value in accordance with relevant stamp Act. The stamp paper to be in the name of the company who is issuing the Power of Attorney)

POWER OF ATTORNEY[1]

Whereas Haryana Rail Infrastructure Development Corporation Ltd. has invited Tenders for the work of ……

on behalf of Haryana Orbital Rail Corridor Limited [hereinafter referred to as "Employer"]

Whereas, the Members of the Joint Venture comprising

1. M/s. …,

2. M/s. …,

and

3. M/s. ……,

are interested in submission of tender for the work of "**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844" in accordance with the terms and conditions contained in the tender documents.

Whereas, it is necessary for the Members of the Joint Venture to designate one of them as the Lead Member as the authorized representative, with all necessary power and authority to do, for and on behalf of the Joint Venture, all acts, deeds and things as may be necessary in connection with the Joint Venture's tender for the project.

NOW THIS POWER OF ATTORNEY WITNESSETH THAT:

We, M/s. …… (Lead Member), M/s_____ and M/s_____ hereby designate M/s. ……, being one of the Members of the Joint Venture, as the Lead Member of the Joint Venture and designate Mr/Ms. _____ being authorized representative of the Joint Venture, to do on behalf of the Joint Venture, all or any of the acts,

deeds or things necessary or incidental to the Joint Venture's tender for the contract, including submission of tender, withdrawal, substitution and modification of tender, participating in conferences, responding to queries, submission of information/ documents and generally to represent the Joint Venture in all its dealings with the Employer or any other Government Agency or any person, in connection with the contract for the said work until culmination of the process of tendering till the contract agreement is entered into with the Haryana Orbital Rail Corporation Limited and thereafter till the expiry of the contract agreement.

We hereby agree to ratify all acts, deeds and things lawfully done by Lead Member, our said attorney, pursuant to this power of attorney and that all acts deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us/ Joint Venture.

Dated this the …… Day of …….. 20..…….

(Signature)	(Signature)	(Signature)
……	……	……..

(Name in Block letters of all Executants with Seal of Company)

……. (Signature)

(Name, Title and address) of the **Person Accepting the POA**

Witness 1:	Witness 2:
Name:	Name:
Address:	Address:
Occupation:	Occupation:

Notes:

1. To be executed by all the Authorized POA holders of each Members of the JV.
2. The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.
3. Authorized Representative of Tenderer's JV shall be from Lead Member of JV.

Form CON-1

Historical Contract Non-Performance, Pending Litigation and Litigation History

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.2.1 and Sub-Clause 3.2.3]
[*The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]*

Tender No.: HORC/HRIDC/C-5/2023

Tenderer's Name: _____

JV Member's Name_____

Page _____of _____pages

1. Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
Description			YES/NO
(i) Whether Contract(s) Non-Performance occurred as a result of Contractor's default since 1st April 2018 specified in Section III, Evaluation and Qualification Criteria, requirement 3.2.1			
(ii) If answer to (i) above is YES, then following details to be submitted:			
Year	**Non-performed portion of contract**	**Contract Identification**	**Total Contract Amount (current value, currency, exchange rate and INR equivalent)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for nonperformance: *[indicate main reason(s)]*	*[insert amount]*
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]*	*[insert amount]*

		Reason(s) for nonperformance: *[indicate main reason(s)]*	

2. Pending Litigation resulting from contracts completed or in ongoing contracts over the last five years, in accordance with Section III, Evaluation and Qualification Criteria

Description	YES/NO
(i) Whether any litigation is still pending against the Contractor in accordance with Section III, Evaluation and Qualification Criteria, Sub-Clause 3.2.3.	
(ii) If answer to (i) above is YES, then following details to be submitted:	

S. No.	**Year of dispute**	**Amount in dispute initiated by Tenderer (currency)**	**Amount in dispute against Tenderer (currency)**	**Contract Identification**	**Total Contract Amount (currency), INR Equivalent (exchange rate)**
				Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: ____ Status of dispute: _____	
				Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	
Total Amount in dispute against Tenderer under pending litigation (INR Equivalent), (A)					

3. Pending Arbitration resulting from contracts completed or in ongoing contracts over the last five years, in accordance with Section III, Evaluation and Qualification Criteria

Description	YES/NO
(i) Whether any arbitration is still pending against the Contractor in accordance with Section III, Evaluation and Qualification Criteria, Sub-Clause 3.2.3.	
(ii) If answer to (i) above is YES, then following details to be submitted:	

S. No.	Year of dispute	Amount in dispute initiated by Tenderer (currency)	Amount in dispute against Tenderer (currency)	Contract Identification	Total Contract Amount (currency), INR Equivalent (exchange rate)
				Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: ____ Status of dispute: _____	
				Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	
Total Amount in dispute against Tenderer in Arbitration (INR Equivalent), (B)					
Total Amount in dispute against Tenderer under pending litigation and Arbitration (INR Equivalent), C= (A) + (B)					

4. Litigation History in accordance with Section III, Evaluation and Qualification Criteria

Description	YES/NO
(i) Whether any Litigation History against the Tenderer since 1st April 2018 in accordance with Section III, Evaluation and Qualification Criteria, Sub-Clause 3.2.4.	
(ii) If answer to (i) above is YES, Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Clause 3.2.4 is indicated below.	

S. No.	Year of award	Outcome as percentage of Net Worth	Contract Identification	Total Contract Amount (currency), INR Equivalent (exchange rate)
	[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]*	*[insert amount]*
	[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]*	*[insert amount]*

Tenderer's Authorized Representative

Signature: ……..
Date: ……..
Company stamp: ……..

Chartered Accountant/Company Auditor/Statutory Auditor

Certified that the information furnished above is correct as per the audited balance sheets of the entity.

Signature: ……..
Name: ……..
Position: ……..
Date: ……

Note: *The Tenderer shall provide accurate information in Form CON-1 about any pending litigation and pending arbitration resulting from contracts completed or in ongoing contracts over the last five years since 1st April 2018 till 28 days prior to deadline of Tender submission*

Form CON-2

Environmental, Social, Health, and Safety Performance Declaration

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.2.5]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5/2023

Tenderer's Name: _____

JV Member's Name_____

Page _____of _____pages

<table>
<tr><td colspan="4">Environmental, Social, Health, and Safety Performance Declaration in accordance with Sub-Clause 3.2.5, Section III, Qualification Criteria and Requirements</td></tr>
<tr><td colspan="3">Description</td><td>YES/NO</td></tr>
<tr><td colspan="3">(i) Declaration of suspension or termination of contract:
Whether contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to Environmental, Social, Health, or Safety (ESHS) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Clause 3.2.5.</td><td></td></tr>
<tr><td colspan="4">(ii) If answer to (i) above is YES, then following details to be submitted:</td></tr>
<tr><td colspan="4">a. Details of Contract(s) suspended/terminated by an employer(s) for reasons related to ESHS performance</td></tr>
<tr><td>Year</td><td>Suspended or terminated portion of contract</td><td>Contract Identification</td><td>Total Contract Amount (current value, currency, exchange rate and INR equivalent)</td></tr>
<tr><td>[insert year]</td><td>[insert amount and percentage]</td><td>Contract Identification: [indicate complete contract name/ number, and any other identification]
Name of Employer: [insert full name]
Address of Employer: [insert street/city/country]
Reason(s) for suspension or termination: [indicate main reason(s)]</td><td>[insert amount]</td></tr>
</table>

[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for suspension or termination: *[indicate main reason(s)]*	*[insert amount]*
...	...	*[list all applicable contracts]*	...
b. **Details of Contract(s) in which Performance Security called by an employer(s) for reasons related to ESHS performance**			
Year		Contract Identification	Total Contract Amount (current value, currency, exchange rate and INR equivalent)
[insert year]		Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for calling of performance security: *[indicate main reason(s)]*	*[insert amount]*

Tenderer's Authorized Representative

Signature: ……..
Date: ……..
Company stamp: ……..

Form FIN-3.3.1:

Financial Situation and Performance

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.3.1 (ii)]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____
Page _____of _____pages

Financial data *(All amounts in Millions)*

Type of Financial information in (currency)	**Historic information for last three Financial Years, (amount in currency, currency, exchange rate*, INR equivalent)**		
	Year 1: 2020-21	**Year 2:2021-22**	**Year 3:2022-23**
	Statement of Financial Position (Information from Balance Sheet)		
Total Assets (TA)			
Total Liabilities (TL)			
Total Equity/Net Worth (NW) = TA-TL			
Current Assets (CA)			
Current Liabilities (CL)			
Working Capital (WC)			
Total Revenue (TR)			
Profits Before Taxes (PBT)			

*Refer to Notes: Exchange Rate for Qualification Criteria, Section III, EQC.

Notes:

(i) In case, the Financial Year is the same as the Calendar Year, the financial data for the year 2020, 2021 and 2022 shall be furnished.

(ii) The Tenderer is not required to submit any document as documentary evidence along with the Tender Documents. All information furnished in this Form shall be certified by a Chartered Accountant/Company Auditor/Statutory Auditor.

(iii) The Form duly certified by a Chartered Accountant/Company Auditor/Statutory Auditor shall also be signed by Tenderer's Authorized representative.

(iv) The above documents shall reflect the financial situation of the legal entity or entities comprising the Tenderer and not the Tenderer's parent companies, subsidiaries, or affiliates.

(v) In the event that the audited accounts for the latest concluded Financial Year are not available, the Tenderer shall furnish information pertaining to the last three financial years after ignoring the latest concluded financial year. In case, the Tenderer submits audited financial information for the last four or more years, only the figures for the latest three years shall be considered for evaluation.

(vi) In case audited balance sheet of the last financial year is not available with the tenderer, he will declare the same vide item (p) prescribed in the Letter of Tender-Technical Part.

(vii) ***If the value of Net Worth is not submitted for any of the last three years, the Tender shall be considered nonresponsive and shall be summarily rejected****.*

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…..

Chartered Accountant/Company Auditor/Statutory Auditor

Certified that the information furnished above is correct as per the audited balance sheets of the entity.

Signature: ……..

Name:

Position:

Date:

Company:

Company stamp:

Membership No:

Address:

Contact No:

Email ID:

Form FIN-3.3.2:

Average Annual Construction Turnover

[Ref. ITT Sub-Clause 17.2, Section III, Evaluation and Qualification Criteria, Sub-Clause 3.3.2 and Sub-Clause 3.3.3]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

*JV Member's Name*_____
Page _____of _____pages

(All amounts in Millions)

Annual Turnover Data for the Last Three (03) Financial Years (Construction Only)			
Year	**Amount Currency**	***Exchange Rate**	**INR Equivalent**
2020-21	*[insert amount and indicate currency]*		
2021-22			
2022-23			

* See Section III, Evaluation and Qualification Criteria, Sub-Clause 3.3.2.

Notes:

(i) In case, the Financial Year is the same as the Calendar Year, the turnover for the year 2020, 2021 and 2023 shall be furnished.

(ii) The Average Annual Construction Turnover shall be calculated by adding the turnover amount of last three financial years divided by three.

(iii) The Tenderer is not required to submit any document as documentary evidence along with the Tender Documents. All information furnished in this Form shall be certified by a Chartered Accountant/Company Auditor/Statutory Auditor.

(iv) The Form duly certified by a Chartered Accountant/Company Auditor/Statutory Auditor shall also be signed by Tenderer's Authorized representative.

(v) The above documents shall reflect the financial situation of the legal entity or entities comprising the Tenderer and not the Tenderer's parent companies, subsidiaries, or affiliates.

(vi) In the event that the audited accounts for the latest concluded Financial Year are not available, the Tenderer shall furnish information pertaining to the last three financial years after ignoring the latest concluded financial year. In case, the Tenderer submits audited financial information for the last four or more years, only the figures for the latest three years shall be considered for evaluation.

(vii) In case audited balance sheet of the last financial year is not available with the tenderer, he will declare the same vide item (p) prescribed in the Letter of Tender-Technical Part..

(viii) If the value of Annual construction Turnover is not submitted for any of the last three years prescribed in Financial Data, the Tender shall be evaluated by considering "NIL" Turnover for that year(s).

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…..

Chartered Accountant/Company Auditor/Statutory Auditor

Certified that the information furnished above is correct as per the audited balance sheets of the entity.

Signature: ……..

Name:

Position:

Date:

Company:

Company stamp:

Membership No:

Address:

Contact No:

Email ID:

Form FIN-3.3.3:

Sources of Finance for the Subject Contract

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.3.1 (i)]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____
Page _____of _____pages

Tenderer should specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current contract commitments, available to meet the total construction cash flow demands of the subject contract **i.e. Package C-5.**

(*All amounts in Millions*)

Financial Resources for Contract Package C-5		
No.	**Source of financing**	**Amount (INR equivalent)**
1		
2		
3		
	Total Sources of Finance for the subject Contract C-5	

(i) The Tenderer is not required to submit any document as documentary evidence along with the Tender Documents. All information furnished in this Form shall be certified by a Chartered Accountant/Company Auditor/Statutory Auditor.

(ii) The Form duly certified by a Chartered Accountant/Company Auditor/Statutory Auditor shall also be signed by Tenderer's Authorized representative.

(iii) The above documents shall reflect the financial situation of the legal entity or entities comprising the Tenderer and not the Tenderer's parent companies, subsidiaries, or affiliates.

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…..

Chartered Accountant/Company Auditor/Statutory Auditor

Certified that the information furnished above is correct.

Signature: ……..

Name:

Position:

Date:

Company:

Company stamp:

Membership No:

Address:

Contact No:

Email ID:

Form FIN-3.3.4:

Bid Capacity

[Ref. ITT Sub-Clause 17.2, Section III, Evaluation and Qualification Criteria, Sub-Clause 3.3.3]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____
JV Member's Name_____
Page _____of _____pages

1.0 Bid Capacity:

The available bid capacity shall be calculated as under:
Available Bid Capacity = [A x N x 2] – 0.33xNxB
Where,

A = Maximum value of construction works executed and payment received in any one of the previous three financial years, taking into account the completed as well as works in progress.

N= Number of years prescribed for completion of work for which Tender has been invited **(i.e 3 years)**.

B = Existing commitments and balance amount of ongoing works with tenderer and also the works which are awarded to tenderer but yet not started upto the date of inviting the Tender.

Notes:

(a) The Tenderer(s) shall furnish the details of :

(i) Maximum value of construction works executed and payment received in any one of the previous three financial years for calculating **'A'**, and

(ii) Existing commitments and balance amount of ongoing works with tenderer and also the works which are awarded to tenderer but yet not started upto the date of inviting the Tender for calculating **'B'**. The details shall be submitted in the prescribed proforma given under **2.0 below.** In case of no works in hand, a 'NIL' statement should be furnished.

The submitted details for (i) and (ii) above should be duly verified by Chartered Accountant.

(b) In case if a tenderer is JV, the Tenderer(s) must furnish the details of:

(i) Maximum value of construction works executed and payment received in any one of the previous three financial years by each member of JV for calculating **'A'**, and

(ii) Existing commitments and balance amount of ongoing works with each member of JV either in individual capacity or as a member of other JV and also the works which are awarded to each member of JV either in individual capacity or as a member of other

JV but yet not started upto the date of inviting the Tender for calculating **'B'**. The details shall be submitted by each member of JV in the prescribed proforma given under **2.0 below.** In case of no works in hand, a 'NIL' statement should be furnished.

The submitted details for (i) and (ii) above should be duly verified by Chartered Accountant.

(c) Value of a completed work/work in progress/work awarded but yet not started for a Member in an earlier JV shall be reckoned only to the extent of the concerned member's share in that JV for the purpose of satisfying his/her compliance to the above mentioned Bid Capacity in the Tender under consideration.

(d) For assessing the combined Bid capacity of JV, the arithmetic sum of individual "Bid Capacity" of all the members shall be taken.

(e) In case, the Tenderer/s failed to submit the above statement along with offer, their/his offer shall be considered as incomplete and will be rejected summarily.

(f) The Available Bid Capacity of Tenderer shall be assessed based on the details submitted by the Tenderer. In case, the available bid capacity is less than that prescribed in Sub-Clause 3.3.1 (ii), Section III, EQC, then the offer shall not be considered even if the Tenderer has been found eligible in other eligibility criteria/tender requirement.

2.0 Tenderer should provide information on their current commitments on all contract that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate is yet to be issued.

Current Contract Commitments /Works in Progress

(All amounts in INR)

S. No.	Name and Brief particulars of contract (Clearly indicate the part of the work assigned to the applicant)	Contract No. & Date	Name of client with telephone number	Contract Value in INR Equivalent (Give only the value of work assigned to the applicant)	Stipulated Period of completion	Value of balance work yet to be done in INR equivalent upto the date of inviting the Tender
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Total value of balance work yet to be done in INR equivalent upto the date of inviting the Tender						**B=**

Notes:

(i) *Where a work is undertaken by a JV, only that portion of the contract which is undertaken by the concerned applicant/member should be indicated and the remaining done by the other members of the JV be excluded.*

(ii) *The Tenderer is not required to submit any document as documentary evidence along with the Tender Documents.* ***All information furnished in this Form shall be certified by a Chartered Accountant/Company Auditor/Statutory Auditor.***

(iii) *The above documents shall reflect the financial situation of the legal entity or entities comprising the Tenderer and not the Tenderer's parent companies, subsidiaries, or affiliates.*

"Certified that current commitments on all the contracts that have been awarded or for which a letter of intent or acceptance has been received or for the works in progress or the works approaching completion, value of outstanding work has been indicated in the above table correctly. It is further certified that if later on the Employer discovers that information provided in the table is incorrect then the Employer will treat our Tender invalid and it will be liable for rejection"

3.0 Calculation of Available Bid Capacity

Description	**Value**
A= Maximum value of construction works executed and payment received in any one of the previous three financial years, taking into account the completed as well as works in progress **as per Form FIN 3.3.2** (in INR Equivalent)	
N= Number of years prescribed for completion of work for which Tender has been invited (in years)	**3**
B= Existing commitments and balance amount of ongoing works with tenderer and also the works which are awarded to tenderer but yet not started upto the date of inviting the Tender (in INR Equivalent)	
Bid Capacity (in INR Equivalent) = [A x N x 2] – 0.33xNxB	

Tenderer's Authorized Representative

Signature: ……..

Date: ……..……..

Company stamp: ……..…..

Chartered Accountant/Company Auditor/Statutory Auditor

Certified that the information furnished above is correct.

Signature: ……..

Name:

Position:

Date:

Company:

Company stamp:

Membership No:

Address:

Contact No:

Email ID:

Form EXP-3.4.1

General Construction Experience

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.4.1]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____
Page _____of _____pages

Details of Works executed under construction contracts in the role of Prime Contractor or a JV member or Management Contractor or a sub-contractor, starting 1st April 2016 till 28 days prior to deadline of Tender submission.

S. No.	Starting Year	Ending Year	Contract Identification	Role of Tenderer [insert "Prime Contractor (Single Entity or JV Member)" or Management Contractor or "Subcontractor"]
			Contract name: _____ Brief Description of the Works performed by the Tenderer: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	
			Contract name: _____ Brief Description of the Works performed by the Tenderer: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	

			Contract name: _____ Brief Description of the Works performed by the Tenderer: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	

Tenderer's Authorized Representative

Signature: ……..

Date: ……..

Company stamp: ……..

Form EXP-3.4.2(a)

Specific Construction and Contract Management Experience

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.4.2 (a)]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____
Page _____of _____pages

Similar Contract No.	**Information**		
Contract Identification			
Award date			
Completion date			
Role in Contract as Prime Contractor or Member in JV or *Management Contractor* or Sub-Contractor	*[insert the role in Contract]*		
Total Contract Amount	*[insert Contract amount(s) and currency(ies)]*		INR [insert *exchange rate and total Contract amount in INR equivalent]
If member in a JV or sub-contractor, specify participation in total Contract amount	*[insert Percentage participation]*	*[insert amount(s) and currency) of participation]*	*INR [insert exchange rate(i) and amount of participation in INR equivalent]*
Employer's Name:			
Address: Mobile: Telephone/fax number E-mail:			
Description of the similarity in accordance with Sub-Clause 3.4.2(a) of Section III:			
1. Amount in (INR)			
2. Works involving:			

(i) Viaduct/Bridges and (ii) Earthwork in formation	
3. Type of Project: Railway/Metro Rail/ Regional Rapid Transit System (RRTS)/High Speed Rail/DFCC/Road project	

**Refer to Notes: Exchange Rate for Qualification Criteria, Section III, EQC.*

Tenderer's Authorized Representative

Signature: ……..

Date: ……..

Company stamp: ……..

Notes:

(i) Value of completed work done by a Member in an earlier JV shall be reckoned only to the extent of the concerned member's share in that JV for purpose of satisfying his/her experience criteria mentioned in 3.4.2(a).

(ii) The Tenderer shall submit copy of certificates issued by the Employer (Owner of the Work) / Concessionaire as documentary proof clearly indicating the similarity of the work as per Sub-Clause 3.4.2 (a), actual completion cost, actual completion date. Tenders submitted without this documentary proof shall not be evaluated.

(iii) In case Tenderer submits work experience certificate issued by other than Govt. / Public Sector undertakings, the Tenderer shall also submit along with work experience certificate, the relevant copy of work order, bill of quantities, bill wise details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

(iv) If a tenderer has successfully completed a work as subcontractor, the work experience certificate issued for such work to subcontractor by the Employer (Owner of the Work) / Concessionaire shall only be considered for the purpose of fulfillment of credentials.

Form EXP-3.4.2(b) (i)

Specific Construction Experience in Key Activity in Completed/Ongoing contracts

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.4.2 (b) (i)]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____

Page _____of _____pages

1. *Key Activity: Construction of minimum 2.00 km cumulative length of viaducts / Bridges in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC/Road project*

	Information	
Contract Identification		
Award date		
Completion date / ongoing contracts		
Role in Contract as Prime Contractor or Member in JV or Management Contractor or Sub-Contractor	*[insert the role in Contract]*	
Total Contract Amount	*[insert Contract amount(s) and currency(ies)]*	*INR [insert *exchange rate and total Contract amount in INR equivalent]*
Employer's Name:		
Address: *Telephone/fax number* *E-mail:*		
Description of the key activity in accordance with Sub-Clause 3.4.2 (b) (i) of Section III:		

	Information
Cumulative length of viaducts / Bridges (km) in infrastructure work Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project (A)	
In case the qualifying contract has been executed as JV/Consortium member:	
a) Specify the percentage share of the participating Tenderer / JV member in the qualifying contract, (B)	
b) Actual Cumulative length of viaducts/Bridges (km) in infrastructure work Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project, (C) = (A) x (B)	

Notes:

(i) Evaluation of length of spans for multitrack/ multilanes bridges shall be done as under:

(a) In case of Railway bridges/Metro viaduct, accommodating multiple tracks, the length of span for each track shall be taken into consideration. In case of Road bridges accommodating multilanes, the credit for length of one span shall be given for every two lanes.

(b) The credit for multiple tracks/multilanes (exceeding two lanes) shall be given only if the number of tracks or number of lanes is specifically mentioned in the certificate of the Employer.

(c) For evaluation purpose, length of bridge will be measured from abutment to abutment of the bridge or the length of bridge certified in the Employer (Owner of the Work) / Concessionaire Certificate.

(ii) For past experience of a firm in earlier JV for specified key activity in Sub-Clause 3.4.2 (b) credit shall be given for execution of that quantity of the specified key activity executed by the firm as per the Note 3 under Sub-Clause 3.4.2 (b).

(iii) The Tenderer shall submit copy of certificates issued by the Employer (Owner of the Work)/ Concessionaire as documentary proof clearly indicating the description of the key activity as per Sub-Clause 3.4.2 (b), actual completed quantity and actual completion date. Tender submitted without this documentary proof shall not be evaluated.

(iv) In case Tenderer submits work experience certificate issued by other than Govt. / Public Sector undertakings, the Tenderer shall also submit along with work experience certificate, the relevant copy of work order, bill of quantities, bill wise

details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

(v) If a tenderer has successfully completed a work as Sub-Contractor, the work experience certificate issued for such work to Sub-Contractor by the Employer (Owner of the Work)/ Concessionaire shall only be considered for the purpose of fulfillment of credentials. Tender submitted without this documentary proof shall be summarily rejected.

Form EXP-3.4.2(b) (ii)

Specific Construction Experience in Key Activity in Completed/Ongoing contracts

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.4.2 (b) (ii)]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____

Page _____of _____pages

1. *Key Activity: Execution of minimum equivalent length of **14,000 RM Pile foundation (of minimum dia 1000 mm)/Well foundation** in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project*

	Information	
Contract Identification		
Award date		
Completion date / ongoing contracts		
Role in Contract as Prime Contractor or Member in JV or Management Contractor or Sub-Contractor	*[insert the role in Contract]*	
Total Contract Amount	*[insert Contract amount(s) and currency(ies)]*	*INR [insert *exchange rate and total Contract amount in INR equivalent]*
Employer's Name:		
Address: *Telephone/fax number* *E-mail:*		
Description of the key activity in accordance with Sub-Clause 3.4.2 (b) (ii) of Section III:		

	Information
*Executed length **Pile foundation (RM) of minimum dia 1000 mm** in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project, (A)*	
*Executed length **Well foundation (RM) of minimum dia. 1000 mm** in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project, (B)*	
In case of Well Foundation, equivalent Pile foundation Length executed, C= 6 x (B)	
Total Equivalent length of Pile/Well Foundation executed, (D) = (A)+(C)	
In case the qualifying contract has been executed as JV/Consortium member:	
a) Specify the percentage share of the participating Tenderer / JV member in the qualifying contract, (E)	
b) Actual executed length Pile /well foundation (RM) of minimum dia 1000 mm in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project, (F) = (D) x (E)	

Notes:

(i) For past experience of a firm in earlier JV for specified key activity in Sub-Clause 3.4.2 (b) credit shall be given for execution of that quantity of the specified key activity executed by the firm as per the Note 3 under Sub-Clause 3.4.2 (b).

(ii) Calculation of equivalent length (RM) of Pile/Well foundation:

In case of Well foundation, depth of 1 RM Well foundation shall be considered equivalent to construction of 6 RM depth of Pile foundation (i.e., 1 RM Well foundation= 6 RM Pile foundation).

(iii) The Tenderer shall submit copy of certificates issued by the Employer (Owner of the Work) / Concessionaire as documentary proof clearly indicating the description of

the key activity as per Sub-Clause 3.4.2 (b), actual completed quantity and actual completion date. Tender submitted without this documentary proof shall not be evaluated.

(iv) In case Tenderer submits work experience certificate issued by other than Govt. / Public Sector undertakings, the Tenderer shall also submit along with work experience certificate, the relevant copy of work order, bill of quantities, bill wise details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

(v) If a tenderer has successfully completed a work as Sub-Contractor, the work experience certificate issued for such work to Sub-Contractor by the Employer (Owner of the Work) / Concessionaire shall only be considered for the purpose of fulfillment of credentials. Tender submitted without this documentary proof shall be summarily rejected.

Form EXP-3.4.2(b) (iii)

Specific Construction Experience in Key Activity in Completed/Ongoing contracts

[Ref. ITT Sub-Clause 17.2 and Section III, Evaluation and Qualification Criteria, Sub-Clause 3.4.2 (b) (iii)]

[The following table shall be filled in for the Tenderer or in case of JV, each member of a Joint Venture]

Tender No.: HORC/HRIDC/C-5 /2023

Tenderer's Name: _____

JV Member's Name_____

Page _____of _____pages

1. *Key Activity: Execution of Earthwork in formation for 1.0 million cum in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project*

	Information	
Contract Identification		
Award date		
Completion date / ongoing contracts		
Role in Contract as Prime Contractor or Member in JV or Management Contractor or Sub-Contractor	*[insert the role in Contract]*	
Total Contract Amount	*[insert Contract amount(s) and currency(ies)]*	*INR [insert *exchange rate and total Contract amount in INR equivalent]*
Employer's Name:		
Address: *Telephone/fax number* *E-mail:*		
Description of the key activity in accordance with Sub-Clause 3.4.2 (b) (iii) of Section III:		
Executed quantities of Earthwork in formation in one contract of infrastructure project in Railway /		

	Information
Metro Rail / RRTS / High Speed Rail / DFCC / Road project, (A)	
In case the qualifying contract has been executed as JV/Consortium member:	
a) Specify the percentage share of the participating Tenderer / JV member in the qualifying contract, (B)	
b) Actual executed quantities of Earthwork in formation in one contract of infrastructure project in Railway / Metro Rail / RRTS / High Speed Rail / DFCC / Road project, (C) = (A) x (B)	

Notes:

(i) For past experience of a firm in earlier JV for specified key activity in Sub-Clause 3.4.2 (b) credit shall be given for execution of that quantity of the specified key activity executed by the firm as per the Note 3 under Sub-Clause 3.4.2 (b).

(ii) The Tenderer shall submit copy of certificates issued by the Employer (Owner of the Work) / Concessionaire as documentary proof clearly indicating the description of the key activity as per Sub-Clause 3.4.2 (b), actual completed quantity and actual completion date. Tender submitted without this documentary proof shall not be evaluated.

(iii) In case Tenderer submits work experience certificate issued by other than Govt. / Public Sector undertakings, the Tenderer shall also submit along with work experience certificate, the relevant copy of work order, bill of quantities, bill wise details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

(iv) If a tenderer has successfully completed a work as Sub-Contractor, the work experience certificate issued for such work to Sub-Contractor by the Employer (Owner of the Work) / Concessionaire shall only be considered for the purpose of fulfillment of credentials. Tender submitted without this documentary proof shall be summarily rejected.

Appendix E to Technical Part: Tender Security

The amount for Tender Security in INR or the equivalent amount in a freely convertible currency will only be paid online by eligible Tenderers on eProcurement Portal of Government of Haryana.

OR

Tender Security can be submitted in the form of unconditional and irrevocable Bank Guarantee[1] in INR or the equivalent amount in a freely convertible currency from the banks specified in Sub-Clause ITT 19.3, Section II- TDS using the Tender Security Form given below:

Note: The rates of exchange for computing INR equivalent shall be the reference rate prevailing twenty-eight (28) days prior to the deadline of Tender submission. Exchange rates shall be taken from the sources specified in Note No.1(iii) given under Sub-Clause 3.4 , Section III, EQC

[1] Refer Sub-Clause ITT 21.4 H and Sub-Clause 19.3, Section II, TDS for submission of the Tender Security in the form of BG. Option of Exemption from payment of EMD mentioned in the module of eProcurement portal is only for exemption of online payment of Tender Security to the Tenderers who wish to submit Tender Security in the form of Bank Guarantee.

Tender Security
Form of Demand Guarantee

Beneficiary:

Haryana Rail Infrastructure Development Corporation Limited,
Plot No 143, 5th Floor, Railtel Tower,
Sector-44, Gurugram, Haryana-122003

Tender No: HORC/HRIDC/C-5/2023

Date: _____*[Insert date of issue]*

TENDER SECURITY GUARANTEE No.: _____

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Tender (hereinafter called "the Tender") for the execution of **"Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844"

Furthermore, we understand that, according to the Beneficiary's conditions, Tenders must be supported by a Tender guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:

(a) has withdrawn its Tender during the period of Tender validity set forth in the Applicant's Letter of Tender ("the Tender Validity Period"), or any extension thereto provided by the Applicant; or

(b) having been notified of the acceptance of its Tender by the Beneficiary during the Tender Validity Period or any extension thereto provided by the Applicant, (i) has failed to execute the contract agreement, or (ii) has failed to furnish the Performance Security in accordance with the Instructions to Tenderers ("ITT") of the Beneficiary's Tender Document.

This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security issued to the Beneficiary in relation to such contract agreement; or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Tendering process; or (ii) twenty-eight days after the end of the Tender Validity Period.

Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

_____

[signature(s)]

Form of Tender-Securing Declaration

DELETED

Letter of Tender – Financial Part

INSTRUCTIONS TO TENDERERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

The Tenderer must prepare this Letter of Tender on stationery with its letterhead clearly showing the Tenderer's complete name and business address.

Note: All italicized text is to help Tenderers in preparing this form.

Date of this Tender submission: [*insert date (as day, month and year) of Tender submission*]

Tender No.: HORC/HRIDC/C-5/2023

To:

Chief Project Manager/ South,
Haryana Rail Infrastructure Development Corporation Limited (HRIDC),
Plot no.143, 5th floor,
Railtel Tower, Sector-44
Gurugram – 122003
Tel: +91 9729410447

We, the undersigned, hereby submit the second part of our Tender, the Tender Price and Price Schedule. This accompanies the Letter of Tender – Technical Part.

In submitting our Tender, we declare that:

(a) **Tender Validity Period**: Our Tender shall be valid for the period specified in TDS 18.1 (as amended, if applicable) after the date fixed for the Tender submission deadline specified in TDS 22.1 (as amended, if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(b) ****Tender Price:** The total price of our Tender including Provisional Sum is: [*insert the total price of the Tender in words and figures in INR*];

(c) **Commissions, Gratuities, Fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Tendering process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]*

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

Name of the Tenderer: [*insert complete name of the Tenderer*]

Name of the person duly authorized to sign the Tender on behalf of the Tenderer: *[*insert complete name of person duly authorized to sign the Tender*]

Title of the person signing the Tender: [*insert complete title of the person signing the Tender*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*Person signing the Tender shall have the power of attorney given by the Tenderer. The power of attorney shall be attached with the Letter of Tender.

** The total price of Tender including Provisional Sums quoted in this Letter of Tender-Financial Part shall be same as given in Worksheet BOQ5 (Price Schedule –Summary Sheet) of MS-Excel File which includes cost of Schedule 'A' plus Schedule 'B' plus Schedule 'C' plus Schedule 'D' and plus Provisional Sum. However, in case of discrepancy between the total price of Tender including provisional sums quoted in this Letter of Tender-Financial Part and the Excel sheet, the total amount as per the Excel Sheet arrived at after arithmetical correction as per ITT 36 shall prevail.

Appendix A to Financial Part: Schedule of Adjustment Data

1. Price adjustment

1.1 The amounts payable to the Contractor for Works shall be adjusted in accordance with the provisions of this Clause 1.0, Sub-Clause 13.7 of GCC and Sub-Clause 13.7, Specific Provision, Part B, Section IX-PCC.

1.2 The Contract Price shall be adjusted for increase or decrease in rates and prices of labour, materials, fuel and lubricants, equipment, Machinery, Plant and other Materials or inputs in accordance with the principles, procedures and formulae specified below:

a) Base month for the purpose of Price Adjustment shall be the month in which the Tender is opened for Civil Works and General Electrical Services Works. The 1st Quarter will start from Base month;

b) For Schedule-'A', Price adjustment shall be applied on completion of the specified stage of the respective item of work.

c) Adjustment for each item of work/stage shall be made separately;

d) The following expressions and meanings are assigned to the value of the work done for Civil works:

EW = Value of work done for the completion of a stage under the Cost Centre 'CE' of Price Schedule 'A' ;

BR = Value of work done for the completion of a stage under the Cost Centre 'CB' of Price Schedule 'A';

STN = Value of work done for the completion of a stage under Cost Centre CS of Price Schedule 'A';

VIA = Value of work done for the completion of a stage under Cost Centre CV of Price Schedule 'A';

CW = Value of work done under Price Schedule 'B';

The following expressions and meanings are assigned to the Cost Centre of Price Schedule 'A':

Cost Centre	Description of Cost Centre
1	**2**
CE	Earthwork and blanketing
CB	Bridges
CS	Station
CV	Viaduct

e) Price adjustment for change in costs of civil works shall be paid in accordance with the following formula:

i) VEW= 0.85 EW x [PLB x (LBi – LBo)/LBo + PF x (Fi –Fo)/Fo + PMACH x (MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

ii) VBR = 0.85 BR x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x (SRi – SRo)/SRo + PF x (Fi – Fo)/Fo + PMACH x (MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

iii) VSTN = 0.85 STN x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x (SRi – SRo)/SRo + PF x (Fi – Fo)/Fo + PMACH x ((MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

iv) VVIA = 0.85 VIA x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x(SRi – SRo)/SRo + PSS x(SSi – SSo)/SSo+ PF x (Fi – Fo)/Fo + PMACH x ((MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

v) VCW = 0.85 CW x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x (SRi – SRo)/SRo+ PSS x(SSi – SSo)/SSo + PF x (Fi – Fo)/Fo + PMACH x (MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

Where,

vi) VEW = Increase or decrease in the cost under the Cost Centre 'CE' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

vii) VBR = Increase or decrease in the cost of Cost Centre 'CB' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

viii) VSTN = Increase or decrease in the cost of Cost Centre 'CS' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

ix) VVIA = Increase or decrease in the cost of Cost Centre 'CV' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

x) VCW = Increase or decrease in the cost of work done under Price Schedule 'B' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

PC, PF, PLB, PMACH, POTH, *PSR and PSS* are the percentages of cement, fuel and lubricants, labour, Plant Machinery and tools, other materials, *Reinforcement steel/ steel components (including strands and steel cables) and Structural Steel*, respectively for the relevant item as specified in sub-paragraph (f);

xi) Co = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for sub-group Cement, Lime & Plaster for the Base Month;

Ci = The WPI for sub-group Cement, Lime & Plaster for the average price index of the 3 months of the quarter under consideration;

xii) Fo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for group Fuel & Power for the Base Month;

Fi = The WPI for group Fuel & Power for the average price index of the 3 months of the quarter under consideration

xiii) LBo = The consumer price index for industrial workers – All India, published by Labour Bureau, Ministry of Labour, Government of India, (hereinafter called "CPI") for the Base Month;

LBi = The CPI for industrial workers – All India for the average price index of the 3 months of the quarter under consideration;

xiv) MACHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for category- k "Manufacturing of Machinery for Mining, quarrying and construction' under (R) Manufacturing of Machinery and Equipment for the Base Month;

MACHi = The WPI for category- k "Manufacturing of Machinery for Mining, quarrying and construction' under (R) Manufacturing of Machinery and Equipment for the average price index of the 3 months of the quarter under consideration;

xv) OTHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for all commodities for the Base Month;

OTHi = The WPI for all commodities for the average price index of the 3 months of the quarter under consideration;

xvi) SRo = Average Rate of RINL for Rebar 8 mm (coil) as published for Ludhiana Branch on their website for the Base Month;

SRi = Average rate of RINL for Rebar 8 mm (coil) as published for Ludhiana Branch on their website for the 3 months of the quarter under consideration;

If only one rate is published for the 3 months of the quarter under consideration, the published rate for that quarter shall be considered for the quarter under consideration.

If no rate is published by RINL for Rebar 8mm (coil) for the 3 months of the quarter under consideration, the value of Si and So will be taken as under:

"SRo": Wholesale Price Index for 'MS Bright Bars' individual commodity of group item (d) Mild Steel- Long products under (N) MANUFACTURE OF BASIC METALS, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry Department of Industrial Policy & Promotion (DIIP) for the Base Month;

"SRi": Average Wholesale Price Index for 'MS Bright Bars' individual commodity of group item (d) Mild Steel- Long products under (N) MANUFACTURE OF BASIC METAL, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry Department of Industrial Policy & Promotion (DIIP) for the 3 months of the quarter under consideration;

xvii) "*SSo": Whole Sale Price Index for group item (e) Mild Steel- Flat products under (N) MANUFACTURE OF BASIC METAL, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry, Department for Promotion of Industry and Internal Trade (DPIIT) for the Base Month;*

"SSi": Whole Sale Price Index for group item (e) Mild Steel- Flat products under (N) MANUFACTURE OF BASIC METALS, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry, Department for Promotion of Industry and Internal Trade (DPIIT) for the 3 months of the quarter under consideration;

f) The following percentages shall govern the price adjustment of the Contract Price for cost of civil works:

Component	EW (Cost Centre CE of Price Schedule 'A')	BR (Cost Centre CB of Price Schedule 'A')	STN (Cost Centre CS of Price Schedule 'A')	CV (Cost Centre CV of Price Schedule 'A')	CW (Price Schedule 'B')
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Cement (PC)	-	20%	15%	20%	20%
Fuel and lubricants (PF)	30%	20%	15%	*15%*	*15%*
Labour (PLB)	20%	10%	25%	10%	10%

Component	EW (Cost Centre CE of Price Schedule 'A')	BR (Cost Centre CB of Price Schedule 'A')	STN (Cost Centre CS of Price Schedule 'A')	CV (Cost Centre CV of Price Schedule 'A')	CW (Price Schedule 'B')
Machinery and Plants (PMACH)	40%	15%	05%	*10%*	*10%*
Other Materials (POTH)	10%	10%	20%	10%	10%
Reinforcement* Steel *(PSR)	-	25%	20%	*17%*	*15%*
Structural Steel (PSS)	-	-	-	*18%*	*20%*
Total	100%	100%	100%	100%	100%

g) The following expressions and meanings are assigned to the value of the work done for Various General Electrical Services works:

i) **ELEGWK** = Value of work done for General Electrical Services under Price Schedule 'C';

h) Price adjustment for changes in cost for various General Electrical Services works shall be paid in accordance with the following formula:

i) **VELEGWK** = 0.85 ELEGWK x [PLB x (LBi – LBo)/LBo + POTH x (OTHi – OTHo)/OTHo]

Where: -

VELEGWK = Increase or decrease in the cost of work done under Price Schedule 'C' of '**General Electrical Services works'** with complete accessories during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (i);

PLB and POTH are the percentages of Labor and, All Other Commodities respectively for the relevant item as specified in sub-paragraph (i);

LBo = The consumer price index for industrial workers – All India, published by Labour Bureau, Ministry of Labour, Government of India, (hereinafter called "CPI") for the Base month;

LBi = The CPI for industrial workers – All India for the average price index of the 3 months of the quarter under consideration

OTHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for "All commodities" for the Base month;

OTHi = The WPI for all commodities for the average price index of the 3 months of the quarter under consideration;

i) The following percentages shall govern the price adjustment of the Contract Price for Various General Electrical Services works:

Component	**General Electrical Services Works**
Labour (PLB)	20%
All other commodities (POTH)	80 %
Total	100.00%

j) The following expressions and meanings are assigned to the value of the work done for Signalling & Telecommunication (S&T) Works:

i) **STWK** = Value of work done for Signalling & Telecommunication (S&T) Works under Price Schedule 'D';

k) Price adjustment for changes in cost for Signalling & Telecommunication (S&T) Works shall be paid in accordance with the following formula:

i) **VSTWK** = 0.85 STWK x [PLB x (LBi – LBo)/LBo + POTH x (OTHi – OTHo)/OTHo]

Where: -

VSTWK = Increase or decrease in the cost of work done under Price Schedule 'D' of '**Signalling & Telecommunication (S&T) Works '** with complete accessories during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (i);

PLB and POTH are the percentages of Labor and, All Other Commodities respectively for the relevant item as specified in sub-paragraph (i);

LBo = The consumer price index for industrial workers – All India, published by Labour Bureau, Ministry of Labour, Government of India, (hereinafter called "CPI") for the Base month;

LBi = The CPI for industrial workers – All India for the average price index of the 3 months of the quarter under consideration

OTHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for "All commodities" for the Base month;

OTHi = The WPI for all commodities for the average price index of the 3 months of the quarter under consideration;

l) The following percentages shall govern the price adjustment of the Contract Price for Signalling & Telecommunication (S&T) Works:

Component	**Signalling & Telecommunication (S&T) Works**
Labour (PLB)	20%
All other commodities (POTH)	80 %
Total	100.00%

Table A. Foreign Currency (FC)

Not applicable as Tenderers are required to quote rates and prices only in INR.

Table B. Summary of Payment Currencies

For ……. [insert name of Works]

Name of Payment Currency	A Amount of Currency	B Rate of Exchange (local currency per unit of foreign)	C Local Currency Equivalent C = A x B	D Percentage of Net Tender Price (NTP) 100xC / NTP
For Schedule 'A'				
Local currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				
Schedule 'B' Local Currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				
Schedule 'C' Local Currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				

Schedule 'D' Local Currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				
Net Tender Price				**100.00**
Provisional Sums Expressed in Local Currency (INR)	100,000,000.00	**1.00**	100,000,000.00	**Not Applicable**
TOTAL TENDER PRICE (including provisional sum)				

Note: *The Tenderer is required to propose and submit the schedules given in tables above as part of the Tender. The rates of exchange shall be the reference rate twenty-eight (28) days prior to the deadline for submission of Tenders published by the Reserve Bank of India (RBI) on its website https://www.rbi.org.in . In case the exchange rate of particular currency on given date is not available on RBI web site, it will be as per the web site https://www.fbil.org.in of Financial Benchmark India Private Limited (FBIL).*

Appendix B to Financial Part: Price Schedules

1 Preamble

1.1.*The* Price Schedules shall be read in conjunction with the Instructions to Tenderers, the General Conditions, the Particular Conditions and the Employer's Requirements General, Functional, Design (Civil & BLT), Construction (Civil & BLT), Outline Design Specifications (ODS)-Civil & BLT, Outline Construction Specifications (OCS)-Civil & BLT, General Electrical Services, Signalling & Telecommunication (S&T) Works, Tender Drawings and Documents, Appendices and the Addenda/Corrigenda (if any). *The price quoted by the Contractor for Price Schedules Schedule 'A', Schedule 'B', Schedule 'C' and Schedule 'D' shall include cost of the Works as per Part 2-Employer's Requirements (General, Functional, Design- Civil & BLT, Construction - Civil & BLT, Outline Design specifications (ODS) - Civil & BLT, Outline Construction Specifications (OCS) - Civil & BLT, General Electrical Services, Signalling & Telecom (S&T) Works, Tender Drawings and Documents, Appendices and the Addenda/Corrigenda (if any).*

1.2.**Schedule 'A'** comprises *cost* of work*s* to be executed under lump sum contract as detailed in Part 2- Employers' Requirements of Tender Document. *Design of all permanent work included in the Scope of Works of Schedule 'A' and Schedule 'B' shall be included in Schedule 'A'.* The Tenderer has to quote a single lump sum amount against Schedule 'A'. Payment to the Contractor will be made in accordance with payment stages/Milestones defined for each Cost Centre detailed in Clause 5.0 below unless otherwise specified in the Contract..

1.3.**Schedule 'B'** comprises of BoQ items for "Retaining Wall, Bridges & other civil works". Schedule 'B' **is** subdivided into fourteen parts i.e. Sub-Schedules B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13 and B14. Cost of design and drawings of all the temporary works, temporary road diversion is deemed to be included in the rates quoted for the relevant item of Schedule 'B' unless otherwise specified in the Contract. The Tenderer has to quote the percentage Excess (+) or Less (-) over the total Estimated amount of each Sub-Schedule of Schedule 'B' (which is shown as "Estimated Rate" against each Sub-Schedule of Schedule 'B' in BOQ2 of MS excel file on eProcurement portal). The payment against this Schedule 'B' will be made on the basis of quantities executed, measured and certified. Under this Schedule, the Contractor is required to carry out all works of retaining walls, bridges and other civil works, which are not covered in Schedule 'A', as per site requirements and as per the direction of the Engineer.

1.4.**Schedule 'C'** comprises of BoQ Items for "General Electrical Services works". The Tenderer has to quote the percentage Excess (+) or Less (-) over the total Estimated amount of Schedule 'C' (which is shown as "Estimated Rate" against Schedule 'C' in BOQ3 of MS excel file on eProcurement portal). The quoted rate includes the cost of design and drawings of relevant systems and items as specified in the Contract Documents. The payment against this Schedule will be made on the basis of quantities executed, measured and certified by the Engineer. Under this Schedule, the Contractor is required to carry out all works of General Electrical Services works, which are

not covered in Schedule 'A' or Schedule 'B', as per site requirements and as per the direction of the Engineer.

1.5. **Schedule 'D'** comprises BoQ Items for "Signalling & Telecommunication (S&T) Works". The Tenderer has to quote the percentage Excess (+) or Less (-) over the total Estimated amount of Schedule 'D' (which is shown as "Estimated Rate" against Schedule 'D' in BOQ4 of MS excel file on eProcurement portal). The quoted rate includes the cost of design and drawings of relevant systems and items as specified in the Contract Documents. The payment against this Schedule will be made on the basis of quantities executed, measured and certified. Under this Schedule, the Contractor is required to carry out all works of shifting of Signalling & Telecommunication (S&T) Gears at DFCCIL New Prithla Station for connection to HORC Prithla Station, which are not covered in Schedule 'A' or Schedule 'B' or Schedule 'C' as per site requirements and as per the direction of the Engineer.

1.6. The Schedules may not generally give a full description of the works to be performed and the plant or equipment to be supplied under each item. Tenderers shall be deemed to have read the Employer's Requirements and the other sections of the Tender Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling the rates and prices.

1.7. The price quoted in the Price Schedules for Schedule 'A', Schedule 'B' Schedule 'C' and Schedule 'D' are for complete and finished items of the work in all respects. The Price quoted in the Price Schedules shall, except otherwise specifically provided, shall include all design, include all necessary survey work, plants , tools, machinery, Contractor's equipment, labour, compliance of labour laws, supervision, materials, transportation, handling, loading & unloading, storage, sampling, testing, fuel, oil, consumables, electric power, water, all leads & lifts, dewatering, all temporary works including temporary accesses, staging, form works and false works, stacking, provision and maintenance of all temporary works area, construction of temporary store and buildings, fencing, barricading, lighting, drainage arrangements, erection & maintenance of inspection facilities above and below ground such as brick, concrete and steel etc., reinstatement, remedy of any defects during the Defects Notification Period, safety measures for workmen and road users, preparation of design and drawings pertaining to permanent and temporary works, & temporary diversion works, temporary road widening, traffic diversion works, mobilisation and demobilisation, establishment and overhead charges, labour camps, insurance cost for labour and works, contractor's profit, all taxes including Goods and Service Tax (GST), insurance, royalties, duties, cess, octroi, other levies and other charges together with all general risks, liabilities and obligations set out or implied in the Contract.

1.8. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Price Schedules, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Work.

1.9. To the extent acceptable to the Employer for the purpose of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Engineer may reasonably require, the Contractor may provide the Engineer with a breakdown of any composite or lump sum items included in the Schedules.

1.10. The Provisional Sums included and so designated in the Price Schedules shall be expended in whole or in part at the direction and discretion of the Engineer. The Provisional Sum shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB in accordance with Sub-Clause 13.4 of Part B-Specific Provisions - Particular Conditions of Contract. The Contractor shall submit the DAAB members' invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those statements submitted under Sub-Clause 14.3. in accordance with Sub-Clauses 13.4 of the General Conditions.

1.11. The prices shall be quoted against Schedule 'A', Schedule 'B', Schedule 'C' and Schedule 'D' in the Price Schedule (Excel Workbook) uploaded on the eProcurement portal.

1.12. The prices quoted shall be comprehensive and must include for complying in all respects with the Price Schedules, Instruction to Tenderers, the General Conditions, the Particular Conditions, Employer's Requirements, Specifications and Drawings and for all matters and things necessary for the proper construction, completion, and making good of any defect in part or of the whole of the Works.

1.13. No claims for additional payment shall be allowed for any error or misunderstanding by the Contractor of the work involved.

1.14. The rates quoted by the Tenderer are for design and construction of the Works as per approved Alignment Plan & L-Section, approved GADs of bridges and approved drawings of other structures as per Scope of the Works.

2 Variations in Price Schedule 'A', Schedule 'B' Schedule 'C' and Schedule 'D'

2.1 Variations in Price Schedules shall be dealt in accordance with Sub Clause 13.3.1 of Part B-Specific Provisions, Section IX- Particular Conditions of Contract.

2.2 The through Chainages mentioned in the Scope of the Works/Tender Drawings can undergo some minor corrections, without any impact on the overall length/Scope of the Works.

3 Measurement and Payment

3.1 The measurement shall be made as per Price Schedules i.e. Schedule 'A'. Schedule 'B' Schedule 'C' and Schedule 'D' and other relevant provisions of the Contract such as Employer's Requirements and the Drawings.

3.2 If during execution of the Contract, it is decided by the Employer/Engineer that one or more

items of Work/Milestone of a Cost Centre in a particular Price Schedule is not required to be executed, the proportionate amount against that particular Item of Work/Milestones shall not be paid. *No claim by the Contractor on this account shall be payable by the Employer.* The Engineer's decision in this regard shall be final.

3.3 The Payment shall be made as per Clause 14 [Contract Price and Payment] of the General Conditions and Particular Conditions.

3.4 The Employer shall make interim payments to the Contractor in accordance with the provisions of Sub-Clause 14.6 [Issue of Interim Payment Certificates] of the General Conditions and Particular Conditions, as certified by the Engineer on the basis of the progress achieved for the items of works/stages/Milestones of the works.

3.5 The Contractor shall base its claim for interim payment in accordance with Sub-Clause 14.3 [Application for Interim Payment] of the General Conditions and Particular Conditions for each stage for various items of work on the basis of actual progress of work executed (i.e. Milestones achieved) till the end of the month for which the payment is claimed in relation to the Contractor's total executed quantity, supported with documents and updated programme in accordance with the Employer's Requirements.

3.6 The Employer may carry out necessary tests, either directly or through an independent agency, of the Works done by the Contractor for which payment has been accepted and certified by the Engineer. The payment shall depend upon the outcome of such tests.

3.7 Format for the Contractor's application for payment shall be agreed between the Engineer and the Contractor.

3.8 All necessary supplementary details to support progress claims, including all certified Request for Inspection in hard bound copy, shall be included with application for payment. Sketches, drawings, approvals, calculations, test reports etc. shall accompany an application for payment to be substantiated and certified by the Engineer and submitted to the Employer.

3.9 Even if no work is executed during the month, or the Contractor does not choose to issue an application for payment, a 'NIL' application shall be submitted.

3.10 For the purposes of payment, the Contractor shall submit to the Engineer a detailed Price Schedule indicating a further breakdown for each stage of payment contained in the Price Schedules within forty-two (42) days after the receipt of the Letter of Acceptance. Such cost breakdowns shall be subject to approval of the Engineer who shall review and evaluate with comments and/or issue approval within twenty-eight (28) days of receipt of same. The Contractor shall resubmit the cost breakdown structure corresponding to the Engineer's comments for review, if required.

3.11 The Engineer is not obliged to issue an Interim Payment Certificate until such breakdown structure of payment schedule has been submitted and accepted by the Engineer.

4 Methodology for Claiming Payment

4.1 The Contractor shall prepare his monthly application for payment in the agreed format in two hard copies and one soft copy. This shall be accompanied by supplementary details in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates] of the General Conditions. All hard copies shall bear the original signatures of the Contractor's Representative and be submitted to the Engineer.

4.2 If these are found in order, in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] of the General Conditions, then the Engineer shall forward two certified copies of the application along with certified supplementary details to the Employer, with his recommendation for payment; otherwise, all documents shall be returned to the Contractor for rectification and resubmission.

5 Price Schedule

5.1 Schedule "A'- Breakup of Lump Sum cost of Works under various Sub-Heads shall be as follows:

Sub-Head	Description	Percentage of the quoted lump sum cost of Schedule 'A'	No. of Cost Centre	Total Cost of Sub-Head
1	2	3	4	5
C	Civil works	100%	5	C= 1xLS*

*LS = Total lump sum accepted cost of the Works for Schedule 'A'

5.2 Apportionment of Contract Price for payments under various Cost Centre for Sub-Head 'C'- Civil Works

Cost Centre	Description of Cost Centre	Percentage of Cost Centre 'C'	Total Cost of Cost Centre	Total Cost of Sub-Head 'C'
1	2	3	4	5
CD	Design and As Built Drawing & Documents	1.50%	CD= 0.015x 'C'	100% of SCH 'A'
CV	Viaduct	69.00%	CV=0.69x 'C'	
CE	Earthwork and blanketing	13.20%	CE=0.132x 'C'	
CB	Bridges	12.00%	CB=0.12x 'C'	
CS	Station	4.30%	CS=0.043x 'C'	
	Total	100.00%		

Note: Value of 'C' shall be as defined in Sub-Clause 5.1 above.

The percentage figures as filled in column (3) for the apportionment of the Contract Price for completion of the Works corresponding to the various Sub-Heads and Cost Centres are fixed and payment will be released for different Cost centre as per above percentage break-up of Contract Price.

5.2.1 Stages of Payment i.e. Milestones of Cost Centre 'CD'- Design and As Built Drawing & Documents

Cost Centre			**'CD'- Design and As Built Drawing & Documents**	
Weightage of Cost Centre 'CD', (X)-			**1.5%**	
Sub Cost Centre	**Item of Work**		**Milestone**	**Weightage (Y)**
	No.	**Description**		
1	2	3	4	5
CD1- Design	**CD1.1**	**Preliminary design**	Preliminary Design	4.00%
	CD1.2	**Formation**	Definitive design & Good for Construction Drawings (GFC)	4.00%
	CD1.3	**Minor Bridges**		
	CD1.3.1		Preparation & approval of GADs	6.00%
	CD1.3.2		Definitive Design	5.00%
	CD1.3.3		Good For Construction (GFC) Drawings	6.00%
	CD1.4	**Major Bridges**		
	CD1.4.1		Preparation & approval of GADs	5.00%
	CD1.4.2		Definitive Design of OWGs & Composite Girder of Bridge No.17, 28, 45 & 68 with BLT/Ballasted track including GFC	2.00%
	CD1.4.3		Definitive Design including RSI (except OWGs & Composite Girder of Bridge No.17, 28, 45 & 68)	5.00%
	CD1.4.4		Good For Construction (GFC) Drawings (except OWGs & Composite Girder of Bridge No.17, 28, 45 & 68)	5.00%
	CD1.5	**Retaining Walls**		
	CD1.5.1		Definitive Design	2.00%

Cost Centre			'CD'- Design and As Built Drawing & Documents	
Weightage of Cost Centre 'CD', (X)-			1.5%	
Sub Cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
	CD1.5.2		Good For Construction (GFC) Drawings	3.00%
	CD1.6	**Stations**		
	CD1.6.1		Preparation & approval of Architectural Drawings	2.00%
	CD1.6.2		Definitive Design	2.00%
	CD1.6.3		Combined Services Drawings & MEP Drawings	2.00%
	CD1.6.4		Good For Construction (GFC) Drawings	2.00%
	CD1.7	**Viaduct**		
	CD1.7.1		Preparation & approval of GADs	4.00%
	CD1.7.2		Definitive Design including RSI	10.00%
	CD1.7.3		Good For Construction (GFC) Drawings	6.00%
	CD.1.8	**BLT**	On completion of design of BLT (except BLT on Bridge No.17, 28, 45 & 68) including GFC	6.00%
CD2- As Built Drawing & Documents	**CD 2.1**	As Built Drawings	Submission of As Built Drawings	14.00%
	CD 2.2	As Built Documents	Submission of As Built Documents	5.00%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CD 1.3.2 will be equal to LS*X*Y= LSx0.015x0.05.

2. Adjustment to Contract Price pursuant to GCC 13.7 shall **NOT** be applicable to the payments of Works executed under this Cost Centre.
3. All minor bridges shall have equal weightage. Payment of each stage/Milestones shall be made on pro rata basis on completion of a stage for a bridge.
4. All major bridges shall have equal weightage. Payment of each stage/Milestones shall be made on pro rata basis on completion of a stage for a bridge.
5. No payment shall be made against the Sub-Cost Centre CD 1.4.1, if design & drawing of superstructure of Br. Nos. 17, 28, 45, 68 is not required and standard RDSO spans for DFC loading are adopted with the approval of the Engineer.
6. All stations shall have equal weightage. Payment of each stage/Milestones shall be made on pro rata basis on completion of a stage for a station.
7. Payment will be made on Completion of each Milestones as per weightage given in this Cost Centre
8. The cost of Milestones include cost of design of the formation, Bridges, retaining wall & other Structures included in Schedule 'A' and Schedule 'B' as mentioned in Section VII-2:Functional, Employer's Requirements.

5.2.2 Stages of Payment i.e. Milestones of Cost Centre 'CV'- Viaduct

Cost Centre			CV- Viaduct	
Weightage of Cost Centre 'CV', (X)			69.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
CV 1 (From Ch. 20942.473 to Ch. 24843.548)	**CV.1.1**	**Foundation**	On completion of the foundation work including pile caps/ well caps and foundations for wing and return walls, and testing.	36.00%
	CV.1.2	**Substructure**	On Completion of Abutment/Piers including Abutment/Pier Cap without bearings.	
	CV.1.2.1		Pier/Abutment	6.00%
	CV.1.2.2		Pier/Abutment cap	3.00%
	CV.1.3	**Superstructure**		
	CV.1.3.1		On completion of steel girder including launching in position.	26.00%
	CV 1.3.2		On completion of deck slab including wearing course, expansion joint etc. complete.	14.00%
	CV.1.3.3		On fixing of bearings in position true to line & level and placement of superstructure on bearings including grouting of holding down bolts complete. *This item shall also include load testing of required numbers of spans as per Employer's Requirements.*	4.00%

Cost Centre			**CV- Viaduct**	
Weightage of Cost Centre 'CV', (X)			**69.00%**	
Sub-cost Centre	**Item of Work**		**Milestone**	**Weightage (Y)**
	No.	**Description**		
1	2	3	4	5
	CV.1.4	**Installation of BLT on Viaduct *including transition on approach of Abutment A-1***		
	CV.1.4.1		On supply of track fitting/fastening system complete	2.00%
	CV.1.4.2		Construction of ballastless track (On account payment will be made on proportionate basis based on actual work progress in meter divided by total length of ballastless track).	4.00%
	CV.1.4.3		On completion of all balance works as per drawings like replacement of service rails by long panel rails, welding into LWR/CWR, destressing, drainage, supply of spares etc. complete.	1.75%
	CV.1.4.4		Maintenance of ballastless track for one year after start of traffic (to be paid monthly on pro rata basis based on satisfactory performance certificate by the Engineer.)	0.25%

Cost Centre			CV- Viaduct	
Weightage of Cost Centre 'CV', (X)			69.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
	CV.1.5	**Miscellaneous works**		
	CV.1.5.1		On completion of Trolley refuge, Pathway on the sides, Inspection arrangement including access ladder etc.as per approved drawings and Employer's requirement,	2.00%
	CV.1.5.2		On completion of balance works as per drawing like- Protection works including Toe wall, Pitching, inspection steps, Bridge plaque, Bridge board, stairs, Height Gauge in RUBs, and Testing on completion, if any, complete in all respect and fit for use.	1.00%
			Total	**100.00%**

Notes-

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CV 1.1 will be equal to LS*X*Y= LSx0.69x0.36.
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Head / Price Schedule.
3. Payment will be made on Completion of each Milestones as per weightage given in this schedule.
4. Stages CV.1.1 to CV.1.2 will further be subdivided into the number of piers + 1 abutments, as applicable as per approved drawing by the Engineer, and Milestones for completed work for each pier and abutment shall be made as per the requirement of the stages stated above.
5. For Steel Composite girder payment against sub cost centre CV.1.3.1 shall be released as per following schedule-

a. On receipt of material at site/workshop against submission of Bank Guarantee: 35%
b. Fabrication of girder: 20%
c. Erection/Launching: 25%
d. On completion in all respect: 20%

5.2.3 Stages of Payment i.e. Milestones of Cost Centre 'CE'- Earthwork and Blanketing

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
CE.1-Earthwork	CE.1.1	Earthwork in formation from Ch (-) 855 m to 0 m for connectivity line, double main line track, loop lines, platform area in Prithla station yard.		
	CE. 1.1.1		Earthwork in embankment / cutting including compaction.	4.56%
	CE. 1.1.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.45%
	CE. 1.1.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.1.2	Earthwork in formation from Ch 0 to 1000 for double main line track, loop lines, platform area in Prithla station yard.		
	CE. 1.2.1		Earthwork in embankment/ cutting including compaction.	7.30%
	CE.1.2.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.60%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.2.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted.	0.20%
	CE.1.3	Earthwork in formation from Ch 1000 to 2000 for double main line track		
	CE.1.3.1		Earthwork in embankment / cutting including compaction.	3.20%
	CE.1.3.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.3.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.13%
	CE.1.4	Earthwork in formation from Ch 2000 to 3000 for double main line track		
	CE.1.4.1		Earthwork in embankment / cutting including compaction.	1.90%
	CE.1.4.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.20%
	CE.1.4.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.5	Earthwork in formation from Ch 3000 to 4000		

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
		for double main line track		
	CE.1.5.1		Earthwork in embankment / cutting including compaction.	3.10%
	CE.1.5.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.25%
	CE.1.5.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.14%
	CE.1.6	Earthwork in formation from Ch 4000 to 5000 for double main line track.		
	CE.1.6.1		Earthwork in embankment / cutting including compaction.	2.70%
	CE.1.6.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.6.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.13%
	CE.1.7	Earthwork in formation from Ch 5000 to 6000 for doble main line track.		
	CE.1.7.1		Earthwork in embankment / cutting including compaction.	2.16%
	CE.1.7.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where	0.20%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
			specified) and drainage arrangement complete in all respects.	
	CE.1.7.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.8	Earthwork in formation from Ch 6000 to 7000 for double main line track.		
	CE.1.8.1		Earthwork in embankment / cutting including compaction.	2.57%
	CE.1.8.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.8.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.9	Earthwork in formation from Ch 7000 to 8000 for double main line track.		
	CE.1.9.1		Earthwork in embankment / cutting including compaction.	3.24%
	CE.1.9.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.9.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.15%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.10	Earthwork in formation from Ch 8000 to 9000 for double main line track.		
	CE.1.10.1		Earthwork in embankment / cutting including compaction.	5.20%
	CE.1.10.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.46%
	CE.1.10.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.1.11	Earthwork in formation from Ch 9000 to 10000 for main line including platform area in Silani station yard.		
	CE.1.11.1		Earthwork in embankment / cutting including compaction.	2.65%
	CE.1.11.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.25%
	CE.1.11.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.12	Earthwork in formation from Ch 10000 to 11000 for main line including platform area in Silani station yard.		
	CE.1.12.1		Earthwork in embankment / cutting including compaction.	4.00%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.12.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.40%
	CE.1.12.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.15%
	CE.1.13	Earthwork in formation from Ch 11000 to 12000 for main line track.		
	CE.1.13.1		Earthwork in embankment / cutting including compaction.	4.26%
	CE.1.13.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.45%
	CE.1.13.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.15%
	CE.1.14	Earthwork in formation from Ch 18000 to 19000 for main line track.		
	CE.1.14.1		Earthwork in embankment / cutting including compaction.	4.60%
	CE.1.14.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.45%
	CE.1.14.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.15	Earthwork in formation from Ch 19000 to 20000 for main line track.		
	CE.1.15.1		Earthwork in embankment / cutting including compaction.	8.14%
	CE.1.15.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.70%
	CE.1.15.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.1.16	Earthwork in formation from Ch 20000 to 20942.473 for main line track.		
	CE.1.16.1		Earthwork in embankment / cutting including compaction.	6.10%
	CE.1.16.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.56%
	CE.1.16.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.2.1	Earthwork in formation from Ch (-) 855 to 0 for connectivity line, double main line track & loop lines in Prithala station yard.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.58%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.2.2	Earthwork in formation from Ch 0 to 1000 for double main line track & loop lines in Prithala station yard. .	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	2.10%
	CE.2.3	Blanketing from Ch 1000 to 2000 for double main line track	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.31%
CE.2-Blanketing	CE.2.4	Blanketing from Ch 2000 to 3000 for double main line	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.37%
	CE.2.5	Blanketing from Ch 3000 to 4000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.38%
	CE.2.6	Blanketing from Ch 4000 to 5000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.27%
	CE.2.7	Blanketing from Ch 5000 to 6000 for doble main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.36%
	CE.2.8	Blanketing from Ch 6000 to 7000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.36%
	CE.2.9	Blanketing from Ch 7000 to 8000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.39%
	CE.2.10	Blanketing from Ch 8000 to 9000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.26%
	CE.2.11	Blanketing from Ch 9000 to 10000 for main line in Silani station yard.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.26%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.2.12	Blanketing from Ch 10000 to 11000 for main line in Silani station yard.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.18%
	CE.2.13	Blanketing from Ch 11000 to 12000 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	2.24%
	CE.2.14	Blanketing from Ch 18000 to 19000 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	2.49%
	CE.2.15	Blanketing from Ch 19000 to 20000 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	3.09%
	CE.2.16	Blanketing from Ch 20000 to 20942.473 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.06%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CE1.1.1 will be equal to LS*X*Y= LSx0.132 x 0.0456.
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Heads / Price Schedule.
3. Payment will be made on Completion of each Milestones as per weightage given in this schedule.
4. If owing to site conditions or any other reasons, locations of retaining walls are changed or new retaining walls are constructed or retaining walls are eliminated & normal bank is provided, the variation caused in quantity of earthwork in embankment on this account shall be payable/ recoverable under Item no. NS-4 of Schedule 'B9'.

5.2.4 Milestones of Cost Centre 'CB'- for Bridges

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
CB1- Minor Bridges	CB.1.1	Construction of minor bridge No. 6 & 7 between Ch (-) 855 to 0.	On completion of bridge works in all respects	4.06%
	CB.1.2	Construction of minor bridge No. 9,10 & 11 between Ch 0 to 1000.	On completion of bridge works in all respects	8.23%
	CB1.3	Construction of minor bridge No. **Nil** between ch 1000 to 2000.	On completion of bridge works in all respects	0.00%
	CB1.4	Construction of minor bridge No. 13 & 14 between ch 2000 to 3000.	On completion of bridge works in all respects	4.71%
	CB1.5	Construction of minor bridge No. 15 between ch 3000 to 4000.	On completion of bridge works in all respects	0.47%
	CB1.6	Construction of minor bridge No. 18,19 & 20 between Ch 4000 to 5000.	On completion of bridge works in all respects	5.43%
	CB1.7	Construction of minor bridge No. 21 & 22 between Ch 5000 to 6000 .	On completion of bridge works in all respects	2.25%
	CB1.8	Construction of minor bridge No. 23 & 24 between ch 6000 to 7000.	On completion of bridge works in all respects	1.96%
	CB1.9	Construction of minor bridge No. 25 & 27 between Ch 7000 to 8000.	On completion of bridge works in all respects	2.10%

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CB1.10	Construction of minor bridge No.29, 30, 31 & 32 between Ch 8000 to 9000 .	On completion of bridge works in all respects	3.63%
	CB1.11	Construction of minor bridge No. 33 & 35 between Ch 9000 to 10000.	On completion of bridge works in all respects	2.34%
	CB1.12	Construction of minor bridge No. 38, 40 & 42 between ch 10000 to 11000.	On completion of bridge works in all respects	5.40%
	CB1.13	Construction of minor bridge No. 43 & 44 between Ch 11000 to 12000 .	On completion of bridge works in all respects	3.19%
	CB1.14	Construction of minor bridge No. 64 & 65 between Ch 18000 to 19000.	On completion of bridge works in all respects	5.11%
	CB1.15	Construction of minor bridge No. 67 between Ch 19000 to 20000.	On completion of bridge works in all respects	8.04%
	CB1.16	Construction of minor bridge No. **Nil** between Ch20000 to 20940 for main line track.		0.00%
CB.2-Major Bridges	**CB.2.1**	**Foundation**	On completion of the foundation work including pile caps/ well caps and foundations for wing and return walls, and testing.	16.08%

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CB.2.2	**Substructure**	On Completion of Abutment/Piers including Abutment/Pier Cap without bearings.	
	CB.2.2.1		Pier/Abutment	4.00%
	CB.2.2.2		Pier/Abutment cap	1.00%
	CB.2.2.3		Completion of the wing walls, return walls in all respects.	2.00%
	CB.2.3	**Superstructure**		
	CB.2.3.1		On completion of superstructure including launching in position.	10.00%
	CB.2.3.2		On fixing of bearings in position true to line & level and placement of superstructure on bearings including grouting of holding down bolts complete.	2.00%
	CB.2.4	**Miscellaneous works**		
	CB.2.4.1		On completion of backfill, transition system on approaches, Trolley refuge, Pathway on the sides, Inspection arrangement including access ladder etc.as per approved drawings and Employer's Requirements.	3.00%

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CB.2.4.2		On completion of balance works as per drawing like- Protection works including Toe wall, flooring/apron, inspection steps, Bridge plaque, Bridge board, painting of HFL, Height Gauge, approach road, drainage arrangement in RUBs, and Testing on completion, if any, complete in all respect and fit for use.	5.00%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CB 1.1 will be equal to LS*X*Y= LSx0.12x0.0406.
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Head / Price Schedule.
3. CB2.2-Major Bridges:
   (vi) For the purpose of stage payment/Milestones, cost of a bridge shall be taken in proportion to its linear length measured along the alignment to the total linear length of all major bridges.
   (vii) Payment of each stage/Milestones for a bridge will be made on completion of the relevant stage as per the weightage given in this schedule in proportion to the cost of the bridge.
4. Stages CB.2.1 to CB.2.2 will further be subdivided into the number of piers + 2 abutments, as applicable as per approved drawing by the Engineer, and Milestones for completed work for each pier and abutment shall be made as per the requirement of the stages stated above.

5. For steel Open Web Girder (OWG) and Composite girders payment against Cost centre CB.2.3.1 shall be released as per following schedule-
   (i) Receipt of material at approved location against submission of Bank Guarantees: 40%
   (ii) Fabrication of girder and transportation to site: 25%
   (iii) Erection/launching and completion of all other balance works: 35%,

   and for PSC girder/slabs payment against sub cost centre 2.3.1 shall be released as per following schedule-

   (i) On casting of PSC girder/slabs: 50%
   (ii) On first stage prestressing: 20%
   (iii) On completion in all respect: 30%

6. The Cost of Milestones includes cost of all temporary works and temporary diversion of roads wherever required, for all bridges included in Schedule 'A', Section VII-2:Functional, Employer's Requirements.
7. The Cost of Milestones include cost of all permanent roads diversion and regrading of roads, wherever required, for all bridges included in Schedule 'A'.

5.2.5 Stages of Payment i.e. Milestones of Cost Centre 'CS'- Stations Buildings

Cost Centre			**'CS'- Stations Buildings**	
Weightage of Cost Centre 'CS', (X)-			**4.30%**	
Sub-Cost Centre	**Item of Work**		**Milestone**	**Weightage**
	No.	**Description**		**(Y)**
1	2	3	4	5
CS.1-Prithla	**CS.1.1**	**Station building**	Construction of station building complete in all respects.	3.40%
	CS.1.2	**Platform & Passenger amenities**		
	CS.1.2.1		Construction of platforms including earthwork in filling above formation level and cast-in-situ platform face wall as per the Employer's requirements.	4.70%
	CS.1.2.2		Surfacing of platform, Precast coping, tactile tiles, fencing at end platform etc.	4.20%
	CS.1.2.3		PF shelters, Mini PF shelters.	1.50%
	CS.1.2.4		Passenger amenities	1.20%
	CS.1.3	**Subway**		
	CS.1.3.1		On completion of barrel of RCC box.	8.00%
	CS.1.3.2		On completion of stairs & ramp to platforms including shed.	3.50%
	CS.1.3.3		On completion of subway in all respect including flooring, wall cladding, drainage, waterproofing etc.	2.00%
	CS.1.4	**Water Supply**	Water supply works including bore well, pump house, underground & overhead water storage tanks, water supply distribution system	1.00%
	CS.1.5	**Drainage and Sewerage**	On completion of drainage and sewerage system**.**	2.50%
	CS.1.6	**Miscellaneous works**	On completion of misc. works such as portico, station name boards at station building and platform, platform number boards and other incidental works in railway station area.	1.00%

Cost Centre			'CS'- Stations Buildings	
Weightage of Cost Centre 'CS', (X)-			4.30%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
CS.2-Silani	**CS.2.1**	**Station building**	Construction of ticket booking office complete in all respects.	0.25%
	CS.2.2	**Platform & Passenger amenities**		
	CS.2.2.1		Construction of platforms including earthwork in filling above formation level and cast-in-situ platform face wall as per the Employer's requirements.	3.40%
	CS.2.2.2		Surfacing of platform, Precast coping, tactile tiles, fencing at end platform etc.	3.00%
	CS.2.2.3		PF shelters, Mini PF shelters.	1.50%
	CS.2.2.4		Passenger amenities	1.00%
	CS.2.3	**Subway**		
	CS.2.3.1		On completion of barrel of RCC box.	5.75%
	CS.2.3.2		On completion of stairs & ramp to platforms including shed.	3.50%
	CS.2.3.3		On completion of subway in all respect including flooring, wall cladding, drainage, water proofing etc.	1.75%
	CS.2.4	**Water Supply**	Water supply works including bore well, pump house, underground & overhead water storage tanks, water supply distribution system.	1.00%
	CS.2.5	**Drainage and Sewerage system**	On completion of drainage and sewerage system.	1.50%

Cost Centre			‘CS’- Stations Buildings	
Weightage of Cost Centre ‘CS’, (X)-			**4.30%**	
Sub-Cost Centre	**Item of Work**		**Milestone**	**Weightage**
	No.	**Description**		**(Y)**
1	2	3	4	5
	CS.2.6	**Miscellaneous works**	On completion of misc. works such as portico, station name boards at station building and platform, platform number boards area and other incidental works in railway station area.	0.75%
CS.3-IMT Sohna	**CS.3.1**	**Station building**	Construction of station building and *S&T huts* complete in all respects.	4.20%
	CS.3.2	**Platform & Passenger amenities**		
	CS.3.2.1		Construction of platforms including earthwork in filling above formation level and cast-in-situ platform face wall as per the Employer’s requirements.	4.70%
	CS.3.2.2		Surfacing of platforms, Precast coping, tactile tiles, fencing at end platform etc.	4.40%
	CS.3.2.3		PF shelters, Mini PF shelters.	1.50%
	CS.3.2.4		Passenger amenities	1.20%
	CS.3.3	**Subway**		
	CS3.*3.1*		On completion of barrel of RCC box.	17.50%
	CS3.3.2		On completion of stairs, ramp to platforms including shed, Lift well.	3.50%
	CS3.3.3		On completion of subway in all respect including flooring, wall cladding, drainage, water proofing etc.	2.50%
	CS.3.4	**Water Supply**	On completion of water supply works including bore well, pump house, underground water storage tanks, water supply distribution system	1.00%
	CS.3.5	**Drainage and Sewerage system**	On completion of drainage and sewerage system**.**	1.50%

Cost Centre			'CS'- Stations Buildings	
Weightage of Cost Centre 'CS', (X)-			4.30%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CS.3.6	Miscellaneous works	On completion of misc. works such as portico, station name boards at station building and platforms, platform number boards and other incidental works in railway station area.	1.60%
			Total	100.00%

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CS1.1–will be equal to LS*X*Y= LS x 0.043 x 0.034
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Head / Price Schedule.
3. Station Building- Unit of measurement is plinth area in square meters. For the buildings having more than one storey, the total area shall be found out by adding the area of each storey. Unit cost shall be determined on pro rata basis with respect to the total area of all stations and service buildings.
   - 50% Payment shall be paid after completion of structural works i.e beam, columns & slab in case of framed structure or walls & slabs in case of other buildings and
   - 30% Payment shall be paid after completion of finishing and
   - 20% Payment on final completion of works in all respects ready for use.
4. Platform- Unit of measurement is area measured in square meter. Unit cost shall be determined on pro rata basis with respect to the total area of all platforms at the station.
5. Payment will be made on Completion of each Milestones as per weightage given in this schedule.
6. Variation in 'Station building':

   In case of variation in the plinth area of any station building on either side i.e. increase or decrease with respect to the area shown in the Tender Drawings, the total value of station as mentioned in respective Sub-Cost Centres as applicable will get modified accordingly on pro rata basis of plinth area.

6 Schedule 'B': Retaining Wall, Bridges & other Civil works

Schedule 'B' is subdivided into fourteen (14) Sub-Schedules as given below:

SCHEDULE 'B': Bridges, Retaining Wall & other Civil works					
S. No.	**Sub Schedule**	**Description**	**Item Range**	**No. of Items**	**Estimated Amount (INR)**
1.	B1	Bridge Works-Steel Super Structure - Open Web Girder (USSOR Based item)	1	1	67,70,29,509.30
2.	B2	Reinforcement (USSOR Based items)	2	1	39,25,25,087.50
3.	B3	RCC Works (NS item)	3	1	17,62,43,627.52
4.	B4	Bridge Works-Pile foundation (NS items)	4	1	10,69,13,193.00
5.	B5	Bridge Works-Steel Super Structure-Composite Girder (USSOR Based item)	5	1	7,63,87,291.44
6.	B6	Backfill Material (USSOR Based item)	6	1	7,12,94,621.42
7.	B7	Bridge Works-Precast Concrete Blocks (NS item)	7	1	4,97,20,839.72
8.	B8	Cement (USSOR Based items)	8	1	4,09,37,764.39
9.	B9	Formation Works (USSOR Based & NS items)	9 to 12	4	6,02,08,512.50
10.	B10	Bridge Works-Steel Super Structure - Miscellaneous (USSOR Based items)	13 to 14	2	10,53,31,396.00
11.	B11	Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)	15 to 52	38	*16,06,83,080.29*
12.	B12	Road and Building Works (DSR Based & NS items)	53 to 109	57	16,60,31,563.15
13.	B13	Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)	110 to 124	15	9,20,01,357.06
14.	B14	P Way Works-Ballastless Track, Rails & Special Sleepers (NS items)	125 to 130	6	8,84,27,376.10
Total Estimated Amount of Schedule 'B' (INR)					***226,37,35,219.39***

6.1 Sub-Schedule 'B1': Bridge Works- Steel Super Structure -Open Web Girder (USSOR Based item)

SUB SCHEDULE-B1: Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
1	041010	Supplying, fabrication, assembling of all types of steel girders of specified spans with structural steel conforming to Quality "B0" Grade Designation E250 conforming to IS:2062, erection / slewing / end launching of steel girders with cranes or any other approved launching methods as per site conditions (not requiring traffic block) on sub-structure including provision of trolley refuges etc., complete as per approved QAP and drawings conforming to IRS-B1-2001 and other relevant codes and specifications. Note: **1.** Detailed fabrication and erection drawings & launching methodology will be prepared by the contractor and got approved from Railway. **2.** The item includes fabrication of all types of battens, bracings, ties, stiffeners, packing, diaphragms, shop rivets / welding, T&F bolts, drifts, SAW, templates, jigs, fixtures, accessories, transporting various components from fabrication shop to site including loading & unloading, assembly of girders with drifts/bolts, field riveting /welding /HSFG Bolting, assembling of temporary support for side slewing, raising of girders to the bed block level, providing sliding arrangements and slewing the girder in position, lowering of girder on				

SUB SCHEDULE-B1: Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		bearings and bed plates with all temporary arrangements or any other method of launching complete. **3.** The bearing sets to be provided with the girders will be paid separately as per relevant item of Sub schedule B13. **4.** Payment for addition in weight for rivets / welds shall be made as per clause 45 of IRS B-1-2001. **5.** In case of composite work (welding and HSFG bolts), addition in weight shall be 1% for welding and HSFG bolts shall be paid separately under relevant item of Sub schedule B10. **6.** Painting of girders will be paid separately under relevant item of this Sub schedule B10. **7. Payment Schedule:** (i) Receipt of material at plant/workshop against submission of Bank Guarantee: 40% (ii) Fabrication of girders: 20% (iii)Erection/Launching: 20% (iv)Completion in all respects: 20%				
1a	041012	Open Web Girder Upto 45.7 m Clear Span	2,091	MT	1,61,971.98	33,86,83,410.18
1b	041013	Open Web Girder Above 45.7 m Clear Span	1,959	MT	1,72,713.68	33,83,46,099.12
Estimated value of SUB SCHEDULE 'B1': Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)						**67,70,29,509.30**

6.2 Sub-Schedule 'B2'- Reinforcement (USSOR Based items)

SUB SCHEDULE 'B2': Reinforcement (USSOR Based items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
2	025070	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete.				
2a	025072	Thermo-Mechanically Treated bars of grade Fe-500D or more.	49,49,875	Kg	79.30	39,25,25,087.50
Estimated value of SUB SCHEDULE 'B2': Reinforcement (USSOR Based items)						**39,25,25,087.50**

6.3 Sub-Schedule 'B3': RCC Works (NS Item)

SUB SCHEDULE-'B3' RCC Works (NS item)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
3	NS-1	Supplying and laying in position M-35 RCC as per approved design mix with admixtures and manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lifts & leads, having continuous agitated mixer, pumping concrete from transit mixer to site of laying, compacting, finishing & curing, with all labour, material, tools, plants, machinery and equipment, taxes, cess etc., as a complete job ,but excluding supplying & fixing form work (centring & shuttering),in accordance with the specification and drawings. Note – (i) Cost of cement is included in the above item. (ii) Cost of Reinforcement steel is not included in the above item and will be paid separately under relevant item of Sub-Schedule B2. (iii) Cost of supplying & fixing form work (centring & shuttering) is not included in the above item (except pile cap & open foundation) and will be paid separately under relevant item of Sub-Schedule B11.				
3a	NS-1A	In Pile caps, open foundation & RCC Box/Sub way	13,304	Cum	7,732.00	10,28,66,528.00
3b	NS-1B	In Piers, abutments	1,941	Cum	7,995.23	1,55,18,741.43

SUB SCHEDULE-'B3' RCC Works (NS item)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
3c	NS-1C	Abutment cap & Pier Cap, pedestals, deck slab, Inspection platform, Trolly refugee	1,781	Cum	8,259.09	1,47,09,439.29
3d	NS-1D	Retaining walls, wing walls, return walls, drop walls, curtain walls, Wearing Coat etc. of all heights	5,515	Cum	7,823.92	4,31,48,918.80
Estimated Value of SUB SCHEDULE 'B3': RCC Works (NS item)						**17,62,43,627.52**

6.4 Sub-Schedule 'B4': Bridge Works-Pile foundation (NS items)

SUB SCHEDULE-B4: Bridge Works-Pile foundation (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
4	NS-2	Boring 1200 mm diameter piles using Hydraulic Rig in all kinds of strata including boulder studded soil, underground structure like channel, sewer manholes, old foundation or any other obstruction, irrespective of sub-soil water level in all conditions whether dry or under water, shoe and temporary casing pipe, if required, with contractor plant, machinery & equipment for pile boring, use of bentonite slurry including all operations, cleaning of bore holes, supplying and laying in-situ with tremie pipe M-35 RCC in piles as per approved design mix with admixtures and manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lifts & leads, having continuous agitated mixer, pumping concrete from transit mixer to site of laying including supplying & fixing form work (centering & shuttering), compacting, finishing, curing, chipping off pile top to remove laitance concrete above cut off level, removal and disposal of surplus excavated earth/debris/muck outside ROW including all lead, lift, ascends, descends, loading, unloading handling, re-handling, crossing of stream, nallahs, railway track, level crossing etc. with all labour, material, tools, plants, machinery and equipment, taxes, cess etc. as a complete job in accordance with the Specification and the Drawings. Note – i.Cost of cement is included in the above item. ii.Cost of Reinforcement steel is not included in the above item	8,718	Rmt	12,263.50	10,69,13,193.00

SUB SCHEDULE-B4: Bridge Works-Pile foundation (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		and will be paid separately under relevant item of Sub-schedule-B2 iii. Cost of temporary casing pipe is included in the above item. However, the cost of permanent casing pipe is not included in this item and shall be paid separately under relevant item of Sub-schedule-B13, if required and approved by the Engineer.				
Estimated Value of SUB SCHEDULE 'B4': Bridge Works-Pile foundation (NS items)						**10,69,13,193.00**

6.5 Sub-Schedule 'B5': Bridge Works-Steel Super Structure - Composite

SUB SCHEDULE 'B5': Bridge Works-Steel Super Structure- Composite Girder (USSOR Based item)						
S. No.	**USSOR Item No**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
5	041020	Supplying, fabrication, assembling of all types of steel Composite girders of specified spans with structural steel conforming to Quality "B0" Grade Designation E250 conforming to IS:2062, erection / slewing / end launching of steel girders with cranes or any other approved launching methods as per site conditions on sub-structure including provision of stud bolts / shear connectors, complete as per approved QAP and drawings conforming to IRS- B1-2001 and other relevant codes and specifications. Note: 1. Detailed fabrication and erection drawings & launching methodology will be prepared by the contractor and got approved from Railway. 2. Rate includes fabrication of all types of battens, bracings, ties, stiffeners, packing, diaphragms, shop rivets / welding, T&F bolts, drifts, SAW, templates, jigs, fixtures, accessories, transporting various components from fabrication shop to site including loading & unloading, assembly of girders with drifts/bolts, field riveting /welding /HSFG Bolting, assembling of temporary support for side slewing, raising of girders to the bed block level, providing sliding				

		arrangements and slewing the girder in position, lowering of girder on bearings and bed plates with all temporary arrangements or any other method of launching complete. 3. The bearing sets to be provided with the girders will be paid separately as per relevant item of Sub schedule B13. 4. Payment for addition in weight for rivets / welds shall be made as per clause 45 of IRS B-1-2001. 5. In case of composite work (welding and HSFG bolts), addition in weight shall be 1% for welding and HSFG bolts shall be paid separately under relevant item of Sub schedule B10. 6. Painting of girders will be paid separately under relevant item of Sub schedule B10. 7. Payment Schedule: (i) Receipt of material at plant/workshop against submission of Bank Guarantee: 40% (ii) Fabrication of girders: 20% (iii) Erection/Launching: 20% (iv) Completion in all respects: 20%				
5a	041021	Composite steel girder of span length up to 36.0m	564	MT	1,35,438.46	7,63,87,291.44
Estimated Value of SUB SCHEDULE 'B5': Bridge Works-Steel Super Structure- Composite Girder (USSOR Based item)						**7,63,87,291.44**

6.6 Sub-Schedule 'B6': Backfill Material (USSOR Based item)

SUB SCHEDULE 'B6' : Backfill Material (USSOR Based item)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
6	051170	Providing and laying of filter media consisting of granular materials of GW, GP, SW groups as per IS:1498 (latest) in required profile behind boulder filling of abutments, wing walls / return walls etc. above bed level with all labour and material complete job as per drawing and technical specification of RDSO Guidelines.	32,782	Cum	2,174.81	7,12,94,621.42
Estimated Value of SUB SCHEDULE 'B6': Backfill Material (USSOR Based item)						**7,12,94,621.42**

6.7 Sub-Schedule 'B7': Bridge Works-Precast Concrete Blocks (NS item)

SUB SCHEDULE 'B7': Bridge Works-Precast Concrete Blocks (NS item)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
7	NS-3	Casting, supplying and installation of Pre-cast cement concrete blocks of size 25X25 X20cm. or of required size as directed by the Engineer for protective works at bridges & banks like pitching, toe wall, flooring, drains etc. using M20 design concrete mix with 20mm aggregate size including Contractor's shuttering, leading to bridge site from casting depot, including dressing and levelling of surface, providing gravel backing, laying & jointing blocks with cement mortar 1:3 with Contractor's labour and as directed by Engineer-in-charge (All labour and materials including cement by Contractor). Note: i) Payment for gravel backing will be paid under relevant item of Sub schedule B11. ii) 60% Payment shall be made after casting of pre-cast concrete blocks and bringing at work site. The balance 40% will be made on completion of laying and finishing. iii) Measurement is based on quantity calculation of blocks used only (no of blocks x volume of one block).	8,102	Cum	6,136.86	4,97,20,839.72
Estimated Value of SUB SCHEDULE 'B7': Bridge Works-Precast Concrete Blocks (NS item)						**4,97,20,839.72**

6.8 Sub-Schedule 'B8': Bridge Works-Steel Super Structure -Miscellaneous (USSOR Based items)

SUB SCHEDULE 'B8': Cement (USSOR Based items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
8	025060	Supply and using Cement at Worksite				
8a	025062	Ordinary Portland Cement 53 grade	295	MT	8,741.08	25,78,618.60
8b	025063	Pozzolana Portland Cement	4,921	MT	7,794.99	3,83,59,145.79
Estimated Value of SUB SCHEDULE 'B8': Cement (USSOR Based items)						**4,09,37,764.39**

6.9 Sub-Schedule 'B9': Formation Works (USSOR Based & NS items)

SUB SCHEDULE 'B9' Formation Works (USSOR Based & NS items)						
S.NO.	**USSOR/NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
9	011010	Earthwork in cutting (classified) in formation, trolley refuges, side drains, level crossing approaches, platforms, catch water drains, diversion of nallah & finishing to required dimension and slopes to obtain a neat appearance to standard profile inclusive of all labour, machine & materials and removing & leading all cut spoils either to make spoil dumps beyond 10m from cutting edge or for filling in embankment with leads within 2 km on either side of cutting edge, lifts, ascent, descent, loading, unloading, all taxes / royalty, clearance of site and all incidental charges, bailing & pumping out water, if required, etc. complete as per directions of the Engineer in-Charge. The work is to be executed as per latest / updated edition of "Guidelines for Earthwork in Railway Projects" issued by RDSO, Lucknow. Cut trees shall be property of HRIDC and to be deposited in the Employers' godown unless specified otherwise in the Special Conditions of Contract. {Note - (i) All usable earth arising from cut spoils shall be led into bank formation and Unusable spoils shall be dumped / stacked (ii) All hard rock /and boulders not fit for filling will be stacked by the Contractor and will be property of HRIDC.}				

SUB SCHEDULE 'B9' Formation Works (USSOR Based & NS items)						
S.NO.	**USSOR/NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
9a	011011	In all conditions and classifications of soil except rock	1,000	Cum	184.70	1,84,700.00
10	013050	Turfing / planting, including all lead & lift and watering as required until properly rooted with. Note - Initially payment of only 40% will be made. Balance 60% will be paid only after 3 months of maintenance period, if the turfing is properly rooted.				
10a	013053	Planting Sarkanda / sarpat or any other suitable species approved by the Engineer	250	100 sqm	7,744.21	19,36,052.50
11	NS-4	Earthwork in embankment for 32.5t axle load and as per RDSO specification No. RDSO/2020/GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation" with contractor's own earth from borrow areas including all lead, lift, ascent, descent, royalty, taxes, cess, compensation, crossing of nallahs /stream and other obstructions including mechanical compaction in layers with watering, handling, re-handling, dressing of banks to the final profile with all labour, material, tools, plant, machinery and equipment, taxes, cess etc. as a complete job in accordance with the specification and drawings. **Note:** 10% of payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory rollers as per RDSO guidelines.	1,35,000	Cum	330.24	4,45,82,400.00

SUB SCHEDULE 'B9' Formation Works (USSOR Based & NS items)						
S.NO.	**USSOR/NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
12	NS-5	Supplying and laying blanketing material produced through mechanical means using crushers and pug mill for 32.5 T axle load as per RDSO specification No. RDSO/2020/GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation" over the top of subgrade including all lead, lift, ascent, descent, royalty, taxes, cess, crossing of nallahs /stream and other obstructions including mechanical compaction in layers not exceeding 200 mm thick with vibratory rollers, watering, handling, re-handling and dressing of formation to the final profile with all labour, material, tools, plants, machinery and equipment, taxes, cess, etc. as a complete job in accordance with the specification and drawings. Note: 10% of payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory rollers as per RDSO guidelines.	5,500	Cum	2,455.52	1,35,05,360.00
Total Estimated Value of SUB SCHEDULE 'B9': Formation Works (USSOR Based & NS items)						**6,02,08,512.50**

6.10 Sub-Schedule 'B10': Bridge Works-Precast Concrete Blocks (NS item)

SUB SCHEDULE 'B10' Bridge Works-Steel Super Structure -Miscellaneous (USSOR Based items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
13	041030	Supplying and fixing HSFG bolts of any dia. and any length with suitable nuts including DTI washers conforming to IRS-B1-2001 for bridges and steel structures with contractors labour, tools and plants and lead and lift etc., complete.	1,87,500	Kg	306.36	5,74,42,500.00
14	041050	Metalizing of steel work of girders with sprayed aluminium after surface preparation by Sand/grit blasting, followed by one coat of etch primer (IS:5666) & one coat of Zinc Chrome primer (IS:104)and two coats of aluminium paint (IS:2339) with all labour, T&P and material as a complete job duly conforming to all relevant specifications and process given under Clause 39 of IRS-B1-2001 Note: Nominal Thickness of Aluminium coating shall be 150 microns. DFT of Zinc chrome primer shall be 25-30 microns and DFT of each coat of Aluminium paint shall be 12-14 microns.	56,320	Sqm	850.30	4,78,88,896.00
Estimated Value of SUB SCHEDULE 'B10' Bridge Works-Steel Super Structure -Miscellaneous (USSOR Based items)						**10,53,31,396.00**

6.11 Sub-Schedule 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
15	013130	Shoring with 'Z' section MS sheet piles side by side in all kinds of soil mechanically or manually as per approved drawing with contractor's own arrangement complete in all respects and removal of sheet piles after completion of the work as directed by engineer in-charge. {Note - Payment will be made as per actual driven length of pile}	400	Sqm	917.12	3,66,848.00
16	014020	Supplying and laying of drainage composite for use behind abutments, wing walls, return walls and retaining walls geo composite drain (vertical) as per RDSO Specification No.-RDSO/2018/GE: IRS-0006 Latest version with all material, labour, equipment, tools and plants, lead, lift etc. complete in all respects as per the direction of engineer-in-charge.	1,407	Sqm	755.43	10,62,890.01

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
17	022010	Earthwork in excavation by mechanical means (Hydraulic Excavator)/Manual Means for foundations and floors of the bridges, retaining walls etc. including setting out, dressing of sides, ramming of bottom, getting out the excavated material, back filling in layers with approved material and consolidation of the layers by ramming and watering etc. including all lift, disposal of surplus soil upto a lead of 300m, all types of shoring and strutting with all labour and material complete as per drawing and technical specification as directed by Engineer. Note: This item will be used for excavation work in connection with other miscellaneous works also like side drains, foundation for OHE masts and other miscellaneous structures in connection with Gauge Conversion, Doubling, New lines.				
17a	022011	All kinds of soils	47,932	Cum	238.30	1,14,22,195.60

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
18	022040	Providing and laying in position machine batched, machine mixed and machine vibrated Design Mix Cement Concrete of specified grade **(M-20** Cast in-Situ) using 20mm graded crushed stone aggregate and coarse sand of approved quality in RCC raft foundation & Pile cap including finishing, using Admixtures in approved proportions (as per IS:9103), to modify workability & other properties without impairing strength and durability complete as per specifications and direction of the Engineer in charge. Payment for cement, reinforcement and shuttering shall be paid extra. **Note**-Cement concrete in drainage and other miscellaneous works shall be paid under this item.	8,804	Cum	3,383.45	2,97,87,893.80
19	022070	Providing and fixing Weep Holes in Abutments, RCC Box, Wing walls and Return walls etc, of new bridges with 110mm dia UPVC pipe (IS :13592) Type A ISI marked with all contractor's men, material, transportation, all taxes as per specifications and as directed by Engineer-in-Charge.	5,601	Meter	259.80	14,55,139.80

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
20	022120	Conducting load testing of a single pile upto following capacity in accordance with IS:2911 (Part IV) including installation of loading platform and preparation of pile head or construction of test cap and dismantling of test cap after test etc. with all labour, material, tool & plants, equipment, machinery, etc. complete as per drawing and specification, as directed by the Engineer.				
20a	022123	Initial load test above 100 ton capacity upto 250 ton capacity pile	6	Each	97,491.59	5,84,949.54
20b	022124	Extra for every increase of 50 ton in pile capacity or part thereof over 250 ton	50	Each	9,599.01	4,79,950.50
20c	022127	Routine Load Test above 100 ton capacity upto 250 ton capacity pile	26	Each	65,525.51	17,03,663.26
21	022130	Lateral load testing of single pile in accordance with "IS Code of practice IS:2911 (Part-IV) for determining safe allowable lateral load of pile" with all labour, material, tool & plants, equipment, machinery, etc complete as per drawing and specification as directed by the Engineer				
21a	022131	Piles with lateral load capacity of upto 50 ton	5	Each	24,363.19	1,21,815.95

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
22	022140	Pulse Echo Test (PET) for integrity testing of piles with contractor's men, materials and machines. The rate includes cost of Inspection of site, preparation of pile head and any other unforeseen cost required for the test, submission of reports in triplicate as per satisfaction of the Engineer in Charge at site.	356	Each	3,476.42	12,37,605.52
23	023010	Earth work in OPEN excavation in foundation of bridges, for placing of well curbs of all shapes and designs in all kinds of soil including taking out the excavated soil, levelling, ramming of bottom of excavation and trimming of sides, returning the soil in layers, consolidation, disposal of surplus soil within a lead of 300m, including all lift, dewatering, shoring and strutting complete as per technical specification and as directed by Engineer in charge. (compaction of surplus soil when led to the bank will be paid as per relevant item separately)	1,654	Cum	263.18	4,35,299.72
24	023040	Dry/Wet Sinking of Circular Wells (Other than pneumatic method) in all types of strata except hard rock requiring ballasting, including bailing and pumping out water, removal of excavated soil with all labour and material required for sinking as per drawing and direction of the Engineer in charge, disposal of surplus soil in				

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		the adjoining bank/embankment (compaction to be paid separately under the relevant item).				
24a	023041	From initial level of cutting edge & upto 3m depth	1,145	Cum	196.29	2,24,752.05
24b	023042	Above 3m to 10m depth	2,671	Cum	296.00	7,90,616.00
24c	023043	Above 10m to 15m depth	1,908	Cum	429.42	8,19,333.36
24d	023044	Above 15m to 20m depth	1,908	Cum	507.41	9,68,138.28
24e	023045	Above 20m to 25m depth	500	Cum	923.30	4,61,650.00
24f	023046	Above 25m to 30m depth	500	Cum	1,147.29	5,73,645.00
25	023090	Providing and laying in position machine batched, machine mixed and machine vibrated Design Mix Cement Concrete of specified grade (Cast in-Situ) using 20mm graded crushed stone aggregate and coarse sand of approved quality in the following elements of well including finishing, using Admixtures in approved proportions (as per IS:9103), to modify workability & other properties without impairing strength and durability complete as per drawings and technical specifications as directed by Engineer. Payment for cement,				

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		reinforcement and shuttering shall be made extra.				
25a	023091	In well Curb	360	Cum	3,555.81	12,80,091.60
25b	023092	In Steining of wells	3,179	Cum	3,555.81	1,13,03,919.99
25c	023093	In Bottom plug for wells including arrangements for placing concrete under water with tremie or bottom opening skips.	1,526	Cum	4,006.18	61,13,430.68
25d	023095	In Intermediate/Top plug with internal shuttering	351	Cum	4,296.35	15,08,018.85
25e	023096	In Well cap and corbel, if provided	668	Cum	4,296.35	28,69,961.80
26	023100	Supplying and filling ordinary sand in between bottom plug and top plug in wells including all lead lift handling, re-handling, as a complete job. Sand should be simultaneously filled with water for three days to achieve full compaction so that further chances of shrinkage due to voids are eliminated.				
26a	023102	Using sand from other than River bed (This item is to be operated if suitable sand is not available in River Bed for filling	2,543	Cum	1,909.88	48,56,824.84
27	025020	Providing and applying two coats of coal tar or bitumen confirming to IS:3117– latest version on the top and sides of RCC box/slabs @ 1.70 kg/sqm after cleaning the surface with all labour	4,740	Sqm	184.49	8,74,482.60

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		and materials complete job as directed by the Engineer				
28	025030	Centering and shuttering including strutting, propping etc. and removal of form for :				
28a	025032	All types of bridge super-structures, e.g. slabs, I-girders, T-girders, Box girders etc. upto 5m above ground level	2,360	Sqm	933.91	22,04,027.60
28b	025033	Extra for additional height over item no. 025032 wherever required with adequate bracing, propping etc. over initial height of 5 metres for every additional height of 1 metre or part thereof	9,030	Sqm	117.66	10,62,469.80

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
29	031020	Providing and laying in position machine batched, machine mixed and machine vibrated Design Mix Cement Concrete of specified grade using 20mm graded crushed stone aggregate and coarse sand of approved quality for the Precast Prestressed (Post tensioned) concrete girder/Box (spans upto 30.5m) in contactor's casting yard, including finishing, using Admixtures in approved proportions (as per IS:9103), to modify workability & other properties without impairing strength and durability, complete as per drawings, specifications and direction of the Engineer. Payment for Shuttering, Cement, reinforcement, HTS cables, anchorage cones, stressing of cables and grouting of the ducts will be done extra. Launching of girder/slab in position is not included in this item.	71	Cum	3,055.96	2,16,973.16
29a	031021	Deduct from 0310220 for casting of Slab in place of Girder/Box	71	Cum	-95.71	*-6,795.41*
30	031040	Providing, fabricating & fixing in position to exact design profiles, prestressing H.T.S. cables of all classification made from Low Relaxation strands conforming to IS:14268– latest version in Prestressed (Post tensioned) Concrete girders/slabs etc. including supplying, cutting, making into cables with necessary spacers, colour coding, protecting with water soluble oil	4	MT	1,99,689.58	7,98,758.32

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		at all time, anchoring of cables, supplying and placing spiral corrugated type galvanized metal steel ducts sheathing made up of Cold Rolled Cold Annealed (CRCA) mild steel conforming to IS:513 of required diameter/ thickness, vent pipe, placing, bending, routing, fixing, stressing & grouting of cable ducts with cement grout, Anchorage sets in required number with provision for future prestressing if any including all lead and lift with contractor's own materials, labour, equipments etc. complete as per drawings & specifications. Rate also includes covering anchorage pads with epoxy mortar of approved quality to avoid corrosion. Cement for grouting to be paid separately. Payment shall be made in terms of weight of HTS cables as per drawing.				
31	031060	Extra for Using HDPE Sheathing in place of CRCA Sheathing	367	Meter	159.26	58,448.42
32	*031110*	*Load testing of one or more spans of bridge as selected by the Engineer as per approved load test procedure following relevant IS/ IRC / Railway codes with contractor's labour, deflection measuring instruments, loading materials, recoding and analyzing the load testing results including all lead & lift, etc. complete as required. The rates are all inclusive and will be paid after load test is*				

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		finished and girder is cleared of the kentledges/ loading material etc. The load shall be 1.25 times the stipulated design load.				
32a	*031111*	*For Span design load up to 100 MT*	*5*	*Each*	*90,478.87*	*4,52,394.35*
32b	*031112*	*Extra for every increase 1 MT or part thereof in the span design load capacity up to 800 MT*	*1000*	*MT*	*893.37*	*8,93,370.00*
33	031140	Providing and fixing in position GI Drainage Spouts of required length with Grating in RCC slab and filling bitumen along kerb as shown in drawing with contractor's pipes, bitumen, tools, equipment, lead, lifts etc. complete as per specifications and as directed by Engineer in-charge				
33a	031142	100mm dia. Drainage Spouts	186	Meter	1,270.12	2,36,242.32

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
34	041240	Surface preparation for painting of bridge plate/composite girders and other steel structures where the finishing coat shows signs of deterioration; but primer coat of paint is sufficiently in good condition and there are no signs of rusting etc. Surface shall be cleaned free from oil grease, scaling and other foreign matters without disturbing the primer coat {Rate includes cost of labour, consumables, tools & plants, scaffolding, jhoola, ladder etc.}	3,250	Sqm	26.97	87,652.50
35	041260	Painting cleaned bridge plate/composite girders including all scaffolding, shuttering and strutting along with provision of Jhoola / hanging scaffolding ladders etc. where required				
35a	041261	With one coat ready mix Zinc Chromate conforming to IS:104 with DFT of 25-30 Microns followed by one coat of Zinc Chromate red oxide conforming to IS:2074 DFT of 25 Microns.	3,250	Sqm	101.72	3,30,590.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
36	041330	Launching & fixing in specified Bridge location all types of Steel Plate girders / PSC girders / Slabs including loading/unloading and transport to the site of launching with a lead of five kilometres & lifting to any height as per site requirement, provision of approaches for leading, cleaning of bed block and minor repairs to bed block with epoxy if required, as directed by Engineer in charge with all labour, tools and plant, equipment etc., complete.				
36a	041331	PSC girders / slabs	176	MT	5,643.58	9,93,270.08
37	051010	Providing and laying boulders apron on river bed for protection against scour with stone boulders weighing not less than 35 kg each with voids filled with spalls complete as per drawing and Technical Specification.	55	Cum	1,510.18	83,059.90
38	051120	Stenciling of Girders with black / blue lettering over yellow background with ready mix paint w.r.t. details of executed inspection, greasing and painting, other details as directed by Engineer in charge.	840	Each	43.40	36,456.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
39	052220	Painting the HFL mark and Danger level mark, year of HFL on bridge abutments and piers with ready mixed paint as per standard in two coats over one coat of primer with all materials, labour, tools, scaffolding, all lead and lift etc. including writing complete.	225	Each	299.88	67,473.00
40	052230	Providing cast in situ bridge number plaques as per Railway drawing in cement concrete 1:2:4 mix using 20mm hard stone aggregate embedded in 30mm notch in Bridge parapet coping duly engraving the letter and figures and an arrow indicating the direction of flow and finishing the top exposed surface with cement mortar 1:3, painting letters and figures with two coats of black enamel paint on two coats of white background with all labour, tools, cement, paint etc. with all leads and lifts.	14	Each	846.77	11,854.78
41	052240	Providing cast in-situ plaques for bridge foundations details of size 45cmx45cmx5cm in cement concrete 1:2:4 mix using 20mm hard stone aggregate embedded in 30mm deep notch over abutment & piers, engraving the letters & figures with CM 1:3 and finished smooth including painting letters and figures with 2 coats of black enamel and plaque with white enamel with all labour, tools, cement, paint, curing etc. as a complete job.	26	Each	1,108.92	28,831.92

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
42	052250	Providing & laying non pressure NP-4 Class RCC pipe with collars, jointing with 1:2 cement and ordinary sand mortar including testing of joints, but excluding earthwork with all labour and material as a complete job. Cement for mortar will be paid separately. (Pipes of 600mm dia and above will be laid using crane/hydra).				
42a	052252	450mm dia.	100	Meter	2,756.69	2,75,669.00
43	052260	Supplying, spreading and filling coarse sand (no cohesive materials to be used) of approved quality including watering and ramming in foundation, plinth, behind the abutment, wing wall, retaining wall in layers not exceeding 150mm thick including its compaction as per direction of Engineer-incharge. The rate includes all lead, lift, ascent, descent, crossing of Railway line etc. complete with contractor's labour, materials, tools and plant.	7,958	Cum	2,020.70	1,60,80,730.60

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
44	191310	Fabrication, supplying and fixing 600mm x 450mm Bridge Board made from 16 SWG MS Sheet duly welded or rivited to back support of two 600mm long horizontal angles of size 25mm x 25mm x 3mm & two 2.5 metre long vertical support of MS Angle of size 50mm x 50mm x 5mm, welded /rivited to board. Vertical supports shall have split ends for proper fixing in ground. Vertical supports of board shall be embedded in ground in M 20 Cement Concrete blocks of size 300mm x300mm x 300mm, complete job including painting & writing of subject matter on bridge board, as directed by Engineer – In charge. {Note : Excavation & concrete work will be paid separately under Sub Schedule-B12}	14	Each	2,715.86	38,022.04
45	195030	Centring and shuttering including strutting, propping etc. and removal of form for :				
45a	195032	Abutment, pier, wing walls and return walls	6,581	Sqm	376.01	24,74,521.81
45b	195033	Abutment cap, Pier Cap, Inspection Platform & Pedestal over Pier cap, Fender wall, Diaphragm wal etc.	2,110	Sqm	364.94	7,70,023.40
45c	195034	Approach slab at formation level, Dirt wall/ ballast wall at formation level	668	Sqm	237.17	1,58,429.56

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
45d	195038	In Bottom/top slab & side walls of RCC Box , toe wall and sumps haunch filling head walls, In well Kerb & Steining or any other component	23,550	Sqm	376.01	88,55,035.50
46	NS-6	Supplying and laying of 150mm thick well graded stones aggregate/gravel as base layer over the slopes of embankment with manual dressing with water compaction including the cost of supply of all material, labour, lead, lift, tools, plants, crossing of tracks etc. complete as per approved drawings and technical specifications.	6,188	Cum	1,096.18	67,83,161.84
47	NS-7	Providing Boulder Backing behind wing wall, return wall, retaining wall with hand packed boulders & cobbles not less than 15cm in any direction & not less than 15kg (except smaller boulders required for filling voids) including all lead, lift, labour & other incidental charges as complete work in all respect. Cost of boulder/cobbles is included in this item.	4,601	Cum	1,219.73	56,11,977.73
48	NS-8	Providing and fixing of 75mm dia PVC pipe for weep holes in abutments, Wing Wall, Return Wall, Face wall, retaining wall etc. at suitable intervals as directed by the Engineer-in-charge.	1,500	Meter	232.42	3,48,630.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
49	NS-9	Manufacturing, transportation (including loading & unloading) and installation in position (including joining and grouting) M-35 **or higher grade** precast reinforced cement concrete U-shaped drain/duct with cover as per the directions of the Engineer. Precast reinforced U-shaped drain shall be factory-made, and steam cured in a controlled environment with inserts for handling/transportation. Dimensional tolerances shall be as per IS: 6408 (part 2) for PC Class 6. Notes:- 1. This item includes cost of all the materials, labour, machinery, tools & plant etc. complete required for manufacture of precast segments except Steel Reinforcement which shall be paid separately under relevant item of Sub schedule B2. 2. Excavation of soil for foundation shall be paid separately under item relevant of Sub Schedule B11. 3. Before placing of wall segments, 20 mm thick stiff 1:3 cement mortar bedding layer shall be laid over a levelling course of 50 mm thick of M20 concrete. Payment for M20 concrete shall be made under relevant item of Sub Schedule	360	Cum	26,770.42	96,37,351.20

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		B11 and for mortar under relevant item of Sub-Schedule- B12. 4. 60% of the rate shall be paid on receipt of the precast retaining wall segments at site and balance 40% will be paid on fixing the same in position in satisfactory condition.				
50	NS-10	Designing, Providing and erection of specified grade precast RCC Facia Panel of thickness 180 mm made with M-35 Grade Concrete Batching plant, Transit Mixer, Concrete Pump and Vibrator for retaining earth with all element and accessories including reinforcing element complete as per approval drawing and Section 3100 of MORT&H specification including all material labour machinery etc. (Scope of work including designing, getting approval, casting in yad, curing, storing, Transporting, lifting, placing in position, erection with all necessaries fasteners etc complete). The cost of cement & steel are included in this item & no separate payment shall be paid whatsoever. The rate also include cost for excavation, foundation, reinforcing element, fasteners, drainage layer, drain pipe, coping beam and other accessories for which nothing extra shall be paid. Mode of Payment:	2640	Sqm	6,068.85	1,60,21,764.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		1- Casting of RE Panel: 60% 2- Erection & fixing: 35 % 3- Final Bill: 5%				
51	NS-11	Providing Placing & Compacting to desired density approved backfill material in layers as per approved methodology including testing of reinforced fill portion in approaches between reinforced soil (RS) wall panels as per approved drawing as per Section 3103 of MORT&H Specification. The soil should be predominantly coarse grained, Not more than 10 % of particles should pass 75 micron sieve. The item shall be measured and paid for the finished volume of backfill and subgrade placed in position excluding the volume of filter media at base and behind the RS RE Wall.	8316	Cum	373.31	31,04,445.96
52	NS-12	Providing & constructing of RCC Crash Barrier of M35 at the edge of road , approaches to bridge structures and medians, constructed with specified grade of concrete using batching plant , transit mixer, concrete pump and vibrator with 450 mm long at expansion joint filled with premolded asphlat filler board, keyed to the structure on which it is built and installed as per design and dimension in the approved drawing and at location directed by the engineer, all as specified as per Section 809 of MORT&H	238	Cum	6,996.32	16,65,124.16

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		Specification including all material labour, scaffolding etc.				
Estimated Value of SUB SCHEDULE 'B11' Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						***16,06,83,080.29***

6.12 Sub-Schedule 'B12': Road and Building Works (DSR Based & NS items)

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
53	2.27	Supplying and filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete	96	Cum	2,212.30	2,12,380.80
54	3.8	1:3 (1 Cement : 3 coarse sand (zone-III)) cement sand levelling mortar. Item will be used as below precast item. Note:- cost of cement is included in the item.	33	Cum	5,142.94	1,69,717.02
55	4.17	Making plinth protection 50mm thick of cement concrete 1:3:6 (1 cement : 3 coarse sand (zone-III) derived from natural sources : 6 graded stone aggregate 20 mm nominal size derived from natural sources) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including necessary excavation, levelling & dressing & finishing the top smooth.	120	Sqm	697.77	83,732.40
56	4.6	Providing and fixing at or near ground level precast cement concrete in kerbs, edgings etc. as per approved pattern and setting in position with cement mortar 1:3 (1 Cement : 3 coarse sand), including the cost of required centering, shuttering complete.				
56a	4.6.1	1:1½:3 (1 Cement: 1½ coarse sand(zone-III) derived from natural sources: 3 graded stone aggregate 20 mm nominal size derived from natural sources)	10	Cum	8,322.88	83,228.80

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
57	5.1	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level.				
57a	5.1.2	1:1.5:3 (1 cement : 1.5 coarse sand (zone-III) derived from natural sources : 3 graded stone aggregate 20 mm nominal size de rived from natural sources).	51	Cum	8,561.96	4,36,659.96
58	5.3	Reinforced cement concrete work in beams, suspended floors, roofs having slope up to 15° landings, balconies, shelves, chajjas, lintels, bands, plain window sills, staircases and spiral stair cases above plinth level up to floor five level, excluding the cost of centering, shuttering, finishing and reinforcement with 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) derived from natural sources : 3 graded stone aggregate 20 mm nominal size derived from natural sources).	48	Cum	10,972.74	5,26,691.52
59	5.9	Centering and shuttering including strutting, propping etc. and removal of form for				
59a	5.9.1	Foundations, footings, bases of columns, etc. for mass concrete	450	Sqm	315.23	1,41,853.50
59b	5.9.2	Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	300	Sqm	685.38	2,05,614.00
59c	5.9.3	Suspended floors, roofs, landings, balconies and access platform	1,200	Sqm	784.67	9,41,604.00
59d	5.9.5	Lintels, beams, plinth beams, girders, bressumers and cantilevers	690	Sqm	622.73	4,29,683.70
59e	5.9.6	Columns, Pillars, Piers, Abutments, Posts and Struts	540	Sqm	823.27	4,44,565.80

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
59f	5.9.19	Weather shade, Chajjas, corbels etc., including edges	240	Sqm	834.22	2,00,212.80
60	5.33	Providing and laying in position ready mixed or site batched design mix cement concrete for reinforced cement concrete work; using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana / Ordinary Portland /Portland Slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads; but excluding the cost of centering, shuttering, finishing and reinforcement as per direction of the engineer-in-charge; for the following grades of concrete. Notes:- Extra cement up to 10% of the minimum specified cement content in design mix shall be payable separately. In case the cement content in design mix is more than 1.10 times of the specified minimum cement content, the contractor shall have discretion to either re-design the mix or bear the cost of extra cement				
60a	5.33.1	All works upto plinth level				
60aa	5.33.1.1	Concrete of M25 grade with minimum cement content of 330 kg /cum	90	Cum	8,889.11	8,00,019.90
60b	5.33.2	All works above plinth level upto floor V level				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
60ba	5.33.2.1	Concrete of M25 grade with minimum cement content of 330 kg /cum	132	Cum	10,549.87	13,92,582.84
61	6.1	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in:				
61a	6.1.2	Cement mortar 1:6 (1 cement : 6 coarse sand)	9	Cum	6,815.67	61,341.03
62	6.4	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes in :				
62a	6.4.2	Cement mortar 1:6 (1 cement : 6 coarse sand)	201	Cum	8,484.36	17,05,356.36
63	8.31	Providing and fixing Ist quality ceramic glazed wall tiles conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	15	Sqm	1,088.59	16,328.85
64	9.7.7	Providing and fixing panelling or panelling and glazing in panelled or panelled and glazed shutters for doors, windows and clerestory windows (Area of opening for panel inserts excluding portion inside grooves or rebates to be measured). Panelling for				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		panelled or panelled and glazed shutters 25 mm to 40 mm thick: Float glass panes.				
64a	9.7.7.1	4 mm thick glass pane (weight not less than 10kg/sqm).	27	Sqm	1,941.95	52,432.65
65	9.21	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters.				
65a	9.21.1	35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws	41	Sqm	2,063.41	84,599.81
66	9.48	Providing and fixing M.S. grills of required pattern in frames of windows etc. with M.S. flats, square or round bars etc. including priming coat with approved steel primer all complete.				
66a	9.48.1	Fixed to steel windows by welding	300	Kg	185.28	55,584.00
67	9.83	Providing and fixing aluminium die cast body tubular type universal hydraulic door closer (having brand logo with ISI, IS : 3564, embossed on the body, door weight upto 35 kg and door width upto 700 mm), with necessary accessories and screws etc. complete.	6	Each	1,049.90	6,299.40

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
68	9.96	Providing and fixing aluminium sliding door bolts, ISI marked anodised (anodic coating not less than grade AC 10 as per IS : 1868), transparent or dyed to required colour or shade, with nuts and screws etc. complete.				
68a	9.96.1	300x16 mm	18	Each	266.51	4,797.18
69	9.97	Providing and fixing aluminium tower bolts, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete				
69a	9.97.1	300x10 mm	18	Each	120.43	2,167.74
69b	9.97.4	150x10 mm	10	Each	77.34	773.40
70	9.100	Providing and fixing aluminium handles, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete				
70a	9.100.1	125 mm	18	Each	61.47	1,106.46
71	9.101	Providing and fixing aluminium hanging floor door stopper, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour and shade, with necessary screws etc. complete				
71a	9.101.2	Twin rubber stopper	6	Each	63.72	382.32

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
72	10.13	Providing and fixing T-iron frames for doors, windows and ventilators of mild steel Tee-sections, joints mitred and welded, including fixing of necessary butt hinges and screws and applying a priming coat of approved steel primer				
72a	10.13.1	Fixing with 15x3 mm lugs 10 cm long embedded in cement concrete block 15x10x10 cm of C.C. 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	600	Kg	117.36	70,416.00
73	10.14	Providing and fixing pressed steel door frames conforming to IS: 4351, manufactured from commercial mild steel sheet of 1.60 mm thickness, including hinges, jamb, lock jamb, bead and if required angle threshold of mild steel angle of section 50x25 mm, or base ties of 1.60 mm, pressed mild steel welded or rigidly fixed together by mechanical means, including M.S. pressed butt hinges 2.5 mm thick with mortar guards, lock strike-plate and shock absorbers as specified and applying a coat of approved steel primer after pre-treatment of the surface as directed by Engineer-in-charge:				
73a	10.14.1	Profile B				
73aa	10.14.1.1	Fixing with adjustable lugs with split end tail to each jamb	180	Meter	455.01	81,901.80
74	10.17	Providing and fixing M.S. fan clamp type I or II of 16 mm dia M.S. bar, bent to shape with hooked ends in R.C.C. slabs or beams during laying, including painting the exposed portion of loop, all as per standard design complete	24	Each	189.58	4,549.92

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
75	10.25	Steel work welded in built up sections/ framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required				
75a	10.25.2	in gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	6,913	Kg	145.66	10,06,947.58
76	10.26	Providing and fixing hand rail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works, including applying priming coat of approved steel primer				
76a	10.26.1	M.S. tube	102	Kg	160.87	16,408.74
76b	10.26.3	G.I. pipes	114	Kg	184.46	21,028.44
77	10.29	Providing & fixing fly proof wire gauze to windows, clerestory windows & doors with M.S. Flat 15x3 mm and nuts & bolts complete				
77a	10.29.1	Galvanised M.S. Wire gauze with 0.63 mm dia wire and 1.4 mm aperture on both sides	120	Sqm	749.51	89,941.20
78	11.20	Chequerred precast cement concrete tiles 22 mm thick in footpath & courtyard, jointed with neat cement slurry mixed with pigment to match the shade of tiles, including rubbing and cleaning etc. complete, on 20 mm thick bed of cement mortar 1:4 (1 cement: 4 coarse sand)				
78a	11.20.1	Light shade pigment using white cement	600	Sqm	1,262.20	7,57,320.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
79	11.21	Providing and fixing 10 mm thick acid and/or alkali resistant tiles of approved make and colour using acid and/or alkali resisting mortar bedding, and joints filled with acid and/or alkali resisting cement as per IS : 4457, complete as per the direction of Engineer-in- Charge				
79a	11.21.1	In flooring on a bed of 10 mm thick mortar 1:4 (1 acid proof cement : 4 coarse sand)				
79aa	11.21.1.1	Acid and alkali resistant tile	120	Sqm	1,551.28	1,86,153.60
79b	11.21.2	In dado/skirting on 12 mm thick mortar 1:4 (1 acid proof cement : 4 coarse sand)				
79ba	11.21.2.1	Acid and alkali resistant tile	90	Sqm	1,676.42	1,50,877.80
80	11.27	Kota stone slabs 20 mm thick in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete.	600	Sqm	2,086.75	12,52,050.00
81	11.38	Providing and laying Ceramic glazed floor tiles of size 300x300 mm (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in all colours, shades, except White, Ivory, Grey, Fume Red Brown, laid on 20 mm thick bed of cement mortar 1:4 (1 Cement : 4 Coarse sand), jointing with grey cement slurry @ 3.3 kg/ sq.m including pointing the joints with white cement and matching pigments etc., complete	35	Sqm	1,133.22	39,662.70

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
82	11.41	Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joints with white cement and matching pigments etc., complete				
82a	11.41.2	Size of Tile 600x600 mm	411	Sqm	1,450.14	5,96,007.54
83	11.55	Providing and laying flamed finish Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge :				
83a	11.55.1	Flamed finish granite stone slab Jet Black, Cherry Red, Elite Brown, Cat Eye or equivalent.	100	Sqm	2,651.13	2,65,113.00
84	13.1	12 mm cement plaster of mix				
84a	13.1.2	1:6 (1 cement: 6 fine sand)	1,800	Sqm	288.67	5,19,606.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
85	13.2	15 mm cement plaster on the rough side of single or half brick wall of mix				
85a	13.2.2	1:6 (1 cement: 6 fine sand)	420	Sqm	331.97	1,39,427.40
86	13.16	6 mm cement plaster of mix				
86a	13.16.1	1:3 (1 cement : 3 fine sand)	360	Sqm	259.03	93,250.80
87	13.42	Distempering with 1st quality acrylic distemper (ready mixed) having VOC content less than 50 gms/litre, of approved manufacturer, of required shade and colour complete, as per manufacturer's specification.				
87a	13.42.1	Two or more coats on new work	780	Sqm	94.94	74,053.20
88	13.45	Finishing walls with textured exterior paint of required shade.				
88a	13.45.1	New work (Two or more coats applied @ 3.28 ltr/10 sqm) over and including priming coat of exterior primer applied @ 2.20kg/10 sqm.	420	Sqm	250.79	1,05,331.80
89	13.47	Finishing walls with Premium Acrylic Smooth exterior paint with Silicone additives of required shade.				
89a	13.47.1	New work (Two or more coats applied @ 1.43 ltr/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/10 sqm).	600	Sqm	166.19	99,714.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
90	13.48	Finishing with Deluxe Multi surface paint system for interiors and exteriors using Primer as per manufacturers specifications:				
90a	13.48.2	Painting wood work with Deluxe Multi Surface Paint of required shade. Two or more coat applied @ 0.90 ltr/10 sqm over an under coat of primer applied @0.75 ltr/10 sqm of approved brand and manufacture.	24	Sqm	148.33	3,559.92
90b	13.48.3	Painting Steel work with Deluxe Multi Surface Paint to give an even shade. Two or more coat applied @ 0.90 ltr/ 10 sqm over an under coat of primer applied @ 0.80 ltr/ 10 sqm of approved brand and manufacture.	30	Sqm	143.36	4,300.80
91	13.50	Applying priming coat:				
91a	13.50.1	With ready mixed pink or Grey primer of approved brand and manufacture on wood work (hard and soft wood).	54	Sqm	62.90	3,396.60
92	13.60	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade.				
92a	13.60.1	Two or more coats on new work	1,170	Sqm	141.11	1,65,098.70
93	13.61	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade.				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
93a	13.61.1	Two or more coats on new work.	111	Sqm	134.56	14,936.16
94	13.80	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	2,580	Sqm	126.78	3,27,092.40
95	16.54	Providing and laying Dense Graded Bituminous Macadam using crushed stone aggregates of specified grading, premixed with bituminous binder and filler, transporting the hot mix to work site by tippers, laying with paver finisher equipped with electronic sensor to the required grade, level and alignment and rolling with smooth wheeled, vibratory and tandem rollers as per specifications to achieve the desired compaction and density, complete as per specifications and directions of Engineer-in-Charge				
95a	16.54.1	50 to 100 mm average compacted thickness with bitumen of grade VG-30 @ 5% (percentage by weight of total mix) and lime filler @ 2% (percentage by weight of Aggregate) prepared in Batch Type Hot Mix Plant of 100-120 TPH capacity.	195	Cum	10,250.05	19,98,759.75
96	16.57	Providing and laying Bituminous concrete using crushed stone aggregates of specified grading, premixed with bituminous binder and filler, transporting the hot mix to work site by tippers, laying with paver finisher equipped with electronic sensor to the required grade, level and alignment and rolling with smooth wheeled, vibratory and tandem rollers to				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		achieve the desired compaction and density as per specification, complete and as per directions of Engineer-in-Charge.				
96a	16.57.1	40/50 mm compacted thickness with bitumen of grade VG-30 @ 5.5% (percentage by weight of total mix) and lime filler @ 3% (percentage by weight of Aggregate) prepared in Batch Type Hot Mix Plant of 100-120 TPH capacity.	103	Cum	11,127.77	11,46,160.31
97	16.69	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineer-in-charge).	161	Cum	8,817.20	14,19,569.20
98	16.75	Providing and laying C.C. pavement of mix M-25 with ready mixed concrete from batching plant. The ready mixed concrete shall be laid and finished with screed board vibrator , vacuum dewatering process and finally finished by floating, brooming with wire brush etc. complete as per specifications and directions of Engineer-incharge. (The panel	5,848	Cum	8,473.26	4,95,51,624.48

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		shuttering work shall be paid for separately). (Note:- Cement content considered in this item is @ 330 kg/cum. Excess/less cement used as per design mix is payable/ recoverable separately).				
99	16.78	Construction of granular sub-base by providing close graded Material conforming to specifications, mixing in a mechanical mix plant at OMC, carriage of mixed material by tippers to work site, for all leads & lifts, spreading in uniform layers of specified thickness with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per specifications and directions of Engineer-in-Charge.				
99a	16.78.2	With material conforming to Grade-II (size range 53 mm to 0.075 mm) having CBR Value-25	6,279	Cum	2,841.28	1,78,40,397.12
100	16.79	Providing, laying, spreading and compacting graded stone aggregate (size range 53 mm to 0.075 mm) to wet mix macadam (WMM) specification including premixing the material with water at OMC in for all leads & lifts, laying in uniform layers with mechanical paver finisher in sub- base / base course on well prepared surface and compacting with vibratory roller of 8 to 10 tonne capacity to achieve the desired density, complete as per specifications and directions of Engineer-in-Charge.	4,868	Cum	2,869.94	1,39,70,867.92

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
101	16.80	Construction of dry lean cement concrete sub base over a prepared sub-grade with coarse and fine aggregate conforming to IS:383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per specifications, cement content not to be less than 150 Kg/cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, for all leads & lifts, laid with a mechanical paver, compacting with 8-10 tonne vibratory roller, finishing and curing etc. complete as per direction of Engineer in- charge.	5,043	Cum	4,228.21	2,13,22,863.03
102	16.90	Providing and laying tactile tile (for vision impaired persons as per standards) of size 300x300x9.8mm having with water absorption less than 0.5% and conforming to IS:15622 of approved make in all colours and shades in for outdoor floors such as footpath, court yard, multi modals location etc., laid on 20mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. complete as per direction of Engineer-in-Charge.	1,000	Sqm	1,759.64	17,59,640.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
103	16.91	Providing and laying factory made chamfered edge Cement Concrete paver blocks in footpath, parks, lawns, drive ways or light traffic parking etc, of required strength, thickness & size/ shape, made by table vibratory method using PU mould, laid in required colour & pattern over 50mm thick compacted bed of sand, compacting and proper embedding/laying of inter locking paver blocks into the sand bedding layer through vibratory compaction by using plate vibrator, filling the joints with sand and cutting of paver blocks as per required size and pattern, finishing and sweeping extra sand. complete all as per direction of Engineer-in-Charge.				
103a	16.91.1	60mm thick cement concrete paver block of M-35 grade with approved colour, design & pattern.	100	Sqm	954.39	95,439.00
103b	16.91.2	80 mm thick C.C. paver block of M-30 grade with approved color design and pattern.	3,570	Sqm	1,035.11	36,95,342.70
104	19.1	Providing, laying and jointing glazed stoneware pipes class SP-1 with stiff mixture of cement mortar in the proportion of 1:1 (1 cement : 1 fine sand) including testing of joints etc. complete :				
104a	19.1.2	150 mm diameter	100	RMT	605.38	60,538.00
105	19.6	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete :				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
105a	19.6.5	450 mm dia. R.C.C. pipe	100	RMT	1,516.58	1,51,658.00
105b	19.6.7	600 mm dia. R.C.C. pipe	100	RMT	2,147.71	2,14,771.00
106	19.36	Providing and laying Non Pressure NP-4 class (Heavy duty) R.C.C. pipes including collars/spigot jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete.				
106a	19.36.5	1200 mm dia RCC pipes. (Laying by manual/mechanical means)	10	RMT	10,104.64	1,01,046.40
107	21.1	Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / panelling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, panelling and dash fasteners to be paid for separately)				
107a	21.1.1	For fixed portion				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
107aa	21.1.1.1	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15).	360	Kg	444.21	1,59,915.60
107b	21.1.2	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately).				
107ba	21.1.2.1	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15).	240	Kg	544.37	1,30,648.80
108		Items included in Delhi Schedule of Rate-(Horticulture & Landscaping) 2020.		LS		10,00,000.00
109	NS-13	Earthwork in filling with contractor's own earth of approved quality from borrow areas including all lead all lead, lift, ascent, descent, royalty, taxes, cess, compensation, crossing of nallahs /stream and other obstructions including mechanical compaction in layers with watering to 95% of MDD (as per IS 2720 part 8), handling, re-handling, dressing to the final profile with all labour, material, tools, plant, machinery and equipment, taxes, cess etc. as a complete job in accordance with the specification and drawings. Note:- This item will be used for earthwork in filling for other than railway embankment work.	1,43,601	Cum	259.50	3,72,64,459.50
Estimated value of SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						**16,60,31,563.15**

6.13 Sub-Schedule 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
110	022100	Providing, fabricating and installing permanent casing pipe for bored piles for all diameters with specified thickness of steel plate including all labour, materials, pumping and bailing out water wherever required, complete as per technical specifications as directed by Engineer in charge. This will include the weight of plate only and no cognizance will be given for the fittings, i.e. rivets and welding etc.	194	MT	93,323.45	1,81,04,749.30
111	023030	Supplying, Fabrication, assembly, erection & placing in position the cutting edge of well curb with structural steel including MS sheet/Plates of specified thickness for pier/abutment complete as per approved plans and as per direction of Engineering In charge including all operations like cutting, bending, straightening, drilling holes, bolting, riveting, welding, threading, jointing of steel sections including outer and inner places liners and skin plates, stiffeners, hooks, bottle nuts, bond rods etc. as per design including all ascent, descents, leads, lifts, handing, re-handling, all other obstructions whatsoever, diverting channels, pumping / bailing out of water wherever required including cost of steel such as flats, sheets, angles,	18	MT	1,01,005.73	18,18,103.14

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		steel bars etc. with all labour and material as a complete job.				
112	031090	Design, manufacturing, supplying and fixing in position elastomeric bearing true to line and level conforming to IS:3400, IS:226, BS-5400 under prestressed concrete girders/ Steel Girders, for Precast as well as cast-in-situ girders as per approved drawing. The rate shall include cost of load test of one no. bearing from Railway approved firms and all fixing materials, equipments, machineries, labour, taxes, loading, unloading, leading, lifting etc. complete. Rates include getting the drawing approved from Railway and cost of inspection during manufacturing from railway approved organization. Note : 1. The rate is for finished item complete and paid only after fixing in position below the girder.	4,42,368	Cu.Cm.	1.68	7,43,178.24

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
113	041060	Providing and fixing railing used in rows for footpath or anti-crash barrier railing with B class G.I. pipe 65/50 mm nominal dia including cost of M.S. angle and channels in vertical posts, welding / bolting, priming painting with one coat ready mix Zinc Chromate conforming to IS:104 with DFT of 25-30Microns, followed by one coat of Zinc Chrome red oxide conforming to IS:2074 with DFT of 25 Microns with all material, labour, T&P as a complete job.	9,933	Kg	107.58	10,68,592.14
114	041080	Providing and fixing various size HTS holding down bolts conforming to IS:1364 in concrete column or in other structures with proper nuts, bolts, washers/plates, grouting of holes with all material, labour, T&P as a complete job. Note: Cement used in grouting will be paid separately under relevant item.	2,000	Kg	165.20	3,30,400.00

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
115	041180	Design, supply and fixing 300MT capacity Spherical Bearing in position true to line and level consisting of set of concave and convex mating steel backing plate with a low friction sliding interface, flat sliding elements ,guides and restraining rings; with all components conforming to approved drawing and technical specifications & Bridge Code including grouting of holes for anchor bolts and underside of baseplate with approved non-shrink epoxy grout with all material, labour, T&P as a complete job. Note: Sliding surface with PTFE or UHMWPE low friction thermoplastic material and steel for backing plate of Mild steel in accordance to IS:2062 grade-B. Cast steel in accordance with IS 1030 Grade 280-520W. Stain less steel in accordance with AISI 304/316.Low friction thermo -plastic sliding PTFE material either pure polytetrafluroethalyne (PTFE) Or Ultra High Molecular weight Polythylene (UHMWPE). Austanitic steel is of stainless steel for the sliding interface shall be in accordance with AISI 316L or O2 Cr17 NI12 of IS-6911. The thickness of the stain less steel sheet shall be 3mm minimum. The stainless steel sheet shall be attached to its backing plate either by screwing/riveting or by continuous fillet weld. Hard chromium plated surface shall be entire curved surface of the convex				

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		steel plate mating with hard chromium plated concave sliding surface. The thickness of the hard chromium plating shall be at least 100 microns and the final surface roughness of the plated surface shall not exceed 3 microns. Bearing manufacturer shall give the guarantee for satisfactory performance of bearing for period specified.				
115a	041181	Spherical Fixed Bearing	26	Each	1,19,070.94	30,95,844.44
115b	041182	Spherical Free Float Bearing	26	Each	1,30,006.81	33,80,177.06
115c	041183	Spherical Slide Guide (L) Bearing	26	Each	1,30,488.44	33,92,699.44
115d	041184	Spherical Slide Guide (T) Bearing	26	Each	1,30,233.46	33,86,069.96

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
116	041390	Supplying fabricating and erecting welded and/or bolted and/or riveted steel work in built up sections, trusses and framed work, staging, racks etc. for Steel Structures other than bridge girders, using RSJ, tees, angles and channels/flats, plates, gussets, round or square bars, cleats, bolts etc., with contractors own steel including cutting, bending, straightening, drilling, riveting, hoisting, fixing, erecting, welding, bolting etc., with Providing stiffeners wherever required as per approved drawing including applying a priming coat of a approved steel primer with all contractor's materials, labour, tools & plants, lead & lift including crossing of tracks if required etc., complete as per specification and as directed by Engineer-in-charge.	85	MT	1,05,186.17	89,40,824.45
117	191260	Supplying & fixing MS chequered plates 6 to 8mm thick between guard rails on unballasted deck bridge for gang pathway, overlapping at regular intervals of 2m to 2.5m with rail screws or bolts duly drilling holes in chequered plate, as directed. [Note: Overlapping of chequered plates shall not fall in between sleepers]	5	MT	94,164.70	4,70,823.50
118	NS-14	Construction of Mild Steel pipe of 323.9 mm outer diameter in the embankment at approximately 500m interval (except in station yards) for crossing utilities in future as shown in drawings.	500	RMT	3,909.00	19,54,500.00

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
119	NS-15	Supplying, fabrication and fixing pathway on Open Web Girder bridges & Composite with hollow steel, rolled and chequred plate including welding / bolting, priming painting with one coat ready mix Zinc Chromate conforming to IS:104 with DFT of 25-30Microns, followed by one coat of Zinc Chrome red oxide conforming to IS:2074 with DFT of 25 Microns with all material, labour, T&P as a complete job as RDSO drawing No. CBS 0045 & CBS 0046.	293	MT	1,17,302.05	3,43,69,500.65
120	NS-16	Supplying and fixing M.S. Angles 100mmx 100mm x 10mm size conforming to IS:2062 in expansion joint of Composite girder bridges including provision of 10mm dia dowel bar & 12mm dia anchor bolts at 150 mm centre to centre and 250mm wide GI plate over the top of angles as per relevant RDSO standard drawing with all material, labour, T&P as a complete job.	88	Each	6,139.09	5,40,239.92

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
121	NS-17	Supplying, fabricating, transportation and fixing galvanized H-Beam sleepers as per RDSO drawing RDSO/B/1636/4/R & RDSO/B/1636/5 with latest alteration and specifications thereto complete with all fittings and fixtures including the cost of all steel sections, all fittings and fixtures ,elastomeric pad, galvanized bolts, nuts, washer, split pin, fish plates 1m and 0.6m long along with fish bolts and nuts for 60Kg running rail and 52Kg guard rail respectively, track fittings and fastenings (Zero Toe Load Fastening) for 60 kg running rail and 52 Kg guard rail as per RDSO drg -RDSO/T-8759 to RDSO/T8765. labour, lead, lift, plants and equipments including galvanized work of full steel components complete in all respects as per approved drawing and technical specifications & as per direction of Engineer on Open Web Girder (OWG) bridges. The rate is also inclusive of the cost of supply of approved quality of epoxy/adhesive and fixing of elastomeric pads with different components of steel sleepers & girder in accordance with approved drawings. The steel to be supplied by the contractor for fabrication of steel H-Beam sleepers shall conform to IS-2062-2006, Grade B0 only. The rate is also inclusive of inspection charges of components of sleepers including all fixtures & fastening, galvanization etc. from the reputed laboratory/organization. Elastomeric pad plate and	135	Each	30,640.06	41,36,408.10

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		other track fittings shall be procured from RDSO approved source. *The rate also includes supply of 10% of spare fittings as per Annexure F-8, Section VII-2:Employer's Requirements: Functional.* Note: Payment under this item shall be made in following manner; i. 75% of the rate shall be paid after fabrication, galvanization and transportation of H beam sleepers to the site and submission of material test certificate of manufacturer and inspection certificate of the agency nominated by Engineer. ii.15% of the rate shall be paid after supply of fittings to the site and submission of inspection certificate of the agency nominated by Engineer. iii. 10% of the rate will be paid after fixing H Beam sleepers to the girder in satisfactory manner. iv. In case fixing is not required, then balance payment will be released on handing over of the sleepers after making recovery @ Rs.850/- per sleeper.				

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
122	NS-18	Providing and fixing stainless steel (Grade 304) railing made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement as per approval of Engineer-in-charge, (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.).	4,144	Kg	651.22	26,98,655.68
123	NS-19	Supply, fabrication and erection of bed plate of approved sizes(as per relevant RDSO drawing No. RDSO/B-11751/4R2, B-11753/5R1, B-11754/3R2 with UpToDate corrections), in exact position over bed block on pier/abutments by giving full and even bearing, setting them on the layer of free flow non-shrinkable grouting compound, scrapping or chipping of bed block, if required, fabrication and fixing of HD bolts of suitable sizes along with nuts, washers etc., drilling holes of required size, grouting of holes by epoxy mortar after fixing HD bolts with all labour, material, T & P as a complete job.				

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
123a	NS-19A	More than 12.2m and upto 18.3m clear span	8,800	Kg	225.63	19,85,544.00
124	NS-20	Supply and fixing of Metallic Guided Bearing in position true to line and level as per RDSO drawing No. RDSO/B-11754/3R2 and IRC:83 pt. III-2018 including supply & grouting of anchor bolts with approved non-shrinking epoxy grout with all material, labour, T&P as a complete job.	32	Each	49,532.72	15,85,047.04
Estimated value of SUB SCHEDULE 'B13' Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						**9,20,01,357.06**

6.14 Sub-Schedule 'B14': P Way Works-Ballastless Track, Rails & Special Sleepers (NS items)

SUB SCHEDULE 'B14': P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
125	NS-21	Construction of ballast less track on straight, curved track on bridges including linking of track with 60 Kg rails in LWR including, supply and fixing of rail fittings/ fastening, Construction of derailment guard , as per design approved by the Engineer. The item include supply and leading of all material, labour and tools & plants as a complete job including welding of track in LWR, destressing, drainage arrangement as per the approved drawing complete in all respect. Nothing extra shall be paid. Note:- 1- 60 Kg, 350 R Rails shall be paid under item no NS-25 of this Sub-Schedule	1,072	Rmt	52,879.28	5,66,86,588.16
126	NS-22	Construction of Transition system of ballastless track to ballasted track on bridge approach including linking of track with 60 Kg rails in LWR including, supply and fixing of rail fittings/ fastening, Construction of derailment guard , as per design approved by the Engineer. The item include supply and leading of all material, labour and tools & plants as a complete job including welding of track in LWR, destressing, drainage arrangement as	8	Each	11,42,190.26	91,37,522.08

SUB SCHEDULE 'B14': P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		per the approved drawing complete in all respect. Nothing extra shall be paid. Note:- 1- 60 Kg, 350 R Rails shall be paid under item no NS-25 of this Sub-Schedule				
127	NS-23	Linking of track on H- beam sleepers on Open Web Girder (OWG) bridges with 60 Kg running rail and 52 kg guard rail with track fittings/fastenings including leading of Running and guard rails from bridge approach and fixing of running rails & guard rails, bending of guard rails, notching, drilling of holes, cutting of rails etc., as directed and making track structure fit for sectional speed. Note- 1. 60Kg, 350R Rails for running rails and 52 Kg class 'IU' rails for guard rals shall be paid under item No. NS-25 & NS -26 respectively.	82	RTM	1,425.98	1,16,930.36
128	NS-24	Supplying at site of work including leading, loading, unloading and stacking of special PSC wider base sleepers for bridge approaches with provision of guard rails as per RDSO Drawing No. T-8673 to T-8680 for 60 Kg Rail.	2	Set	49,622.71	99,245.42

SUB SCHEDULE 'B14': P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
129	NS-25	Supplying, Transporting of Rail 60 kg Class 'A' ,R350 rail of 13/26 meter length as per IRS: T-12/2009 Specifications with latest amendments issued by RDSO.	2912	Rmt	7,396.29	2,15,37,996.48
130	NS-26	Supplying, Transporting of Rail 52 kg Class 'IU' as per IRS: T-12/2009 Specifications with latest amendments issued by RDSO.	164	Rmt	5,177.40	8,49,093.60
Estimated Value of SUB SCHEDULE 'B14' P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						**8,84,27,376.10**
					Total Estimated Amount of Schedule 'B'	***226,37,35,219.39***

Total Estimated Amount of Schedule 'B': INR*: 226,37,35,219.39*

7 Schedule 'C': General Electrical Services

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
1	**CONDUITS, WIRING, PLUGS, FAN AND DISTRIBUTION BOARDS**				
1.1	Point Wiring By 3x2.5 sqmm Copper Cable (With Modular Switches & Socket) in Conduits.	Nos	636	448.27	*2,85,099.72*
1.2	Supply of Material and Erection of 3x2.5 Sqmm Copper Cable in Conduits.	m	4183	93.20	*3,89,855.60*
1.3	Supply of Material and Erection of 3x6 Sqmm Copper Cable in Conduits.	m	673	141.86	*95,471.78*
1.4	Supply and Installation of 6A Modular Switch Socket.	Nos	481	254.38	*1,22,356.78*
1.5	Supply and Installation of 16A Modular Power Switch Socket.	Nos	129	281.42	*36,303.18*
1.6	Supply and Installation of 02 Module Plate GI Box.	Nos	86	109.37	*9,405.82*
1.7	Supply and Installation of 04 Module Plate GI Box.	Nos	242	151.15	*36,578.30*
1.8	Supply and Installation of 08 Module Plate GI Box.	Nos	99	260.53	*25,792.47*
1.9	Supply and Installation of 12 Module Plate GI Box.	Nos	12	280.19	*3,362.28*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
1.10	Supply, Installation, Testing and Commissioning (SITC) of 1200 mm Sweep Ceiling Fan with Fan Regulator.	Nos	181	2775.38	*5,02,343.78*
1.11	Supply, Installation, Testing and Commissioning (SITC) of 300 mm Sweep Exhaust Fan.	Nos	29	1606.70	*46,594.30*
1.12	Supply, Installation, Testing and Commissioning of Double Door, MCB TPN, 440V, 8 Module Distribution Boards (DB).	Nos	17	19614.74	*3,33,450.58*
1.13	Supply, Installation, Testing and Commissioning of Double Door, MCB SP, 12 Way Distribution Board (DB).	Nos	15	9319.16	*1,39,787.40*
1.14	Supply, Installation, Testing and Commissioning of 440V, 3-phase Change Over Distribution Board.	Nos	2	25884.66	*51,769.32*
1.15	Supply, Installation, Testing and Commissioning of MCCB 200A, 440V, 3-phase (4 Pole, 36 KA).	Nos	4	20784.60	*83,138.40*
1.16	Supply, Installation, Testing and Commissioning of Double Door, 63A, 240V, MCB SP 8 Way Distribution Board.	Nos	19	4659.58	*88,532.02*
1.17	Supply and Installation of Junction Box Size 390(H)x305(B)x170(D) mm.	Nos	10	3024.90	*30,249.00*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
1.18	Supply, Installation, Testing and Commissioning of Control and Distribution Panel for Colour Light Signalling (CLS) for 10/ 25/ 50 kVA AT supply.	Nos	3	94442.82	*2,83,328.46*
1.19	Supply and Installation of Metal Clad Plug Socket 20A, 240V, Single Phase with 32A MCB.	Nos	40	1098.64	*43,945.60*
1.20	Supply and Installation of Metal Clad Plug Socket 16A, 240V, Single Phase with 20A MCB.	Nos	4	878.91	3,515.64
1.21	Supply, installation, testing and commissioning of 32 mm dia GI Conduit.	m	80	188.02	*15,041.60*
1.22	Supply, installation, testing and commissioning of 25 mm dia GI Conduit.	m	600	146.89	*88,134.00*
1.23	Design and Drawing of conduits, wiring, panels, distribution board, as built drawings, survey, calculation etc. for Item no. 1.1 to 1.22.	LS	LS		54,281.50
2	**LT & HT CABLES AND LAYING**				
2.1	Supply of 2 Core x 10 Sqmm Copper Cable.	m	11645	194.24	*22,61,924.80*
2.2	Supply of 2 Core x 16 Sqmm Copper Cable.	m	7250	310.78	*22,53,155.00*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
2.3	Supply of 2 Core x 35 Sqmm Copper Cable.	m	2400	679.82	*16,31,568.00*
2.4	Supply of 2 Core x 70 Sqmm Copper Cable.	m	16000	1359.65	*2,17,54,400.00*
2.5	Supply of 2 Core x 95 Sqmm Copper Cable.	m	3200	1845.23	*59,04,736.00*
2.6	Supply of 4 Core x 120 Sqmm Copper Cable.	m	1800	3884.70	69,92,460.00
2.7	Supply of 4 Core x 240 Sqmm Copper Cable.	m	600	7769.40	46,61,640.00
2.8	Supply, Installation, Testing and Commissioning of LT Heat Shrinkable Straight Through Joint.	Nos	20	2581.41	51,628.20
2.9	Supply of 3 Core x 120 Sqmm 11 kV Copper Cable.	m	600	7320.32	*43,92,192.00*
2.10	Supply and Installation of End Termination Kit for 3 core, 70 Sqmm to 185 Sqmm, 11 kV Copper Cable.	Nos	24	14797.94	*3,55,150.56*
2.11	Laying of LT/ HT Cables (All Sizes) In Air/ Pipe/ Cable Tray/ Trench Etc.	m	20210	46.96	*9,49,061.60*
2.12	Excavation and Refilling of Trench of Size 500 mm Wide and depth up to 1200 mm (as per design) for cables.	m	20210	129.47	*26,16,588.70*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
2.13	Excavation and Refilling of Trench of Size 500 mm Wide and depth up to 1200 mm with brick protection (as per design) for cables.	m	2100	329.67	*6,92,307.00*
2.14	Supply and Laying of HDPE Pipe (90 mm outside dia).	m	8400	143.90	*12,08,760.00*
2.15	Supply and Laying of HDPE Pipe (90 mm outside dia) at platform along with pit and cover.	m	2400	151.09	*3,62,616.00*
2.16	Supply and Laying of HDPE Pipe (125 mm outside dia).	m	3200	466.37	*14,92,384.00*
2.17	Supply and Laying of HDPE Pipe (160 mm outside dia).	m	600	596.96	*3,58,176.00*
2.18	Supply and Laying of GI Pipe (nominal bore 125 mm).	m	1800	1694.86	*30,50,748.00*
2.19	Supply and Installation of Cable Route Marker.	Nos	210	2119.38	*4,45,069.80*
2.20	Drilling of horizontal bore below Railway track or road by pushing method for laying of HDPE/ GI pipe.	m	1610	2754.27	*44,34,374.70*
2.21	Design and Drawing of cable layout, trench layout, route markers, cable and pipe schedule, as built drawings, survey, calculation etc. for Item no. 2.1 to 2.20.	LS	LS		13,17,374.39

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
3	**LIGHTING, STREET LIGHT POLE AND HIGH MAST**				
3.1	Provision of 22 Watt LED Tube Light with fitting.	Nos	476	733.38	*3,49,088.88*
3.2	Provision of 40 Watt LED Street Light with Fitting.	Nos	100	5080.26	*5,08,026.00*
3.3	Provision of 120 Watt LED Street Light with Fitting.	Nos	44	12700.66	*5,58,829.04*
3.4	Provision of Rechargeable Batten Type 240 Watt Emergency Light.	Nos	8	3179.16	*25,433.28*
3.5	Provision of Outdoor LED Type Flood Light Luminaries (200 Watt).	Nos	60	33066.46	*19,83,987.60*
3.6	Supply, installation, testing and commissioning of 11 meter high cast iron decorative street light pole.	Nos	210	30000.00	63,00,000.00
3.7	Supply, Installation, Testing and Commissioning of (OFF Delay) Modular Digital Timers.	Nos	15	6527.92	*97,918.80*
3.8	Supply, Installation, Testing and Commissioning of 20 Meter High Mast.	Nos	5	355937.16	*17,79,685.80*
3.9	Design and Drawing of high masts, platform/ street poles, digital timer, foundation, lighting lux calculations, earthing, calculation, survey, as built drawings etc. for Item no. 3.1 to 3.8.	LS	LS		2,32,059.40

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
4	**ELECTRICAL EQUIPMENTS (PUMPS, AIR-CONDITIONERS, UPS, WATER COOLER, ETC.)**				
4.1	Supply of Submersible Pump Set of 7.5 kW.	Nos	4	69291.53	*2,77,166.12*
4.2	Supply, Installation, Testing and Commissioning of Automatic Control Panel for 7.5 kW, 440V, 3- Phase Submersible Pump.	Nos	3	20031.07	60,093.21
4.3	Installation, Testing and Commissioning of Submersible Pump Set of 7.5 kW.	Nos	3	4505.15	*13,515.45*
4.4	Supply, installation, testing and commissioning of Mono-Block Pump 1.5 kW, 240V, Complete with All Accessories.	Nos	1	15953.58	15,953.58
4.5	Supply and Installation of G.I. Pipe 50 mm nominal dia Medium Class With Flanges and Sockets.	m	300	529.17	*1,58,751.00*
4.6	Supply and Installation of G.I. Pipe Fitting Bends, Sockets, Flanges, Delivery Valve, Non-Return Valve.	Set	3	4592.40	13,777.20
4.7	Supply, Installation, Testing, Commissioning of 3 Core, 10 Sqmm Copper Flat Cable.	m	1350	165.90	*2,23,965.00*
4.8	Supply of Mono Block Pump 3.75 kW.	Nos	3	41574.92	*1,24,724.76*
4.9	Supply, Installation, Testing and Commissioning of Automatic Control Panel with DOL Starter for 3.75 kW Pump.	Nos	2	12018.64	24,037.28

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
4.10	Installation, Testing and Commissioning of 3.75 kW Mono Block Pump Set.	Nos	2	2703.09	5,406.18
4.11	Supply, Installation, Testing and Commissioning of 32A, 240V, DP MCB.	Nos	12	2123.01	*25,476.12*
4.12	Supply, Installation, Testing and Commissioning of Heavy Duty 5 Star, 1.5 Ton Split Inverter Type Air Conditioner.	Nos	4	50385.48	*2,01,541.92*
4.13	Supply, Installation, Testing and Commissioning of Heavy Duty 5 Star, 2 Ton Split Inverter Type Air Conditioner.	Nos	40	67180.64	*26,87,225.60*
4.14	Supply, Installation, Testing and Commissioning of 2 KVA, 240 Volt, AC, Pure Sine Wave Online UPS cum Inverter.	Nos	4	53940.00	2,15,760.00
4.15	Supply, Installation, Testing and Commissioning of Water Cooler (150 Litre).	Nos	7	78612.49	*5,50,287.43*
4.16	Supply, Installation, Testing and Commissioning of 5 star rated storage geyser 25 litre capacity.	Nos	4	4763.22	*19,052.88*
4.17	Design and Drawing of pumps, control panels, AC, water coolers, geyser, UPS, survey, calculation, as built drawings etc. for Item no. 4.1 to 4.16.	LS	LS		92,334.70

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
5	**SUBSTATION 11kV/ 0.44 KV, HT PANEL, LT PANEL, APFC PANEL, DG SET AND EARTHING**				
5.1	Supply, Installation, Testing and Commissioning Of 11kV/0.44kV, 1x250 kVA, Compact Substation (CSS).	Nos	2	1086256.66	21,72,513.32
5.2	Supply, Installation, Testing and Commissioning of Automatic Power Factor Correction Panel (APFC panel) with 150 kVAR shunt capacitors complete in all respects.	Nos	2	226735.74	*4,53,471.48*
5.3	Supply, Installation, Testing and Commissioning of Indoor Type 400A LT Panel.	Nos	2	210318.23	*4,20,636.46*
5.4	Supply, Installation, Testing and Commissioning of Indoor Type 160A LT Panel.	Nos	1	126190.94	1,26,190.94
5.5	Supply, Installation, Testing and Commissioning of Indoor Type 160A Essential LT Panel.	Nos	1	132500.48	1,32,500.48
5.6	Supply and Installation of 3 mm Thick Rubber Mat.	Sqm	60	11743.53	*7,04,611.80*
5.7	Supply, Installation, Testing and Commissioning of 125 kVA Capacity, Radiator Cooled Silent DG Set.	Nos	1	1240029.30	12,40,029.30

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
5.8	Supply, Installation, Testing and Commissioning of Feeder Pillar.	Nos	6	114443.66	*6,86,661.96*
5.9	Supply, Installation, Testing and Commissioning of Earth Electrode Complete with RCC chamber etc.	Nos	39	3778.11	*1,47,346.29*
5.10	Supply, Installation, Testing and Commissioning of Earth Electrode buried in ground complete.	Nos	136	3589.21	*4,88,132.56*
5.11	Supply and Installation of 40x5 mm Copper Strip on Surface or in Recess or in GI Pipe.	m	100	1700.35	*1,70,035.00*
5.12	Supply and laying of 40x6 mm GI Flat.	m	1080	137.78	*1,48,802.40*
5.13	Supply and Installation of 5 mm Dia GI Wire.	m	4500	70.13	*3,15,585.00*
5.14	Supply, installation, testing and commissioning of CO2 Panel Flooding System for length above 6000 mm.	Nos	2	309812.99	*6,19,625.98*
5.15	Supply, installation, testing and commissioning of CO2 Panel Flooding System for length up to 6000 mm.	Nos	1	259765.55	2,59,765.55
5.16	Design and Drawing of Sub-station, LT panels, APFC panel, DG set, earthing, feeder pillar, fire trace system, as-built drawings, calculations, survey etc. for Item no. 5.1 to 5.15.	LS	LS		1,61,717.79

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
6	**FIRE FIGHTING EQUIPMENTS**				
6.1	Supply and Installation of Safety Items in the Substation.	Set	3	18559.30	55,677.90
6.2	Supply and installation of Set of 04 fire buckets (10 litre) capacity with one GI stand and GI cover.	Set	5	6709.54	*33,547.70*
6.3	Supply and installation of Portable fire extinguisher Dry Chemical Powder (5 kg).	Nos	33	1263.03	*41,679.99*
6.4	Supply and installation of Carbon dioxide fire extinguishers, capacity 4.5 kg.	Nos	33	6249.38	*2,06,229.54*
7	**VIADUCT LIGHTING**				
7.1	Provision of 22 Watt LED with Bulkhead Light Fitting on Viaduct.	Nos	420	3461.19	*14,53,699.80*
7.2	Laying of 2 Core x 70 Sqmm LT Cable in Viaduct/ Tunnel/ Air Etc.	m	16000	205.93	*32,94,880.00*
7.3	Laying of 2 Core x 10 Sqmm LT Cable in Viaduct/ Tunnel/ Air Etc.	m	8000	94.24	*7,53,920.00*
7.4	Supply and Installation of Junction Box Size 250(H)x200(B)x105(D) mm.	Nos	22	2817.98	*61,995.56*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
7.5	Design and Drawing of Viaduct lighting, cabling, earthing, calculation, survey, as-built drawings etc. for Item no 7.1 to 7.4.	LS	LS		1,11,289.65
8	**MISCELLANEOUS**				
8.1	Supply, Installation, Testing and Commissioning of 25 Litre Fully Automatic with Auto Cut-Off RO water purification system.	Nos	5	17000.00	85,000.00
8.2	Supply, Installation, Testing and Commissioning of Single Sided LED Signage Board.	Sqm	300	7780.43	*23,34,129.00*
8.3	Supply, Installation, Testing and Commissioning of Double Sided LED Signage Board.	Sqm	360	9649.85	*34,73,946.00*
8.4	Dismantling of Rail Pole, Cable Pole, Overhead Line, Cable Tray complete.	Nos	12	693.72	*8,324.64*
8.5	Supply and Installation of GI Cable Duct 40x60 mm (wxh) Minimum 2 mm Thick.	m	250	105.78	*26,445.00*
8.6	Supply and Installation of Stainless Steel Wire Mesh 25mm x 25mm (of 5 mm dia wire) Welded on GI Angle.	Kg	500	66.93	*33,465.00*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
8.7	Supply, Installation, Testing and Commissioning of GI Perforated Cable Tray of Size 150x50 mm with Thickness 1.6 mm.	m	400	636.63	*2,54,652.00*
8.8	**Spares**				
8.8.1	Digital Earth Testers	Nos	2	9991.00	19,982.00
8.8.2	Earth Leakage Detector 1000 V	Nos	2	24849.00	49,698.00
8.8.3	Digital Insulation Tester 2.5 kV	Nos	2	8559.00	17,118.00
8.8.4	Digital Insulation Tester 0 – 1000 V	Nos	2	2175.00	4,350.00
8.8.5	Digital Vernier Caliper	Nos	5	12872.00	64,360.00
8.8.6	Portable Diesel Generating set, 3 kVA, 240 V AC	Nos	1	110400.00	1,10,400.00
8.8.7	Digital micrometer	Nos	5	9957.00	49,785.00
8.8.8	Digital Multi-meter	Nos	5	1490.00	7,450.00
8.8.9	Safety Helmet	Nos	10	995.00	9,950.00
8.8.10	Tool Kit Box	Nos	3	6603.00	19,809.00
8.8.11	Portable Grinder Electrically Operated	Nos	2	8463.00	16,926.00

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
8.8.12	Portable Electrical Drill	Nos	2	14914.00	29,828.00
8.9	Operation and Maintenance Manuals	LS	LS	98784.70	98,784.70
8.10	Training to Staff	LS	LS	246726.49	*2,46,726.49*
	Total amount of Schedule C				***10,77,20,424.79***

Total Estimated amount of Schedule 'C': INR *10,77,20,424.79*

8 Schedule 'D': Signalling & Telecommunication (S&T) Works

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D1	**Supply of Signalling and Telecom equipment and associated material (S. No. 1 - 12)**				
1	Supply of Relay- AC immune plug in type QNA1, DC neutral line relay, 24 V DC 8F/8B contacts, metal to carbon with plug-in arrangement etc. conforming to BRS: 931A. The interlocking code for this unit shall be "ABDGH or latest.	Nos.	4,360	15	65,400
2	Supply of 16/0.2mm, size tinned flexible single core indoor wire as per IRS:S 76/89 (latest) specification, PVC coated in different colours as per requirement and to be supplied in coils of 100 meters.	Nos.	1,041	50	52,050
3	Supply Fabrication and fixing of cable termination board of size as per Drg. No.NR/S&T/Project/13/2015 duly fitted with Bakelite sheet of size 6 mm thick. This also includes fixing of ARA terminals & fuse bases with Location box inside/outside painting, writing, cable fixing, bunching, numbering as per Indian railway standard.	Nos.	54,930	1	54,930
4	Supply of Disconnect Terminal block for four conductors with screwing cage clamp type/sliding switch disconnect as per RDSO specification. No. RDSO/ SPN/189/2004 Ver. 1.2 (latest) for conductor size upto 2.5 sq. mm for M6 terminals.	Nos	140	200	28,000
5	Supply of ARA terminal block 25 mm centre spacing for small M-6 terminal as per RDSO specifications IRS-S75/2006 (latest).	Nos	98	200	19,600
6	Supply of PVC Insulated Armoured, Unscreened, Underground Railway Signalling cable copper conductor as per specification no. IRS-S-63/2014 (latest) Size 24 Core x 1.5 Sq. mm.	Km	4,98,267	2	9,96,534

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D1	**Supply of Signalling and Telecom equipment and associated material (S. No. 1 - 12)**				
7	Supply of PVC insulated armoured, unscreened, underground railway signalling cable copper conductor as per specification no. IRS: S-63/2014 (latest) size 12 Core x 1.5 sq. mm.	Km	2,22,628	8	17,81,024
8	Supply of PVC insulated armoured, unscreened, underground railway signalling cable copper conductor as per specification no. IRS: S-63/2014 (latest) size 6 Core x 1.5 sq. mm.	Km	1,43,385	2	2,86,770
9	Supply of Power cable as per BIS specification No. IS: 694/2010 (2 x 25 sq. mm, red & black colour).	Km	1,43,038	3	4,29,114
10	Supply of 6 Quad cable. 0.9 mm jelly filled underground, screened, armoured cable as per RDSO specification No IRS TC: 30/2005 (latest) amendment.	Km	2,95,313	11	32,48,443
11	Supply of Armoured Optical Fiber Cable (OFC) (24 Fiber) Mono Mode as per Spec. No. RDSO/SPN/TC/110/2020.	Km	1,01,792	11	11,19,712
12	Supply of permanently lubricated high density polyethylene (PLB-HDPE) duct of 40 mm/ 33 as per RDSO spec. No. RDSO/SPN/TC/45/2013 Rev.2.0, complete with all accessories caps, couplers, bends etc.	Km	77,794	10	7,77,940
			Sub Total of 'D1' (INR)		**88,59,517**

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
13	Final Location Survey of cable route, Preparation of cable route plan, Track crossing plan, Location Description plan, Cable insulation chart and other outdoor diagram for way side stations. Three sets of above drawings will be submitted for approval & for execution of work to engineer (job complete work).	Nos.	48,245	1	48,245
14	Supply of Location Box /Apparatus Case single as with 'E' type lock, key ward No. 42 and handle as per RDSO drg. No. RD- SO/S-11500 or latest.	Nos.	24,550	6	1,47,300
15	Supply of Location Box /Apparatus Case steel half with with 'E' type lock, key ward No. 42 and handle as per RDSO drg. No. RD- SO/S-11507 or latest.	Nos	19,254	6	1,15,524
16	casting, concreting and curing of foundation and Installation and Erection of single location box /apparatus cases as per RDSO drg. No. NR/S&T/CON/2.7/97. All installation material as cement, sand, aggregate and anchor bolt etc. shall be supplied by the contractor.	Nos.	13,045	6	78,270
17	casting, concreting and curing of foundation and Installation and Erection of half location box /apparatus cases as per RDSO drg. No. NR/S&T/CON/2.8/97. All installation material as cement, sand, aggregate and anchor bolt etc. shall be supplied by the contractor.	Nos.	8,764	6	52,584

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
18	Fabrication and fixing of phenolic laminated sheet of grade P3, minimum 10 mm thick, in location box /apparatus cases and providing all fixtures like M6/ ARA/Disconnect terminals, fuse blocks, relays etc. on square bars. This includes fixing of PVC coated string rods at the back side for cable support with contractor's own material like iron angle, nuts, bolts etc. The iron angle for fixing shall be minimum 3 mm thick. This includes providing teak wood shelf minimum 25 mm thick for holding track circuit equipments. The work shall be done as per instructions of engineer. (Location Box/Apparatus case single involving wiring of relays).	Nos.	5,961	6	35,766
19	Fabrication and fixing of phenolic laminated sheet of grade P3, minimum 10 mm thick, in location box / apparatus cases and providing all fixtures like M6/ ARA/Disconnect terminals, fuse blocks, relays etc. on square bars. This includes fixing of PVC coated string rods at the back side for cable support with contractor's own material like iron angle, nuts, bolts etc. The iron angle for fixing shall be minimum 3 mm thick. This includes providing teak wood shelf minimum 25 mm thick for holding track circuit equipments. The work shall be done as per instructions of engineer. (Location Box/Apparatus case half).	Nos	3,322	6	19,932
20	Termination of all type of cables at either end on terminal boards providing identification, ferrules, dressing, lacing with thread. This includes testing, meggering and submitting test reports etc. and defect rectification *(*per condutor).	Nos	16	852	13,632

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
21	Dismantling and Releasing of existing Location boxes/Apparatus cases/Jn boxes including releasing of terminal boards, release, terminals, fittings installed therein complete with fittings. All dismantled material to be transported and stacked in the store of the employer.	Nos	779	12	9,348
22	Excavating and refilling of trench, in Normal Soil to the level of ground with rammed earth as per drg. No. NR/S&T/CON/1.1/97-A so as not to form a drain, 0.3 Mtrs. Wide & 1.0 m. Deep alongside the track.	M	83	10,000	8,30,000
23	Excavating and refilling of trench 0.3 Mtr./ as required Wide & 1.0 m. Deep from bottom of rail flange across the track or 0.5 Mtr. from ground level whichever is more (NR/S&T/CON /1.2/97). Earth should be rammed so as not to form a drain. This includes removal and refilling of ballast & restoration of surface under normal traffic conditions. Lesser depth of the trench is to be paid proportionately.	M	95	200	19,000
24	Supply & installation of Double walled corrugated HDPE Pipe of outer dia 120 mm (other than black in colour) in 6 m straight length with one coupler for every 6 m length conforming to RDSO/SPN/204/2011 or equivalent IS specification wherever required as per approved cable route plan. This includes brick work and other arrangements required to secure the pipe for road crossing/Platform/track crossing and for bridges & culverts etc.	M	546	200	1,09,200

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
25	Supply and installation of Half split Double wall corrugated pipe of HDPE in 2 or 3 m. length produced out of full round DWC pipes as per RDSP specn. No. RDSO/SPN/204/2011 or equivalent IS specifications. The pipe should have necessary fixing and coupling arrangements. Size 200/ 175 mm inner dia).	M	389	5,000	19,45,000
26	Supply and laying of 2nd class bricks in the trench and laying as per drg. No. NR/S&T/CON/1.1/97-A as per instructions of the Engineer's.	M	8	1,000	8,000
27	Supply & installation of earth electrodes pipe of 3 metre length and 50 mm dia. pointed on lower end by tapering for a length of 150 mm as per drg. No. NR / S&T/ Proj /16.1 /2015 and connecting with signalling gears. This includes casting and plastering of cement concrete enclosures as per drg. No. NR / S&T/ Proj /16.2 /2015.	Nos	3,751	12	45,012
28	Fabrication, supply and fixing of cable marker of 1:3:6 concrete as per No.NR/S&T/CON/1.5/97A. The marker shall be fixed at various places of cable route as per instructions of the Engineer's representative.	Nos	387	100	38,700
29	Laying of signalling/Telecom/power/ other all type of cables etc. of different sizes as per drg. No. NR/S&T/CON/1.1/97-A and testing & meggering of cable before and after laying.	M	8	26,000	2,08,000
30	"Laying of HDPE duct in the trenches, HDD/Manual Boring, RCC ducts, Pipes etc. and supply & pulling of Nylon rope through it as required.	M	10	10,000	1,00,000

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
31	"Blowing/drawing of OFC cable in the HDPE duct laid in trenches & protective works".	M	14	10,000	1,40,000
32	Supply and installation of optical fiber cable joint enclosure as per RDSO/SPN/TC/68/2014 or equivalent TEC specifications (Make: Reychem or superior) and splicing of OFC cables. This includes fabrication & installation of RCC jointing pit (1 m inner dia x 1 m deep) for OFC joint closure.	Nos.	17,622	10	1,76,220
33	Supply & installation of thermos shrinkable straight through joint suitable for making straight through/deviation joint without transformer in underground 6 quad/jelly filled cables. RDSO specification No. RDSO/SPN/TC/77/2010 (latest amendment) with all accessories.	Nos.	6,421	10	64,210
34	Supply & Installation of 1120:470 Ohms VF isolation transformers rack mounting type as per RDSO Specification IRS/TC/22/76 with latest amendment applicable on the date of opening of the tender. (Select joint type).	Nos.	1,605	10	16,050
				Sub Total of 'D2' (INR)	**42,19,993**
				Total Estimated Amount of Schedule 'D' (D1+D2) INR	***1,30,79,510.00***

Total Estimated amount of Schedule ‘D’ - INR *1,30,79,510.00*

Price Schedule

(Please refer Price Schedule uploaded on eProcurement portal)

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Tender Inviting Authority: Haryana Rail Infrastructure Development Corporation Limited

Name of Work: Contract Package C-5: Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for:
(i)Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942;
(ii)Design & Construction of viaduct from km 20.942 to km 24.844;
(iii)Design & Construction of Ballastless track from km 20.842 to km 24.844; and
(iv)Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844.

Contract No: HORC/HRIDC/C-5/2023

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

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Bidders are allowed to enter the Bidder Name and …

NUMBER #	TEXT #	TEXT #	NUMBER #		TEXT #
Sl. No.	Item Description	Units	BASIC … Rs. P	…MOUNT With Taxes Rs. P Rs. P	TOTAL AMOUNT In Words
1	Schedule A: Lumpsum component of Work…	…p Sum		0.00	INR Zero Only
Total in Figures				0.00	INR Zero Only
Quoted Rate in Words					INR Zero Only

SAMPLE Price Schedule

**Tenderer is only required to fill the information in the boxes highlighted with cyan colour in Price Schedule (Excel sheet)*

Price Schedule

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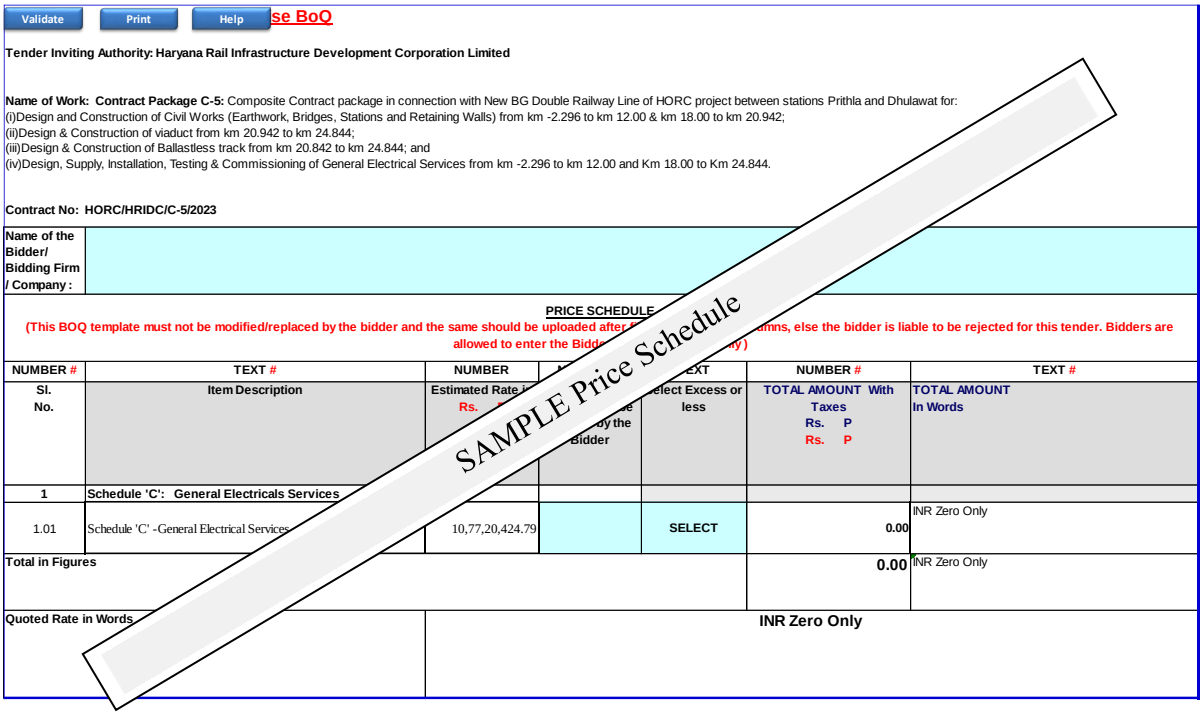
Contract No: HORC/HRIDC/C-5/2023

Name of the Bidder/ Bidding Firm / Company :						
PRICE SCHEDULE (This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)						
NUMBER #	TEXT #	NUMBER	NUMBER #	TEXT	NUMBER #	TEXT #
Sl. No.	Item Description	Estimated Rate in Rs. P	PERCENTAGE RATE (%) to be entered by the Bidder	Select Excess or less	TOTAL AMOUNT With Taxes Rs. P Rs. P	TOTAL AMOUNT In Words
1	Schedule 'B': Bridges, Retaining Wall & other Civil works					
1.01	SUB SCHEDULE-B1: Bridge Works-Steel Super Structure - Open Web Girder (USSOR Based item)	67,70,29,509.30		SELECT	0.00	INR Zer
1.02	SUB SCHEDULE-B2: Reinforcement (USSOR Based items)	39,25,25,087.50		SELECT		
1.03	SUB SCHEDULE-B3: RCC Works (NS item)	17,62,43,627.52		SELECT		Zero Only
1.04	SUB SCHEDULE-B4: Bridge Works-Pile foundation (NS items)	10,69,13,193.00		SELEC	0.00	INR Zero Only
1.05	SUB SCHEDULE-B5: Bridge Works-Steel Super Structure-Composite Girder (USSOR Based item)	7,63,87,291.44			0.00	INR Zero Only
1.06	SUB SCHEDULE-B6: Backfill Material (USSOR Based item)	7,12,94,621.42		LECT	0.00	INR Zero Only
1.07	SUB SCHEDULE-B7: Bridge Works-Precast Concrete Blocks (NS item)	4,97		SELECT	0.00	INR Zero Only
1.08	SUB SCHEDULE-B8: Cement (USSOR Based items)			SELECT	0.00	INR Zero Only
1.09	SUB SCHEDULE-B9: Formation Works (USS NS items)	3,02,08,512.50		SELECT	0.00	INR Zero Only
1.10	SUB SCHEDULE-B10:Bridge W Miscellaneous (USSOR Bas	10,53,31,396.00		SELECT	0.00	INR Zero Only
1.11	SUB SCHEDULE-B1 Superstructure (USSOR Ba	16,06,83,080.29		SELECT	0.00	INR Zero Only
1.12	SUB &	16,60,31,563.15		SELECT	0.00	INR Zero Only
1.13	SUB SCHEDULE-B13: Bridge Bearing & Miscellaneous Structu Steel Works (USSOR Based & NS items)	9,20,01,357.06		SELECT	0.00	INR Zero Only
1.14	SUB SCHEDULE-B14: P Way Works-Ballastless Track, Rails & Special Sleepers (NS items)	8,84,27,376.10		SELECT	0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only
Quoted Rate in Words		INR Zero Only				

**Tenderer is only required to fill the information in the boxes highlighted with cyan colour in Price Schedule (Excel sheet)*

Price Schedule

(Please refer Price Schedule uploaded on eProcurement portal)



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Tender Inviting Authority: Haryana Rail Infrastructure Development Corporation Limited

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Contract No: HORC/HRIDC/C-5/2023

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after [illegible] mns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidd[illegible]y)

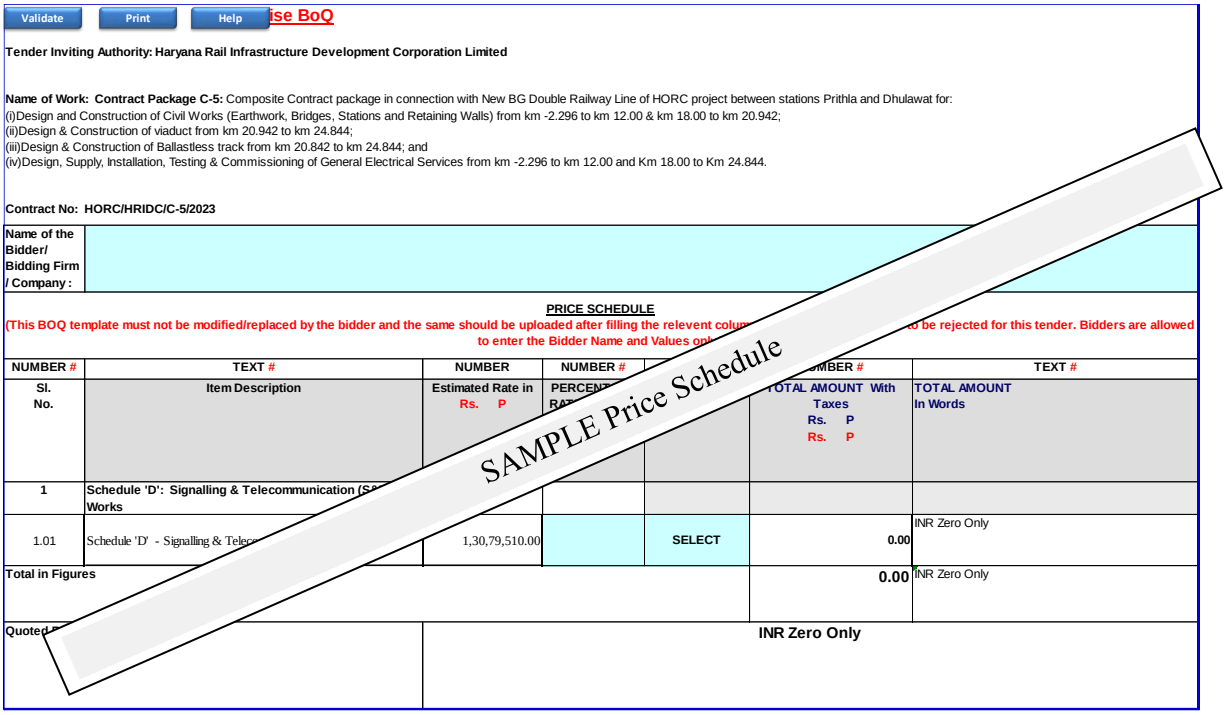
NUMBER #	TEXT #	NUMBER	[illegible]	EXT	NUMBER #	TEXT #
Sl. No.	Item Description	Estimated Rate / Rs.	[illegible]e by the Bidder	elect Excess or less	TOTAL AMOUNT With Taxes Rs. P Rs. P	TOTAL AMOUNT In Words
1	Schedule 'C': General Electricals Services					
1.01	Schedule 'C' -General Electrical Services	10,77,20,424.79		SELECT	0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only
Quoted Rate in Words			INR Zero Only			

SAMPLE Price Schedule

**Tenderer is only required to fill the information in the boxes highlighted with cyan colour in Price Schedule (Excel sheet)*

Price Schedule

(Please refer Price Schedule uploaded on eProcurement portal)



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Tender Inviting Authority: Haryana Rail Infrastructure Development Corporation Limited

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(i)Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942;
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Contract No: HORC/HRIDC/C-5/2023

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent colum... to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

NUMBER #	TEXT #	NUMBER	NUMBER #		NUMBER #	TEXT #
Sl. No.	Item Description	Estimated Rate in Rs. P	PERCENT... RA...		TOTAL AMOUNT With Taxes Rs. P Rs. P	TOTAL AMOUNT In Words
1	Schedule 'D': Signalling & Telecommunication (S... Works					
1.01	Schedule 'D' - Signalling & Teleco...	1,30,79,510.00		SELECT	0.00	INR Zero Only
Total in Figures					0.00	INR Zero Only
Quoted ...					INR Zero Only	

SAMPLE Price Schedule

**Tenderer is only required to fill the information in the boxes highlighted with cyan colour in Price Schedule (Excel sheet)*

Price Schedule

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Contract No: HORC/HRIDC/C-5/2023

Name of the Bidder/ Bidding Firm / Company :			
PRICE SCHEDULE-SUMMARY SHEET (This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)			
NUMBER #	TEXT #	NUMBER #	TEXT #
Sl. No.	Item Description	TOTAL AMOUNT With Taxes Rs. P Rs. P	TOTAL AMOUNT In Words
1	Schedule A: Lumpsum component of Works	0.00	
2	Schedule 'B': Bridges, Retaining Wall & other Civil works		ero Only
3	Schedule 'C': General Electricals Services	0.00	INR Zero Only
4	Schedule 'D': Signalling & Telecommunication (S&T) Works	0.00	INR Zero Only
5	Provisional Sums	10,00,00,000.00	INR Ten Crore Only
Total in Figures		10,00,00,000.00	INR Ten Crore Only
Quoted Rate in Words		INR Ten Crore Only	

SAMPLE Price Schedule

**Tenderer is only required to fill the information in the boxes highlighted with cyan colour in Price Schedule (Excel sheet)*

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Non-Consulting Services in Bank-Financed Procurement

In reference to ITT 4.8 and 5.1, for the information of the Tenderers, at the present time, firms, goods and services from the following countries are excluded from this Tendering process:

Under ITT 4.8 (a) and 5.1: ***None***

Under ITT 4.8 (b) and 5.1: ***None***

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Section VI - Prohibited Practices

1. The Bank requires that the Recipient (and all other beneficiaries of the Bank financing), as well as tenderers, suppliers, contractors, concessionaires and consultants under Bank-financed contracts for the Project, observe the highest standard of transparency and integrity during the procurement, execution and implementation of such contracts.

2. Definitions. In pursuance of this policy, the Bank defines the terms set forth below as Prohibited Practices:

   (a) "**coercive practice**" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of a party to influence improperly the actions of a party;
   (b) "**collusive practice**" means an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
   (c) "**corrupt practice**" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
   (d) "**fraudulent practice**" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation.
   (e) "**misuse of resources**" means improper use of the Bank's resources, carried out either intentionally or through reckless disregard;
   (f) "**obstructive practice**" means any of the following practices: (i) deliberately destroying, falsifying, altering or concealing of evidence material to a Bank investigation; (ii) making false statements to investigators in order to materially impede a Bank investigation into allegations of a Prohibited Practice; (iii) failing to comply with requests to provide information, documents or records in connection with a Bank investigation; (iv) threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to a Bank investigation or from pursuing the investigation; or (v) materially impeding the exercise of the Bank's contractual rights of audit or inspection or access to information; and
   (g) "**theft**" means the misappropriation of property belonging to another party.

3. Any occurrence, or suspected occurrence, of a Prohibited Practice in the procurement, award, or implementation of a Bank-financed contract is dealt with in accordance with the provisions of the Bank's Policy on Prohibited Practices. Suppliers, contractors, service providers and consultants selected pursuant to the provisions of Section II and concessionaires selected pursuant to paragraph 14.3 of the Bank's Procurement Instructions for Recipients, as well as the Recipient shall fully cooperate with the Bank (or a cofinancier undertaking an investigation pursuant to paragraph 6.1 of the Bank's Procurement Instructions for Recipients) in any investigation into an alleged Prohibited Practice to be carried out pursuant to the Policy on Prohibited Practices, and permit the Bank or its representative (including such co-financier) to

inspect such of their accounts and records as may be relevant for such investigation and to have such records and accounts audited by the auditors appointed by the Bank.

4. Provisions to this effect are included in the Legal Agreements and the procurement contracts with such entities.

5. If the Project is financed by a sovereign-backed loan, the Bank (or, where relevant, a co-financier having undertaken an investigation pursuant to paragraph 6.1 of the Bank's Procurement Instructions for Recipients):

   (a) may take any of the following additional actions in connection with a Prohibited Practice under the Project:

      (i) reject a proposal for award if it determines that the tenderer recommended for award, or any of its personnel, or its agents, or its sub-consultants, subcontractors, service providers, suppliers or their employees, has, directly or indirectly, engaged in a prohibited practice in competing for the contract in question; and

      (ii) cancel the undisbursed portion of the loan allocated to a contract (and require reimbursement of the disbursed portion of the loan allocated to the contract) if it determines at any time that representatives of the Recipient or of a recipient of any part of the proceeds of the loan engaged in a prohibited practice during the procurement, administration or implementation of the contract in question; and

   (b) requires that a clause be included in tender documents and in contracts financed by the Bank loan, requiring tenderers, suppliers and contractors, and their subcontractors, agents, personnel, consultants, service providers, or suppliers, to permit the Bank (and a co-financier undertaking an investigation pursuant to paragraph 6.1 of the Bank's Procurement Instructions for Recipients) to inspect all accounts, records, and other documents relating to the submission of tenders and contract performance, and to have them audited by auditors appointed by the Bank.

Final Tender Document for Works

(Two-Envelope Tendering Process Without Prequalification)

Procurement of:

Contract Package C-5: Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for:

(i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942;

(ii) Design & Construction of viaduct from km 20.942 to km 24.844;

(iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and

(iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844.

Summary

Specific Procurement Notice (SPN)

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Summary Table

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Section VII-1: General

EMPLOYER'S REQUIREMENTS – GENERAL

1 Project Profile and Background.

1.1 General

State of Haryana is strategically located bordering the National capital of Delhi. NCT, Delhi shares three fourth of its border with Haryana alone and remaining with Uttar Pradesh. The development of Haryana region, bordering Delhi is very important for balanced growth of NCR as it acts as buffer zone against rampant migration and other support infrastructure. At present on account of growth of Metro network in Delhi & NCR, there is radial movement of commuters to and from, Delhi being in centre. This "Hub and Spoke" traffic planning has resulted in rapid growth of Noida, Greater Noida, Faridabad and Gurugram. However, for hub and spoke concept to sustain it is necessary to link the ends of spoke by ring connectivity. There will be natural demand for commuter movement within these towns like Gurugram, Faridabad, Ballabhgarh, Palwal, Sohna, Manesar etc. Peripheral roads have been commissioned recently, linking these towns around Delhi but Rail link provides economical, sustainable, eco-friendly and bulk freight transport option. The peripheral Rail link will also help in growth of other cities within the same distance from Delhi like Sonipat, Panipat, and Rohtak. Western DFC originating from Dadri station is passing through Asaoti Station on Delhi- Mathura route, providing connectivity to Haryana Orbital Rail Corridor (HORC). This will also help in easing the pressure on the transport network of Delhi as some of the commuter traffic moving on the radials will get shifted to HORC. Apart from passenger traffic, substantial amount of freight traffic, which is entering the Delhi area of rail network but is not meant to be consumed in Delhi, will also get diverted via this corridor. Apart from this, there are major goods sheds in the heart of Delhi causing endless avoidable traffic jams. The goods sheds in west Delhi are Azadpur, Shakurbasti, Dayabasti, Sabzi Mandi which are located on prime commercial land and are black spots of the urban planning. Previously moving out commercial activity to other states had interstate taxation issues but now with GST in place, there is no reason of not shifting these activities to the peripheral region. In any case, if freight traffic movement through Delhi is restricted, then these goods sheds or alternatives will be serviced via the proposed HORC. Haryana Orbital Rail Corridor (HORC) from Palwal to Sonipat Via Sohna, Manesar, Kharkhoda and Harsana Kalan is to be constructed as an Electrified (1X25kV AC-50Hz) double line track, capable of operating at a maximum train speed of 160 kmph.

1.2 Forest and Environmental Clearance

It is mentioned that for Railway projects no prior environmental clearance is required as per Environment Impact Assessment (EIA) Notification, 2006. *However, as per Ministry of Environment, Forest and Climate Change (MoEF&CC) clarification dated 19.10.2023, forest clearance is required for the Protected Forest portion of Project. List of crossings where Protected Forest clearance is required is given in the Table below:*

S. No.	*Chainage (m)*	*Name of Crossings*	*Type of Structure*	*District*
1.	Ch:-795.733	Gaunchi drain	Bridge No. 4	Palwal
2.	Ch:-592.612	Village road from Prithla to Chaprola	Bridge No. 5	Palwal
3.	Ch:371.033	Dhatir distributary	Bridge No. 10	Palwal
4.	Ch:1696.624	Village road from Alhapur to Kalwaka	Bridge No. 12	Palwal
5.	Ch:2493.015	Chandpur minor canal	Bridge No. 14	Palwal
6.	Ch:3472.548	Village road from Sehrala to Paroli	Bridge No. 16	Palwal
7.	Ch:4373.615	Village road from Jaindapur to Paroli	Bridge No. 18	Palwal
8.	Ch:7753.296	Village road from Khuntpuri to Bhogpur	Bridge No.26	Gurgaon
9.	Ch:8036.354	Gurugram Canal	Bridge No. 28	Gurgaon
10.	Ch:8298.110	Nuh drain	Bridge No. 30	Gurgaon
11.	Ch:10709.675	Permit line from Silani to Karnki	Bridge No. 41	Gurgaon
12.	Ch:11543.518	Palwal Sohna Rewari Road	Bridge No. 45	Gurgaon
13.	Ch:18310.000	Indri distributary	Bridge No. 63	Nuh
14.	Ch:19435.000	Rewasan drain	Bridge No. 67	Nuh
15.	Ch:20184.000	Gurugram Alwar Road	Bridge No. 68	Nuh
16.	Ch:23720	Nuh sub branch	Canal (Nuh-sub Branch)	Nuh
17.	Ch:24085	GA road to Khor Basai	GA Road to Khor Basai	Nuh

Protected Forest clearance will be taken by the Employer which is under process. Aravalli clearance is required between Ch. 24635.000 m to Ch. 24850.000m.

Tree cutting permission is available from Ch:(-)2.296 to Ch:5.547. For remaining portion, tree cutting permission is under process. Permission for cutting of trees wherever required will be obtained by the Employer. Cutting of trees within ROW wherever required for execution of the Works shall be done by the Contractor.

Compensatory plantation is not included in the Scope of Works.

2 DEFINITIONS AND INTERPRETATIONS

In addition to the words and expressions defined in the General Conditions of Contract, further following words and expressions shall have the meaning assigned to them except where the context otherwise requires:

- **"As-Built Drawings"** means those drawings produced by the Contractor and endorsed by its true records of construction of the Permanent Works and which have been given a consent from the Engineer.

- **"As-Built Documents"** mean the set of drawings and documents which are a true record of the construction of the Permanent Works prepared by the Contractor.

- **"CAD Standards"** means requirements for CAD, as specified in the Appendix 9 of Employer's Requirements.

- **"Charted Utilities"** mean identified Utilities listed in Employer's Requirements-Tender Drawings and Documents, which may be affected by the execution of the Works under the Contract.

- **"Cold Joint"** means a joint or discontinuity formed when a concrete surface hardens before the next batch is placed against it, characterised by poor bond unless necessary procedures are observed.

- **Combined Services Drawings" (CSD):** means drawings showing the locations, layouts and sizes of all services including those of other contractors co-ordinated so as to eliminate all clashes.

- **"Construction Phase":** has the meaning identified in the Employer's Requirements - General.

- **"Construction Reference Drawings":** means those drawings referred in the Employer's Requirements - Design in respect of which a Notice has been issued.

- **"Construction Reference Drawings Submission":** means the submission of Construction Reference Drawings representing elements of the Permanent Works and for which the Contractor seeks a Notice.

- **"Contract Spares"** means any Spare Parts recommended by the Contractor for the operation and maintenance of the Permanent Works following the Taking Over of the Works.

- **"Consumables"** means those parts that are not repairable and usually have a relatively short life span.

- **"Critical Path Method"** means a schedule network analysis technique used to determine the amount of scheduling flexibility (the amount of float) on various logical network paths in the project schedule network, and to determine the minimum total project duration.

- **"Definitive Design Submission":** means the submission of documents which comprise the whole or parts of the proposed Definitive Design and for which the Contractor seeks a Notice.

- **"Design Criteria":** means the criteria defined in Employer's Requirements-Design and Outline Design Specifications.

- **"Design Manual":** means the manual to be prepared and submitted by The Contractor as part of the Definitive Design and as described in the Employer's Requirements - Design.

- **"DN Line"** means the down line of the HORC double line track route from Sonipat to Palwal.

- "**Final Design":** has the meaning identified in the Employer's Requirements – Design.

- **"Fixed Structure Gauge":** means the profile related to the designed normal co-ordinated axis of the track into which no part of any structures or fixed equipment may penetrate.

- **"Good For Construction Drawings (GFC)":** Construction Reference Drawings or Working Drawings which have received Notice from the Engineer, shall be endorsed as "Good For Construction Drawings" and will be issued to the Site. Execution of work shall be carried out only as per drawings which have been endorsed as GFC.

- **"Interface Management Plan"** means the plan for all interface issues that may arise during the design, construction, testing and commissioning of the Works, in consultation with the Interfacing Contractors/ Interfacing Parties and the Engineer.

- **"Independent Laboratory"** means a laboratory, submitted by the Contractor to the Engineer for approval, that is free from outside control and not subject to direct or indirect influence or authority of the Employer, the Engineer, or the Contractor

- **"Inspection and Test Plan"** means a document that states inspection and testing requirements and actions provisioned for the Works, related process, Plant, or Materials. It is used to control, check, monitor and record; testing procedures that are required for quality assurance and to achieve the agreed quality requirements for the Works.

- **"Installation Tests"** means the tests to be performed to verify the conformity of completion of an installation/assembly to the design documents approved by the Engineer prior to the start of Commissioning, and they must be successfully completed before the Tests on Completion.

- **"Interface Coordinator"** means the person who has the responsibility, and authority with substantial experience to resolve interface matters to the satisfaction of the Engineer and provide the necessary support team for the Interface Management System as specified in Appendix 5

- **"Interfacing Contractor"** means the Contractor engaged by the Employer or other agencies having an interface issue with the Contractor for the Works.

- **"Interfacing Parties"** comprises the interfacing contractors / consultants / service providers, who are engaged in part of the works, relevant authorities and public utility agency.

- **"Interface Table"** means the table that describes the relationships between the Contractor and Interfacing Contractors / Interfacing Parties and their roles and responsibilities is a key document.

- **"Kick-Off Meeting"** means the meeting held by the Engineer to formally notify all parties concerned under the Contract that the project has commenced and to ensure that every party has a common understanding of

their role from the Commencement Date up until issuance of the Performance Certificate.

- **"Maintenance Manuals"** means the manuals providing detailed instructions for the maintenance of infrastructure and maintenance facilities.

- **"Method Statement"** means a document that states the way a particular work, task, or process along with various associated aspects such as quality, safety, environment protection, time and resources; are planned to be directly controlled by the Contractor or its Subcontractor.

- **"Monthly Progress Meeting"** means the meeting specified under Appendix 7 of the Employer's Requirements.

- **"Monthly Progress Report"** means the report that the Contractor shall prepare and submit to the Engineer.

- **"Nonconformity Report"** means a report documenting non-fulfilment of a requirement, with objective evidence, the location and time of occurrence or detection, and provision for its proper resolution by the concerned responsible.

- **"Notice":** means a Notice of No Objection.

- **"Notice of Objection"** means a category of Engineer's response, issued by the Engineer to the Contractor.

- **"Not Reviewed"** means a category of Engineer's response, issued by the Engineer to the Contractor.

- **"On-Site Laboratory"** means Contractor's own laboratory submitted by the Contractor to the Engineer for approval as specified in Appendix 12 of the Employer's Requirements.

- **"Operation and Maintenance Manuals (O&M Manuals)"** means the manual that will be indicating the provisions which are required for maintenance of various assets created under the Contract by the Employer under their operation phase.

- **"Priority Section"** means the section from Km 49.7 to Km 55.6 of HORC Main line and connectivity line from Manesar station on HORC and Patli station on Delhi-Rewari section of Indian Railway Network.

- **"Programme Analysis Report"** means the report submitted to the Engineer that shall, in narrative format, describe the basis and assumptions used to develop each programme.

- **"Project"** means the project named as "Haryana Orbital Rail Corridor (HORC)".

- **"Project Management Plan"** refers to the plan that will be established by the Contractor for the management of activities related to design, procurement, manufacture, execution/construction, delivery, installation, testing and commissioning.

- **"Project Management Information System"** means a document, information and communication technology system (platform) that is to be implemented by the Contractor so that the management of information between the Contractor, the Employer and the Engineer is efficient, reliable, and secure.

- **"Preliminary Design":** means the submission of documents which comprise the initial stage of the design phase.

- **"Indian Railway"** means the rail tracks of the Indian Railway or any other organization and any ancillary areas of Indian Railway such as the depots, sidings, stations, terminus, traction power stations, etc.

- "**Request for Inspection"** means the form used to give notice by the Contractor to the Engineer.

- **"Railway Representative"** means a person, or persons, nominated by the Employer / Engineer to liaise with the Contractor and the Engineer on matters affecting the operation of Indian Railway.

- **"Tender drawings and Documents"** means the drawings and documents prepared by the Employer for reference purposes only and included in the Tender Documents.

- **"Right of Way"** means the land area of the Project, either acquired by the Employer or for which the Employer has the permission of the Stakeholder to construct the embankment & bridges, etc. over their area.

- **"Environmental, Social, Health and Safety Management Plan"** means the plan in accordance with the requirements of Appendix 13 of the Employer's Requirements.

- "**Safety**" freedom from unacceptable risk of harm.

- **"Site Office"** means Site Office for Employer's/Engineer's Personnel constructed by the Contractor.

- **"Spare Parts"** means those parts which are generally repairable and have normally a service life of several years.

- **"Specification"** has the meaning identified in the Employer's Requirements - General.

- **"Station Yard"** is defined as the section between points at either end of the station which are located 50 m from the outermost points away from the station.

- **"Tertiary Control Points (TCP)"** means the benchmarks provided by the Employer, used to locate & confirm the Right of Way (ROW) and its co-ordinates including levels for the purpose of execution of works.

- **"Three Months Rolling Programme"** means the programme which the Contractor shall prepare and update monthly as per Appendix 6 of the Employer's Requirements.

- **"Three Weeks Rolling Programme"** means the programme which the Contractor shall prepare and update weekly as per Appendix 6 of the Employer's Requirements.

- **"Time Bar Chart",** known as "Gantt Chart" too is a type of bar chart which illustrates a project schedule. i.e. the start and finish dates of the activities and summary elements of a project

- **"Uncharted Utilities"** mean Utilities other than Charted Utilities which are identified during a survey conducted by the Contractor or encountered during excavation/ other works.

- **"UP Line"** means the up line of the HORC double line track route from Palwal to Sonipat.

- **"Utilities"** means the electricity, lighting, traffic control, telephone and/or communication cables, gas, water, sewage and drainage pipes, including all associated protection, supports, ancillary structures, fittings and equipment.

- **"Working Drawing"** means additional drawings developed by the Contractor as necessary to supplement the Construction Reference Drawings and to specify additional details and procedures for construction of the Works, such as shop drawings, fabrication drawings, erection drawings, Temporary Works drawings, bar bending schedules, bar reference drawings, embankment/cutting cross sections. All such drawings shall comply with the requirements of the Contract.

- **"Works Areas"** means the areas of the Site within the Right of Way *of HORC including land in KMP ROW, land in DFC ROW and land in ROW of Road Authority for the Work of construction/ regrading of road of RUB* and any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working area.

- **"Works Programme"** means the time-scaled and resource-loaded critical path network, updated from time to time in accordance with the General Conditions of Contract and Employer's Requirements, depicting activities, durations, sequences and interrelationships that represent the Contractor's work plan, work breakdown, schedule structure for constructing and

completing the Works, distributed over the Time for Completion of the Contract.

- **Abbreviations**

AC	**:**	**Alternating Current**
ACB	**:**	**Air Circuit Breaker**
AIIB	**:**	**Asian Infrastructure Investment Bank**
ALARP	**:**	**As Low As Reasonably Practicable**
ASLI	**:**	**Automatic Safe Load Indicator**
BG	**:**	**Broad Gauge**
BIS	**:**	**Bureau Of Indian Standards**
BOCW	**:**	**Building Or Other Construction Work**
BS	**:**	**British Standards**
CAD	**:**	**Computer Aided Design**
CCTV	**:**	**Closed Circuit Television**
CP	**:**	**Contract Package**
CPCB	**:**	**Centre Pollution Control Board**
CPM	**:**	**Critical Path Method**
CRS	**:**	**Commissioner Of Railway Safety**
CSD	**:**	**Combined Service Drawings**
CV	**:**	**Curriculum Vitae**
DB	**:**	**Distribution Box**
DCN	**:**	**Design Change Notice**
DFC	**:**	**Dedicated Freight Corridor**
DFCCIL	**:**	**Dedicated Freight Corridor Corporation Of India Limited**
DG	**:**	**Diesel Generator**
DGPS	**:**	**Differential Global Positioning System**
DIN	**:**	**Deutsche Industrial Norms**

DL	**:**	**Double Line**
DNP	**:**	**Defect Notification Period**
DPR	**:**	**Daily Progress Report**
DT	**:**	**Down Time**
E&M	**:**	**Electrical & Mechanical**
EIA	**:**	**Environmental Impact Assessment**
ELCB	**:**	**Earth Leakage Circuit Breaker**
EMC	**:**	**Electro Magnetic Compatibility**
EMI	**:**	**Electro Magnetic Interference**
ESHS	**:**	**Environmental, Social, Health And Safety**
FAT	**:**	**Factory Acceptance Test(S)**
FCN	**:**	**Field Change Notice**
FFL	**:**	**Finished Floor Level**
FL	**:**	**Formation Level**
GAD	**:**	**General Arrangement Drawing**
GCC	**:**	**General Conditions Of Contract**
GE	**:**	**Geotechnical Engineering**
GFL	**:**	**Ground Floor Level**
GIS	**:**	**Geographical Information System**
GL	**:**	**Ground Level**
GNSS	**:**	**Global Navigation Satellite System**
GOI	**:**	**Government Of India**
GPS	**:**	**Global Positioning System**
GRC	**:**	**Grievance Redress Committee**
GRM	**:**	**Grievance Redress Mechanism**
HDPE	**:**	**High Density Polyethylene**
HFL	**:**	**Highest Flood Level**

HORC	**:**	**Haryana Orbital Rail Corridor**
HT	**:**	**High Tension**
HV	**:**	**High Voltage**
HVAC	**:**	**Heating, Ventilation And Air Conditioning**
Hz	**:**	**Hertz**
IC	**:**	**Integrated Circuit**
ID	**:**	**Identification**
IMD	**:**	**Integrated Maintenance Depot**
IMP	**:**	**Interface Management Plan**
INR	**:**	**Indian Rupee**
IP	**:**	**Point Of Intersection**
IPS	**:**	**Integrated Power Supply**
IR	**:**	**Indian Railways**
IRC	**:**	**Indian Road Congress**
IRS	**:**	**Indian Railway Standards**
IS	**:**	**Indian Standards**
ISO	**:**	**International Organization For Standardization**
IT	**:**	**Information Technology**
ITP	**:**	**Inspection And Test Plan**
Km	**:**	**Kilometre**
kV	**:**	**Kilo Volt**
LAN	**:**	**Local Area Network**
LCD	**:**	**Liquid Crystal Display**
LCX	**:**	**Leaky Coaxial Cable**
LED	**:**	**Light Emitting Diode**
LT	**:**	**Low Tension**

LV	**:**	**Low Voltage**
LWL	**:**	**Lowest Water Level**
MC	**:**	**Municipal Corporation**
MCB/LV	**:**	**Miniature Circuit Breaker / Low Voltage**
MCCB	**:**	**Moulded Case Circuit Breaker**
MDR	**:**	**Major District Roads**
MOR	**:**	**Ministry Of Railway**
MPR	**:**	**Monthly Progress Report**
MQR	**:**	**Monthly Quality Report**
MS	**:**	**Method Statement**
MSDS	**:**	**Material Safety Data Sheet**
MSL	**:**	**Mean Sea Level**
NABL	**:**	**National Accreditation Board For Testing And Calibration Laboratories**
NCR	**:**	**Nonconformity Report**
NFPA	**:**	**National Fire Protection Association**
NGO	**:**	**Non-Governmental Organization**
NH	**:**	**National Highway**
NHAI	**:**	**National Highway Authority Of India**
NOC	**:**	**No Objection Certificate**
NONO	**:**	**Notice Of No Objection**
NONOC	**:**	**Notice Of No Objection With Comments**
NOO	**:**	**Notice Of Objection**
NR	**:**	**Not Reviewed**
O&M	**:**	**Operation And Maintenance**
OCS	**:**	**Overhead Catenary System**
ODR	**:**	**Other District Roads**

OEM	**:**	**Original Equipment Manufacturer**
OFC	**:**	**Optical Fibre Cable**
OHE	**:**	**Over Head Electrification**
OHSAS	**:**	**Occupational Health And Safety Assessment Series**
OHTL	**:**	**Over Head Transmission Lines**
PCC	**:**	**Particular Conditions Of Contract**
PDF	**:**	**Portable Document Format**
PHA	**:**	**Preliminary Hazard Analysis**
PMIS	**:**	**Project Management Information System**
PPE	**:**	**Personal Protective Equipment**
PR	**:**	**Public Relation**
PS	**:**	**Particular Specifications**
PVC	**:**	**Polyvinyl Chloride**
PWD	**:**	**Public Works Department**
QA	**:**	**Quality Assurance**
RAMS	**:**	**Reliability, Availability, Maintainability And Safety**
RAP	**:**	**Resettlement Action Plan**
RCC	**:**	**Reinforced Cement Concrete**
RDSO	**:**	**Research Designs And Standards Organization**
RFI	**:**	**Request For Inspection**
RFO	**:**	**Rail Fly Over**
RINL	**:**	**Rashtriya Ispat Nigam Limited**
RL	**:**	**Reduced Level**
ROB	**:**	**Road Over Bridge**
ROW	**:**	**Right Of Way**

RUB	**:**	**Road Under Bridge**
S&T	**:**	**Signalling And Telecommunication**
SAIL	**:**	**Steel Authority Of India Limited**
SAT	**:**	**System Acceptance Test**
SCADA	**:**	**Supervisory Control And Data Acquisition**
SH	**:**	**State Highway**
SI	**:**	**International System Of Units**
SL	**:**	**Single Line**
SM	**:**	**Station Master**
SOD	**:**	**Schedule Of Dimensions**
SP	**:**	**Sectioning Post**
SRR	**:**	**Submission Review Request**
SSP	**:**	**Sub-Sectioning Post**
TSS	**:**	**Traction Substation**
UG	**:**	**Under Ground**
UPS	**:**	**Uninterrupted Power Supply**
USB	**:**	**Universal Serial Bus**
UTM	**:**	**Universal Transverse Mercator**
VN	**:**	**Variation Notice**
WGS84	**:**	**World Geodetic System 84**
WHO	**:**	**World Health Organization**
WQMP	**:**	**Works Quality Management Plan**

3 RELEVANT DOCUMENTS

The Design Criteria shall be read in conjunction with the General Conditions of Contract (GCC), the Particular Conditions of Contract (PCC), the Employer's Requirements, the drawings and any other document forming part of the Contract.

In case of conflict in Design Criteria in various Sub-Sections of Section VII, Employer's Requirement the order of precedence shall be as follows :

CIVIL

- Outline Design Specifications (ODS)-Civil & BLT,
- Outline Construction Specification (OCS)-Civil & BLT,
- Tender drawings,
- Employer's Requirements - Functional,
- Employer's Requirements -Design (Civil & BLT) ,
- Employer's Requirements- Construction (Civil & BLT),
- Employer's Requirements- General,
- Employer's Requirements- Appendices,
- Indian and other International Standards referenced herein,
- Indian and other International Standards.

All relevant RDSO Standards/drawings required by the Contractor for performance of its obligations under the Contract shall be obtained by the Contractor at their own cost from the office of RDSO. RDSO drawings can also be purchased online from RDSO website.

4 PHASES (DESIGN AND CONSTRUCTION)

a) The Contractor shall execute the Works in two phases, the Design Phase and the Construction Phase.

b) The Design Phase shall commence upon the date of Letter of Acceptance (LOA). This phase shall include the preparation and submission of:

i. the Preliminary Design,

ii. the Definitive Design;

iii. The Construction Reference Drawings.

iv. The Design Phase will be complete upon the issue of a Notice in respect of the comprehensive and complete Construction Reference Drawings Submission for the whole of the Permanent Works.

c) The requirements for the Preliminary Design, Definitive Design and Construction Reference Drawings are stated in Clause 2 of the Employer's Requirements -Design.

d) The Construction Phase for the whole or a part of the Permanent Works shall commence immediately upon the issue of a Notice by the Engineer/Employer in respect of the relevant Construction Reference Drawings Submission. Such Notice may be issued by the Engineer in respect of a Construction Reference Drawing Submission covering a major and distinctive part of the Permanent Works. However, construction shall not be commenced until the appropriate Working Drawings have been endorsed:

(a) by the Contractor as "Good for Construction"; and

(b) by the Engineer that he has no objections to the drawing.

The Construction Phase shall include the completion and submission of the Final Design and the preparation and submission of the As Built Drawings and other records as specified.

e) Notwithstanding Clause *4 (b) (iv)* above, for those elements identified under Clause *2.6* of the Employer's Requirements - Design, the Construction Phase may commence immediately upon the issue of the Notice in respect of the Definitive Design Submission in respect of each such element subject to availability of the site in accordance with agreed programme.

f) The Contractor shall furnish Contractor's Warranty in the format approved by the Employer given in Section X – Contract Forms.

5 SPECIFICATIONS

In accordance with the provisions of these Employer's Requirements (Section VII-1 to Section VII-9), the Contract Specification contained in the Contract shall be developed during the design stage and submitted as part of the Definitive Design Submission. When the Specification has received a Notice of No Objection from the Engineer, it shall become the Particular Specifications and shall take precedence over the other Specifications for construction purposes.

6 SPECIFICATIONS IN METRIC AND IMPERIAL UNITS

a) The Contract shall utilise the SI system of units. Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.

b) Conversion between metric units and imperial units shall be in accordance with the relevant Indian Standards.

7 WORKS PROGRAMME

a) The Key Dates are defined in Appendix 2 to these Employer's Requirements.

b) The Contractor shall prepare and submit its Works Programme and three-month rolling programmes and the detailed requirements contained in Appendix 6 to these Employer's Requirements.

c) In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for co-ordinating and completing the design, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Interfacing Contractors, the review procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or licence is required prior to the execution of any work.

d) The Works Programme shall take full account of the Design Submission Programme.

8 MONITORING OF PROGRESS

a) Project Monitoring shall be done by Project Monitoring and Information System (PMIS). The contractor has to prepare Primavera P6 schedule as per the Programme Requirements provided in Appendix 6.

b) The Contractor shall submit to the Engineer three copies (along with an additional copy in digital format) of a Monthly Progress Report (MPR), as described in Appendix 7 to these Employer's Requirements, describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.

c) The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed in the current month.

d) The MPR shall be divided into two sections. The first section shall cover progress and current status relating to design and the second section shall cover progress and current status relating to construction.

e) A monthly meeting to monitor & review the progress of the project shall be convened by the Engineer. Contractor's site Representative & Designer Representative of Contractor and site representative of all Interfacing Contractors shall also attend the meeting. The Employer may also be present in the meeting.

f) The Engineer or Employer may also conduct progress review meetings and Interface meetings on weekly /bi-weekly intervals depending upon the requirements or urgency of works. In these review meetings Engineer may call Contractor's Supplier/Sub-Contractor/Designer etc. as per the requirements.

9 QUALITY ASSURANCE

The Contractor shall establish and maintain a Quality Assurance System in accordance with Appendix 11 to these Employer's Requirements for design and construction procedures and the interfaces between them. This Quality Assurance system shall be applied without prejudice to, or without in any way limiting, any Quality Assurance Systems that the Contractor already maintains.

10 DELETED

11 CO-ORDINATION WITH INTERFACTING CONTRACTORS

11.1 General

a) The Contractor is responsible for detailed co-ordination of his design and construction activities with Interfacing Contractors. Such co-ordination responsibilities of the Contractor shall include the following:

i. To provide all information reasonably required by the Interfacing Contractors in a timely and professional manner to allow them to proceed with their design or construction activities, and specifically to meet their contractual obligations.

ii. To ensure that the Contractor's requirements are provided to all other Interfacing Contractors before the cut-off dates to be identified in the Interface Management Plan (IMP).

iii. To obtain from the Interfacing Contractors information reasonably required to enable the Contractor to meet the design submission dates as identified in Appendix 2.

iv. Where the execution of the work of the Interfacing Contractors depends upon the site management or information to be given by the Contractor, the Contractor shall provide to such Interfacing Contractors the services or correct and accurate information required to enable them to meet their own programme or construct their work.

v. To attend regular co-ordination meetings convened by the Engineer with the Interfacing Contractors. The Contractor shall conduct separate meetings with the Interfacing Contractors as necessary to clarify particular aspects of the interfacing requirements of the Works. The

party who convenes the meeting shall prepare minutes recording all matters discussed and agreed at the meeting.

vi. To ensure that copies of all correspondence, drawings, meeting minutes, programmes, etc. relating to the Contractor's co-ordination with the Interfacing Contractors are issued to all concerned parties and the Engineer no later than two (2) calendar days from the date of such correspondence and meetings.

b) The Contractor, shall in carrying out his co-ordination responsibilities, raise in good time and provide sufficient information for the Engineer to decide on any disagreement between the Contractor and the Interfacing Contractors as to the extent of services or information required to pass between them. If such disagreement cannot be resolved by the Contractor despite having taken all reasonable efforts, then the decision of the Engineer shall be final and binding on the Contractor.

c) Where an Interfacing Contract is yet to be awarded the Contractor shall proceed with the co-ordination activities with the Engineer until such time when the Interfacing Contractor is available. The Contractor shall provide the Interfacing Contractor with all information necessary to enable the Interfacing Contractor to follow-on and proceed with their co-ordination.

d) The cut-off dates to be identified in the IMP are the latest dates. Any claim of additional costs by the Interfacing Contractors as a result of the Contractor's failure in adhering to these dates shall be borne by the Contractor. The Contractor shall note that the information exchange is an iterative process requiring the exchange and update of information at the earliest opportunity and shall be carried out on a regular and progressive basis so that the process is completed for each design stage by the cut-off dates.

e) The Contractor shall co-ordinate with the Engineer on all matters relating to works that may affect the Operation & Maintenance of the already operational Section corridor of the of Employer in general. Such work shall be subject to the rules and regulations imposed by the Employer.

11.2 Design Interface

a) The dates shown in Employer's Requirements Appendix 2 are critical to the timely completion of the project. The Contractor shall commence design interface with the Interfacing Contractors as soon as he has been notified by the Engineer that such Interfacing Contract has been awarded. In the case of utility agencies and other statutory boards, interface shall commence as soon as it is practicable. Where no design interface date has been established whether because the Interfacing Contractor(s) have not been identified or for whatever reason, the Contractor shall liaise with such Interfacing Contractor/s as soon as they have been awarded.

b) The Contractor shall immediately upon award of the Contract gather all necessary information and develop his design to a level where meaningful interaction can take place as soon as the Interfacing Contracts are available. The Contractor shall submit together with each of his Design Submissions a joint statement from the Contractor and the relevant Interfacing Contractor confirming that design co-ordination has been completed and that they have jointly reviewed the appropriate document to ensure that a consistent design is

being presented.

c) The design interface is an iterative process requiring regular exchange and update of interfacing information. The Contractor shall ensure that the information he requires from the Interfacing Contractors is made known at the outset of each design interface and vice versa so that the information can be provided in time for the Contractor and the Interfacing Contractors to complete their design to meet their various design submission stages.

11.3 Construction Interface

a) Construction interface will be necessary throughout the duration of the Works commencing from the time the Contractor mobilises to the Site to the completion of the Works. Construction interface will overlap design interface, involving cast-in and buried items such as pipes for electrical and mechanical services, supports, brackets, plinths, ducts, service buildings, openings, cableways, trenches etc. that are to be incorporated at the early stage of the construction up to provision of attendance during the testing and commissioning stage.

b) The Contractor shall ensure that there is no interference with the Works of the Interfacing Contractors and shall maintain close co-ordination with them to ensure that his work progresses in a smooth and orderly manner. The Contractor shall carry out and complete the Works, or any part thereof, in such order as may be agreed by the Engineer or in such revised order as may be requested by the Engineer from time to time. The Contractor shall, unless otherwise provided, be liable for and shall indemnify the Employer against all costs, charges, expenses and the like resulting from failure of the Contractor to co-ordinate the Works as specified.

12 SURVEY AND SITE INVESTIGATIONS

a) The datum used for the Contract shall be Mean Sea Level Datum.

b) The Contractor shall carry out all further site investigations (such as detailed utility identification, detailed geo technical investigation) necessary for the design of the Permanent Works and to enable the determination of the methods of construction and the nature, extent and design of the Temporary Works.

c) The Contractor shall carry out geotechnical investigation using conventional method of boreholes and geo-physical methods for the entire alignment.

13 CLIMATIC CONDITIONS

a) The entire section of HORC with connecting IR Station is situated in the state of Haryana. During summer months the temperature can be as high as 45°C with a high level of humidity, nights can be relatively cool with temperatures dipping to 30°C. Torrential rains and high humidity accompany the monsoon in late June to early September. In the winter months temperatures can vary from a high of 21°C during day to a low of 2°C during night.

b) The information given above is only indicative. The contractor shall obtain detailed climatic data in respect of minimum & maximum temperatures, rain, relative humidity, sunshine, and wind velocity/pressure etc. from "India Meteorological Department publications" and the same shall be taken into account by the Contractor when designing any part of the Permanent Works.

The Contractor shall ensure that due allowance is made for more severe local conditions when Permanent Works are required to operate, for example, with restricted ventilation that may lead to higher local ambient temperatures, and any other factors that may affect the operating environment in any way.

c) Unless specific figures are provided elsewhere, the Permanent Works will generally be required to function at its rated value with the values of ambient temperature and relative humidity appropriate to the location of the equipment within the classifications shown in Table given below. Certain parts of the Permanent Works may need to be rated for more or less onerous conditions as required by the PS.

d) The Contractor's attention is drawn to the more severe environmental conditions that may exist during the construction/installation period and shall take adequate measures to protect the Permanent works against any deleterious effects of such conditions during the time between installation and final completion of the project. Also, Air throughout the project will contain considerable moisture content, hence the permanent works shall be tropicalized and vermin proof.

14 PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

The Employer is using SPEED (Systematic Program Evaluation for Efficient Delivery of Project) software for Project Management. The Contractor shall use the SPEED Software for Project Management which will be made available by the Employer to the Contractor free of cost. Necessary *Training in software for Contractor's staff will be arranged by the Employer.*

The Contractor shall develop Work Breakdown Structure of the Works Programme specified in Appendix 6 of Section VII-9: Appendices in Primavera suiting to the Work Breakdown Structure of SPEED.

The Contractor's application for payment shall be submitted through Billing module of SPEED Software.

The Contractor shall process and update all data related to Project and progress monitoring viz., Progress updates, RFI(s), NCR and NCN compliances etc. through SPEED Software.

15 CONTRACTOR'S PROJECT ORGANISATION

a) The Contractor shall have a competent team of Managers, Engineers, Technical staff etc so as to complete the work satisfactory as per various requirements of the Contract.

b) The designations of the various project organisations team members shall be got approved by the Engineer before adoption so as to avoid any duplication of the designations with those of the Employer or the Engineer.

16 CONTRACTOR'S CERTIFICATE

The Contractor shall provide his registration details for GST Registration, EPF registration, ESI registration, Statutory Certificate, Certificate as per ESHS Manual etc. as required for the execution and completion of the Works.

Section VII: Employer's Requirements

Section VII-2: Functional

EMPLOYER'S REQUIREMENTS – FUNCTIONAL

Objective

The objective of the Contract is the design, construction, testing and commissioning of the permanent works by the Contractor (including without limitation, the design, construction and removal of the Temporary Works) and the rectification of defects appearing in Permanent Works in the manner and to the standards and within the time obligations, liabilities and risks which may be involved, the Contractor shall undertake the execution of the Works.

1. GENERAL

1.1 The Works to be executed under Package C-5 is for design and construction of civil works and General Electrical Services work as per Employer's Requirements on 'Design Build' basis. All information available with the Employer has been furnished in Section VII-Tender Drawings and Documents, Part 2, Employer's Requirements. The Works are to be designed by the Contractor. Any other site data and information required for design *and execution* of the Works shall be collected (through tests or otherwise), arranged, produced by the Contractor at his own cost. No claim from the Contractor whatsoever shall be entertained on the ground of certain information not being furnished in the Contract. The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Employer's Requirements – Functional.

1.2 The design of the Permanent Works shall be developed in accordance with these Employer's Requirements – Functional and other requirements of the Contract.

1.3 The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date good engineering practices. The Specifications shall in no case specify standards which, in the Engineer's opinion, are less than or inferior to those described in the Outline Design Specifications (ODS) - Civil & BLT and Outline Construction Specifications (OCS) -Civil & BLT. Construction shall be carried out employing the procedures established by the Contractor as per approved Quality Assurance and Quality Control plan and Environmental, Social, Health and Safety (ESHS) Plan.

1.4 The Contractor shall be responsible for obtaining all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies in the design and construction of the Works at his own cost.

1.5 Employer's Requirements- Functional shall be read in conjunction with Employer's Requirements- Design, Construction, Outline Design Specifications (ODS)- Civil & BLT, Outline Construction Specifications (OCS) -Civil & BLT, General Electrical Services, S&T *Works* and other requirements of the Contract. The price quoted by the Contractor shall *include* cost of Works as per Part 2-Employer's Requirements (General, Functional, Design- Civil & BLT, Construction - Civil & BLT, Outline Design specifications (ODS) - Civil & BLT, Outline Construction Specifications (OCS) - Civil & BLT, General Electrical Services, *S&T Works*, Tender Drawings and Documents and Appendices).

1.6 Jurisdictional Sketch of Civil works under C-5 package is given in Section VII-8: Tender Drawings and Documents, Part 2, Employer's Requirements.

2. SCOPE OF WORK

2.1 Scope under Lump Sum Price Schedule 'A'

2.1.1 The Lumpsum Scope of Work in brief is given below but the scope also includes all other requirements stipulated in various parts/sections of the Contract Document including Appendices and Annexures. The through Chainages mentioned in the Scope of the Works/Tender drawings can undergo some minor corrections, without any impact on the overall length/Scope of the Works.

2.1.2 Design of the Works

i. Schedule 'A'

a) Design and drawings of all items of the Works under Schedule 'A' shall be carried out by the Contractor and the payment for the same is included in Cost Centre 'CD' of Schedule 'A'.

b) Design and drawings of all the temporary works, temporary road diversion shall also be carried out by the Contractor and the payment for the same is included in Cost Centre 'CD' of Schedule 'A'.

ii. Schedule 'B'

a) Design and drawings of all items of the Works under Schedule 'B' shall be carried out by the Contractor and the payment for the same is included in Cost Centre 'CD' of Schedule 'A'.

b) Design and drawings of all the temporary works, temporary road diversion shall also be carried out by the Contractor and the cost for the same is deemed to be included in the rates quoted for the relevant item of Schedule 'B' unless otherwise specified in the Contract.

iii. Payment matrix

Payment matrix for design of bridges, viaduct, temporary diversions, permanent diversions, widening of existing roads, restoration of existing roads *and diversion of canals / nallah* is given in **Annexure F-7.**

2.1.3 Design and construction of railway formation

2.1.3.1 The Contractor shall design and construct railway formation for 32.5 t axle load as per updated RDSO Specifications "Comprehensive Guidelines and Specifications for Railway Formation-Specification No. RDSO/2020/GE: IRS-0004, (Including ACS No-01 dated 16.12.2021)" from Chainage -855.0 m to Chainage 12000 m and from Chainage 18000 m to Chainage 20942.473 m for double tracks of Main line as per Employer's Requirements and shall include earthwork in cutting/filling, subgrade, prepared subgrade and blanketing including mechanical compaction. The Contractor shall arrange borrow areas for earthwork in embankment at his own cost.

2.1.3.2 Excavated earth (approximately 2.0 lakh cum) from C-4 Package (herein after called the Employer's earth) *which will be* available between Chainage 18,000 m to 20,000 m shall be

utilised *by the Contractor* for construction of formation in C-5 Package. *Measurement of the Employer's earth shall be taken by recording cross-section of the formation after compaction.* A deduction @ INR 225.0 per cum shall be made from the Cost Centre 'CE-Earthwork and Blanketing' for use of Employer's earth. *Royalty, if any, for use of Employer's earth will be reimbursed to the Contractor on submission of proof of royalty payment. However, all other taxes payable, if any, for use of Employer's earth shall be borne by the Contractor.*

2.1.3.3 Formation width in station yards (i.e. from platform end to a distance of 200m beyond outermost SRJs on both up and down sides at both ends of station) shall be increased by 1.0m XXX to lay cables and other utilities.

2.1.3.4 Formation at Chainage 7860 to 8036 (176m), Chainage 8036 to 8298 (262m) & Chainage 9650 to 9890 (240m) passes through pond/waterlogged stretches. In all such stretches, before undertaking earthwork in formation, minimum 500 mm thick layer of coarse sand (Zone I, II & III as per IS:383) shall be provided at bottom of embankment after dewatering by providing suitable arrangement like bunding etc. and removing slush/mud. Depression/ditch shall be filled with earth up to a distance beyond toe equal to H (height of embarkment) or ROW, whichever is less. A toe wall of boulder filled in crates shall be provided at the end of earth filling as shown in Tender drawings.

2.1.4 Design and construction of slope protection work

The slope of embankment/cuttings shall be protected by vegetative cover comprising perennial turf forming grass in accordance with Section VII- 6 Outline Construction Specifications (OCS)-Civil & BLT. On embankments higher than 4 m, vegetative cover shall be provided using coir netting as per IS:15869, IS:15872 and IRC: 56.

After Taking Over the Works, the Contractor shall maintain slopes of embankment/cutting and vegetative cover for a period of one (01) year and shall make good any loss/damage to formation and vegetative cover due to rain cuts, pedestrian movement or any other reason.

2.1.5 Design and construction of drainage system on embankments by providing precast RCC drains on berms, chute drains & sumps

The Contractor shall design and construct precast RCC longitudinal drains on berms of embankments to collect surface runoff from the slope. Precast RCC chute drains shall be provided at approximately every 50 m for collecting water from drains on berms and discharging it safely away from toe of embankments as shown in the Tender drawings. RCC collecting chambers shall be provided at the junction of longitudinal berm drains and chutes.

After Taking Over the Works, the Contractor shall maintain drainage system on embankments including sump, drain on berms, chutes etc. for a period of one (01) year and shall make good any damage to the drainage system due to rain cuts, pedestrian movement or any other reason.

2.1.6 Design and construction of Viaduct with Ballastless track

The Contractor shall design and construct viaduct *with Ballastless Track (BLT) with derailment guards and Long Welded Rails (LWR)* for *UP and DN line* from Chainage 20942.473 m to Chainage 24843.548 m, including *supply of rails, track fittings/fastenings system and welding complete in all respects. P*rotection works on viaduct approaches at A1 *shall be provided* as

per Employer's Requirements. *The* Contractor shall carry out RSI analysis *for providing LWR on viaduct*.

Superstructure of proposed viaduct shall consist of *composite girders of RDSO* standard span *length* of 24.4m*, 30.5m and 45.7m* with *minimum* 1.0 m wide pathway *on outside of UP & DN line tracks as shown in Tender drawings*.

Substructure of proposed viaduct shall *be provided with deep* foundation at locations shown in Tender drawings. Open foundation may be permitted, *only at locations* shown in Tender Drawings, subject to availability of sufficient bearing capacity as per GT investigations duly approved by the Engineer.

Design and construction of abutment A2 is not in the scope of C-5 Package. However, the Contractor shall make design data available to C-4 contractor for design and construction of abutment A2.

The work also includes supply of spare track fittings/fastenings and maintenance of Ballastless track for a period of three years after start of traffic as per Employer's Requirements - Outline Design Specifications (ODS) – Civil & BLT.

C-5 Contractor shall provide holding down bolts with washers, nuts, locknuts and template on viaduct piers, for each line, at the locations given by the SYS-1 Contractor. The design and specification of (a) holding down bolts i.e length, dia, thread part, material composition, washers, nuts, locknuts, galvanisation etc. and (b) template i.e length, breadth, thickness, hole location, material composition, galvanisation etc. shall be given by SYS-1 Contractor to C-5 Contractor. C-5 Contractor shall arrange the material and install the same on viaduct piers for OHE mast/portals in coordination with SYS-1 Contractor.

C-5 Contractor shall provide anchor bolts for OHE guy rod arrangement on the viaduct deck slab at the locations supplied by the SYS-1 Contractor. SYS-1 Contractor shall provide design details and material composition etc. of GI anchor bolts of guy rod arrangement to C-5 Contractor. C-5 Contractor shall arrange the anchor bolts of guy rod arrangement and install the same on viaduct deck slab for OHE in coordination with SYS-1 Contractor.

2.1.7 Design and Construction of *Transition from* Ballastless Track *to Ballasted Track* on *A-1 Approach of Viaduct*

The Contractor shall design and construct *transition from* ballastless track to *ballasted track on A-1 approach of* including *supply of rails, track fittings/fastenings system, welding into LWR* complete in all respect on abutment A1 side approach.

The Chainage of 20.842 Km for the design and construction of Ballastless track given in the Name of Work is only an indicative chainage. The actual chainage will be based on the design of transition from Ballastless Track to Ballasted Track on A-1 Approach of Viaduct.

2.1.8 Design and construction of minor bridges

The Contractor shall design and construct minor bridges (RUBs, canal and waterway bridges) including protection works on bridge approaches and height gauges at all RUBs as per

Employer's Requirements. List of minor bridges is given in **Annexure-F-1.** Approach road on both sides of RUBs shall be designed *by the Contractor. The Contractor shall construct RCC road* upto ROW of HORC for full clear width of RUB. *Construction of approach road work beyond ROW of HORC shall be paid under Schedule 'B'*. Design and construction of permanent diversion at RUBs shall be carried out by the Contractor, as shown in the Tender drawings or wherever required. In bridges over canals, RCC lining *of canal over soil* shall be designed & constructed by the Contractor upto ROW of HORC. Payment matrix for various items incidental to bridges is given in **Annexure F-7.** Drainage arrangement shall be designed and constructed at RUBs where road level in the RUB is below natural ground level.

2.1.9 Design and construction of major bridges

The Contractor shall design and construct major bridges (RUBs, canal and waterway bridges) including protection works on bridge approaches and height gauges at all RUBs as per Employer's Requirements. List of major bridges is given in **Annexure- F-2/1**. Approach road on both sides of RUBs shall be designed *by the Contractor.* In case of RUB major bridges with RCC box, t*he Contractor shall construct RCC road* upto ROW of HORC for full clear width of RUB. *Construction of approach road work beyond ROW of HORC shall be paid under Schedule 'B'*. Design and construction of permanent diversion at RUBs shall be carried out by the Contractor, as shown in the Tender drawings or wherever required. In bridges over canals, RCC lining *of canal over soil* shall be designed & constructed by the Contractor upto ROW of HORC. Payment matrix for various items incidental to bridges is given in **Annexure F-7.** Drainage arrangement shall be designed and constructed at RUBs where road level in the RUB is below natural ground level.

LWR shall be provided on major bridges. The Contractor shall carry out RSI analysis of major *b*ridges *wherever required* to cater to the effect of providing LWRs in design of bridges.

C-5 Contractor shall provide holding down bolts with washers, nuts, locknuts and template on piers of major bridge (having multiple spans with overall span length of more than 25m), for each line, at the locations given by the SYS-1 Contractor. The design and specification of (a) holding down bolts i.e length, dia, thread part, material composition, washers, nuts, locknuts, galvanisation etc. and (b) template i.e length, breadth, thickness, hole location, material composition, galvanisation etc. shall be given by SYS-1 Contractor to C-5 Contractor. C-5 Contractor shall arrange the material and install the same on major bridge piers for OHE mast/portals in coordination with SYS-1 Contractor. The above items shall also be provided on piers of major bridge (having multiple spans with overall span length of more than 25m) included in Schedule "B". Payment of these items is deemed to be included in Schedule 'A' under Cost Center 'CB.2'.

2.1.10 Design and construction of stations

The Contractor shall design and construct three new stations namely Prithla, Silani & IMT Sohna.

i. Prithla station

This is a crossing station with four tracks, two end platforms, a double storey station building, RCC portico etc as shown in Tender drawings.

ii. Silani Station

This is a halt station having only two tracks, two end platforms, *t*icket *b*ooking *o*ffice building, RCC portico etc as shown in Tender drawings.

iii. IMT Sohna

This is a crossing station with four tracks, two end platforms, a double storey station building, RCC portico, *S&T hut on both ends of station yard*, etc as shown in Tender drawings.

The items of works to be carried out at various stations are shown in **Annexure F-3.** Two subways shall be constructed at Prithla, Silani & IMT Sohna stations each as shown in Tender drawings. The list of subways is shown in **Annexure F-5.** The *W*orks at stations shall be carried out in accordance with Tender drawings, Outline Design specifications (ODS) – Civil & BLT, Outline Construction Specifications (OCS) - Civil & BLT and other requirements of the Contract.

2.1.11 ***Design of formation from chainage (-) 2296 m to (-) 855 m***

Design of formation from chainage (-) 2296 m to (-) 855 m as per Sub-Clause 2.1.3.1 of Section VII-2, Employers Requirement – Functional.

2.1.12 Design and application of water proofing system

Design and application of water proofing system in subway at three stations i.e, Prithla, Silani and IMT Sohna as per the Employer's Requirements.

2.1.13 Design and construction of MS pipe in embankment

Design and construction of Mild Steel pipe of *minimum* 323.9 mm outer diameter in the embankment at approximately 500m interval (except in station yards) for crossing utilities in future as shown in Tender drawings.

2.1.14 Design of Auto Location Hut (ALH):

Design of *4* Nos. Auto Location Huts along the alignment between km 0 to km 25.0 as per Tender drawings**.** Floor level of the Auto Location Hut shall be at least 300 mm above the formation level. Construction of Auto Location Huts shall be paid under Schedule 'B'.

2.1.15 Design of approach road *at stations*

Design of concrete *station* approach road at Prithla, Silani and IMT Sohna stations including retaining/RE wall, footpath, ramp drain etc as shown in Tender drawings. Construction of road, retaining/RE wall, footpath, ramp, drain etc shall be paid under schedule 'B'.

2.1.16 Design of prefabricated/precast cable duct

Design of prefabricated/precast cable duct of 300mm x 300mm internal size, with RCC cover, for laying of S&T cables in station yards buried under formation. The top of duct cover shall be minimum 690 mm below the formation level. The duct shall be designed with chamber of size 1200mmX1200mmX1500mm depth with a lid and locking arrangement at suitable interval, not more than 500m along the duct and at each track crossing location. Construction

of precast duct and chamber shall be paid under schedule 'B'. *Cable route plan for ducts shall be provided by SYS-2 Contractor.*

2.1.17 Design of precast/cast in situ RCC longitudinal drains

Design of precast/cast in situ RCC longitudinal drain of required capacity with suitable slope and outfall at *locations* where HORC embankment overlaps with DFC embankment to safely cater the surface runoff from the slopes of HORC embankment and DFC embankment. Construction of precast/cast in situ RCC drain shall be paid under Schedule 'B'. *The outfall of drains shall be at the nearest bridges on HORC alignment.*

2.1.18 Design of precast and cast in-situ retaining walls

Design of precast and cast in-situ retaining walls for retaining formation slope along the alignment *between New Prithla and Prithla stations* at locations given in **Annexure F-4**. Construction of these retaining walls shall be paid under Schedule 'B'.

2.1.19 Design of bridges *including* protection works included in Schedule ' B'

Design of bridges including protection works as mentioned in **Annexure F-6.** In major bridge Nos. 17, 28, 45 & 68 superstructure shall also be designed for *BLT with* LWR. In case, the Employer/Engineer decides to adopt *design of* standard RDSO span, the design of superstructure of above bridges shall not be done by the Contractor and shall be deleted from the scope of the work. Construction of these bridges shall be paid under Schedule 'B'.

2.1.20 Design of minor works at stations not included in Schedule 'A'

Design of minor works at stations like circulating area, land scaping etc. shall also be carried out by the Contractor. Construction of above-mentioned items shall be paid under Schedule 'B'.

2.1.21 Design of Staircase in Viaduct

Design *and drawing* of Staircase in viaduct at interval of 500 m in staggered manner on Up and Down tracks to evacuate the passengers in case of emergency. Construction of stair case shall be paid under Schedule 'B'.

2.1.22 Traffic management

Traffic management along the work site including construction works required in connection with traffic management like road works, footpaths, drains and other services etc. and repair and maintenance of these construction works during construction period. Any road widening / diversion along with associated drainage system required to facilitate the movement of traffic and their repair & maintenance shall also be carried out by the Contractor. It also includes reinstatement of land/structure/roads/services etc. to original condition wherever road diversion has been made outside original road including reconstruction of structure demolished for traffic management. Materials and other specification related to traffic control devices shall conform to IRC standards.

2.1.23 Barricading

The Contractor shall provide and maintain during progress of works barricading around the work area where vehicular or pedestrian traffic passes with all safety measures as shown in Tender drawings. The excavations near habitations/public movement areas and all works along the roads shall be provided with proper caution signs and marked with red lights, reflectors at night to avoid accidents near public places to ensure safety of public.

2.1.24 Reinstatement/Restoration of roads and services

Reinstatement/Restoration of roads and services *within and outside of ROW* with new material of similar specification as per codal requirement after completion of work for the area disturbed by the Contractor during construction activities. However, reinstatement of roads and its drainage system will be as per current standards being used by the roads/service owning agency for similar roads. Proper survey to be done before dismantling of any of the above services along with extensive photographs, videos & sample of these services by the Contractor & get it verified by the Engineer so as to ascertain the extent of these existing services and its specification.

2.1.25 There is possibility of some of the items not getting mentioned in the above list of works. Tenderers are requested to go through the Tender drawings also in details as the works listed in Clause 2.1 above as well as indicated in the Tender drawings would be considered inclusive in the scope of work under lump sum quoted price except the items mentioned in Sub-Clause 2.2, 2.3 and 2.4 below unless specified otherwise in the Contract. Engineer's decision shall be final in this regard in case of dispute.

2.1.26 The work content against the lump sum component of the work i.e. Schedule 'A' shall also include, but not be limited to, the following:

a) Site Clearance *as per Sub-Clause 10.14 of Appendix 10, Section VII-9: Appendices, Part 2-Employer's Requirements* or as directed by the Engineer;

b) True and proper setting out and layout of the Works, benchmarks and provision of all necessary labour, instruments and appliances in connection therewith as specified or as directed by the Engineer;

c) All aspects of quality assurance including testing of materials as per the approved Inspection and Test Plan and other components of the work as specified or as directed by the Engineer;

d) Day to day cleaning of worksite throughout the execution period;

e) Maintenance of the completed Works during the period as specified or as directed by the Engineer;

f) Submission of completion (i.e., 'As-Built') drawings 06 (Six) sets in A-1 size and all other related documents as specified including scanned (in .pdf) and AutoCAD copy with soft copies in both formats of all As-built drawings & documents.

g) Preparing Definitive Design, Construction Reference drawings, Good For Construction (GFC) drawings and working drawings for various components of the *W*orks and obtaining approval in respect thereof from the Engineer, inclusive of

incorporation of all modifications, alterations, changes, etc. that may be required to be carried out as directed by the Engineer;

h) Compliance of requirements of Environmental, Social, Health and Safety (ESHS) Manual as per Appendix 13 of Employer's Requirements, Section VII-9: Appendices.

i) Results of sub-surface investigations conducted at project site are enclosed with the Tender documents. This information about the soil and sub-soil water conditions is being made available to the Contractor in good faith and the Contractor shall have to obtain the details of sub-soil parameters independently. There are certain locations where weak sub-soil exist. Tentative location of weak subsoil stretches for formation has been given in ODS. Contractor shall be required to take necessary action for ground improvement. No claim whatsoever on account of any discrepancy/variation about the soil parameters and sub soil water conditions that may be actually encountered at the time of execution of the work and those given in these Tender Documents shall be *payable* to the Contractor under any circumstances.

2.1.27 Other Works under Lump Sum

The Interface Management Document as per Appendix- 5 of Employer's Requirements shall also be complied with**.**

2.1.28 Safety of adjoining structures of DFC

Alignment is passing adjacent to DFC Tracks. The Contractor shall ensure that the design and construction of the Works *shall* be carried out with adequate measures for the safety & protection of DFC or any other nearby structures. Construction activities shall be planned without affecting the operations of the existing system. It shall be ensured that no damage is caused to any element/person/ property of these systems. The Engineer/ Employer shall be indemnified against any damage caused to such structures at no extra cost.

2.1.29 Associated Works

Works to be performed shall also include all general works, preparatory works for the construction and works of any kind necessary for the design and satisfactory construction, completion and maintenance of the *W*orks to the intent and meaning of the drawings adopted and Outline Construction Specifications (OCS) - Civil & BLT , to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the execution of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

2.1.30 Land for Contractor's Facilities & Site Office

For batching plants, field quality control laboratories, site offices and other activities (excluding labour camps), land total measuring approx. 20,000 Sq. m will be made available at multiple locations between km 0 to km 12.00 and km 18.00 to km 24.84 by the Employer on 'as is where is basis' free of cost. This land shall be made good for such offsite activities as needed by the Contractor at no extra cost to the Employer. Any land required beyond the above area will have to be arranged by the Contractor at his own cost. The land shall be cleared from debris, all structures made by the Contractor including RCC footings and rafts etc. and reinstated to the line, level and to the same conditions as existed before the work started before handing over back to the Employer within 91 days after Taking over Certificate. The final bill shall be released to the Contractor after all structures from the Contractor facility and site office are removed & *cleared* of site. The cost of setting up of all the above-mentioned facilities & the office and reinstatement of site is included in lump sum price in Schedule 'A'.

2.1.31 *Design of Permanent Diversion of Canal*

Design of permanent diversion of canal/drain/nallah *at bridges included in Annexure F-1, F-2 and F-6 as shown in Tender drawings. Construction of permanent diversion of canal shall be paid in Schedule 'B'.*

2.2 Scope under BOQ Schedule 'B'

Under this Schedule, the Contractor is required to carry out works which are not covered in Schedule 'A'. Broadly following works shall be carried out under this Schedule 'B':

a) Construction of railway formation from Chainage (-) 2296 m to Chainage (-) 855 m for connecting single track *between* Prithla Station and New Prithla Station (DFC)

b) Construction of cast in-situ retaining walls along the embankment at locations as given in **Annexure F-4** *as shown intender drawings. There shall be retaining wall at DFC New Prithla yard between HORC track and DFC Prithla SSP. The cross feeder gantry at SSP location shall be suitably modified by SYS-1 Contractor. There is space constraint at DFC Prithla SSP and retaining wall shall have to accommodate cross feeder gantry structure OHE foundation. C-5 Contractor shall coordinate with SYS-1 Contractor and shall provide the integrated retaining wall housing the cross feeder gantry structure OHE foundation as per the approved drawings given by the SYS-1 Contractor.*

c) Construction of bridges including slope protection on bridge approaches and height gauge *drawings* mentioned in **Annexure F-6** *as shown intender drawings*.

d) Construction of Ballastless *T*rack *(BLT)* on major bridges *(OWG)* Nos. 17, 28, 45 & *68* including supplying & fixing rails and fittings complete in all respect. *This shall also include* transition from ballastless track to ballasted track on approaches & derailment guard.

e) Construction of stairs in viaduct at interval of 500 m in staggered manner.

f) Construction of permanent diversion of canal/drain/nallah at bridges included in Annexure F-1, F-2 and F-6 as shown in Tender drawings

g) *Earthwork in excavation and c*onstruction of precast S&T cable ducts of 300mmX300mm internal dimensions with RCC cover and chambers in station yards *as shown in Tender drawings*. The top of duct cover shall be minimum 690 mm below the formation level. The Chamber shall be 1200 mmx 1200 mm x1500 mm (depth) size, with a lid & locking arrangement, shall be provided at suitable interval not more than 500m along the duct and at each track crossing location. The design of cable ducts is included in Schedule 'A'. *Cable route plan for ducts shall be provided by SYS-2 Contractor.*

h) Construction of *station* approach road including RE wall/Retaining wall, foot path, ramp, drain etc at Prithla, IMT Sohna and Silani Stations.

i) Construction of circulating area at Prithla, IMT Sohna and Silani Stations.

j) Construction of precast/cast in-situ RCC longitudinal drain of required capacity with outfall arrangement where HORC embankment overlaps with DFC/KMP embankment to safely cater the surface runoff from the slopes of HORC embankment and DFC/KMP embankment.

k) Earth filling in station area near the circulating area to improve drainage etc.

l) Construction of 4 Nos. Auto location Huts (ALH) at approximate chainage 4350 m, 7950 m, 10950 m & 24843 m.

m) Any other item as directed by the Engineer related to the work.

2.3 Scope under Schedule 'C' (General Electrical Services works)

Under this Schedule, the Contractor is required to carry out General Electrical Services works. Detailed Scope of Works is given in Section VII-7A: General Electrical Services, Part 2- Employer's Requirements.

2.4 Scope under Schedule 'D' (Signalling and Telecommunication works)

Under this Schedule, the Contractor is required to carry out Signalling & Telecommunication (S&T) works. Detailed Scope of the Works is given in Section VII-7B: Signalling & Telecommunication (S&T) Works, Part 2- Employer's Requirements.

2.5 REFERENCE TO THE STANDARD CODES OF PRACTICE

2.5.1 All Standards, Outline Construction Specifications (OCS) - Civil & BLT, Technical Specifications and Codes of Practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Standard Codes of practice, *viz* IRS, IS, IRC, UIC, *etc* as applicable.

2.5.2 Wherever Indian Standards do not cover some particular aspects of design/ construction, relevant International Standards will be referred to. The Contractor shall make available at site such standard codes of practice.

2.5.3 In case of discrepancy among Standard codes of practice and Section VII-6: Outline Construction Specifications (OCS) -Civil & BLT, the order of precedence shall be as given below:

a. Outline Design Specifications (ODS) - Civil & BLT

b. Outline Construction Specifications (OCS) - Civil & BLT.

c. Standard Codes of Practice. In case of discrepancy among Standard Codes of Practice, the order of precedence will be

   i. IRS,

   ii. IS,

   iii. IRC,

   iv. other International codes

d. Indian Railway Unified Standard Specifications,

e. CPWD specifications,

f. NBC 2016,

g. MORTH Specification for Road & Bridges

2.6 DIMENSIONS

As regards errors, omissions and discrepancies in Specifications and *Tender d*rawings, relevant clause of Particular Specification will apply. The levels, measurements and other information concerning the existing *S*ite as shown on the conceptual / layout drawings are believed to be correct, but the Contractor shall verify them for himself and examine the nature of the ground as no claim or allowance whatsoever shall be entertained on account of any errors or omissions in the levels or strata turning out different from what is shown on *Tender* drawings.

2.7 INSPECTION

The Employer may appoint an independent agency to ensure the quality checking of design, supply, fabrication, erection and construction of all works under scope of work. Payment to the independent agency shall be made by the Employer separately. The Contractor shall ensure complete co-operation with the agency to perform their work satisfactorily. In addition, the Employer also reserves right to undertake quality check and inspection directly by itself.

2.8 ALIGNMENT OF TRACKS

2.8.1 The alignment *of tracks* shall be as shown in the Tender drawings. The alignment has been developed by the Employer to meet operational and technical criteria. The Contractor is not required to evaluate the alignment for compliance with these criteria but shall review it with respect to his own design and construction proposals and shall satisfy himself that it suites to the available land width and there is no conflict with the clearances at proposed structures.

2.8.2 The Contractor is permitted to propose minor deviations in alignment to suit his construction proposals, but he must demonstrate that any such deviations shall comply with good design

practice and the alignment requirement of the *d*esign *c*riteria. Such deviations shall require prior approval of the Employer subject to following conditions:

i. There is no extra cost to the *E*mployer.

ii. Changes proposed are essentially required to suit the *C*ontractor's specific design.

iii. There is no change at the *C*ontract boundaries or if there is any, the same is agreed by the Contractor of the adjoining section without any extra cost to the *E*mployer**.**

2.8.3 The ground levels shown in Conceptual Alignment Plan & L-Section Tender drawings are based on preliminary survey. Detailed survey *shall* be carried out by the Contractor for confirming and preparation of final Alignment Plan & L-Section. *No claim by the Contractor* shall be *entertained on account of* any variation in the ground levels with respect to ground levels shown in conceptual Alignment Plan & L-Section *T*ender drawings.

2.9 DURABILITY AND MAINTENANCE

The *p*ermanent Works shall be designed and constructed such that, if maintained reasonably, they shall endure in a serviceable condition throughout their minimum *life* as described in Section VII-5: Outline Design Specifications (ODS) – Civil & BLT. The *p*ermanent Works shall be designed and constructed so as to minimise the cost of maintenance whilst not compromising the performance characteristics and ride quality of the railway.

2.10 OPERATIONAL REQUIREMENTS

a) The vertical and horizontal alignments for the main and connectivity line shall comply with the conditions laid in para 2.8 above.

b) During construction the Contractor shall be responsible for providing and maintaining adequate flood protection to ensure protection of the *W*orks.

2.11 ENVIRONMENTAL CONSIDERATIONS

All provisions and conditions contained in the Environmental, Social, Health and Safety (ESHS) Manual as per Appendix 13 shall be strictly complied with *by the Contractor*.

2.12 TRAFFIC MANAGEMENT

The Contractor shall carry out the Works so as to minimise disruption to road and pedestrian traffic. The Contractor shall prepare his traffic management plan based on his proposed construction methodology in co-ordination with the Engineer and in conjunction with the concerned road authority as per Appendix 10. He shall comply strictly with the approved plan during construction of his works.

2.13 CRS INSPECTION

The Contractor shall note that the Commissioner for Railway Safety (CRS) will inspect the Works from time to time for the purpose of determining whether the HORC Project complies with the terms of operational and infrastructural safety in accordance with the Laws of India. The Contractor shall note that CRS approval is mandatory for commissioning the system. Notwithstanding other provisions of the Contract, the Contractor shall ensure that the Works comply with the requirements of CRS in terms of construction to the drawings and shall make all necessary arrangements and assist the representatives of the Employer and CRS in carrying out their inspection duties and also comply with their instructions regarding rectifying any defects and making good any deficiencies. *The* Contractor shall prepare and make available all drawings, documents, sketches, photographs etc. as required for submission of application for inspection of CRS as instructed by the Engineer.

2.14 STANDARDS

Equipment, materials and systems shall be designed, manufactured and tested in accordance with the latest issue of National and/or International codes and standards. The Contractor shall submit hard copies in original to the Engineer of all codes and standards used for the work.

Reference to standards or to materials and equipment of a particular manufacturer shall be regarded as followed by the words "or equivalent". The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified. If the Contractor for any reason proposes alternatives to or deviations from the specified standards, or desires to use materials or equipment not covered by the specified standards, the Contractor shall apply for the consent of the Engineer. The Contractor shall state the exact nature of the change, the reason for making the change and relevant specifications of the materials and equipment in English language. The decision of the Engineer in the matter of quality *shall* be final.

ANNEXURE-F-1
(Ref. Sub-Clause 2.1.8)

LIST OF MINOR BRIDGES**

S. No.	Br. No.	*Chainage (m)	Type of Crossing	Type of Bridge	SPAN	No. of Tracks
					No. x L (in m) x H (in m)	
1.	6	-574.471	Balancing Culvert	RCC Box	1x2.0x2.0	2
2.	7	-252.537	RUB	RCC Box	1x4.6x5.65	4
3.	9	139.953	RUB	RCC Box	1X4.6X4.15	4
4.	10	371.033	Canal + RUB	RCC Box	1X5.2X5.0+ 1X4.7X5.0	4
5.	11	958.395	RUB	RCC Box	1X4.6X4.15	2
6.	13	2034.964	RUB	RCC Box	1X4.6X4.15	2
7.	14	2493.015	RUB+ Drain	RCC Box	2X5.2X4.15	2
8.	15	3153.203	Balancing Culvert	RCC Box	1X2.0X2.0	2
9.	18	4373.615	RUB	RCC Box	1X9.75X6.7	2
10.	19	4858.791	RUB	RCC Box	1X4.6X4.15	2
11.	20	4891.994	Balancing Culvert	RCC Box	1X2.0X2.0	2
12.	21	5340.100	RUB	RCC Box	1X4.6X4.15	2
13.	22	5807.675	RUB	RCC BOX	1X4.6X4.15	2
14.	23	6409.986	Balancing Culvert	RCC BOX	1X3.0X3.0	2
15.	24	6881.539	RUB	RCC Box	1X4.6X4.15	2
16.	25	7548.546	RUB	RCC BOX	1X4.6X4.5	2

S. No.	Br. No.	*Chainage (m)	Type of Crossing	Type of Bridge	SPAN	No. of Tracks
					No. x L (in m) x H (in m)	
17.	27	7941.374	Balancing Culvert	RCC BOX	1X2.0X2.0	2
18.	29	8141.419	Balancing Culvert	RCC BOX	1X2.0X2.0	2
19.	31	8593.734	Balancing Culvert	RCC BOX	1X4.0X3.0	2
20.	32	8891.591	Balancing Culvert	RCC BOX	1X4.0X3.7	2
21.	33	9293.620	RUB	RCC BOX	1X7.0X4.15	2
22.	35	9591.677	Balancing Culvert	RCC BOX	1X2.0X2.0	2
23.	38	10090.792	Balancing Culvert	RCC BOX	1X3.0X3.0	2
24.	40	10410.702	RUB	RCC BOX	1X8.4X5.15	2
25.	42	10907.894	Balancing Culvert	RCC BOX	1X2.0X2.0	2
26.	43	11203.249	RUB	RCC BOX	1X4.6X5.65	2
27.	44	11403.443	Balancing Culvert	RCC BOX	1X2.0X2.0	2
28.	64	18558.000	RUB	RCC Box	2X6.0X4.0	2
29.	65	18735.000	Balancing Culvert	RCC Box	1X2.0X2.0	4
30.	67	19435.000	Canal	RCC Box	2x7.5x7.5	4

Notes:

1. *Chainages start from Prithla station of HORC.
2. **Payment of bridges in Annexure F-1 will be made in Cost Centre 'CB'-Bridges under lumpsum Schedule 'A'.
3. There can be minor change in span arrangement to suit site conditions. Nothing extra shall be payable to the Contractor on this account.
4. Deep foundation shall be provided at *bridge Nos. 38, 40, 44, 64 & 67* as shown in *T*ender drawings. Type of foundation at other locations shall be decided as per design requirements.

ANNEXURE-F-2
(Ref. Sub-Clause 2.1.8)

ANNEXURE-F-2/1

LIST OF MAJOR BRIDGES**

A. Bridges other than Viaduct

S. No.	Bridge No.	*Chainage (m)	Type of Crossing	Type of Bridge Super structure	Span Arrangement	No. of Tracks
1.	5	-592.612	ROAD	RCC Box	1x12x6.10	2
2.	12	1696.624	RUB	PSC U SLAB	1x12.2	2
3.	16	3472.548	RUB	RCC Box	1x12.0x6.10	2
4.	26	7753.296	RUB	RCC Box	1x12.0x6.10	2
5.	34	9536.901	IOCL Pipeline	Composite Girder	1X24.4	2
6.	41	10709.675	RUB	RCC BOX	1X12.0X5.65	2
7.	69	20400.000	Sub-station	Composite Girder + PSC U slab	1x12.2+2x18.3+1x12.2	2

Note:

1. *Chainages start from centre line of Prithla station of HORC.
2. **Payment of bridges in Annexure F-2/1 will be made in Cost Centre 'CB'-Bridges under lumpsum Schedule 'A'.
3. There can be minor change in span arrangement to suit site conditions. Nothing extra shall be payable to the Contractor on this account.
4. Deep foundation shall be provided at locations shown in Tender drawings. Type of foundation at other locations shall be decided as per design requirements.

ANNEXURE-F-2/2

(Ref. Sub-Clause 2.1.6)

B. Viaduct**

S. No.	Bridge No	*Chainage (m)	Type of Crossing	Type of Bridge Superstructure	Span Arrangement	No. of Tracks
1.	70	20942.473 to 24843.548	Viaduct	Composite Girder	107x24.4+1x30.5+41x24.4+1x29.5+1x12.2 (UP Line) & 107x24.4+1x30.5+41x24.4+1x46.1+1x12.2 (DN Line)	2

Note:

1. *Chainages start from centre line of Prithla station of HORC.
2. **Payment of Viaduct in Annexure F-2/2 will be made in Cost Centre 'CV- Viaduct under lumpsum Schedule 'A'.
3. There can be minor change in span arrangement to suit site conditions. Nothing extra shall be payable to the Contractor on this account.
4. Deep foundation shall be provided at locations shown in Tender drawings. Type of foundation at other locations shall be decided as per design requirements.

ANNEXURE-F-3

(Ref. Sub-Clause 2.1.10)

List of items of works to be carried out at stations under Schedule 'A'

S. No	Item	Prithla	Silani	IMT Sohna
1	**Station Building**			
	a) Station Building.	1 No.	Ticket Booking Office	1 No.
	b) S & T huts.	-.	-	*2 Nos.*
2	***High Level* Platforms -**			
	a) Earthwork in filling above formation level,	2 Nos. *each* 600m *long* *(as shown in Tender drawings)*	02 No. *each* 425m *long* *(as shown in Tender drawings)*	2 Nos. *each* 600m *long* *(as shown in Tender drawings)*
	b) *C*ast in-situ RCC platform face wall.	*2 Nos. each 600m long* *(as shown in Tender drawings)*	*02 No. each 425m long* *(as shown in Tender drawings)*	*2 Nos. each 600m long* *(as shown in Tender drawings)*
	c) Surfacing of platform with VDC, RCC precast coping, tactile tiles, precast fencing at end platforms.	For entire area of platform.	For entire area of platform.	For entire area of platform.
	d) PF Shelters	2 x 20m on each PF	2 x 20m on each PF	2 x 20m on each PF
	e) Mini PF Shelters	4 Nos. on each PF	4 Nos. on each PF	4 Nos. on each PF
	f) Passenger amenities-			
	i) Toilet blocks.	01 No. on each PF	01 No. on each PF	01 No. on each PF
	ii) Drinking water booths at platforms.	5 Nos. on each PF	5 Nos. on each PF	5 Nos. on each PF

S. No	Item	Prithla	Silani	IMT Sohna
	iii) Seating arrangement (Stainless steel).	48 Nos. seats on each PF	24 Nos. seats on each PF	48 Nos. seats on each PF
	g) Two HDPE pipes on platforms for laying Electrical and S&T cables.	*All Stations*		
3	a) Subway for inter-platform transfer *including* covered stairs & ramps to platforms *covered with self supported roof*, flooring, dado, wall cladding, water proofing, drainage, complete in all respects.	2 Nos.	2 Nos.	2 Nos.
	b) Lift Well & space for escalator	-	-	2 Nos.
4	**Water supply system-**			
	a) *Tube well with minimum 15000 litres/hr yield*, pump house and *overhead gantry*.	Yes	Yes	Yes
	b) Underground RCC water storage tank. (litres)	50,000	50,000	50,000
	c) Overhead RCC water storage tank. (litres)	20,000	20,000	20,000

S. No	Item	Prithla	Silani	IMT Sohna
	d) Water supply distribution system complete from borewell to *station* building and platforms.	Yes	Yes	Yes
5	**Drainage & Sewerage system-**			
	i) Platform drainage.	Yes	Yes	Yes
	ii) Station Yard drainage *as shown in Tender drawings.*	Yes	Yes	Yes
	iii) Sewerage system.	1 No. septic tank for 50 users at each PF; 1 No. septic tank for 100 users for station building.	1 No. septic tank for 50 users at each PF.	1 No. septic tank for 50 users at each PF; 1 No. septic tank for 100 users for station building.
6	**Miscellaneous Work –**			
	a) Station name board at station building and at platform ends.	Yes	Yes	Yes
	b) Platform number boards at each platform.	Yes	Yes	Yes
	c) RCC portico at entrance to subway	Yes	Yes	Yes

Note: The above requirements must be read in conjunction with Employer's Requirement mentioned in Section VII-5: Outline Design Specifications (ODS) Civil & BLT and Section VII-6: Outline Construction Specifications (OCS) Civil & BLT .

Annexure-F-4

[Ref. Sub-Clause 2.2 b)

Approximate Details of Retaining Wall Along Formation *Between New Prithla (DFC) and Prithla Station* Under Schedule 'B'

Connectivity Line (LHS) along the formation				
S. No.	Chainage (m)		Length (m)	Approx. Height (m) Above ground level
	From	To		
1.	-1900	-1840	60	2.50
2.	-1840	-1720	120	6.00
3.	-1720	-1600	120	1.50
4.	-1600	-1480	120	2.00

ANNEXURE-F-5

(Ref. Sub-Clause 2.1.10)

LIST OF SUBWAYS AT STATIONS**

S. No.	Bridge No.	*Chainage (m)	Type of Crossing/Station	Type of Bridge	SPAN	No. of Tracks
					No. x L (in m) x H (in m)	
1	8	-145.0	Pedestrian Subway/ Prithla	RCC Box	1x6x3.15	4
2	8A	55.0	Pedestrian Subway/ Prithla	RCC Box	1x6x3.15	4
3	39	10240.0	Pedestrian Subway/ Silani	RCC Box	1x6x3.15	2
4	39A	10440.0	Pedestrian Subway/ Silani	RCC Box	1x6x3.15	2
5	66	18985.0	Pedestrian Subway/ IMT Sohna	RCC Box	1x10x3.15	4
6	66A	19185.0	Pedestrian Subway/ IMT Sohna	RCC Box	1x10x3.15	4

Note:-

1. *Chainages start from Prithla station of HORC
2. * *Payment of above subways *shall* be made in Cost Centre 'CS'-Stations under lumpsum Schedule 'A'.

ANNEXURE-F-6
(Ref. Sub-Clause 2.2 c)

LIST OF BRIDGES UNDER SCHEDULE 'B'

ANNEXURE-F-6/1

1) LIST OF MINOR BRIDGES

S. No.	Br. No.	*Chainage (m)	Type of Crossing	Type of Bridge	SPAN No. x L (in m) x H (in m)	No. of Tracks
1	1	-1950.000	Drain	RCC pipe	1x1.2	1
2	2	-1832.759	Road + Balancing Culvert	RCC Box	(1x2.50x5.05) + (1x3.6x5.05)	1
3	3	-1312.056	Road	RCC Box	1x4.6x5.65	1
4	36	9882.453	Balancing Culvert	RCC BOX	1X2.0X2.0	2
5	37	9894.460	RUB	RCC BOX	1X5.7X4.15	2

***Note**:*

1. **Chainages start from centre line of Prithla station of HORC.*
2. *Payment for design of bridges in Annexure F-6/1 will be made under Lumpsum Schedule 'A'.*
3. *Payment for construction of bridges in Annexure F-6/1 will be made under BOQ Schedule 'B'.*
4. *There can be modifications in span arrangement to suit site conditions. Payment shall be made as per actual quantities executed.*

ANNEXURE-F-6/2

2) LIST OF MAJOR BRIDGES

S. No.	Bridge No.	*Chainage (m)	Type of Crossing	Type of Bridge	Span Arrangement	No. of Tracks
1.	4	-795.733	Canal + Road	CG + RCC Box	(1x 8 x 7.5) + (1x24.4) + (1x8x7.5)	2
2.	17	4256.298	RUB	OWG	4X30.5	2
3.	28	8036.354	Canal	OWG+CG	1x18.3+2x30.5 +1x18.3	2
4.	30	8298.110	RUB+ Drain	Composite Girder	1X30.5	2
5.	45	11543.518	NH71B RUB	OWG	2X76.2	2
6.	63	18310.000	Drain	PSC U Slab+ RCC Box	1x5x4.9+1x12. 2+1x5x4.9	2
7.	68	20184.000	RUB + Canal	OWG	2 x 61.0	2
8.	53#	14472.112	Stream	CG	2 x 24.4	2

Note:

1. *Chainages start from centre line of Prithla station of HORC.
2. *Payment for design of bridges in Annexure F-6/2 will be made under Lumpsum Schedule 'A'.*
3. Payment for construction of bridges in Annexure F-6/2 will be made under BOQ Schedule 'B'.
4. #*F*abrication, erection *& launching* of composite steel superstructure including bearings of *Br. No. 53 is included in the scope of Contract Package C-5*. Construction of substructure is included in the scope of *C-4 Contract*.
5. There can be *some modifications* in span arrangement to suit site conditions/ *stakeholders requirement*. Payment shall be made as per actual quantities executed.
6. Deep foundation shall be provided at locations shown in Tender drawings. Type of foundation at other locations shall be decided as per design requirements.
7. *Span arrangement of Br. No. 45 is tentative and may change.*

Annexure F-7

[Ref. Sub-Clause 2.1.2, Sub-Clause 2.1.31, Sub-Clause 2.2 (f), Annexures F-1, F-2 and F-6]

Payment matrix for Design of Bridges, Viaduct, Temporary diversions, Permanent diversions, widening of existing roads and Restoration of existing roads for C5 package.

Sr No	Activity	Minor bridges in Annexure F-1 included in Schedule 'A'	Major bridges in Annexure F-2 included in Schedule 'A'	Subways at stations in Annexure F-5 included in Schedule 'A'	Bridges in Annexure F-6 included in Schedule 'B'
	Number of bridges covered	30	8	06	13
i.	a. Submission *and approval* of design of permanent works, permanent diversion and regrading of roads and submission of As Built drawings and documents	Included in Cost Centre 'CD' of Price Schedule A	Included in Cost Centre 'CD' of Price Schedule A	Included in Cost Centre 'CD' of Price Schedule A	Included in Cost Centre 'CD' of Price Schedule A
	b. Design of Temporary works and temporary diversion/widening of roads	Included in Cost Centre 'CD' of Price Schedule A	Included in Cost Centre 'CD' of Price Schedule A	NA	Included in quoted rates of relevant items under Schedule-B
ii.	*Construction of all permanent works as shown in Tender drawings*	*Included in Cost Centre 'CB' of Price Schedule A*	*Included in Cost Centre 'CB' of Price Schedule A*	*Included in Cost Centre 'CS' of Price Schedule A*	*Included in quoted rates of relevant items under Schedule-B*
iii.	Construction of temporary diversions, if any, including additional land (if any required beyond ROW) for constructing the same	Included in quoted lumpsum cost of works under Schedule A	Included in quoted lumpsum cost of works under Schedule A	NA	Included in quoted rates of relevant items under Schedule-B

Sr No	Activity	Minor bridges in Annexure F-1 included in Schedule 'A'	Major bridges in Annexure F-2 included in Schedule 'A'	Subways at stations in Annexure F-5 included in Schedule 'A'	Bridges in Annexure F-6 included in Schedule 'B'
	Number of bridges covered	30	8	06	13
iv.	Construction of permanent diversions and re-grading *of roads*, if any required	Included in quoted lumpsum cost of works under Schedule A	Included in quoted lumpsum cost of works under Schedule A.	NA	Will be paid separately under Schedule -B
v.	Widening of existing roads (within HORC ROW)	Included in quoted lumpsum cost of works under Schedule A	Included in quoted lumpsum cost of works under Schedule A	NA	Included in quoted rates of relevant items under Schedule-B
vi.	Restoration of existing roads damaged during construction activities	Included in quoted lumpsum cost of works under Schedule A	Included in quoted lumpsum cost of works under Schedule A	NA	Included in the rates quoted under Schedule-B
vii.	*Design of permanent diversion of Canal/Drain/ Nallah*	*Included in Cost Centre 'CD' of Price Schedule A*	*Included in Cost Centre 'CD' of Price Schedule A*	*NA*	*Included in Cost Centre 'CD' of Price Schedule A*
viii.	*Construction of permanent diversion of Canal/Drain/ Nallah*	*Will be paid separately under Schedule-B*	*Will be paid separately under Schedule-B*	*NA*	*Will be paid separately under Schedule-B*

ANNEXURE F-8

(*Ref. Sub-Clause 7.3.17 of Section VII-6: OCS (Civil & BLT))*

LIST OF TRACK FITTINGS

LIST OF MATERIALS FOR 1 SET OF H- BEAM SLEEPER.

S. No.	DESCRIPTION OF PARTS	DRAWING NO.	SPECIFICATION	Nos.
1	H-BEAM (ISHB 200X200) 2655 mm LENGTH	BASED ON R.D.S.O./B-1636/4/R	BS :45, IS :4759	1
2	M.S BASE PLATE	R.D.S.O./T-8760	IS.2062-2011	2
3	RAIL PAD WITH EMBEDDED STEEL PLATE	R.D.S.O./T-8761	IRS. SPECIFICATION FOR 10mm. THICK G.R. PAD (PROVISIONAL-1989) & STEEL AS PER PROVISIONAL-2019	2
4	SPL.CAST LINER (INNER)FOR 60KG RAIL	R.D.S.O./T-8762	IRS. SPECIFICATION PROVISIONAL -2019	2
5	SPL.CAST LINER (OUTER)FOR 60KG RAIL	R.D.S.O./T-8763	IRS. SPECIFICATION PROVISIONAL -2019	2
6	ELASTIC RAIL CLIP MK III	RDSO/T-3701	IRS T-31-2018	4
7	TAPPER WASHER (FOR GUARD RAIL)	R.D.S.O./T-5161	IS.226-1962	4
8	TAPPER WASHER (FOR GUARD RAIL)	R.D.S.O./T-5162	IS.226-1962	4
9	SINGLE COIL SPRING WASHER	R.D.S.O./T-10773	IRS T-42-1988	4
10	6mm GROOVED RUBBER PAD (FOR GUARD RAIL)	R.D.S.O./T-5163	IRS. SPECIFICATION FOR 6mm. THICK G.R. PAD (PROVISIONAL-1989)	4
11	305X300X25/30mm ELASTOMERIC PAD	R.D.S.O./B-1636/5	REV.-02 Dt-26/11/2012	2
12	TAPERED SPLIT PIN	CE's NO.22994/8	IS.226-1962	8
13	Φ28 HOOK BOLT347mm Length and 2 Nos NUT & 3 Nos. Washer	BASED ON R.D.S.O./B-1636/5	IS.226-1962	4
14	PACKING PLATE FOR GUARD RAIL 150mmX22mmX75mm		IS.226-1962	4
15	BOLT & NUT FOR GUARD RAIL	R.D.S.O./T-5164	IRS T-10-1968	2

Note: The above list excluding Sr No.1, 2 & 14 will be considered equal to 1 set of spare fittings. The Contractor shall supply spare set of fittings for 10% quantity of H Beam sleepers under NS Item No. 17 of Schedule 'B'.

Section VII: Employer's Requirements

Section VII-3: Design (Civil & BLT)

EMPLOYER'S REQUIREMENTS – DESIGN (CIVIL & BLT)

1 INTRODUCTION

1.1 The Employer's Requirements - Design specifies the procedural requirements for the preparation of the design of the Permanent Works. These requirements are subdivided into those that are to occur during the Design Phase, those that are to occur during the Construction Phase, and those that are of general application.

1.2 In addition to the express requirements herein, the Contractor shall, whenever the Engineer so requests, provide information and participate in discussions that relate to design matters.

1.3 The Contractor shall engage the Designer who shall undertake and prepare the design of the Permanent Works and Temporary Works. The Contractor shall place his core design team at Gurgaon.

1.4 The Contractor shall ensure presence of Design team at Gurgaon at all times by staff whose seniority and experience are to the satisfaction of the Engineer and whose representative is available on the Site as necessary or as required by the Engineer.

1.5 The Contractor shall submit his Quality Assurance Plan as required at **Appendix 11** for the design required by the Contract.

1.6 The Contractor shall furnish Designer's Warranty in the format approved by the Employer.

1.7 The Design and Construction Standards shall be in conformity with the requirements of "Rules for Opening of a Railway or a Section of a Railway for Public Carriage of Passengers" and to the satisfaction of the Commissioner of Railway Safety whose sanction is mandatory for commissioning of the System.

2 REQUIREMENTS DURING DESIGN PHASE

2.1 The principal requirements of the Design Phase are the production of the Preliminary Design and General Arrangement Drawings, the Definitive Design and the Construction Reference Drawings.

2.2 Preliminary Design and General Arrangement Drawings

The Preliminary Design shall define the main structural elements. In addition, General arrangement drawing, general construction methods and documentation needed to develop the Definitive Design shall be submitted.

2.3 Definitive Design -Bridges, Viaduct, BLT and other Civil structures

2.3.1 Definitive Design shall be the design developed to the stage at which all elements of the structures are fully defined and specified and in particular:

a) Calculation and analysis are complete;

b) All main and all other significant elements are delineated;

c) All tests and trials and all selection of materials and equipment are complete;

d) Shall take full account of the effect on the Permanent Works of the proposed methods of construction and of the Temporary Works.

e) Interface Management Plan (IMP).

2.3.2 During the preparation of the Definitive Design, the Contractor shall complete all surveys, investigations and testing necessary to complete the design of the Permanent Works.

2.4 The Contractor shall sub-divide the proposed Definitive Design into Design Packages to be submitted in advance of the Definitive Design Submission and to be identified in the Design Submission Programme. The Design Packages are to relate to the significant and clearly identifiable parts of the proposed Definitive Design and shall address the design requirements as described herein. The Design Packages shall facilitate the review and understanding of the Definitive Design as a whole and shall be produced and submitted in an orderly, sequential and progressive manner.

2.5 Separate Definitive Design Submissions may be prepared for those major elements to be procured by sub-contract and which sub-contracts include design. Where such work is to be procured by the Contractor on the basis of outline design, design briefs and performance specifications, such documents may be submitted as Definitive Design Submissions.

2.6 Upon issue of the Notice in respect of the Definitive Design Submission, the Contractor shall complete the design in all respects and produce the Construction Reference Drawings, the purpose of which is to illustrate all the Permanent Works and to be the drawings governing construction.

2.7 Construction Reference Drawings shall fully detail for the construction of the elements covered by the Definitive Design and shall show in full the works to be constructed.

3 REQUIREMENTS DURING CONSTRUCTION PHASE

3.1 The principal requirements relating to design during the Construction Phase are the production of Working Drawings, the preparation of technical submissions as required under the Contract, the compilation of the Final Design and the production of the As-Built Drawings.

3.2 Working Drawings shall be prepared as required under the Contract. They shall be endorsed by the Contractor as being in accordance with the Construction Reference Drawings.

3.3 The Contractor shall endorse the submissions required under the contract that "all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of these parts"

3.4 At least 3 months but not more than 6 months prior to the anticipated date of substantial completion of the Works, the Contractor shall submit the Final Design to the Engineer.

3.5 The Final Design is the design of the Permanent Works embodied in:

a) the latest revisions of the documents comprised in the Definitive Design, taking account of comments in the schedules appended to Notices of No Objection

b) the latest revisions of the Construction Reference Drawings;

c) the calculations (see Clause 11 herein); and

d) such other documents as may be submitted by the Contractor at the request of the Engineer to illustrate and describe the Permanent Works and for which a Notice has been issued.

3.6 The Contractor shall maintain all records necessary for the preparation of the As-Built Drawings. Upon completion of the Works or at such time as agreed to or required by the Engineer, the Contractor shall prepare drawings which, subject to the Engineer's agreement, shall become the As-Built Drawings. All such drawings shall be endorsed by the Contractor as true records of the construction of the Permanent Works and of all temporary works that are to remain on the site. The Contractor shall also show the locations of utilities exposed and retained as directed.

4 DESIGN INTERFACES WITH INTERFACING CONTRACTORs

The Contractor shall co-ordinate all design and installation work with the Interfacing Contractors as described in Appendix 5, Section VII-9: Appendices, Part 2 – Employer's Requirements. The Contractor shall co-ordinate with all Interfacing Contractors to produce a detailed programme of access dates, equipment delivery routes and occupation periods for each work area.

5 DESIGN SUBMISSIONS: -

5.1 PRELIMINARY DESIGN AND GAD SUBMISSION

The preliminary design shall provide initial design documents for review and shall be sufficiently detailed to show the element of the design main and documents required for preparation of the definitive design. It shall also include:

a) the quality assurance plan for design

b) a review of the outline design criteria

c) the submission of design manuals

d) the submission of one licensed copies of proposed software

e) the submission of specifications proposed for the work

f) the identification of design codes and standards

g) the CAD procedures

h) an alignment review

i) the preliminary construction methodology

j) the design submission programme (update)

k) the utility diversion plan

l) proposed site surveys and other field surveys

m) a review of permanent land requirement

n) the preliminary ground treatment

o) GAD of bridges after carrying out site survey and architectural drawings of stations

p) The preliminary reinstatement drawings.

5.2 DEFINITIVE DESIGN SUBMISSION

5.2.1 GENERAL

The Definitive Design Submission shall be a coherent and complete set of documents properly consolidated and indexed and shall fully describe the proposed Definitive Design. In particular, and where appropriate, it shall define:

a) the dimensions of all major features, structural elements and members;

b) all materials;

c) potential forces and movements due to all possible loadings and actions on the structures, and their accommodation;

d) all second order effects;

e) the layout and typical details of reinforcement in structural concrete members;

f) the locations and nature of all relevant joints and connections and details thereof;

g) Standard details;

h) location, geometry and setting-out of all main elements and features;

i) electrical and mechanical services and equipment and their interaction with the structures;

j) provisions and proposals for construction interfacing with the Interfacing Contractors;

k) Erection / launching scheme;

l) utilities to be diverted /supported;

m) Traffic or other civic service affected.

5.2.2 DRAWINGS

The Definitive Design Submission shall include drawings that shall illustrate the proposed Definitive Design and in particular shall include, without limitation:

a) general arrangements;

b) layouts and details of structural elements;

c) associated fittings;

d) slopes and earthworks;

e) structural and surface drainage;

f) existing and proposed utilities;

5.2.3 CONTRACT SPECIFICATION

The Specification included in the Outline Design Specifications (ODS) - Civil & BLT and Outline Construction Specifications (OCS) - Civil & BLT for Civil Works shall be amplified so as to specify comprehensively the design and construction of the Permanent Works.

5.2.4 DESIGN MANUAL

The Design Manual shall incorporate all design requirements, standards, codes, loading cases, permissible movements and deflections, limit states, design stresses and strains, material properties and all other documents or matters which are relevant to and govern the design. The Design Manual shall refer to all materials, codes and standards used, making clear their specific applications. The Design Manual shall be produced so that it can be used by those involved in the preparation or review of the design of the Permanent Works as a comprehensive reference text and efficient working document.

5.2.5 INTERFACE REPORT ON INTERFACING CONTRACTORS

This will include the following:

(i) Details of the design and construction of the Works adjacent to other contracts.

(ii) Details of provisions for the Interfacing Contractors, indicating arrangements

for accesses, fixings, casting-in, openings, supports and the like;

(iii) updated interface management plan relating to design integration and co-ordination.

5.2.6 TESTING AND COMMISSIONING REPORT

Details of proposals for testing and commissioning procedures for all relevant elements and equipment contained in the Permanent Works.

5.2.7 SUPPORTING DOCUMENTS

The Definitive Design Submission shall be accompanied by the following documents, which will be considered by the Engineer in his review of the Definitive Design Submission. Where relevant or required, these documents shall be accompanied by a design note stating clearly how information has been used in the design of the Permanent Works.

5.2.8 GEOTECHNICAL INTERPRETATIVE REPORT

A report including site investigation results and covering the geotechnical interpretation of site investigation work including that undertaken by the Contractor in sufficient detail to confirm and justify parameters used in the bridges and other structures foundation and geotechnical designs. The report shall include the full logs and descriptions of confirmatory boreholes drilled by the Contractor.

5.2.9 SURVEY REPORT

A report on all survey work undertaken by the Contractor, including checks on mapping, survey stations, co-ordinates and setting-out. Updated topographical and survey drawings shall also be included.

5.2.10 UTILITIES REPORT

A report giving details of arrangements and working methods in respect of the existing utilities, including protection measures, diversions, reinstatements and programme allowances.

5.2.11 TEMPORARY WORKS DESIGN REPORT

A report which provides sufficient information on the design of the Temporary Works to allow the Engineer to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the Definitive Design.

5.2.12 INSTALLATION ANALYSIS REPORT

A report containing a stage-by-stage construction / installation sequence for all structures / equipment.

5.2.13 CONSTRUCTION METHOD STATEMENT

A report which provides sufficient information on the methods of construction and Contractor's Equipment to allow the Engineer to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the Definitive Design.

5.2.14 PROJECT SCHEDULE REVIEW

i. The Contractor shall, prior to submitting the Definitive Design Submission, review the Project Schedule against the current version of the Design Submission Programme.

ii. In the event that the Contractor considers that there are any discrepancies or inconsistencies between the Design Submission Programme and the Project Schedule, the Contractor shall submit with the Definitive Design Submission its proposed revisions to the Project Schedule such that the discrepancies or inconsistencies are removed.

iii. The Contractor shall provide details of submissions of the proposed Working Drawings and their anticipated timing during the Construction Phase and shall identify information required from or actions to be undertaken by the Employer or others which are necessary to permit the completion of the design of the Permanent Works and the Working Drawings. Desired Dates for the receipt required by the Contractor of such information or for the completion of such actions shall be included with appropriate justification.

5.2.15 NOTICES ON DEFINITIVE DESIGN SUBMISSION

The Contractor may make Definitive Design Submissions and seek separate Notices in respect of:

(i) The temporary works for construction of the bridges

(ii) Major elements as identified under Clause 2.6 herein.

The issue of such separate Notices under (i) and (ii) above shall be conditional upon the Contractor having demonstrated, to the satisfaction of the Engineer, that the effect of each structure on other structures, utilities, etc., has been fully accommodated in the design.

6 DESIGN SUBMISSIONS - CONSTRUCTION REFERENCE DRAWINGS SUBMISSIONS

6.1 The Construction Reference Drawings shall be derived directly from the Definitive Design and shall detail and illustrate in full the Permanent Works. The Construction Reference Drawings shall form part of the Working Drawings to be used for construction purposes.

6.2 Prior to any Construction Reference Drawings Submission, the Contractor shall prepare a full list of Construction Reference Drawings in order to demonstrate, to the satisfaction of the Engineer, that such Construction Reference Drawings will be sufficient in extent to cover the construction of the whole of the Permanent Works.

6.3 Unless otherwise required by the Engineer, the Construction Reference Drawings need not include bar bending schedules, bar reference drawings, fabrication or shop drawings as well as other schedules or erection drawings which are to be provided by the Contractor during the Construction Phase.

6.4 The latest Construction Reference Drawing for which Notice has been issued by the Engineer shall be drawn on a tracing film duly signed by the Designer and the Contractor and shall be submitted to the Engineer for his approval. The Engineer will issue Notice in respect of such drawings, endorse them and return to the Contractor. The Contractor shall endorse such drawings as "Good For Construction (GFC)" and shall issue them to the Site for execution of the works.

7 DESIGN SUBMISSIONS – CONSTRUCTION PHASE

7.1 The Contractor shall prepare proposed Working Drawings such as site sketches, bar bending schedules, bar reference drawings, fabrication and shop drawings, construction erection sequences and the like. All such drawings shall be based on Construction Reference Drawings and shall comply with the requirements of the Contract. Working Drawings shall be submitted to the Engineer for his approval.

7.2 If the Working Drawings are considered in order, the Engineer shall issue Notice in respect of such drawings, endorse them and return to the Contractor. On the endorsement by the Engineer, the original will forthwith be returned to the Contractor as the Working Drawings. The Contractor shall endorse such drawings as "Good For Construction (GFC)" and shall issue them to the Site for execution of the works.

7.3 The contractor shall finalize details of the excavation scheme and installation sequence of primary support system and submit such finalized details to the Engineer for review. The proposed excavation scheme and primary support system requirement and installation sequence shall not adversely affect the final lining.

7.4 The Contractor shall finalise details of the proposed method of construction and submit such finalised details to the Engineer for review. The proposed method shall have no adverse effects on the partially completed Permanent Works and shall ensure the Works are statically and, if appropriate, aerodynamically stable.

7.5 The Contractor shall undertake and submit a stage by stage construction sequence and the effect of any Temporary Works and the Contractor's Equipment on the Permanent Works. This analysis shall be in sufficient detail to demonstrate that the Contractor's proposals are safe and have no adverse effects upon any parts of the Permanent Works.

7.6 As-Built Drawings, endorsed by the Contractor shall be submitted to the Engineer for agreement in accordance with Clause 5.5 of the GCC and in electronic format using a commercially available CAD program.

8 DESIGN SUBMISSIONS - REVIEW PROCEDURES

8.1 Submissions of Design Data shall be made and reviewed by the Engineer. The form and detail of the review shall be as determined by the Engineer and will not release or remove the contractor's responsibility for the design under the contract.

8.2 The issue of a Notice shall be without prejudice to the issue of any future Notices.

8.3 The Contractor shall, prior to the submission of the Design Data, obtain all required and/or statutory approvals that relate to that submission including, where appropriate, the approval of the Concerned Government Authorities and utility undertakings, and demonstrate that all required approvals have been obtained.

8.4 All submissions shall be accompanied by two original copies of a `Design Certificate' as set out in Attachment D1 hereto and signed by the Contractor and the Designer.

9 DESIGN SUBMISSION PROGRAMME

9.1 The Contractor shall prepare the Design Submission Programme which is to set out fully the Contractor's anticipated programme for the preparation, submission and review of the Design Packages, the Definitive Design Submission and the Construction Reference Drawings Submissions and for the issue of Notices in relation thereto.

9.2 The Design Submission Programme shall:

a) be consistent with and its principal features integrated into the Works Programme, and show all relevant Key Dates;

b) identify dates and subjects by which the Engineer's decisions should be made;

c) make adequate allowance for periods of time for review by the Engineer and other review bodies;

d) make adequate allowance for the design and development of specialist works;

e) include a schedule identifying, describing, cross-referencing and explaining the Design Packages into which the Contractor intends to divide the Definitive Design and Construction Reference Drawings; and

f) indicate the Design Interface and Co-ordination periods for each Interfacing Contractor.

10 PROGRAMME FOR SUBMISSIONS DURING THE CONSTRUCTION PHASE

In accordance with Clause 4 of the Employer's Requirements - General, the Contractor shall identify submissions required during the Construction Phase.

11 CALCULATIONS

11.1 Unless otherwise required by the Engineer, calculations relevant to the Definitive Design and Construction Reference Drawings shall be submitted for review with the respective Design Packages or Submissions. The Engineer may require the submission of applicable software including in house software programmes/

worksheets developed by the Contractor, computer input and programme logic for its review prior to the acceptance of the computer output.

11.2 The Contractor shall prepare and submit a comprehensive set of calculations for the Definitive Design in a form acceptable to the Engineer. Should the design of the Permanent Works be revised thereafter and such revision renders the calculations as submitted obsolete or inaccurate, the Contractor shall prepare and submit the revised calculations.

11.3 Similarly, the Contractor shall submit such further calculations as have been prepared in connection with the Construction Reference Drawings. Calculations to be included as part of the submission herein shall comprise the up-to-date calculations in respect of the Definitive Design, the Construction Reference Drawings and such further calculations which the Contractor has prepared during the production of Working Drawings.

11.4 The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

12 DOCUMENTS REQUIREMENTS

12.1 Drawings shall be prepared generally to A1 size, but to A0 size where appropriate.

12.2 The Contractor shall submit 03 copies of his design and/or drawings for review by the Engineer. After receipt of "No Objection" from the Engineer's Representative, the Contractor shall submit 06 copies of design and/or drawing for the use of the Engineer.

12.3 The submission of drawings should be as per **Appendix 9** of the Employer's Requirements.

12.4 The contractor to provide *one* licensed working software copy being used by its DDC to Employer/Engineer's design department maintained for the entire contract period.

13 System Provider for Ballastless Track (BLT) System

13.1 *Upon award of the Contract, the Contractor shall engage System Provider for design of BLT. The Contractor shall submit details of System Provider proposed to be engaged for Design of Ballastless track system for the approval of the Engineer. System Provider shall be engaged within twelve months of the Commencement Date*.

13.2 System Provider shall has successfully developed a proven ballastless track system along with a fastening system and have either of (i) or (ii):

i. *has experience of designing of ballastless track and can modify it to suit the HORC technical requirements.*

ii. *has a MOU with a designer firm who has experience of designing of ballastless track and can modify it to be suit to HORC technical requirements.*

Definition of Proven Ballastless Track System:

A Ballastless Track System in conjunction with a fastening system, which in operation for a minimum length of 10Km, with minimum operational axle load of 22T & operational speed of 100Km/h, for a last five years before the deadline for submission of the Tender

13.3 *In case of proven Ballastless Track system for which patent of some of the component(s) has expired or does not exist and manufacturing of these component(s) is proposed to be done in India, the Contractor (who may not have successfully developed a proven Ballastless Track System but fulfils one of the conditions stipulated in sub-para(i) or (ii) of para13.2 above shall submit following undertakings/documents*:

i. *An undertaking that the Patent Rights have expired for the specific components(s) of the Proven Ballastless Track System (Name) which was earlier patented.*

OR

An undertaking that the Proven Ballastless Track System is not Patented.

ii. *An undertaking that the proposed Ballastless Track System along with fastening system shall be provided as per the design, drawing and specification of Proven Ballastless Track System subject to HORC requirements.*

iii. *An undertaking that the Test Report of the proposed Ballastless Track System along with fastening system are in accordance with Cat 'C' requirement as specified in EN-13481 Part-1& EN-13481 Part-5 (Latest version) to suit HORC requirements. Tenderer shall also submit test report of category "C" requirement. The test plan and testing criteria of Ballastless Track System shall meet the permissible values given in IRPWN including all updates correction slips published by Indian Railway.*

iv. *The Contractor will submit declaration regarding manufacturing source(s) of component of BLT along with fastening system of India, given details of components which will be manufactured directly by the tenderer and other components which will be out sourced from other manufacturing firms in India.*

Acceptance of the proposed system and capability assessment of unproven source(s) proposed for manufacturing of components (s) to be examined and certified by RDSO. For this purpose, requisite documents such as Schedule of Technical Requirement (STR), Quality Assurance Plan (QAP) and inspection Test Plan (ITP) etc. shall be furnished by the Contractor.

The Employer shall refer the schedule of Technical Requirement (STR), Quality Assurance Plan (QAP) and Inspection Test Plan (ITP) etc. to RDSO for examination and certification.

13.4 *The detailed design of Ballastless track system including compatible fastening system*

shall not deviate from the proven ballastless track system on the basis of which the proposal is accepted except for detailed design customization to suit HORC requirements.

13.5 *The contractor shall submit following documents to establish technical eligibility of system provider as mentioned as para 13.2 & 13.3 above .*

i. *Documents as proof of proven Ballastless track system as mentioned in para 13.2. In case user Railway/Operator documents do not contain required details, the Service Provider shall give self-certification by MD/CMD of the firm, to this effect. The Employer, if required, may confirm the validity of provenness from user Railway/Operator, contact details of which will be arranged by the Contractor.*

Note: In case the user railway /operator is from foreign country and the certificate is issued in language other than English, the supporting documents shall be translated into English. The translation of the certificate shall be either stamped by Embassy/High Commission of India or Partner Countries of Hague convention may submit these documents with "Apostille" stamp. The experience certificate issued by foreign user railway administration in English shall also be either stamped by Embassy/High Commission of India or submitted with "Apostille" stamp.

ii. *Undertaking to the effect that Service Provider has experience of designing of ballastless track and can modify it to suit the HORC technical requirements as per para 13.2 (i).*

iii. *Documents as proof of MOU duly apostilled, with designer firm as per para 13.2(ii), if applicable.*

iv. *Certificate for fulfilment of proven fastening system as per Cat 'C" requirement as specified in EN-13481-Part-1 & EN-13481-Part-5 (Latest Version) to suit HORC requirements.*

v. *Undertaking by the Contractor to the effect that detailed design will not deviate from proven ballastless system as per para13.4*

vi. *Undertaking by the Contractor to the effect that they shall furnish copy of agreement between the Contractor and the patent holder permitting the use the patented items as per para 13.6 below.*

vii. *Indemnity Bond as per para 13.7 indemnifying the HORC & HRIDC for use of Intellectual Property Rights.*

viii. *Indemnity Bond as per para 13.8 indemnifying the HORC & HRIDC for use of fastening system for future maintenance.*

13.6 *In case the system of track and /or fastening system offered by the Contractor is a patented one, the Contractor shall furnish copy of agreement entered into between the Contractor and the patent holder permitting the Contractor to use the patented items for work.*

13.7 *The Contractor shall indemnify HORC & HRIDC against any claims for any other*

party in connection with the intellectual property rights of the drawings and design /fastening system/ ballastless track system or any other documents submitted by the Contractor or any other patent rights.

13.8 *The Contractor shall indemnify HORC & HRIDC against any claim for any other party for use of fastening system for future maintenance of ballastless track and will not charge any royalty on account of Intellectual Property Rights.*

13.9 *The component(s) of proven Ballastless Track System including fastening system which is no longer patented and proposed to be manufactured in India as per para 13.3 above, can be manufactured as per specification(s) with Quality Assurance / Quality Control plan approved by RDSO. The initial quantity (15%) shall be inspected by RDSO. Subsequent regular product inspection shall be done by the Employer/Engineer or the Third party under the supervision of the Engineer as per QAP approved by RDSO.*

Note:

The qualifications of Service Provider given above are based on Railway Boards letter No. EBS/CB-I/BLT/Committee dated 17.10.2023. If the criteria given in Railway Boards letter is modified by Railway Board / concerned government authority / RDSO, the same will be followed. However, the modified criteria will not be stricter than the criteria given above.

13.10 *The Contractor shall submit detailed design and drawings of ballastless track for viaduct including fastening system, derailment prevention arrangement, arrangement for provision of ducts for signal/telecommunication/electrical in longitudinal and transverse direction, transition system, drainage system with construction procedure & maintenance /repair procedure, QAP etc. to the Engineer for approval*.

ATTACHMENT D 1

1. DESIGN CERTIFICATE

This Design Certificate refers to design submission no. ..... , which comprises of Definitive Design submission / Construction Reference Drawings submission, working drawing submission scheduled in the attached transmittal, in respect of:

(Description of Permanent Works to which the submission refers)

DESIGNER'S STATEMENT:

We certify that:

a) the outline designs, design briefs and performance specifications of those elements of the Permanent works as illustrated and described in the documents scheduled in the attached transmittal, complies with the Outline Design Specifications (ODS) - Civil & BLT and other contract provisions.

b) an in-house check has been undertaken and completed in accordance to approved Quality Assurance Plan (QAP) to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in the attached transmittal.

c) all necessary and required approval relating to the design of the Permanent Works, as illustrated and described in the documents listed in the attached transmittal, have been obtained.

d) all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of those parts.

Signed by Designer's Authorised Representative

Name : .....

Position : .....

Date : .....

CONTRACTOR'S CERTIFICATE:

The Certifies that all design has been performed utilizing the skill and care to be expected of a professionally qualified and competent designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us and the design proposed by the designer has been accepted by us.

Signed by Contractor's authorised representative

Name : .....

Position : .....

Date : .....

Note 1

The Contractor shall insert one of the following, as applicable:

(i) the Contractor's Technical Proposals

(ii) the Contractor's Technical Proposals and Design Packages Nos. ..... for which a Notice of No Objection has been issued.

(iii) Design Packages Nos. ....….. for which a Notice of No Objection has been issued if such Design Packages develop and amplify the Contractor's Technical Proposals.

(iv) The Definitive Design

SAMPLE DESIGN/DRAWING TEMPLATE

(a) 'Design Quality Assurance' by designer & contractor:

DESIGN QUALITY ASSURANCE			
The responsibility of control, check and verification of accuracy, correctness, completeness, integration and full compliance of contract provisions in respect of design analysis and drawings rests with the design consultants and the contractor.			
By Designer			**By Contractor**
Sig. :	Sig. :	Sig. :	Sig. :
Date. :	Date. :	Date. :	Date. :
Name :	Name :	Name :	Name :
Designed by	Checked by	Approved by	Accepted By

(b) <u>Notice of 'No Objection' from the Engineer:</u>

Notice of 'No Objections' from the Engineer			
Notice of "No Objections" from the Engineer is being accorded for design Principles. However, the overall responsibility for the detailing and design accuracy lies with Design and Build Contractor.			
	REMARKS		
Design Engineer (GC/HORC)	Reviewed		
Senior Design Expert (GC/HORC)	Reviewed		
Chief Design Expert (GC/HORC)	Reviewed		
DPD (GC/HORC)	Reviewed & comments as marked on drawing		

<u>Section C</u>

[Contractor to attach copies of necessary and required approvals]

Section VII: Employer's Requirements

Section VII-4: Construction (Civil & BLT)

Contents

EMPLOYER'S REQUIREMENTS – CONSTRUCTION (Civil & BLT)

1. CONTRACTOR'S SUPERINTENDENCE

The Contractor shall submit a Staff Organization Plan in accordance with the Attachment C-1

This plan shall be updated and resubmitted whenever there are changes to the staff. The plan shall show the management structure and state clearly the duties, responsibilities and authority of each staff member.

The Contractor's Representative and his associates/supervisors shall have experience and qualification appropriate to the type and magnitude of the Works as per Attachment C-2. Full details shall be submitted of the qualifications and experience of all proposed staff to the Engineer for his approval.

2. CONTRACTOR'S TEMPORARY WORKS DESIGN

The Contractor shall, prior to commencing the construction of the Temporary Works, submit a certificate to the Engineer signed by him certifying that the Temporary Works have been properly and safely designed and checked and that the Contractor has checked the effect of the Temporary Works on the Permanent Works and has found this to be satisfactory.

2.1 UTILITIES

a) Refer Employer's Requirements – Functional and Appendix-10 of Section VII-9: Appendices, Employer Requirements.

2.2 STRUCTURES, ROADS AND OTHER PROPERTIES

a) The Contractor shall immediately inform the Engineer of any damage to structures, roads or other properties.

2.3 SITE LABORATORIES

a) The Contractor shall provide, erect, and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of cement, aggregate, concrete and soil samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in Appendix 12 to these Employer's Requirements.

3. TESTING

3.1 GENERAL

a) The Contractor shall provide and perform all forms of testing procedures applicable to the Works and various components and the interfacing of the Works with the other Contract works and shall conduct all necessary factory, site and acceptance tests.

b) All testing procedures shall be submitted at least thirty (30) days prior to conducting any Test. The Testing procedures shall show unambiguously the extent of testing covered by each submission, the method of testing, the Acceptance Criteria, the relevant drawing (or modification) status and the location.

c) The testing Procedures shall be submitted, as required, by the Contractor during the duration of the Contract to reflect changes in system design or the identification of additional testing requirements.

d) The Engineer shall have the facilities for monitoring all tests and have access to all testing records. Ample time shall be allowed within the testing programmes for necessary alterations to equipment, systems and designs to be undertaken, together with re-testing prior to final commissioning.

e) The Contractor is reminded that at some point, the High Voltage Power Supply system will be energised and the additional precautions for the safety of staff and co-ordination of activities after power-on shall be anticipated in its testing and commissioning programmes.

f) All costs associated with the Testing shall be borne by the Contractor, unless otherwise specified, including the services of any specialised personnel or independent assessors. The Contractor shall also bear any expenses incurred due to resetting caused by defects or failure of equipment to meet the requirements of the Contract in the first instance. No such testing shall relieve the Contractor from any obligation or responsibility

g) All testing equipment shall carry an appropriate and valid calibration labels.

3.2 BATCHES, SAMPLES AND SPECIMENS

a) A batch of material is a specified quantity of the material that satisfies the specified conditions. If one of the specified conditions is that the material is delivered to the Site at the same time, then material delivered to the Site over a period of a few days may be considered as part of the same batch if in the opinion of the Engineer there is sufficient proof that the other specified conditions applying to the batch apply to all of the material delivered over the period.

b) A sample is a specified quantity of material that is taken from a batch for testing and which consists of a specified amount, or a specified number of pieces or units, of the material.

c) A specimen is the portion of a sample that is to be tested.

3.3 SAMPLES FOR TESTING

a) Samples shall be of sufficient size and in accordance with relevant Standards to carry out all specified tests.

b) Samples taken on the Site shall be selected by, and taken in the presence of, the Engineer and shall be suitably marked for their identification. An identification marking system should be evolved at the start of works in consultation with the Engineer.

c) Samples shall be protected, handled and stored in such a manner that they are not damaged or contaminated and such that the properties of the sample do not change.

d) Samples shall be delivered by the Contractor, under the supervision of the Engineer, to the specified place of testing. Samples on which non-destructive tests have been carried out shall be collected from the place of testing after testing and delivered to the Site or other locations instructed by the Engineer.

e) Samples which have been tested may be incorporated in the Permanent Works provided that:

   I. the sample complies with the specified requirements.

II. the sample is not damaged; and

III. the sample is not required to be retained under any other provision of the Contract.

f) Additional samples shall be provided for testing if in the opinion of the Engineer :

I. material previously tested no longer complies with the specified requirements; or

II. material has been handled or stored in such a manner that it may not comply with the specified requirements.

3.4 TESTING

a) The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests shall be carried out in the Contractor's laboratory, unless otherwise permitted or required by the Engineer. Where the laboratory is not appropriately equipped and/or staffed for some tests, or if agreed to by the Engineer, tests may be carried out in other laboratories provided that:

i. they are accredited for the relevant work to a standard acceptable to the Engineer; and

ii. particulars of the proposed laboratory are submitted to the Engineer for his consent.

b) In-situ tests shall be done in the presence of the Engineer.

c) Equipment, apparatus and materials for in-situ tests and laboratory compliance tests carried out by the Contractor shall be provided by the Contractor. The equipment and apparatus shall be ISI marked as far as possible and maintained by the Contractor and shall be calibrated before the testing starts and at regular intervals as permitted by the Engineer. The equipment, apparatus and materials for in-the situ tests shall be removed by the Contractor as soon as practicable after the testing is complete.

d) The Contractor shall be entitled in all cases to attend the testing carried out in the Employer's or other laboratories, to inspect the calibration certificates of the testing machines and to undertake the testing on counterpart samples. Testing of such samples shall be undertaken in laboratories and particulars of the laboratory proposed shall be submitted to the Engineer for consent prior to the testing.

e) Attendance on tests, including that by the Engineer, Contractor and Designer, shall be as laid down in the Quality Assurance procedures.

3.5 COMPLIANCE OF BATCH

a) The results of tests on samples or specimens shall be considered to represent the whole batch from which the sample was taken.

b) A batch shall be considered as complying with the specified requirements for a material if the results of specific tests for of the specified properties comply with the specified requirements for the properties.

c) If additional tests are permitted or required by the Engineer but separate compliance criteria for the additional tests are not stated in the Contract, the Engineer shall determine if the batch complies with the specified requirements for the material on the basis of the results of all tests, including the additional tests, for every properties.

3.6 RECORDS OF TESTS

a) Records of in-situ tests and laboratory compliance tests carried out by the Contractor shall be kept by the Contractor on the Site and a report shall be submitted to the Engineer within seven (7) days, or such other time stated in the Contract or in the Quality Assurance Programme, after completion of each test. In addition to any other requirements, the report shall contain the following details:

i. material or part of the Works tested;

ii. location of the batch from which the samples were taken or location of the part of the Works;

iii. place of testing;

iv. date and time of tests;

v. weather conditions in the case of in-situ tests;

vi. technical personnel supervising or carrying out the tests;

vii. size and description of samples and specimens;

viii. method of sampling;

ix. properties tested;

x. method of testing;

xi. readings and measurements taken during the tests;

xii. test results, including any calculations and graphs;

xiii. specified acceptance criteria; and

xiv. other details stated in the Contract.

b) Reports of tests shall be signed by the site agent or his assistant, or by another representative authorised by the Contractor.

c) If requested, records of tests carried out by the Employer's staff or by the Engineer shall be given to the Contractor.

4. RECORDS

4.1 DRAWINGS PRODUCED BY THE CONTRACTOR

a) Drawings produced by the Contractor including drawings of site layouts, Temporary Works, etc. for submission to the Engineer shall generally be to A1 size. They shall display a title block with the information as detailed in Appendix 9 to these Employer's Requirements. The number of copies to be submitted to the Engineer shall be as stated in the Contract, or as required by Engineer.

4.2 PROGRESS PHOTOGRAPHS

The Contractor shall provide monthly progress photographs and drone survey report along with video which have been properly recorded to show the progress of the works to the Engineer. The photographs shall be taken on locations agreed with the Engineer to record the exact

progress of the Works. Survey by drone for the Works shall be carried out every month and submitted to the Engineer.

a) The Contractor shall mount each set of each month's progress photographs in a separate album of a type to which the Engineer has given his consent, and shall provide for each photograph two typed self-adhesive labels, one of which shall be mounted immediately below the photograph and one on the back of the photograph. Each label shall record the location, a brief description of the progress recorded and the date on which the photograph was taken.

b) All photographs shall be taken by a skilled photographer whose name and experience shall be submitted to the Engineer for consent and approval received. Processing shall be carried out by a competent processing firm to the satisfaction of the Engineer.

c) The Contractor shall ensure that no photography is permitted on the Site without the agreement of the Engineer. Contractor should be aware of the local regulations and conditions with regard to Photography.

5. MATERIALS

a) Materials and goods for inclusion in the Permanent Works shall be new unless the Engineer has consented otherwise. Preference shall be given to local materials where available. Approved Manufacturers/Suppliers of few important items have been given in Section VII-8: Tender Drawings and Documents. These materials shall be procured only for these manufacturers/Suppliers.

b) Certificates of tests by manufacturers which are to be submitted to the Engineer shall be current and shall relate to the batch of material delivered to the Site. Certified true copies of certificates may be submitted if the original certificates could not be obtained from the manufacturer.

c) Parts of materials which are to be assembled on the Site shall be marked to identify the different parts.

d) Materials which are specified by means of trade or proprietary names may be substituted by materials from a different manufacturer which has received the consent of the Engineer provided that the materials are of the same or better quality and comply with the specified requirements.

e) Samples of materials submitted to the Engineer for information or consent shall be kept on the Site and shall not be returned to the Contractor or used in the Permanent Works unless permitted by the Engineer. The samples shall be used as a mean of comparison which the Engineer shall use to determine the quality of the materials subsequently delivered. Materials delivered to the Site for use in the Permanent Works shall be of the same or better quality as the samples which have received consent.

6. PROVISIONS FOR INTERFACING CONTRACTORS

Interface responsibilities mentioned in Appendix–5 shall be followed by the Contractor.

7. RESTORATION OF AREAS DISTURBED BY CONSTRUCTION.

Unless otherwise directed by the Engineer, any areas disturbed by the construction activity, either inside or outside the Project Right of Way, shall be reinstated as follows:

All areas affected by the construction work shall be reinstated to their original condition, with new materials, including but not necessarily limited to, sidewalks, parking lots, access roads, roads, adjacent roads properties, footpath, kerb stone, boundary wall, grill, fencing, grill, any type of structures (underground & above ground), bore well, horticulture and landscaping. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

8. TAKING OVER OF WORKS / SECTIONS

8.1 Inspection

a) General

Within seven (7) days of receipt of the Contractor's written application for a Taking-Over Certificate, pursuant to Sub-Clause 10.1 of the General Conditions of Contract, the Engineer, in the company of the Contractor, will inspect the Works or Section covered by the application, as per the requirements described in this Sub-Clause. During the joint inspection, the Works or Section will be examined and relevant documentation will be reviewed. The Engineer will prepare a written list of outstanding items, if any, to be completed or corrected before issuance of the Taking-Over Certificate and a separate written list of items to be completed or corrected during the remainder of the Contract orthe Defects Notification Period. The list shall include an agreed date of correction for each deficiency.

The Contractor shall also obtain written confirmation from all applicable Interfacing Contractors that all interfacing matters have been concluded.

If there are no outstanding items to be completed or corrected before the Taking Over ofthe Works or a Section, the Contractor shall submit to the Engineer all guarantees, warranties, final certifications or similar documents or both as are required under the Contract.

b) Static Inspection

The inspection listed in the following table shall be conducted by the Engineer, in coordination with Interfacing Contractors as necessary.

The Contractor shall prepare and submit for review and approval by the Engineer a Static Inspection Plan detailing and explaining how the Contractor will plan, perform and document all tests and inspections that shall be conducted to verify and validate the Works. The Static Inspection Plan shall consist of a narrative description supported by graphics, diagrams and tabulations as required.

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
Earthwork	Formation width	At every 100m on straight line, at every 20m on curved line, at	✓		✓

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
		each terminal point of structures			
	Cross section	At every 100m on straight line, at every 20m on curved line, at each terminal point of structures.	✓		✓
	Retaining wall	List of location of retaining walls	✓	✓	
	Construction	Soil test records, compaction records, CBR & deformation modulus (Ev_2) records, construction photos	✓		
	Blanket	Blanket material test records, compaction test records, CBR & deformation modulus (Ev2) test records.	✓		
		Thickness	✓		✓
	Structures Crossing	List of structures crossing the Railway (earth cover, overhead clearance, etc.)	✓		✓
	Drainage system	Drainage works at embankment/cutting, drainage diagram	✓		✓
Bridges/ Viaduct	Formation width	At each bridge	✓		✓
	Construction	Quality records of aggregate used, reinforcement,	✓		

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
		concrete quality control data, measurement records of cast-in-situ piles/ open foundation etc.			
	Repairing of structures	Records of repaired parts of structures	✓	✓	
	Rebar cover	Records of measurement of rebar cover	✓		
	Clearance under girder/slab	Above roads/rail	✓		✓
	Abutment/ pier structures/ RCC box etc.	All structural Drawings & Records.	✓	✓	
	Concrete strength	Schmidt hammer tests	✓		✓
	List of bridges	List of bridges	✓	✓	
	Pile load test	Pile load test results	✓		
	Steel Girder	Material test record, fabrication, welding & trial assembly records, dead load camber in OWG	✓		✓
	Bearings	Acceptance test record	✓	✓	

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
	Track on OWG	Fabrication record of H-beam sleeper, acceptance test record of rails & track fittings, Track parameters at every sleeper location	✓		✓
	BLT on viaduct	Quality control record of aggregate, reinforcement steel & concrete, Inspection certificate and acceptance test records of rails & fittings/ fastenings, track parameters at every sleeper location, record of welding parameters, ultrasonic testing & finishing tolerance measurements of welds	✓		✓
	Load test	Load test parameters of superstructure (OWG /CG /PSC girders)	✓		✓
		Load test parameters of skew RCC box	✓		
Station	Platform length, width	At every 10m on straight line, at every 5m on curved line, control points of curve	✓		✓
	Clearance of isolated and continuous	All structures	✓		✓

Structure	Inspection Item		Inspection Method		
			Confirmation of "As-Built" Records	Visual Inspection	Measurement Test Check
	structures on platform as per SOD				
	Staircase and pavement	Results of stair width measurement	✓	✓	
	Drainage of platform & yard	Drawings, Section & slope at every 20m	✓		✓
	Safety fence, etc.	List of facilities (clearance from platform end to fixed/movable fence, etc.)	✓	✓	
Protective facilities	Fire protection	Fire extinguisher layout and numbers	✓	✓	
	Abutment/ Pier protection	Drawings	✓	✓	
	Slope protection works	List, location and Drawings of slope protection works	✓	✓	

After Static Inspection of the Works as mentioned above the Contractor shall submit the Inspection Report in the agreed format in four (4) signed copies to the Engineer for review and approval.

8.2 Remedial Action and Re-inspection

Within twenty-eight (28) days of receipt of a written application for a Taking-Over Certificate, the Engineer shall proceed in accordance with Sub-Clause 10.1 of the General Conditions of Contract.

8.3 Taking Over Certificate

If the Engineer does not issue a Taking-Over Certificate, but gives instructions in accordance with sub-paragraph (ii) of Sub-Clause 10.1 of the General Conditions of Contract, the Contractor shall, when he considers the work specified by the Engineer completed, give written notice to the Engineer and the Contractor.

The Contractor shall submit documents required by Commissioner of Railway Safety (CRS) and shall accompany him during his inspection along with necessary records.

9. Sub-Contractor for Fabrication, Assembly & Launching of Open Web Girders (OWG), Composite Girder Bridges/Viaduct

9.1 Upon award of the Contract, the Contractor shall engage Sub-Contractor for fabrication, assembly & launching of Open Web Girders (OWG) and Composite Girder Bridges. The Contractor shall submit details of Sub-Contractor proposed to be engaged for fabrication, assembly & launching of OWG and Composite Girder Bridges. Sub-Contractor shall be engaged within 60 days of issue of LOA.

9.2 Sub-Contractor to be engaged shall have the experience of execution of bridge work consisting of fabrication, assembly and launching of at least one span of Open Web Girders (OWG)/Bowstring Girder of 45.7m or longer spans in Railway/Metro/RRTS or Road Over Bridge (ROB) over Railway/Metro/RRTS in a single contract during last seven years.

9.3 Sub-Contractor to be engaged shall submit experience certificate issued from the Employer (owner of the Work)/Concessionaire.

9.4 The Contractor/ Sub-Contractor must own RDSO approved workshop or must submit an undertaking to the effect that he will enter into a MOU with RDSO approved vendor workshop in Part-A for fabrication of Open Web Girders.

9.5 The Contractor is required to enter into a legally enforceable agreement with the Sub-Contractor within 60 days of approval of Sub-Contractor and submit a copy of the agreement to the Engineer. The agreement must specify the specific role and responsibility of the Sub-Contractor.

10. Sub-Contractor for Construction of Ballast less Track System

10.1 Upon award of the Contract, the Contractor shall engage Sub-Contractor for Construction of ballastless Track System. The Contractor shall submit details of Sub-Contractor proposed to be engaged for Construction of ballast less Track System for the approval of the Engineer.

10.2 Sub-Contractor to be engaged shall have experience of construction of ballastless track system i.e.

Execution of at least one contract which involves execution of minimum 2.0km length of ballastless track that has been successfully or is substantially completed with in the last seven years before the deadline for submission of the bids.

OR

Execution of at least two contracts each of which involves execution of minimum 1.0 km length of ballastless track that has been successfully or is substantially completed within the last seven years before the deadline for submission of the bids.

10.3 Sub-Contractor to be engaged shall submit experience certificate for construction of ballast less track system issued by the user railway administration.

In case the user railway administration is from foreign country and the certificate is issued in language other than English, the supporting documents shall be translated into English language. The translation of Certificates / documents in foreign language shall be done by the licensed translator. The Contractor must submit copy of license issued by the competent authority in their country of origin.

10.4 Proposed Sub-Contractor shall submit details containing, but not limited to the name of line in which the system has been constructed/under construction, details of user railway administration such as name of the Railway administration and its contact person, address, telephone number, E-mail id etc.

10.5 Upon approval of the Sub-Contractor, the Contractor is required to enter into legally enforceable agreement with the Sub-Contractor within 60 days of approval of designer and submit a copy of the agreement to the Engineer. The agreement must specify the specific role and responsibility of the Sub-Contractor.

10.6 Construction of BLT by the Sub-Contractor shall not be started unless agreement with the Sub-Contractor is submitted to the Engineer.

ATTACHMENT - C-1

MINIMUM ORGANISATION STRUCTURE REQUIRED *& PENALTY FOR NON-DEPLOYMENT*

The figures indicated in Table below are the minimum number of Project-Personnel required which are to be deployed as per the minimum level of supervision. The qualification/experience of such Project personnel is given under Attachment-C-2.

S. No.	***Designation of Project Personnel***	***Minimum no. of Project-Personnel required***	***Penalty for Non-deployment per week or part thereof per person***
1.	Contractor's Representative/ Project Manager	As per Section III, EQC	*Rs 1,00,000/-*
2.	Deputy Project Manager (Viaduct)	As per Section III, EQC	*Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter*
3.	Deputy Project Manager (Formation)	1	*Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter*
4.	Deputy Project Manager (Bridges & station)	1	*Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter*
5.	Planning Engineer	2	*Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter*
6.	Senior Quality Assurance /Quality Control Expert	As per Section III, EQC	Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter
7.	Quality Assurance /Quality Control Expert	2	-
8.	Civil Engineer (Formation)	2	-
9.	Civil Engineer (Bridge)	2	-
10.	Civil Engineer (Viaduct)	4	-
11.	Civil Engineer (Station)	1	-
12.	Civil Engineer (Fabrication & launching of steel OWG & CG)	2	-
13.	Procurement Manager	1	-
14.	Health & Safety Expert	2	Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter
15.	Environmental Expert	1	Rs 40,000/- for first 3 months and Rs. 80,000/- thereafter
16.	Surveyor	3	-
17.	Civil Engineer (Concrete Expert)	1	-

NOTES:-

i. The Contractor shall deploy resources as per the above-mentioned table. The Contractor shall also confirm to deploy manpower over and above the minimum numbers indicated above, if the work so requires.

ii. Deleted

iii. The performance of project personnel deployed will be evaluated periodically by the Engineer during the contract period. In case the performance of any of the project personnel is not satisfactory, the Contractor shall replace them with good personnel immediately as per directions of the Engineer.

iv. The personnel at Sr.No.1, must be deployed by Commencement Date. Personnel at Sr. No.2, 3, 4,5,6, 14 & 15 in the above table must be deployed within 30 days of Commencement Date. Non adherence to these provisions shall attract penalty as indicated in the table above.

v. The resources indicated in table above are for peak requirement. All resources need not be mobilized simultaneously for entire duration of the contract. The Contractor shall mobilize the resources as per the deployment programme approved by the Engineer.

vi. In case of non-deployment of project personnel, the penalty shall be imposed as indicated above and deducted from Contractor's running / final bills. The decision of the Engineer in this regard shall be final and binding.

ATTACHMENT C-2

Minimum level of supervision & qualification/ experience of Project Personnel is as follows:

S. No.	*DESIGNATION*	*QUALIFICATION*	*EXPERIENCE LEVEL*
1.	Contractor's Representative/ Project Manager	Graduate in Civil Engineering	Minimum total experience of 10 years out of which, minimum 2 years as In-charge in projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.
2.	Dy. Project Manager (Viaduct)	Graduate/ Diploma in Civil Engineering	Minimum total experience of 06/08 years out of which minimum 03/05 years in relevant filed of projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.
3.	Dy. Project Manager (Formation)	Graduate/Diploma in Civil Engineering	Minimum total experience of 06/08 years out of which minimum 03/05 years in relevant filed of projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways
4.	Dy. Project Manager (Bridges & station)	Graduate/Diploma in Civil Engineering	Minimum total experience of 06/08 years out of which minimum 03/05 years in relevant filed of projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways
5.	Planning Engineer	Graduate in Civil Engineering	Minimum total experience of 05 years out of which minimum 01 years in relevant field in planning of Infrastructure projects.
6.	Senior Quality Assurance /Quality Control Expert	Graduate / Diploma in Civil Engineering	Minimum total experience of 05/07 years out of which minimum 02/04 years in QA (Field) in Infrastructure Projects.
7.	Quality Assurance (QA) /Quality control Expert	Graduate / Diploma in Civil Engineering	Minimum total Experience of 03/05 years out of which minimum 02/03 years in *QA (Field) in* Infrastructure Project
8.	Civil Engineer (Formation)	Graduate / Diploma in Civil Engineering	Minimum total experience of 03/05 years out of which 2 year experience in relevant field in projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways
9.	Civil Engineer (Bridge)	Graduate / Diploma in Civil Engineering	Minimum total experience of 03/05 years out of which 2 year experience in relevant field in *projects of Railway/ DFC/ Metro/*

S. No.	*DESIGNATION*	*QUALIFICATION*	*EXPERIENCE LEVEL*
			RRTS/ Highway /Expressways.
10.	Civil Engineer (Viaduct)	Graduate / Diploma in Civil Engineering	Minimum total experience of 03/05 years out of which 2 year experience in relevant field in *projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.*
11.	Civil Engineer (Station)	Graduate or Diploma in Civil Engineering	Minimum total experience of 03/05 years out of which 2 year experience in relevant field in *projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.*
12.	Civil Engineer (Fabrication & launching of steel OWG)	Graduate or Diploma in Civil Engineering	Minimum total experience of 03/05 years out of which 2 year experience in relevant field in *projects of Railway/ DFC/ Metro/ RRTS/ Highway /Expressways.*
13.	Procurement Manager	Graduate in Engineering / Diploma in procurement	Minimum total Experience of 05/07 *years* out of which 2 year experience in procurement in Infrastructure Project.
14.	Health & Safety Expert	Bachelor degree in any science stream with one-year full time Diploma in Industrial Safety. (Or) Diploma in Engineering with one year full time Diploma in Industrial Safety. (Or) Graduate in Engineering with one year full time Diploma in Industrial Safety	*Minimum total experience of 03 years with relevant experience of 02 years in infrastructure projects.* *(Or)* *Minimum total experience of 03 years with relevant experience of 02 years in infrastructure projects.* *(Or)* *Minimum total experience of 02 years with relevant experience of 01 years in infrastructure projects.*

S. No.	***DESIGNATION***	***QUALIFICATION***	***EXPERIENCE LEVEL***
15.	Environmental Expert	Graduate in Science with one year PG Diploma in Environment Science/Management (Or) Graduate in Environmental Engineering (Or) Bachelor degree in any engineering stream with Master's degree in Environmental Science or one year PG Diploma in Environment Science/Management	Minimum total post qualification experience of 02 years out of which 01 years relevant experience in infrastructure projects
16.	Surveyor	Diploma in Civil Engineering / ITI	Minimum total Experience of 01/02 years in survey work for *linear* Infrastructure project
17.	Civil Engineer (Concrete Expert)	Graduate in Civil Engineering	Minimum total experience of 05 years out of which minimum 03 years in relevant field in Infrastructure projects.

NOTES:

1. The CVs of concerned personnel shall be submitted to the Engineer for approval. No person mentioned in table above shall be deployed in the project without Engineer's approval.
2. Relaxation in qualification / experience can be given by the Engineer in exceptional cases where candidates have got high level of professional competency. Decision of the Engineer in such cases shall be final and binding.
3. *The candidates must have obtained Degree/Diploma as full time regular candidates.*

ATTACHMENT C-3

MINIMUM REQUIREMENT OF THE DDC'S ORGANIZATIONAL STRUCTURE

The DDC shall submit an Organisation Chart together with clear description of the responsibilities of each member within the overall works programme.

S. No	Designation	Numbers	Experience
1	Team Leader	01	Graduate degree in Civil Engineering having experience not less than 10 years and would have handled minimum 02 projects as Team Leader of similar nature & complexity.
2	Bridge Design Expert	01	Graduate degree in Civil Engineering with total experience of 10 years and minimum 05 years of relevant experience in the concerned field and would have handled minimum 01 project involving railway bridge involving deep foundation.
3	Embankment Design Expert	01	Graduate degree in Civil Engineering with total experience of 10 years and minimum 5 years of relevant experience in the concerned field and would have handled minimum 01 project involving railway/highway embankment of minimum 6 m height.
4	Rail Structure Interaction (RSI) Design Expert	01	Graduate degree in Civil Engineering with total experience of 10 years and minimum 3 years of relevant experience in the concerned field and would have handled minimum 02 projects involving RSI study of railway bridge having minimum length of 100m.

NOTES:

1. Sufficient documentary proof to substantiate the qualification and work experience shall be submitted. The Contractor shall submit proposal of DDC experts having experience as mentioned above to the Engineer for approval before deployment.
2. The requirement given above is minimum. The Contractor shall be required to supplement the above mentioned design team as per requirement of the Works so as to adhere to the timelines given in Appendix-2- Contract Key Dates and Completion Date, Section VII-9: Appendices, Part 2- Employer's Requirements under the Contract.
3. Design expert at item No. 4 shall not be required for the entire period of the project and may be deployed as per the requirement.

ATTACHMENT C-4

MINIMUM RESOURCES PROPOSED FOR THE PROJECT- PLANTS & EQUIPMENTS

The figures indicated below are the minimum number of equipment required.

S. No.	Types of Equipment Required for the Work	Minimum No. of Unit of Equipment Required for the Work
1.	Vibratory Roller (10 T)	4
2.	Pugmil/Crusher(200MT/hr)	1
3.	Concrete Batching Plant	2 (Combined. capacity of 2 batching plant minimum 90 cum/hr.)
4.	Concrete Boom Placer	*2*
5.	Stationary Concrete Pumps (36 cum/hr)	2
6.	Survey Instruments (Total Station)	2
7.	Lab Testing equipment- fully equipped for site tests.	As per Appendix 12 of Section VII-9: Appendices, Part 2- Employer's Requirements
8.	Digital Level (Leica, Sokia)	3

Notes:

1. These resources are for peak period of each activity. All plants and equipment need not be mobilized simultaneously. Plants and equipment as required as per the progress of the work shall be brought at site in advance as directed by the Engineer.

2. The Contractor must have a tie up for fabrication of steel bridge girders included in this contract with RDSO approved plant/workshop in Part-A.

Part 2-Employer's Requirements

Section VII-5: Employer's Requirements -Outline Design Specifications (ODS) – Civil & BLT

Section VII-5: Employer's Requirements -Outline Design Specifications (ODS) – Civil & BLT

TABLE OF CONTENTS

1 INTRODUCTION

This part lays down the specifications/criteria for design of civil structures i.e., Viaduct, bridges, stations, embankments, retaining walls, Ballastless Track, RE wall and other structures.

The broad parameters covered in these specifications are listed below:

1. Design Requirements
2. Material Parameters (Concrete, Reinforcement steel & Structural Steel etc.)
3. Design Parameters
4. Loading Consideration (Dead Load, Super imposed Dead Load, Footpath Live Load, Railway Vehicular Load, Temperature Loads, etc.)
5. Load Combinations
6. Allowable stresses
7. Design Methodology
8. List of Design Codes and Standards

2 OUTLINE DESIGN SPECIFICATIONS-GENERAL

The bridges, stations and other structures to be designed in C-5 Package are mentioned in the Scope of Works. The design works include the preparation and approval of GADs/architectural drawings, Definitive Design and Construction Design for structures as per the Employer's Requirement- Design.

Initially GADs of bridges shall be prepared by the Contractor after carrying out detailed topographical survey based on conceptual GADs. ROW shall be taken as per conceptual Plan and L-section provided in Tender drawings. These GADs will be sent to the Site for checking feasibility of construction by Engineer's Representative and Contractor's Representative. The initial GADs shall be modified incorporating remarks of construction feasibility and submitted to the Engineer along with the preliminary design calculations. After approval of the Engineer, GADs shall be submitted to the stakeholders for approval, if any. Getting approval of GAD from the concerned stakeholders is the responsibility of the Contractor. The Contractor shall address all the queries of the stakeholders. However, the Engineer/ Employer will assist the Contractor in obtaining approval from the concerned stakeholders. The Contractor shall attend any meeting/presentation/joint site visit with stakeholders, as per the requirement, for the approval of GADs. After approval of the stakeholders, the GAD shall be finally approved by the Employer.

2.1 Employer's Inputs

The Employer shall furnish following documents to the Contractor: -

a) Conceptual Plan and L-section of the main & connectivity line

b) Conceptual ESP of station yards

c) Conceptual GAD of bridges

d) Conceptual GAD of viaduct

e) Conceptual layout plan for stations

f) Geo-technical investigation reports

2.2 Codes & Standards

For loadings, load combinations, analysis, and design of structures, all relevant IRS, IS, IRC and other relevant codes shall be followed.

The list of relevant codes and standards, listed in these specifications, is only tentative. The Contractor shall follow provisions of appropriate codes and standards in force for items which are not covered in these specifications.

All codes & standards shall be of latest revision including all amendments & corrections.

2.3 Design Life

The design life of a structure is that period for which it shall be designed to fulfill its intended function.

The Contractor is required to submit a report demonstrating the approach in design, construction and selection of material so as to achieve the design life as specified.

The design life of each structure, facilities and systems shall be as follows:

a) Structures of the Civil works for Railway/Road Loading

The design life of viaduct, bridges and retaining walls (if any) shall be 100 years.

b) Structures of the Building works

The design life of all building and other structures shall be 50 years.

c) Mechanical, Electrical and Plumbing (MEP)

The design life of MEP services including water supply, drainage services and fire protection services etc. shall be 30 years.

d) Ventilation and Air-conditioning (VAC)

The design life of all VAC facilities, systems and services shall be 10 years. The design life of window AC shall be 5 years.

2.4 Maximum Moving Dimensions (MMD) and Clearances

The bridges and other structures shall be designed to cater for double stack container with high rise OHE. The Maximum Moving Dimensions, Structure Gauge and Clearances shall be as per IR Schedule of Dimensions for Broad Gauge.

2.5 Geo-technical investigation

Geo-technical investigation reports included in the Tender Document are indicative in nature and the Contractor shall carry out independent detailed GT investigations as per codal provisions. However, if there is a wide variation (>20%) in the bearing capacity of the soil / pile capacity compared to GT report of nearest bore hole given in the Tender document, the same shall be brought to the knowledge of the Engineer and a confirmatory (repeat) bore bole shall be done to ascertain bearing capacity/pile capacity. The result that is minimum of the two Boreholes carried out by the Contractor shall be adopted for design.

In case, bearing capacity assessed after drilling of Boreholes by the Contractor is less than the value shown in the Tender, the value obtained by the Contractor shall be adopted for design.

a) Liquefaction

Liquefaction shall be considered as per IS 1893-Part-1. The design ground water table shall be used for liquefaction potential calculation. The moment magnitude Mw to be taken in design shall be 7.0. The factor of safety shall be more than 1.0 to ascertain that the strata is not liquefiable.

b) Design Ground Water Table

The ground water table (Base value) shall be considered as maximum (in terms of RL) of ground water table data published/recorded by/in

(a) Central Ground Water Board (CGWB),

(b) Ground water table reported in Geotechnical report provided in Tender Documents,

(c) Ground water table encountered by the Contractor during GT investigation.

The design ground water table shall be taken as minimum 3.0m higher than the Base value for evaluation of effects for liquefaction design purposes.

2.6 Differential Settlement

Differential Settlement between two adjacent bridge piers shall be as follows:

a) 12mm for Long Term Settlement;

b) 6mm for Short Term Settlement

Differential settlement shall be considered only in the design of continuous structures, if any.

2.7 General Design Requirements

a) The Project entails construction of BG double-track electrified railway lines capable of handling "25t loading -2008" double stack container for maximum train speed of upto 160 km/h. The project is a feeder route to DFC also. The embankment and cutting shall be designed for "DFC loading (32.5t axle load)". Bridge and viaduct substructures shall be designed for "DFC loading (32.5t axle load)"and superstructure shall be designed for "25t loading – 2008" unless specified otherwise in the Contract.

b) All levels shall be quoted in metres correct to three decimal places and shall be with reference to Mean Sea Level (MSL) Datum India. The rail level on a track shall refer to the top of the inner rail of the UP Line i.e. line going from Prithla to Sonipat.

c) The Contractor shall comply with the provisions of IR Schedule of Dimensions with regard to the clearance over the existing IR network.

d) Horizontal and vertical alignment has been given in the Conceptual Plan and L-Section drawings. Proposed Right of Way (ROW) has been also marked on these drawings. The Contractor should check the feasibility at site and may propose any minor modifications, if required.

e) All structures shall be designed and detailed to withstand earthquake forces for Seismic Zone IV.

f) Exposure conditions shall be considered as 'moderate' for all type of structures/bridges. However, in case of Nallah crossing (upto 50m on either side of the edge of Nallah), the exposure condition may be treated as "Severe".

g) Minimum Grade of reinforcement steel shall be Fe 500D conforming to IS 1786.

h) Backfill on approaches of Minor Bridge shall be placed in accordance with IRS Substructure Code. Approaches of Viaduct and Major Bridges (i.e. bridges having span equal to or more than 12 m) shall be provided transition system as per RDSO report GE:R-50 as shown in Sketch No. GC-HRIDC-SK-GEN-019.

i) The data like bridge length, size, barrel length, type of crossing, total waterway and indicative span configuration etc. in respect of the proposed road/ waterway bridges has been shown in the conceptual GAD of the bridges. The bridge opening (Horizontal and Vertical) shall not be less than that indicated in the Conceptual GADs.

j) RCC drains shall be designed where existing DFC/KMP and new HORC embankment overlaps, for drainage of storm water from both the embankments.

k) In case of viaduct and bridges on pile foundation, bored cast in-situ concrete piles of minimum diameter 1.2m shall be designed unless otherwise mentioned in the drawing. Number and depth of piles shall be as per sub-soil conditions and design requirements.

l) Inspection platform all-round the abutment caps/pier caps shall be designed along with access ladder.

m) Trolley refuge on bridges shall be designed as per provisions of IRSOD/IRPWM.

n) Side pathway shall be provided on all the girder bridges on outer side of the tracks. Suitable arrangement shall be designed to maintain continuity of pathway throughout the length of bridge and to reach the formation at approach.

o) In case, the bridge is at a location where the Right of Way is restricted, special type of abutment / pier / return wall / wing wall shall be proposed subject to approval of the Engineer.

p) Bridges shall have standard RDSO span lengths. PSC superstructure can be adopted upto 18.3 m clear span only. *Load testing of non-standard superstructure (one number of each typical span) shall be carried out as per the scheme designed by the Contractor and approved by the Engineer*.

q) The embankment on approaches of bridges shall be protected by pitching with CC blocks of suitable sizes, over 15cm thick consolidated gravel bed, encased in cast-in-situ RCC grid frames of suitable cross section having opening size of 1.75m x 1.75m.The pitching shall be provided for a length of 30m on both approaches in case of major bridges & 15m on both approaches in case of minor bridges. For viaduct pitching shall be provided for a length of 30 m on the approach of A1 abutment. Toe wall shall be designed at the end of the

embankment slope as shown in Tender drawings.

r) Inspection steps (1m wide) on either side of formation shall be designed with CC of M20 grade as shown in Tender drawings.

s) Adequate provision shall be kept for inspection and replacement of bearings without major disruption to railway operations or any activity underneath the bridge.

t) The approach roads to the RUBs shall be provided from RCC box to ROW of HORC for the width equal to clear opening of RCC box in concrete of M35 grade *as shown in Tender drawings*.

u) Crash Barriers / medians / footpaths / railings shall be provided as per the requirements of IRC Codes.

v) Height gauge shall be provided at Road Under Bridges (RUB) on all approach roads as per approved *design. Span of height gauge shall be at least equal to clear opening of RUB + 2 m. Height Gauge shall be of single span for roads without median. In case of roads with median(s), height gauges having multiple spans can be provided. However, the Contractor shall be required to provide Height Gauge as per span agreed by Road Authority. No Claim by the Contractor on account of additional span length shall be admissible.*

The Contractor shall obtain approval/NOC of Road authority for GAD of height gauge(s) and its installation.

w) Provision for signages shall be kept on both side of RUBs.

x) Drainage system shall be designed for RUBs where the road level in RUB is below the natural ground level in accordance with Section VII-6, Outline Construction Specifications, Part-2 Employer's Requirements. Protection works / ancillary works shall be designed for all RUBs as shown in the Tender drawings.

y) Necessary provisions for OHE mast shall be kept on bridges.

z) Compensated Ruling Gradient for the Section is 1 in 150. Station yard gradients shall be as shown in the Conceptual ESPs. *The Contractor shall design vertical curves at all locations where change in gradient is more than 0.4 %. Length of vertical curve shall be in multiple of 10 m & minimum radius 4000 m. Equilibrium speed for horizontal curves shall be taken as 90 kmph.*

3 OUTLINE DESIGN SPECIFICATIONS - EARTHWORK IN FORMATION

3.1 General

This part lays down criteria for design of formation in embankment/cutting.

3.2 Details of Structures to be designed

The Contractor shall design formation in embankment/cutting for various heights as per approved L-section. Design of embankment/cutting shall include, but not limited to, the following: -

a) Design of formation for "DFC loading (32.5t axle load)"

b) Slope stability analysis and design of protection measures for erosion control

c) Design of drainage system- longitudinal and cross drains including catch water drains in cuttings.

d) Design of Trolley refuge

e) Design of opening for future utility crossings with MS pipe of 323.9 mm outer diameter.

f) Any other item which is required for complete design of formation in embankment/cutting.

3.3 Design Criteria

3.3.1 For design of formation, the "Comprehensive Guidelines and Specifications for Railway Formation: RDSO/2020/GE: IRS 0004", issued by RDSO (hereinafter written as RDSO Guidelines) shall be followed. The geometric parameters of embankment/cutting shall also conform to Indian Railway Schedule of Dimensions (IRSOD) and Indian Railway Permanent Way Manual (IRPWM). Blanket material shall conform to RDSO Guidelines. Additional cess width of one (01) m on both left and right side of formation shall be provided in station area (i.e. from platform end to 200 m beyond SRJ of last turnout on both sides of station) to lay cable ducts etc.

3.3.2 The design criteria for design of embankment/cutting slopes shall be as under

a) A minimum side slope of 2H:1V for embankment shall be adopted up to 4m height. For higher embankments (more than 4m height.), the slopes shall be designed. However, side slope shall not be steeper than 2H:1V.

b) Both 'End-of-Construction' (EOC) and 'Long-Term' (LT) stability with most adverse drainage conditions shall be considered in design of slopes.

c) Design shall be carried out using effective stress analysis method both for EOC and LT stability conditions, adopting realistic values of shear strength and pore water pressure parameters.

d) Width of berm shall be adequate to suit the mechanical compaction of earth with heavy rollers. However, berm width shall be kept minimum 2m on banks and 4m in cuttings.

e) Erosion Control

i. The slopes of embankments and cutting shall be protected against erosion by providing a protective vegetative cover comprising perennial turf forming grass.

ii. The species of grass shall be compatible with the local soil and climatic conditions.

iii. The materials and techniques proposed by the Contractor shall be suitable for the slope height and angle, soil type and climatic conditions and shall perform its function with minimum maintenance requirements.

iv. Coir netting shall be used for turfing of slopes of embankment/cuttings higher/deeper than 4.0m in addition to the vegetation cover to be provided as per (i) above.

v. The coir netting shall not be lighter than 600 g/sqm. It shall conform to IS: 15869 'Open weave Coir Bhoovastra-Specification' and laid as per IS: 15872 'Application of Coir Geotextiles (coir woven Bhoovastra) for Rainwater Erosion Control in Roads, Railway Embankments and Hill Slopes-Guidelines' and IRC: 56.

vi. The Contractor shall water and maintain the vegetation cover provided on slopes for a period of 12 months from date of Taking Over.

f) Ground Improvement

Suitability of subsoil below formation shall be ensured before starting of earthwork in formation as per RDSO guidelines. Ground improvement shall be adopted in case soft soil is encountered after investigations.

As per initial GT investigations following locations may encounter soft soil:

S. No.	**Starting Chainages (km)**	**End Chainage (km)**	**Formation Length (km)**
1	(-)0.125	0.050	0.275
2	3.685	4.385	0.700
3	7.745	8.045	0.300
4	10.200	10.600	0.600
5	10.800	11.375	0.575
6	11.480	11.545	0.075
7	18.210	19.210	1.000
8	20.220	20.420	0.100
Approximate length = 3.625km			

Note: These locations are tentative. Exact locations of weak sub soil shall be identified by the Contractor after detailed GT investigations.

3.3.3 Drainage Arrangement

i. Top of the formation shall be finished to cross slope of 1 in 30 from centre of formation to both sides in case of single/ double line. However, in case of multiple lines, the cross slope shall be towards cess/drain.

ii. In the double track section, the longitudinal drain between two tracks shall not be provided outside station yards.

iii. In station yard a system of covered/underground RCC longitudinal and cross drains of adequate section shall be designed to ensure efficient drainage as shown in Tender drawings. The Contractor shall submit a drainage plan for approval of the Engineer. Such plans shall be sufficiently detailed. The longitudinal drains shall be extended as necessary to lead the water clear of the Works to natural drainage courses, culverts or any other suitable outlets.

iv. In cuttings, a system of catch water drains of adequate capacity on both sides shall be designed to intercept the surface runoff of adjoining areas from entering into the cutting and to lead the surface runoff safely away from cutting. In addition, longitudinal side drains of adequate capacity on both sides of formation shall be designed to cater to the surface runoff from slopes and formation. Typical Section of cuttings has been shown in Tender drawings.

v. In high/deep embankments/cuttings (height/depth > 6m), a system of precast RCC longitudinal drain of adequate capacity shall be designed along the toe of berm and RCC chute (at about 50 m interval) to collect and lead the surface runoff safely away from the toe of embankment or to side drains in cutting. A concrete chamber shall be provided at the junction of longitudinal berm drain and chute. In embankments, chute shall be extended by about 1.0m beyond the toe of embankment to avoid erosion near the toe. At locations where retaining wall is provided, suitable outfall arrangement shall be provided to avoid erosion of retaining wall foundation.

vi. All cast-in-situ drains shall be designed with RCC of M25 grade.

vii. All the drains shall slope towards the nearest culvert or natural low ground or natural outlets existing nearby where the water shall be discharged with appropriately designed outfall arrangement duly consented by the Engineer.

viii. *All drains shall be designed for a return period of 15 years.*

3.3.4 Trolley Refuge

Trolly refuge shall be designed as shown in Tender drawing. It shall be provided at

400m center to center on each Up and Dn tracks in a staggered manner in case of double line section except platform area. In case of single line connectivity, Trolley Refuge shall be provided at an interval of 200m centre to centre.

3.3.5 MS Pipe

The pipe shall be of 323.9mm outer diameter, fabricated as per IS: 3589 from mild steel plates 5.6 mm thick conforming to IS: 2062 and shall be provided with cement mortar protective lining & coating on inside & outside as per Annexure A of IS: 3589. The length of pipes shall not be less than 6 -8 m.

Pipeline shall be laid as per RDSO guidelines on pipeline crossings under railway track (Report No. BS-105).

3.4 Submittals

Prior to the start of construction operations, the Contractor shall submit to the Engineer all relevant documents, drawings, calculations and data including, but not limited to the following, and shall obtain the approval of the Engineer for the proposed materials, design, construction methods and quality control procedures:

a) Geotechnical investigation reports and evaluation of sub-surface conditions along the alignment.

b) Report detailing the identification of borrow areas for formation, blanket material, prepared subgrade. Geotechnical investigation reports for borrow areas duly indicating the soil properties of the proposed borrow areas.

c) Material test reports for embankment fill, prepared sub-grade and blanket.

d) Cross-section of embankment/cutting along the alignment, at every 20 m interval.

e) Slope stability calculations. Analysis of the stability and settlement of formation and design of remedial measures, if required. Details of earthwork design solutions and criteria used.

f) Details of construction equipment.

4 OUTLINE DESIGN SPECIFICATIONS – VIADUCT & BRIDGES

4.1 General

This part lays down specifications for the design of bridges. The Bridges in HORC Project comprise of simply supported Prestressed Girders (U)/ Steel Composite Girders / Open Web Girders (OWG)/RCC Box Bridges/Culverts with RCC sub-structure and open/deep foundation.

Minimum Centre to Centre distance between two tracks shall be kept as 5.3m according to IR-SOD(BG).

All the bridges shall be provided with bridge number plaque, painting of HFL and bridge boards, where required.

Embankment on minor bridge approaches shall be provided protection measures for a length of 15m as shown in Tender drawings.

Embankment on major bridge approaches and viaduct approach shall be provided protection measures for a length of 30m as shown in Tender drawings.

4.2 Details of Structures to be designed

The structures to be designed and constructed under C-5 Package have been grouped in following six categories:

a) Viaduct

b) Bridges with superstructure of Composite Plate Girders (CG)

c) Bridges with superstructure of Open Web Girder (OWG) with concrete deck for providing Ballastless/ ballasted track

d) Bridges with superstructure of PSC U- slab

e) RCC Box bridges

f) RCC Pipe Bridges

4.2.1 Viaduct

Viaduct for double track shall consist of steel composite superstructure Long Welded Rail (LWR) on Ballastless track (BLT).

HORC viaduct is crossing under DFC Br.No.87. The Contractor shall comply with the requirements of DFC as mentioned in in-principle approval letter No. DFCC/Noida Unit/DMIC/HRIDC/8228 dated 03/06/2023 from DFC attached in Tender documents.

Viaduct elements to be designed by the Contractor includes, but not limited to, the following: -

i. Superstructure for ballastless track and side pathway at deck level

ii. Abutments & abutment cap including foundations & wing/return walls

iii. Piers & pier caps including foundations

iv. Spherical bearings, bearing pedestals, inspection platforms including arrangements for access from track.

v. Provision of jacking arrangements on abutment caps & pier caps for lifting of superstructure

vi. Seismic arrestors in pier/abutment cap

vii. Trolley refuge

viii. Supports for placing OHE mast for traction system of 2x25kV

ix. Protection work at abutment A1

x. Inspection steps on approaches

xi. Drainage arrangements

xii. Arrangement for supporting signaling & telecom cables and other utilities.

xiii. Emergency staircase from pathway to ground

xiv. Ground improvement technique/procedures, if required according to the GT data and design requirements along with the method of verification of the bearing capacity after implementation of ground improvement technique.

xv. RSI Analysis for permitting LWR

xvi. Ballastless track system including transition with ballasted track on A1 side approach

xvii. Steel fencing between two tracks to prevent trespassing.

xviii. Construction methodology, launching scheme (including casting of deck slab) *and span load deflection test scheme.*

xix. Any other item which is required for complete design and construction of the viaduct.

4.2.2 Bridges with superstructure of Composite Plate Girders (CG)

This group includes 04 Nos. of bridges (Br No. 04, 30, 34 & 69) having superstructure of steel *composite plate girders*.

Bridge elements to be designed by the Contractor includes, but not limited to, the following: -

i. Composite girder superstructure *with ballasted* track.

ii. Abutments & abutment caps including foundations & wing/return walls

iii. Piers & pier caps including foundations

iv. Load on bearings, design and drawings of bearings including bearing pedestals, inspection platforms including arrangements for access from track.

v. Provision of jacking arrangements on abutment caps & pier caps for lifting of superstructure

vi. Seismic arrestors in pier/abutment cap

vii. Trolley refuge and man refuse on bridges as per latest IR standards

viii. Provision of supports for placing OHE mast for traction system of 2x25kV

ix. Protection works of abutments

x. Inspection steps on approaches of bridges

xi. Side pathway on bridges for maintenance (Arrangement for pathway shall be provided as per RDSO drawings No. CBS-0046).

xii. Drainage arrangements

xiii. Arrangement for supporting signaling & telecom cables and other utilities.

xiv. Ground improvement technique/procedures, if required according to the GT data and design requirements along with the method of verification of the bearing capacity after implementation of ground improvement technique.

xv. RSI Analysis for permitting LWR

xvi. Ballastless track system including transition with ballasted track on approaches

xvii. Construction methodology and launching scheme (including casting of deck slab)

xviii. Any other item which is required for complete design and construction of the bridges.

4.2.3 Bridges with superstructure of Open Web Girder (OWG) with concrete deck for providing *Ballastless* track.

This group includes 04 Nos. of bridges (Br. Nos. 17,28,45 & 68) having steel OWG superstructure. *Br. No. 28 has two spans of CG one on either side of OWG.*

Bridge elements to be designed by the Contractor includes, but not limited to, the following: -

i. Superstructure *with RCC deck and BLT (OWG and CG both)*

ii. Abutments & abutment caps including foundations & wing/return walls

iii. Piers & pier caps including foundations

iv. Spherical bearings, bearing pedestals, inspection platforms including arrangements for access from track.

v. Jacking arrangements on abutment caps & pier caps for lifting of superstructure

vi. Seismic arrestors in pier/abutment cap

vii. Trolley refuge and man refuge on bridges as per latest IR standards.

viii. Support for placing High Rise OHE mast for traction system of 2x25kV, wherever required

ix. Protection works of abutments

x. Inspection steps on approaches of bridges

xi. Side pathway on bridges for maintenance

xii. Drainage arrangements

xiii. Arrangement for supporting signalling & telecom cables and other utilities

xiv. Ground improvement technique/procedures, if required according to the GT data and design requirements along with the method of verification of the bearing capacity after implementation of ground improvement technique.

xv. RSI Analysis for permitting LWR

xvi. Ballastless track system including transition with ballasted track on approaches

xvii. Construction methodology, launching scheme (including casting of deck slab) *and span load deflection test scheme.*

xviii. Any other item which is required for complete design and construction of substructure.

Note: In case *BLT* on OWG is not considered feasible due to site conditions or any other reason, standard RDSO drawings of OWG for "DFC loading (32.5t axle load)" shall be followed for the superstructure. Item No.(i) & (xvi) mentioned above will not be required to be designed and in that case the payment against Milestone CD 1.4.2 under Cost Centre CD1-Design of Price Schedule shall not be made.

4.2.4 Bridges with superstructure of PSC U- slab

This group includes 03 Nos. of bridges (Br No. 12, 63 & 69) having superstructure of **PSC U- slab (**post tensioned). Bridge elements to be designed by the Contractor includes, but not limited to, the following:-

i. Abutments & abutment caps including foundations & wing/return walls

ii. Piers & pier caps including foundations

iii. Seismic arrestors in pier/abutment cap

iv. Protection works of abutments

v. Inspection steps on approaches of bridges

vi. Drainage arrangements

vii. Arrangement for supporting signaling & telecom cables and other utilities

viii. Ground improvement technique/procedures, if required according to the GT data and design requirements along with the method of verification of the bearing capacity after implementation of ground improvement technique.

ix. Construction methodology

x. Any other item which is required for complete design and construction of the bridges.

4.2.5 RCC Box Bridges

This group includes the bridges with RCC Box fit for "DFC loading (32.5t axle load)".

Bridge elements to be designed by the Contractor includes, but not limited to, the following: -

i. RCC Box

ii. Wing wall, return wall, drop wall, curtain wall, protection works

iii. Inspection steps at approaches of bridges

iv. Ground improvement technique/procedures, if required according to the GT data and design requirements along with the method of verification of the bearing capacity after implementation of ground improvement technique

v. Construction methodology

vi. In case of RUB, drainage arrangement, height gauge and approach road

vii. Any other item which is required for complete design of RCC box bridge

4.2.6 RCC Pipe Bridges

This group includes one bridge (Br. No.1) with RCC pipe fit for "DFC loading (32.5t axle load)".

Bridge elements to be designed by the Contractor includes, but not limited to, the following: -

i. Standard Reinforced NP-4 class concrete pipes shall be provided as per IS:458

ii. Concrete face wall

iii. Rigid collar Joints between the prefabricated pipe lengths

iv. Protection Works.

4.3 Design Requirements

a) Viaduct

i. The superstructure shall consist of composite girder of standard RDSO span length of 24.4m */ 30.5 m / 45.7 m / 61.0 m / 76.2 m* and one non-standard *slab at* abutment A2. Superstructure shall be designed for "25t Loading-2008" considering ballastless track with LWR/CWR. However, sections of various components of superstructure adopted shall not be less than the sections adopted in the corresponding RDSO standard*s* drawing. Load on side pathway shall be considered as per IRS Bridge Rules.

ii. The substructure and foundation of bridges shall be designed for DFC loading (32.5T loading) as per IRS Bridge Rules and other relevant codes. For the purpose of design of substructure and foundation, dead load of superstructure shall be taken 120% of dead load of superstructure designed for 25T loading. The substructure and foundation of bridge shall also be designed for 25T loading with double stack container.

iii. Substructure shall consist of wall type or separate pier under each track as shown in Tender drawings.

iv. The foundation of proposed elevated viaduct shall be designed with deep foundation at locations shown in Tender drawings.

v. *Deck slab of CG shall have minimum 1.0 m wide pathway with railing and duct underneath at outside of UP & DN line tracks* as shown in the Tender drawings. *Duct* shall be used for *laying of electrical and S&T* cables.

vi. Provision of OHE masts / portal for both the tracks shall be kept on all the pier/abutment caps.

vii. Provision of Signal Post and junction box for both tracks shall be provided on superstructure as shown in Tender drawings.

viii. Steel fencing between two track to prevent trespassing shall be designed.

ix. Viaduct shall be designed to accommodate curvature of the track alignment.

x. Viaduct shall be designed for permitting LWR / CWR.

xi. Hand railing of pathway, trolley/man refuge and inspection platforms shall be metallized with same specifications as that of steel girders. The design shall be such that it can be easily maintained and replaced, if required.

xii. Arrangements for enabling inspection of superstructure and bearings shall be provided as per RDSO report BS-113.

xiii. Spherical bearings shall be designed for all spans. Bearing type for each girder shall be fixed, longitudinal guided, transverse guided and free. All

bearings shall be easily replaceable without major disruption to railway operations or to any activity underneath the viaduct. Bearings shall be placed on bearing pedestals designed in accordance with applicable codes. Appropriate jacking points, on the pier/abutment cap in consideration with the requirements of the superstructure for lifting, shall also be provided. The bearings shall be sandwiched between two true horizontal surfaces. Steel Wedge shall be provided to cater to longitudinal slope of superstructure, wherever required. Minimum thickness of steel wedge shall be 12mm and shall be more on the other side as per the requirement of the gradient. Higher size single plate shall be used for fabrication of wedge plate.

xiv. Expansion/Movement Joints and other necessary measures to control shrinkage and thermal effects shall be incorporated in the structural design so that the performance of the viaduct structures are not adversely affected during normal working conditions. Movement joints shall be designed to be easily maintained and replaceable.

xv. Minimum depth of foundation of bridges shall be scour depth plus 1.75m below the bed level.

xvi. The water from deck shall be taken down from pier with adequately designed drainage system using GI pipes and bends.

xvii. Span load deflection test shall be carried out on each typical girder. Load testing scheme shall be as per IRC SP 51.

Note: If same span girder is fabricated by different fabricators, separate load testing shall be conducted on girders fabricated by each fabricator.

b) Bridges with Superstructure of Composite Plate Girder (CG)

i. This group includes 06 Nos. of bridges (Br No. 04, 28, 30, 34, 68 & 69) having superstructure of steel CG. Standard RDSO drawings for "25t Loading-2008" will be used for superstructure of CG (except for Br. No.28 & 68 where BLT is proposed).

Superstructure of these bridges shall conform to standard RDSO drawings for "25t Loading-2008" or shall be desiged as given below:

S. No.	Bridge No.	Span	Reference RDSO Drawings/Remarks
1.	04	24.4 m	B-11751 series
2.	28	18.3m	To be designed with BLT
3.	30	30.5 m	B-11754 series
4.	34	24.4 m	B-11751 series
5.	68	18.3m	To be designed with BLT
6.	69	18.3m	B-11753 series

However, where standard RDSO drawings are used, the Contractor shall verify the adequacy of RDSO standard drawings of CG for double stack containers.

Minimum Grade of deck slab in composite girders shall be maximum of M-35 or that mentioned in RDSO drawings.

ii. The substructure and foundation of bridges shall be designed for DFC loading (32.5T loading) as per IRS Bridge Rules and other relevant codes. For the purpose of design of substructure and foundation, dead load of superstructure shall be taken maximum of dead load of corresponding standard RDSO superstructure for DFC loading (32.5 T loading) or 120% of dead load of superstructure designed for 25T loading. The substructure and foundation of bridge shall also be designed for 25T loading with double stack container.
iii. Bridges shall be designed to accommodate curvature of the track alignment, wherever required.
iv. Bridges shall be designed for permitting LWR / CWR.
v. Metallized side pathway with hand railing shall be provided on bridges on outer side of Up & Down track as per RDSO drawing No. CBS-0046. Adequate arrangement shall be made on the bridges for providing electrical/ telecommunication cables and other utilities as required.
vi. Hand railing of pathway, trolley/man refuge and inspection platforms shall be metallized with same specifications as that of steel girders. The design shall be such that it can be easily maintained and replaced, if required.
vii. Arrangements for enabling inspection of superstructure and bearings shall be provided as per RDSO report BS-113.
viii. Spherical bearings shall be designed for all composite girders. Bearing type for each girder shall be fixed, longitudinal guided, transverse guided and free. All bearings shall be easily replaceable without major disruption to railway operations or to any activity underneath the viaduct. Bearings shall be placed on bearing pedestals designed in accordance with applicable codes. Appropriate jacking points, on the pier/abutment cap in consideration with the requirements of the superstructure for lifting, shall also be provided. The bearings shall be sandwiched between two true horizontal surfaces. Steel Wedge shall be provided to cater to longitudinal slope of superstructure, wherever required. Minimum thickness of steel wedge shall be 12mm and shall be more on the other side as per the requirement of the gradient. Higher size single plate shall be used for fabrication of wedge plate.
ix. Expansion/Movement Joints and other necessary measures to control shrinkage and thermal effects shall be incorporated in the structural design so that the performance of the bridge/structures are not adversely affected

during normal working conditions. Movement joints shall be designed to be easily maintained and replaceable.

x. Height Gauges shall be provided on approach roads on both sides of RUBs. Height gauge for road-under-bridges shall be as per RDSO drawing no. RDSO/M- 0001. If RDSO drawing is not applicable, the Contractor shall design height gauge for the required span considering road width & applicable loading. However, the section of height gauge shall not be less than RDSO drawing No. RDSO/M-0001. Height gauge shall be provided with reflecting strip & height warning signs as per standard practices.

xi. Minimum depth of foundation of bridges shall be scour depth plus 1.75m below the bed level.

xii. The water from deck shall be taken down from pier with adequately designed drainage system using GI pipes and bends.

xiii. Provision of OHE most/portal for both tracks shall be provided on pier cap, as required.

c) Bridges with superstructure of Open Web Girder (OWG) with concrete deck for providing Ballastless/ ballasted track

i. OWG for span 30.5, 45.7m and 76.2m span shall be designed for "25t Loading-2008" with BLT/ ballasted track with LWR/CWR suitable for double stack container. The configuration of OWG to be designed shall be kept similar to that of RDSO standard OWG for 32.5t axle load for double stack container. RCC deck shall be provided over stringers with shear connector arrangement. Specification of all materials like steel, welds etc. shall be as per below mentioned RDSO drawings. All field connections in OWG shall be with HSFG bolts. Grade of bolts to be used shall be of property class 8.8. The weight of the steel structure shall not be less than that of corresponding standard RDSO OWG for "25t Loading-2008".

ii. STAAD/Midas or any equivalent software shall be used for analysis and design of OWG. All the joints shall be designed by FEM software like IDEA StatiCa or equivalent. The software proposed to be used shall be got approved from the Engineer. Manual design shall also be performed for the truss member design and connection design along with the checks done by software. Excel sheet for manual calculations shall be submitted along with the software files. All the steel drawings shall be prepared using Tekla software.

iii. Metallized side pathway and man refuge for maintenance shall be provided similar to arrangement shown in RDSO drawing No. CBS-0045 and CBS-0028, respectively, on one side of each OWG (i.e. outer side).

iv. The design of OWG with ballasted deck/ballastless track shall also be got checked from a third party consultant of repute or RDSO. The third party consultant proposed to be deployed shall be got approved from the Engineer. Design and drawings duly proof checked by third party consultant shall be

submitted to the Engineer for approval. The cost of third party consultancy shall be borne by the Contractor.

v. Third party consultant engaged shall be the reputed consultant with minimum 5years of experience in steel bridge design and should have successfully completed design and drawing of at least one OWG for railway loading of minimum 45.7m span. The checking by third party consultant shall be done with a software other than that used in the original design by DDC. Design and drawings of launching scheme and temporary structures shall also be got checked by the third party. Getting approval of launching scheme from the concerned stakeholders shall be the responsibility of the Contractor.

vi. The Contractor shall submit the detailed design by the DDC and third party consultant for approval by the Engineer. The Contractor shall also make available to the Engineer, all the software used by the DDC of the Contractor and third party consultant for proof checking and approval.

vii. In case BLT/ballasted track on OWG is not considered feasible due to site conditions or any other reason, following standard RDSO drawings shall be followed for the superstructure:

S. No.	Span	Reference RDSO Drawings/Remarks
1	30.5m	B-17061 to B-17078 or any other design drawing provided by the Employer.
2	45.7 m	B-17081 to B-17098 or any other design drawing provided by the Employer.
3	61.0 m	B-17121 to B-17138 or any other design drawing provided by the Employer.
4	76.2 m	B-17101 to B-17118 or any other design drawing provided by the Employer.

Notes for above Table:

a. RDSO drawings shall be with latest revision.
b. All connections in OWG shall be with HSFG bolts even if it is riveted shown in the above drawings. HSFG bolts shall be of property class 8.8.
c. Spherical bearings shall be used instead of roller rocker bearings shown in the RDSO drawings. The Contractor shall design and carry out modifications to RDSO drawing of L0/L0' joints of OWG for accommodating spherical bearings and shall get it approved from Chief Bridge Engineer (CBE), Northern Railway/ Nominated Authority of the Employer.
d. Side pathway and man refuge for maintenance shall be provided as per RDSO drawing No. CBS-0045 and CBS-0028, respectively, on one side of the truss.
e. Arrangement for prevention of train droppings on road/rail users underneath the track shall be provided.

viii. These bridges shall be desiged to permit LWR / CWR.

ix. The substructure and foundation of bridges shall be designed for DFC loading (32.5T loading) as per IRS Bridge Rules and other relevant codes. For the purpose of design of substructure and foundation, dead load of superstructure shall be taken maximum of dead load of corresponding standard RDSO superstructure for DFC loading (32.5 T loading) or 120% of dead load of superstructure designed for 25T loading. The substructure and foundation of bridge shall also be designed for 25T loading with double stack container.

x. Bridges shall be designed to accommodate curvature of the track alignment, wherever required.

xi. Provision of OHE masts/portal for both the tracks shall be provided on all pier / abutment caps.

xii. Hand railing of pathway, trolley/man refuge and inspection platforms shall be metallized with same specifications as that of steel girders. The design shall be such that it can be easily maintained and replaced, if required.

xiii. Adequate arrangement shall be made on the bridges for providing electrical/ telecommunication cables and other utilities as required. Specifications and guidelines of the owning agencies in such cases shall be followed.

xiv. Arrangements for enabling inspection of superstructure and bearings shall be provided as per RDSO report BS-113.

xv. Spherical bearings shall be designed for all OWG. Bearing type for each girder shall be fixed, longitudinal guided, transverse guided and free. All bearings shall be easily replaceable without major disruption to railway operations or to any activity underneath the viaduct. Bearings shall be placed on bearing pedestals designed in accordance with applicable codes. Appropriate jacking points, on the pier/abutment cap in consideration with the requirements of the superstructure for lifting, shall also be provided. The bearings shall be sandwiched between two true horizontal surfaces. Steel Wedge shall be provided to cater to longitudinal slope of superstructure, wherever required. Minimum thickness of steel wedge shall be 12mm and shall be more on the other side as per the requirement of the gradient. Higher size single plate shall be used for fabrication of wedge plate.

xvi. Expansion/Movement Joints and other necessary measures to control shrinkage and thermal effects shall be incorporated in the structural design so that the performance of the bridge/structures are not adversely affected during normal working conditions. Movement joints shall be designed to be easily maintained and replaceable.

xvii. Height gauge for road-under-bridges shall be as per RDSO drawing no. RDSO/M-0001. If RDSO drawing is not applicable, the Contractor shall design height gauge for the required span considering road width & applicable loading. However, the section of height gauge shall not be less than RDSO drawing No. RDSO/M-0001.

Height gauge shall be provided with reflecting strip & height warning signs as per standard practices.

xviii. Minimum depth of foundation of bridges shall be scour depth plus 1.75m below the bed level.

xix. The water from deck shall be taken down from pier with adequately designed drainage system using GI pipes and bends.

xx. *Span load testing shall be carried out on all typical OWG's in case of OWG with deck system, span load testing scheme shall be designed as per IRC SP-51.*

Note: If same span OWG is fabricated by different fabricators, separate load testing shall be conducted on girders fabricated by each fabricator.

d) Bridges with Superstructure of PSC U-slab

i. Superstructure to be adopted shall conform to standard RDSO drawings for "25t Loading-2008". Following standard RDSO drawings for "25t Loading-2008" will be used for PSC superstructure.

S. No.	Span	Reference RDSO Drawings
		25t loading
1	12.2m	B-10281 series (**PSC U-slab)**

However, the Contractor shall verify the adequacy of the above RDSO standard drawings for double stack containers.

ii. The substructure and foundation of bridges shall be designed for DFC loading (32.5T loading) as per IRS Bridge Rules and other relevant codes. For the purpose of design of substructure and foundation, dead load of superstructure shall be taken maximum of dead load of corresponding standard RDSO superstructure for DFC loading (32.5 T loading) or 120% of dead load of superstructure designed for 25T loading. The substructure and foundation of bridge shall also be designed for 25T loading with double stack container.

iii. Height Gauges shall be provided on both approach roads on sides of RUBs. Height gauge for road-under-bridges shall be as per RDSO drawing no. RDSO/M- 0001. If RDSO drawing is not applicable, the Contractor shall design height gauge for the required span considering road width & applicable loading. However, the section of height gauge shall not be less than RDSO drawing No. RDSO/M-0001. Height gauge shall be provided with reflecting strip & height warning signs as per standard practices.

iv. Minimum depth of foundation of bridges shall be scour depth plus 1.75m below the bed level.

v. The water from deck shall be taken down from pier with adequately designed drainage system using GI pipes and bends.

e) RCC Box

i. Bridges shall be designed for "DFC loading (32.5t axle load)". In addition, the design shall consider the loading standards as applicable to the type of the crossing/existing road or Class A/Class 70R loading as per IRC 6-2017, as the case may be.

Standard RDSO drawing for box culvert shall be followed if available. Minimum Grade of concrete in RCC Box shall be maximum of M-35 or that mentioned in RDSO drawings.

If standard RDSO drawing is not available for desired sizes/fill height, box shall be designed by the Contractor. However, the thickness of walls and top & bottom slabs shall not be less than that shown in the Tender drawings and reinforcement of the box shall not be less than the closest available box size & fill height of RDSO drawing.

ii. Size of the Box openings (minimum required) has been shown in the conceptual GADs. Height of box shown includes clear height and wearing coarse of 150mm. Overall height of box may vary as per site requirement and actual road/ground profile.

iii. The barrel length of the culvert shall be decided based on the fill height and ROW.

iv. For Road under bridges (RUBs) top (including wearing coarse) of bottom slab of RCC box shall not be kept above the surrounding natural ground level. However, road level and vertical clearance above road level shall be maintained as shown in Tender drawings. Overall height of the box shown in Tender drawings may need modification in such cases. Financial cost incurred due to change in design and construction on account of above mentioned situations shall be borne by the Contractor and shall be deemed to have been included in Price Schedule 'A'.

v. Fill Depth shall be the height of fill from the bottom of the sleepers to the top of the box and shall be inclusive of depth of ballast and depth of soil fill as per IRS Concrete Bridge Code (CBC).

vi. All waterway bridges shall be protected by a well-designed flooring system. The concrete/CC block shall be protected by curtain wall at upstream side and drop wall at downstream side. The minimum depth of the curtain wall and drop wall shall be scour depth plus 1.75m below the bed level.

vii. Height Gauges shall be provided on both sides of RUBs. Height gauge for road-under-bridges shall be as per RDSO drawing no. RDSO/M- 0001. If RDSO drawing is not available for the road width, the Contractor shall design height gauge for the required span considering applicable loading. However, the section of height gauge shall not be less than RDSO drawing No. RDSO/M-

0001. Height gauge shall be provided with reflecting strip & height warning signs as per standard practices.

viii. Unless otherwise shown in Tender drawings or in Tender Documents, a well compacted layer of coarse sand shall be provided under RCC box upto bottom of the shear key.

f) RCC Pipe Bridges

i. Reinforced NP-4 class concrete pipes of diameter 300mm, 600mm, 900mm, 1000mm, 1200 mm and 1800mm are suitable for DFC Loading (32.5t axle loading) and shall be used subject to conditions mentioned below:
   a. Maximum cushion of 5.0m and minimum cushion of 900mm (including ballast cushion) below bottom of sleepers and above top of pipes shall be ensured.
   b. "Positive Projection Embankment Condition: Type -A Bedding- Earth foundation" shall be provided.

ii. Reinforced (NP-4 class) concrete pipes shall be provided as per IS: 458 "Precast concrete pipes (with and without reinforcement)".

iii. Laying conditions shall be as per IS:783-1985 "Code of practice for laying of concrete pipes".

iv. Pipe shall be extended well beyond the bank as shown in the Tender drawing.

v. Concrete face wall of suitable lengths shall be provided at the ends of pipe culvert.

vi. Protection Works.

4.4 Outline Design Criteria

This Outline Design criteria pertains to the Bridges for HORC Project.

a) ROADWAY AND RAILWAY CLEARANCES

The alignment of HORC crosses several existing roadways and existing railways. The general clearance requirements for these crossings shall be as follows:

(i) CLEARANCES FOR ROAD TRAFFIC

Vertical clearance for road traffic shall be higher of the values as per Clause 104.4.2 of IRC-5 plus 100 mm or as per Conceptual GAD or as per requirement of stakeholder, whichever is more

General Arrangement Drawings at road crossings shall be got approved from the concerned authorities/stake holders.

(ii) CLEARANCES FOR ROLLING STOCK

Clearance for railway traffic shall be as per Schedule of Dimensions of Indian Railways applicable for high rise OHE for double/triple stack container route. General Arrangement Drawing at railway crossings shall be got approved from the concerned Railway Authority.

b) MATERIALS PARAMETERS

i. CONCRETE

1) Grade of Concrete & Cover

Grade of concrete shall be minimum M-35 for RCC works and minimum M-20 for plain cement concrete including levelling course.

In case of foundation, cover shall be taken as 75mm for all conditions of exposure. For substructure, cover shall be taken as 50mm.

2) Cement

The minimum cementitious material content, maximum water-cement ratio, total chloride content by weight of cement shall be as per IRS-CBC.

3) Density

Density of concrete shall be 2500 kg/m^3 for PSC and RCC, 2500 kg/m^3 for Plain cement concrete and 2600 kg/m^3 for Wet concrete.

4) Poisson's Ratio

Poisson's ratio for all grades of concrete shall be 0.15.

5) Thermal Expansion Coefficient

Coefficient of thermal expansion shall be considered as 11.7 x10-6/ ^oC in accordance with IRS-Bridge Rules.

6) Time-Dependent Characteristics of Materials

Long-term losses should be calculated in accordance with IRS- CBC.

The design shall be done according to construction sequence to be adopted in site.

ii. REINFORCEMENT STEEL

High strength deformed (HYSD) reinforcement bars of minimum Fe-500D grade, conforming to IRS-CBC & IS 1786 shall be used.

Young's Modulus = 200,000 MPa

Yield Stress(fy) = 500 MPa.

Density = 7850 kg/m^3

Reinforcement shall fulfill the criteria laid down in IRS Seismic code for earthquake resistant design of Railway bridges.

iii. STRUCTURAL STEEL (FOR OPEN WEB /COMPOSITE BRIDGES & OTHER STRUCTURES IF ANY)

Structural steel shall be used for OWG, composite girders and for miscellaneous use such as railing, supporting utilities, coverings etc.

1) Structural Steel for Open Web/Composite Bridges

(a) General

Structural steel conforming to IS: 2062(Grade E250 – B0, E350 – B0) shall be adopted.

Fabrication shall be done as per the provisions of IRS B1 (Fabrication Code).

Design of steel structures shall be done as per IRS steel Bridge Code.

IRC Code: 22 shall be referred for steel-concrete composite construction.

Welding shall be done following IRS Steel Bridge Code, IRS welded Bridge code or relevant IS codes for welding.

(b) Young's Modulus shall be taken as 21100 kg/mm^2 as per IRS- Steel Bridge Code.

(c) Density: 7850 kg/m^3

(d) Poisson's Ratio: 0.30 as per IS 800

(e) Thermal Expansion Coefficient: $12x10^{-6}/^oC$ as per IS 800

Note: In case design of any component/member is done using foreign code, material shall confirm to the specifications of the relevant foreign code.

2) Structural Steel for Miscellaneous Use

The design of miscellaneous structure shall be done as per IS: 800 and related provisions.

Hollow steel sections for structural use shall be as per IS: 4923.

Steel tubes for structural purpose shall be as per IS: 1161.

Steel for General Structural Purposes (Grade E250 – B0, E350 – B0) shall be as per IS: 2062.

c) LOADS TO BE CONSIDERED FOR DESIGN

For loadings, load combinations, analysis, and design of structures, all relevant IRS, IS, IRC and other relevant codes shall be followed.

The superstructure, bearing, substructure and foundation will be checked for one track loaded condition as well as multiple/all track loaded conditions as well as for single span and two adjacent spans loaded conditions, as the case may be.

Design of structures shall take into account construction methodology/ construction sequence to be adopted during execution.

The analysis and design will be carried out for all possible cases of rolling train loads. All the supporting structures such as superstructure, bearings, substructure and foundations shall be checked for all possible load combinations.

Following are the major loads to be taken into consideration for analysis and design of structures as prescribed in IRS-Bridge Rules up to latest up-to-date correction slip.

i. DEAD LOAD

Dead load shall be based on the actual cross section area and unit weights of materials and shall include the weight of the materials that are structural components of the bridge and permanent in nature.

ii. SUPER IMPOSED DEAD LOAD (SIDL)

Superimposed dead load include all the weights of materials on the structure that are not structural elements but are permanent. It includes weight of track from BLT/ballast/sleepers/rails/ fasteners/ cables/parapet/ hand-rail OHE mast/ cable trough/ Signaling equipment etc.

iii. SHRINKAGE & CREEP

Shrinkage and Creep effects will be calculated as per IRS CBC.

iv. LIVE LOAD (LL)

(a) Railway Vehicular Load

Live load shall be followed as per Clause 2.3 of IRS Bridge Rules.

(b) Dynamic Augmentation

CDA will be considered as specified in IRS Bridge Rule.

(c) Footpath Live Load

Footpath live load shall be taken as per IRS Bridge Rules

(d) Longitudinal Force

Longitudinal force shall be followed as per Clause 2.8 of IRS Bridge Rules.

Tractive force of one track and braking force of another track will be taken in the same direction to produce worst condition of loading.

As per IRS-Bridge Rules, in transverse / longitudinal seismic condition, only 50% of gross tractive effort/braking force will be considered.

Dispersion, of longitudinal forces is not allowed as per IRS Bridge Rules except during checking of Rail stress.

(e) Forces due to curvature and eccentricity of track

The forces due to curvature and eccentricity of track is to be considered as per IRS: Bridge Rules.

Centrifugal forces shall be considered to act at a height of 3m (same as in case of DFC loading) above rail top level on the safer side as it is not defined in Bridge Rules for double stack containers.

(f) Racking Force

The horizontal transverse force due to racking as specified in IRS-Bridge Rules is applicable to design.

v. Earth/Surcharge load

Earth pressure and surcharge load/pressure shall be taken as per the provisions of IRS Substructure & Foundation Code.

vi. TEMPERATURE EFFECTS

(a) Temperature

- Overall Temperature (OT)

The loads shall be considered as per IRS-Bridge Rules and IRC:6. Temperature variation of + 35°C shall be considered, details of which are given below

Maximum Temperature considered as per Annex. F of IRC 6: +49°C

Minimum Temperature considered as per Annex. F of IRC 6: -0.4°C

Temperature variation as per Clause 215.2 of IRC 6 will be =

49-(-0.4)/2+10=34.7°C say 35°C.

- Differential Temperature (DT)

  The provision given in IRC 6, shall be considered to compute effect of differential temperature gradient.

(b) Rail Structure Interaction (RSI)

Movement and rotation of girders on viaduct and bridges can impact the track design significantly and the limitations posed by the safe performance of the track can impact significantly the design of components of bridges/viaduct. Therefore, design of viaduct/bridges and track require extensive interaction between the viaduct/bridges designer and the track designers.

Rail structure interaction [RSI] analysis for continuing Continuous Welded Rail/Long Welded Rail over bridge shall be carried out as per provisions of "IRS Bridge Rules" and the following guidelines issued by the RDSO:

1. BS 114 (version-2): "RDSO Guidelines for carrying out Rail-Structure Interaction studies on Indian Railway" for ballasted deck bridges.
2. BS 119 (version-2): "RDSO Guidelines for carrying out Rail-Structure Interaction studies on Metro Systems " for ballastless deck bridges (bridges with slab track).

The following shall be adhered to:

a. Track resistance in loaded and unloaded conditions for ballasted or unballasted deck shall be obtained from cl. 2.8.2.4.3 of IRS Bridge Rules. As per the clause, the recommended values for track stiffness for ballasted tracks are 50 KN/m and 25 kN/m for loaded and unloaded track respectively. The recommended values for track stiffness for unballasted tracks are 60 kN/m and 40 kN/m for loaded and unloaded track respectively.

b. The elastic limit is 2 mm for ballasted tracks and 0.5mm for ballastless track.

c. The track stiffness can be modified by suitably changing the clamping force applied by the track fastening system, if required from RSI considerations.

d. The deck temperature variation, to be used for analysis, shall be derived from the ambient temperature given in Annexure- F of IRC 6-2017. For co-relation between the ambient temperature and deck temperature the provision of cl. 6.1.3 of en.1991.1.5.2003 may be used

e. The rail temperature variation, to be used for analysis, shall be obtained from the nearest SSE/P. Way depot of Indian Railways.

f. Maximum additional stresses in rail in tension as well as compression on account of rail-structure interaction shall be within the permissible limits as prescribed in cl. 2.8.2.4.3 of IRS Bridge Rules. The limit prescribed in the document shall be used as it is and no benefit on account of lesser axle load of actual rolling stock shall be permitted.

g. The provisions of Displacements of Bridge Elements as mentioned in the guidelines and UIC 774-3R shall be adhered to.

h. For ballastless track, the checks must be performed for break in rail continuity due to unusual conditions such as fractures or for maintenance purposes.

i. The longitudinal design force for the substructures and foundations shall be the longitudinal force specified in the IRS Bridge Rules (without dispersion) or the longitudinal force obtained from RSI analysis, whichever is more.

j. In the case of track on curve, staged detailed analysis shall be performed. For bridges on straight alignment, simplified analysis will suffice.

k. The software and general methodology to be used for carrying out Rail Structure interaction analysis must be validated as per guidelines given in UIC 774-3R before adopting the same.

l. Representative stretches must be chosen for carrying out Rail-Structure interaction which shall include special spans. The same shall be approved of by the Engineer.

RSI shall be carried out by RSI expert engaged by the Contractor and approved by the Engineer. RSI expert shall have minimum 3 years of experience of RSI for bridges or viaduct.

vii. WIND LOAD (WL)

The wind load shall be calculated as per IRS: Bridge Rules and IS: 875 (Part 3).

Vb = Basic wind speed = 47m/s for Delhi Zone

viii. SEISMIC FORCE (EQ)

The purpose of this section is to summarize the methodology and the assumptions that shall be used for the seismic analysis.

(a) Seismic Design

Seismic design philosophy as stated in IRS Seismic Code shall be considered. HORC project area lies in Seismic Zone IV of seismic map of India. The peak ground acceleration denoted as zone factor is taken as 0.24 for zone IV.

(b) Definition of Seismic Input

Spectral Acceleration (Sa/g vs T) as prescribed in IRS Seismic code, shall be used for seismic load computation.

(c) Horizontal Seismic Coefficient

The horizontal seismic design coefficient shall be calculated as per following expression

Ah = (Z/2) * (I/R) * (Sa/g)

Where,

Ah	=	horizontal seismic coefficient to be considered in design
Z	=	peak ground acceleration or zone factor = 0.24
I	=	importance factor = 1.5
R	=	response modification factor as per Table 3
Sa/g	=	Average acceleration coefficient

(d) Response Reduction Factor

Response Reduction Factor "R" shall be as per IRS Seismic code Table -3.

Note: In addition to the response reduction factor, reinforcement detailing of Piers/Portal Piers and joints with pier cap and foundations shall conform to ductility/capacity design requirements as per Annexure-B of IRS Seismic Code.

(e) Vertical Seismic Coefficient

The vertical seismic coefficient shall be 2/3 of horizontal seismic coefficient.

(f) Computation of Fundamental period of vibration

The fundamental time period shall be calculated by any rational method of analysis. Each pier is considered as a single degree of freedom oscillator with mass placed at the Centre of Gravity (COG) of the deck.

The time period can also be calculated as per IRS Seismic Code.

(g) Direction Combinations

The seismic forces shall be assumed to come from any horizontal direction. For this purpose, two separate analyses shall be performed for design seismic forces acting along two orthogonal horizontal directions. The design seismic force resultant (that is axial force, bending moment, shear force and torsion) at any cross section of a bridge component resulting from the analysis in the two orthogonal horizontal directions shall be combined according to IRS Seismic Code.

When vertical seismic forces are also considered, the design seismic force resultants at any cross-section of a bridge component shall also be combined as mentioned in IRS Seismic Code.

In case of abutment design, Seismic force on soil mass behind the abutment and confined between the retaining wall shall also be considered in addition to dynamic increment in earth pressure.

(h) ERECTION TEMPORARY LOADS (ETL)

Erection forces and effects shall be considered as per IRS-Bridge Rules.

The weight of all permanent and temporary materials together with all other forces and effects which can operate on any part of structure during erection shall be considered in design. The loads arising from most onerous conditions of the construction methods adopted is awaited from the Contractor.

Special care shall be taken that no damage is caused by the construction contractor to the permanent structure. In case of any hole etc., drilled in permanent structural element, the same will be made good by using non-shrink, expansive, high strength grout and its strength shall be better than the structural element and will have to be demonstrated.

(i) DERAILMENT LOADS (DR)

Checks shall be made in accordance with the IRS-Bridge Rules.

(j) FORCES ON PARAPET

The parapets shall be designed to resist lateral horizontal force & a vertical force of 150 kg/m applied simultaneously at the top of the parapet as per Clause 2.10 of IRS Bridge Rules.

(k) DIFFERENTIAL SETTLEMENT (DS)

Differential Settlement (post construction) between two adjacent bridge piers shall be as follows.

12mm for Long Term Settlement

6mm for Short Term Settlement

Differential settlement shall be considered only in the design of continuous structures, if any.

(l) BUOYANCY LOADS

The design of the foundation shall be done considering design ground water table as per Sub-Clause 2.6 (b) of Outline Design Specification- General.

In case of river bridges, stability check and calculation of base pressure, full buoyancy shall be considered on submerged portion of substructure and foundation up to HFL or LWL as the case may be, irrespective of the type of soil on which the foundation will rest.

Hydro dynamic forces will be considered as per IRS Seismic code.

(m)WATER CURRENT FORCES

Water current force in submerged portion of substructures and foundations shall be calculated as per IRS Bridge Substructure & Foundation Code.

(n) VEHICLE COLLISION LOAD (VCL)

The vehicle collision load on piers shall be as per IRC: 6.

All structure near railway track shall be checked for accidental impact from derailed trains as per IRS Bridge Rules as per Addendum & Corrigendum Slip No. 48 dated 22.06.2017.

(o) VIBRATION EFFECT

Effect of vibration due to movement of train on bridge structure will be taken into consideration. This will be checked in dynamic analysis.

d) LOAD COMBINATIONS

Provisions of IRS-CBC shall be followed. The partial load factors and load combinations shall be as per IRS-CBC.

Notes:

ULS-Ultimate Limit state.

SLS-Serviceability Limit state

Wind load and earthquake loads shall not be assumed to be acting simultaneously.

Load combination for Road Vehicle collision shall be as per IRC 6 but design of members under vehicle collision load combination shall be carried out as per IRS CBC.

i. The Superstructure/bearing, sub-structure and foundation will be checked for one track loaded condition as well as multiple/all track loaded condition, for single span and both spans loaded conditions, as the case may be.

ii. Design of bridge shall be done considering the construction methodology/ construction sequence to be adopted during execution.

iii. The analysis and design will be carried out for all possible cases of rolling train loads. All the structures, such as superstructure, bearings, substructure and foundations shall be checked for the most onerous cases.

e) DESIGN CHECK FOR REINFORCED CONCRETE STRUCTURE

Design of all RCC structures shall be done as per IRS CBC for Serviceability Limit State (SLS) and Ultimate Limit State (ULS)

If prestressing is to be used in any structural member, it shall be checked as per relevant clauses of CBC.

f) DESIGN CHECK FOR STEEL/COMPOSITE STRUCTURE

The design of steel structure shall be done as per IRS Steel Bridge Code/IRS-Welded Bridge Code. In case of steel structure, IRS-steel bridge code shall be followed. While designing for composite action IRC :22 shall be referred.

g) DURABILITY & CRACK WIDTH

(a) DURABILITY

Provision of IRS-CBC shall be followed. The exposure condition is Moderate and in case of Nallah crossing the exposure condition may be treated as "Severe".

(b) CRACK WIDTH CHECK

For SLS Combination, crack width in reinforced concrete members shall be calculated as per IRS-CBC.

The allowable crack width shall be as per exposure conditions given in IRS-CBC.

(c) DEFLECTION

Deflections shall be taken into account as per IRS: CBC while checking appearance, efficiency of the structure and minimum specified clearances. Clause no. 13 of IRS CBC shall be kept in view while calculating deflection/deformation. Permissible values of deformation shall also be in accordance with provision of UIC-776-3R.

h) FATIGUE

Fatigue phenomenon shall be analyzed for those structural elements that are subjected to repetition of significant stress variation (under traffic load).

(a) PRESTRESSED/REINFORCED CONCRETE STRUCTURE

The fatigue shall be checked as per IRS-CBC. However, fatigue check for prestressed concrete structures does not need to be performed as long as the whole section (from top to bottom fiber) remains under compression under SLS load combination.

(b) STEEL/STEEL COMPOSITE STRUCTURES

IRS-Steel Bridge Code (up to latest correction slip) / IRS-Welded Bridge code shall be adopted for fatigue check of structural steel members and connections.

Annual Traffic Density for fatigue checks shall be considered as 50 GMT (Gross Million Tonnes per annum) per track (i.e. 100 GMT for two tracks).

Simplified approach method given in Clause 14 of Appendix-G of IRS Steel Bridge Code(Fatigue Assessment of steel bridges) shall be followed for fatigue assessment.

4.5 Drainage

The drainage of bridge deck shall be designed to cater to the maximum envisaged rainfall intensity and suitable longitudinal and transverse slope shall be provided. Moreover, the provisions of IRS-CBC shall be followed.

The top of soffit slab will be profiled so as to collect the run-off water at multiple points by providing a cross slope of 2.5%. Drainage pipes will be provided to collect the run-off.

4.6 Bearing System

(a) Type of Bearing System

Spherical bearings shall be designed as per IRC: 83 part-IV.

(b) Replaceability of Bearings

While finalizing the proposed bearing system, it shall be kept in mind that accessibility and replacement of each part of bearing are of paramount importance as the design life of bearings is shorter than that of the structure. Keeping in view the above cited criteria, all the bearings, pedestals and pier caps will be detailed for replacement of bearings in the future. The girders/end diaphragms shall be designed to facilitate the operations of jacks during maintenance as per clause IRS-CBC.

(c) Uplift

If required a holding-down device connecting the deck and the pier head shall be placed in order to prevent the deck from overturning. The holding-down device may be integrated in the bearing system or be a separate system constituted of bars embedded in pier cap and bridge with appropriate details, permitting translation/rotation. Other systems can also be foreseen.

Due to the lack of appropriate guidelines in Indian codes, the design criteria for holding down device (upward force limit requiring holding down device, design formulas) will be taken from the latest international practice.

4.7 Substructure System

(a) Pier Cap

For designing the pier cap as corbel the provisions of IRS-CBC should be followed. In case of shear span to effective depth ratio being more than 0.6, pier cap will be designed as flexural member.

Height of pedestal should be in between 150mm and 350mm.

The Pier cap shape shall be suitable at transition pier supporting different types of superstructure instead of providing raised/column pedestal over pier cap.

(b) Piers

The effective length of a cantilever pier for the purpose of slenderness ratio calculation will be taken as per IRS-CBC.

The design of pier shall be done as per IRS CBC.

Ductile detailing is mandatory. Shear reinforcement & ductile detailing shall be done as that of RCC column.

4.8 Foundation System

4.8.1 Foundation shall be designed as per IRS Bridge Substructure & Foundation Code, IRS Concrete Bridge Code, Manual on the design and construction of well foundation, IS- 2911, IRC-78.

4.8.2 Soil replacement may also be resorted, if the difference of bearing pressure and bearing capacity is upto 30%, keeping other practical aspect and site conditions in mind.

4.8.3 Pile Foundation

a) Foundation analysis and design will be based on IRS Code for Substructure & IRC-78. The forces applied by the pier are transferred to the bottom of the pile cap for this purpose. Reactions in pile are calculated using rivet theory. *The* pile and pile cap *shall be designed* are as follows:

i. Bored-cast-in-situ multiple pile groups will be adopted.

ii. Minimum 1.2m diameter (unless specified otherwise in tender drawing) bored cast-in-situ vertical piles in soil/rock have been contemplated for the foundation of piers. Minimum number of pile in each pile cap shall be 4.

iii. For piles and pile caps, load combinations shall be considered as per IRS-CBC, Table-12. The various specific assumptions made for the pile and pile cap design including pile load testing shall be as per IS: 2911, IRC-78 and IRS-Bridge Sub-structure and Foundation Code.

iv. For pile bearing capacity, all SLS Load combinations as per IRS-CBC will be considered.

v. Increase in vertical load capacity of pile shall be as per IS 1893-Part-1.

vi. The lateral load capacity of pile shall be evaluated by using empirical formulae given in IS: 2911 (Part-1/ section-2).

vii. Initial load tests on test pile shall be conducted as per IS: 2911 - Part IV. Initial test shall be conducted for a load of 2.5 times as per the safe load based on static formula.

viii. The working load on pile for vertical and horizontal loads shall be verified through routine load tests during construction.

ix. In case of multiple pile system, spacing between the piles shall not be less than 3 times the diameter of pile in soil and 2.5 times the diameter when founded on rock.

x. In general, the top of pile cap shall be kept about min 500mm below the existing ground level and weight of the earth cover will be applied on top of pile cap when unfavorable. The earth cover on pile cap for any favorable effect (stability, soil horizontal capacity.) will be neglected.

xi. In case the location of foundation (all types) is within Load Impact Line of nearby passing load(rail/road) then the effect of surcharge (dead load + live load) corresponding to that passing load shall be taken into account.

b) Structural Design

i. Pile design shall be done according to IRS CBC. However, for crack control in piles, it will be clarified that actual axial load will be considered to act simultaneously.

ii. Where there is a risk of liquefaction, the lateral soil resistance of the liquefied layer will be taken as zero.

iii. Pile cap shall be designed based on IRS –CBC. No support from soil below pile cap shall be considered.

iv. The thickness of the pile cap shall be kept minimum 1.5 times diameter of the piles for multiple-pile group.

v. The structural design and crack width check of the pile cap shall be carried out as IRS CBC.

vi. Minimum reinforcement in pile caps at top shall be at least 0.12% in each direction in case of compression and in case of tension, it shall not be less than 0.2%.

c) Soil Structure Analysis

Soil structure interaction shall be considered during RSI to evaluate the forces & displacements on structures for LWR. While evaluating element forces or estimating displacements *during RSI* the soil stiffness and other parameters shall be assessed based on the design ground water table.

4.8.4 Well Foundation

Well Foundation shall be designed as per IRS Bridge Substructure & Foundation Code, IRS Concrete Bridge Code, IRS manual on the design and construction of well and pile foundations (1985) & IRC: 78.

a) Depth of Foundation

The depth of foundations shall be adequate to provide stability against overturning and sliding. Only 50% of the passive earth pressure that can be mobilised on the sides of the well foundations below max. scour level shall be considered while considering stability against overturning. The choice of type and shape of well foundation will depend upon the soil, type, the size and shape of pier or abutment, depth of foundation and available construction material. Where major obstructions such as uneven, rocky strata are likely to be encountered, provision for pneumatic sinking may be made. Small obstructions can be removed either with the help of divers or by chiseling.

b) Shape and Cross-Section of Wells

i. The well shall be circular or double D shape.
ii. The dredge hole should be large enough to permit dredging.
iii. The steining thickness should be sufficient to enable sinking without excessive kentledge and provide adequate strength against forces acting on the steining, both during sinking and service. The well steining should also be designed to withstand the earth pressures acting only on two opposite sides or only on diametrically opposite quadrants under conditions of sand blowing. The effect of heap of earth dumped near the well during sinking shall also be taken into account.
iv. It should accommodate the base of the substructure.
v. The overall size should be sufficient to transmit the loads safely to the soil without exceeding its allowable bearing pressure.
vi. It shall allow rectification of the tilt and shift of the well without damaging the well.

c) Loading

Wells shall be designed to resist the worst condition due to possible combination of the following loads, as may be applicable, with due regard to their direction and point of application.

Vertical Loads:

i. Self-weight of well.
ii. Buoyancy
iii. Dead load of superstructure, substructure.
iv. Live load, and
v. Kentledge during sinking operation

Horizontal Forces:

i. Braking and tractive effort of moving vehicles.

ii. Forces on account of resistance of bearings.

iii. Forces on account of water current or waves.

iv. Centrifugal force, if the bridge is situated on a curve.

v. Wind forces or seismic forces.

vi. Earth pressure.

vii. Other horizontal and uplift forces due to provision of transmission line tower (broken wire condition) etc.

d) Tilt And Shifts

As far as possible wells shall be sunk without any tilt and shift. A tilt of 1 in 100 and shift of D/40 subject to a minimum of 150 mm shall be taken into account in the design of well foundation (D is the width or diameter of well).

If greater tilts and shifts occur, their effects on bearing pressure on soil, steining stresses, change in span etc. should be examined individually.

e) Cutting Edges

Cutting edge shall be properly anchored to the well curb. When there are two or more compartments in a well the bottom of the cutting edge of the intermediate walls may be kept about 300 mm above the cutting edge of the outer wall to prevent rocking.

f) Well Curb

It should transmit the superimposed load to the bottom plug without getting overstressed and it should offer minimum resistance to sinking. The slope to the vertical of the inner faces of the curb shall preferably be not more than 30 degrees. In sandy strata, it may be upto 45 degrees. An offset on the outside (about 50 mm) may be provided to ease sinking. The curb shall invariably be of reinforced concrete of minimum M 35 with a minimum reinforcement of 72 kg/m^3 excluding bond rods. In case blasting is anticipated, the inner face of the curbs shall be protected by steel plates or any other means to sufficient height.

g) Well Steining

Well steining shall be built of RCC with cement concrete not weaker than M-25 grade. Sufficient bond rods shall be provided to bond the units of the steining during the progress of construction. Bond rods shall be distributed

evenly on both faces of steining and tied up by providing adequate horizontal hoop reinforcement.

h) Bottom Plug

A bottom plug shall be provided for all wells and its top shall be kept 300 mm above the top edge of the inclined face of the curb. The concrete used for the bottom plug when placed under dry conditions shall generally be of M20 proportions and it shall be placed gently in one operation. When the concrete is placed under water, the quantity of cement shall be increased by 10% and it shall be placed by tremie or skip boxes under still water condition.

i) Top Plug

A 300 mm thick plug of cement concrete M-20 grade shall be provided over the hearting which shall normally be done with sand.

j) Well Cap

The bottom of the well cap shall, as far as possible, be located 300 mm above low water level. All the longitudinal bars from the well steining shall be anchored into the well cap. The well cap shall be designed as a slab resting on the well.

k) Design and analysis

The design of well foundations shall be carried out for either of the following two situations:

i. Wells surrounded by non-cohesive soils, below maximum scour level and resting on non- cohesive soils:

For wells resting on non-cohesive soils like sand and surrounded by the same soil below a maximum scour level, the design of foundations shall be checked by both Elastic Theory and Ultimate Resistance Methods as given in Appendix V of IRS Bridge Substructure and Foundation code.

ii. Wells surrounded by cohesive soils or mixed strata below maximum scour level and resting on any strata viz. Cohesive soil, non–cohesive soil or rock:

For wells founded in clayey strata and surrounded by clay below max. scour level, the passive earth pressure shall be worked out by C & Ø parameters of the soil as obtained from UU (unconsolidated undrained) test.

In wells through clayey strata, the skin friction will not be available during the whole life of the structure, hence support from skin friction should not be relied upon.

l) Settlement of well foundation

The settlement of well foundation may be the result of one or more of the following cases :

i. Static loading,
ii. Deterioration of the foundation structure;
iii. Mining subsidence and
iv. Vibration subsidence due to underground erosion and other causes.

Catastrophic settlement may occur if the static load is excessive. When the static load is not excessive, the resulting settlement may be due to the following:

i. Elastic compression of the foundation structure;
ii. Slip of the foundation structure relative to the soil;
iii. Elastic deformation or immediate settlement of the surrounding soil and soil below the foundation structure ;
iv. Primary consolidation settlement of the surrounding soil;
v. Primary consolidation settlement of the soil below the foundation structure.
vi. Creep of the foundation structure under the constant axial load; and
vii. Secondary compression of the surrounding soil and soil below the foundation structure.

If a structure settles uniformly, it will not theoretically suffer damage, irrespective of the amount of settlement. In practice, settlement is generally non-uniform. Such non-uniform settlements induce secondary stresses in the structure. Depending upon the permissible extent of these secondary stresses, the settlements have to be limited. Alternatively, if the estimated settlements exceed the allowable limits, the foundation dimensions or the design shall be suitably modified.

m) Wells Founded In Cohesionless Soil :

For wells constructed in cohesionless soils, the settlement due to dead load of sub-structure will take place by the time the construction is completed and the

necessary adjustment in the final level can be made before erection of the girder. In such cases, settlement shall be evaluated only for the dead load of the super-structure.

n) Wells Founded In Cohesive Soil :

When wells are founded in cohesive soil, the total settlement will be computed as per the provisions of clause 6.4 of IRS Bridge Substructure & Foundation code.

4.9 Open Foundation

4.9.1 Open foundation shall be designed as per IRS Bridge Substructure & Foundation Code & IRS-CBC.

4.9.2 The depth of open foundation shall not be less than 1.75m below the anticipated scour level or below the lowest ground level in case of no scour. The top of open foundation shall be kept at least 0.5m below the anticipated scour level or below the lowest ground level in case of no scour. Foundation shall not rest on compressible soils.

4.9.3 The width of open rectangular foundation shall be so adjusted that the resultant of all the forces on the base of foundation shall fall within the middle third.

4.10 Ground Improvement

4.10.1 Ground improvement needs to be done at open foundation locations where allowable bearing capacity is less than the actual bearing pressure at the base of the structure/ foundation and at locations where strata is prone to liquification. Ground improvement shall be done by soil replacement method.

4.10.2 Soil replacement may be proposed where susceptibility for liquification is upto 4m depth below the ground. For liquefaction depths more than 4 m, deep foundation shall be provided depending upon the site requirement. Soil replacement shall be done at least 500mm below the liquification depth. Width/length of soil replacement shall be at least equal to width/length of foundation plus twice the depth of replacement below founding level. After ground improvement SBC at the base of foundation shall be verified by SPT and plate load test.

4.11 Codal Reference

The IRS Codes shall be followed in principle. Although main clauses have been mentioned in the ODS, the other relevant clauses as available in the IRS codes shall also be followed, whenever applicable. If provisions are not available in IRS, the order of preference shall be as follows, unless specified otherwise:

For railway loading related issues:

I. UIC Codes

II. Euro Codes

III. Any other code, which covers railway loading.

For other Design/ detailing related issues:

I. IS Codes

II. IRC Codes

III. EURO Codes

IV. AASHTO Codes

V. Any international code with approval of the Engineer.

5 OUTLINE DESIGN SPECIFICATIONS -: STATIONS

5.1 General

Concept Plan of the station building has been provided in the Tender drawings. The Contractor shall prepare the detailed architectural design and drawings of the station. The structural design of buildings and other works as mentioned in the Design Requirement Criteria shall be done by the Contractor as per the requirements briefed hereunder.

This Outline Design Specification (ODS) is applicable for station buildings and other Civil works.

5.2 Details of Structures to be designed

The Contractor shall prepare and submit architectural drawings of various stations. Various architectural alternatives shall be prepared for the station building with better aesthetics, pleasing appearance, durability and environment friendliness.

The Contractor shall design station buildings and structures at three stations namely Prithla, Silani & IMT Sohna.

The design of station shall include, but not limited to, the following -

i. Station cum S&T and Electrical Service Buildings
ii. Cast-in-Situ RCC Platform wall with pre-cast coping, platforms, platform shelter, mini platform shelter, water booths, toilets and seating arrangements at platforms
iii. Water supply system
iv. RCC/ RE retaining walls within station yards
v. Platform and Yard drainage
vi. Subway for inter-platform transfer including stairs & ramp with self supporting covering lift wells and waterproofing system.
vii. Bore well, pump house, pipe connections, underground & overhead water storage tanks
viii. Septic tank and soak pits for toilets of station buildings and platforms
ix. RCC portico
x. Approach road to stations
xi. Ticket counter
xii. RCC pre cast fencing at end platforms
xiii. Signal hut and other service buildings
xiv. Circulating area and landscaping

The design of station building shall include, but not limited to, the following: -

i. Architectural and structural design

ii. Plumbing arrangement

iii. Arrangement for ventilation

iv. All other building services as necessary for functioning of the station as per NBC 2016

5.3 Design Requirements

5.3.1 Layout Criteria

i. The layouts of the stations, as prepared & provided by the Employer are indicative. The Contractor shall develop the layout so as to comply with the Employer's Requirements.

ii. Architecture and profile of all buildings shall conform to local aesthetics, cultural ethos, local architecture and environment and shall be subject to consent and approval of the Engineer.

iii. The functional and structural design of all the station buildings shall be carried out as per provisions of National Building Code 2016 and the by-laws of the local authorities to the extent of their applicability.

iv. Structural design of subway shall be carried out as per provisions laid for RCC Box bridges.

v. Method of structural analysis shall be appropriate for the structure or component to be analysed and shall be carried out by the Contractor using well established software duly consented by the Engineer. However, critical designs shall be supported by manual checks.

vi. Dynamic analysis shall be performed to obtain the design seismic force by Response Spectrum Method as per latest IS 1893. Analysis of framed structure shall be carried out considering fixed support at top of pile cap / Open foundation Structural design of building shall confirm to codal provision of IS 456, IS 4326 and IS 13920. Design of water retaining structure shall confirm to codal provision of IS 3370.

vii. Loading due to earthquake shall be assessed based on the provisions of IS: 1893 (Part I) and IRS seismic code, with latest revision.

viii. Loads and load combinations shall be for most unfavorable effects and shall comply with relevant Indian Standards including IS: 456 and IS:800.

ix. Overall stability and serviceability requirements shall be checked in accordance with the provisions of relevant Indian Standards.

x. All the buildings shall have provision for concealed ducts/pipes for wiring of telecom facilities in addition to the wiring for power supply and distribution. Concealed ducts/pipes for wiring of telecom & power supply facilities shall be provided in consultation with the Engineer.

xi. False ceiling shall be proposed at a clear height of about 3m in the rooms with air-conditioning facilities with a view to help in energy conservation.

xii. Station signages shall be designed as per IR standards.

xiii. Benches at platform shall be four-seater bench with backrest, with seat partition as per RDSO drawing no. RDSO/WKS/2018/2.

5.3.2 VAC Requirements for Station Building

Ventilation of station building shall be provided as per provisions of ISHARE / National building Code except for Signalling/ Telecommunication / UPS/ IPS/ Battery Rooms.

5.3.3 Other requirements

The minimum requirement of the facilities for Operation and Maintenance shall be as specified below: -

i. Amenities for persons with disability (PwD) shall be provided as per as per extant Railway Board instructions/guidelines. All platforms shall be accessible for disabled passenger on wheelchair. Tactile tiles shall be provided on platforms, subway, entry & exit and other places to guide the visually impaired person as per the Railway Board guidelines.

ii. In stairs, riser shall be kept maximum as 150mm (net height) and tread minimum as 300 mm (clear width) in the station area and inter-platform connectivity.

iii. Approach roads shall be designed for 450 commercial vehicle /day & for a design period of 30 years or more as per IRC:58-2015. Approach road shall have VDC of minimum thickness 250 mm.

iv. Covered underground RCC water storage tanks shall be provided at all the station having minimum capacity of 50,000 litres. Effective depth of tanks shall be kept about 1.5 m to 2.0 m.

v. RCC overhead water storage tanks shall be provided for a capacity of 20,000 litres at all the stations over RCC staging of suitable height as per requirements.

vi. Platform-

a) All platforms shall be high level.

b) Platform surface shall be smooth and provided with fiber reinforced Vacuum Dewatered Concrete (VDC) flooring of minimum M35 grade.

c) End platforms shall be provided a slope of about 1:60 away from the track.

d) Platform coping shall be of approximate size of 1125mmx530mmx100mm prefabricated from M-35 or higher-grade concrete by vibro compaction in a factory under controlled environment.

e) Effluent from drinking water taps etc. shall be collected and disposed of safely through underground drainage system.

vii. Two underground HDPE pipes of 150mm dia with manholes at about 25 m interval along the length of platform shall be provided for electrical and S&T wiring etc.

Stairs and ramps shall be provided with self-supporting covering in accordance with Section VII-6: OCS.

5.4 Outline Design Criteria

5.4.1 Objective

The objective is to lay down the structural analysis & design of the proposed station building. It also incorporates the design process to establish the overall design philosophy to be adopted in the Analysis and design.

5.4.2 Statutory Requirements

The design of the Civil Structure will comply with the requirements of the following:

i. National Building Code.

ii. Local Building Regulations.

iii. Bureau of Indian standard codes.

iv. Indian Railway Standard

v. International codes as applicable.

vi. Any other regulation as per requirements.

5.4.3 Structural Design Requirement

The main considerations followed for the design of structure are:

i. Structure safety and stability.

ii. Functional suitability

iii. To meet the demands of aesthetics conceived by the architect.

iv. Availability of material, equipment and expertise.

v. Constructability and ease of maintenance.

vi. Durability.

vii. Economy

5.4.4 Structural Arrangement

The proposed building is considered to be of RCC frame structure with Isolated/ Strip /Raft/Pile foundations.

5.4.5 Loads

The structural members are loaded with various loads combinations during its services conditions. The loads on the structure are taken for analysis and design as per the relevant latest IS codes of practice.

i. Dead load as per IS: 875 (Part-1)

ii. Imposed live load as per IS: 875(Part-2)

iii. Wind loads as per IS: 875(Part 3)

iv. Seismic Loads as per IS: 1893

Dead loads comprise of the self-weight of all permanent construction including walls, slabs, beams, columns, water proofing treatment, water tanks, staircase, floor finish etc. Other super imposed loads shall be considered. The structure would be designed for earthquake resistance as per IS 1893, with due consideration for the structural detailing as per provisions of IS 13920 and SP 34.

(a) Dead Load (DL)

Dead load shall be based on the actual cross-sectional area and unit weights of materials and shall include the weight of structural members of the station building.

(b) Super Imposed Dead Load For NON-TRACK Area (SIDL)

For platform slabs, the following loads in SIDL shall be taken:

i. Floor finishes load shall be assumed minimum 3.6kN/m^2 uniform load as per architectural requirement.

ii. Suspension load shall be assumed minimum 2.0kN/m^2 uniform load (Suspension load will be considered as the load of false ceiling and services etc. This load will be considered wherever is applicable.

iii. Light partition wall load shall be assumed minimum 1.0kN/m^2 uniform load.

For concourse area, the following loads in SIDL will be considered:

i. Floor finishes load shall be assumed minimum 3.6kN/m^2 uniform load as per architectural requirement.

ii. Load due to additional fill in the toilets (brick bat) shall be considered as per architectural drawing.

iii. Suspension load shall be assumed minimum 2.0kN/m^2 uniform load (Suspension load will be considered as the load of false ceiling and services etc. This load will be considered wherever is applicable.

iv. Loads due to escalator / lift will be considered as per manufacturer's detail.

v. Light partition wall load shall be assumed minimum 1.0kN/m^2 uniform load.

vi. Loads due to solar panel shall be considered as 30 kg/m^2.

Notes:

The walls loading will be taken based on actual location shown in architectural drawings. External wall load/glazing load will be taken as per details provided in architectural drawings. It is proposed to take 230 mm thick brick wall with 20 mm thick plaster on either side. However, the same shall not be taken less than 2.4kN/m^2.

Above loads intensities are minimum loads to be considered in design, Actual load may be higher as per detailed architectural drawings.

(c) Live loads (LL)

Live loads shall generally follow the requirements of National Building Code and IS 875:(Part 2), except where the loadings given below are more severe:

(d) Earthquake Loads (EQ)

Location of proposal site lies in Zone IV. The design parameters shall be taken as per IS-1893.

Seismic Ductile detailing:

i. For RCC structures as per IS: 13920

ii. For other structures as per IS: 4326

(e) Wind Loads (WL)

Wind Loads (longitudinal & transverse) shall be calculated in accordance with IS 875: Part 3.

Design wind speed Vz(m/s) = 50m/s (As per NBC)

(f) Construction and Erection Loads (ER)

The weight of all temporary and permanent materials together with all other forces and effects which can operate on any part of structure during erection shall be taken into account. Allowances shall be made in the permanent design for any locked in stresses caused in any member during erection.

(g) Temperature Load (TL)

As per IS: 456. Temperature gradient shall be considered as per IRC-6, if applicable.

(h) Shrinkage & creep

Shrinkage & creep strain shall be evaluated as per IS: 456 for plain and RCC structures and IS: 1343 for prestressed concrete structures.

(i) Earth Pressure (EP) & Water pressure (WP)

In the design of structures or part of structures below ground level, such as retaining walls and underground pump room/ water tanks etc. the pressure exerted by soil or water or both shall be duly accounted for. When a portion or whole of the soil is below the free water surface, the lateral earth pressure shall be evaluated for weight of soil diminished by buoyancy and the full hydrostatic pressure. (As per IS: 875-part 5).

All foundation slabs / footings subjected to water pressure shall be designed to resist a uniformly distributed uplift equal to the full hydrostatic pressure. Checking of overturning of foundation under submerged condition shall be done considering buoyant weight of foundation.

If any of the structure supporting railway loading is subjected to earth pressure, the loads and effects shall be calculated in accordance with IRS substructure code.

(j) Surcharge Load (SL)

In the design of structures or the parts of the structures below ground level, such as retaining walls & underground pump room/ water tank etc. the pressure exerted by surcharge from stationary or moving load, shall be duly accounted for. For the area approachable by road traffic, the minimum live load surcharge shall be taken as 24 kN/m^2.

(k) Other Forces and Effects

As per IS: 456.

5.4.6 Deflection Criteria

The deflection limitations as per IS: 456 for Plain and RCC Structures.

5.4.7 Settlement (DS)

Maximum and differential settlement shall not exceed, as provided in Table 1 of IS: 1904. The allowable settlement for pile group is 25mm (as per IS 2911-part 4).

5.4.8 Lateral Sway

The lateral sway at the top of the building due to wind loads should not exceeds H/500, where 'H' is the height of the building.

5.4.9 Load combinations

For loadings, load combinations, analysis, and design of structures, all relevant IRS, IS, IRC and other relevant codes shall be followed.

i. For steel structures, the load combinations shall be as per IS: 800.

ii. For RCC structures / elements, shall be as per Table 18 of IS: 456.

5.4.10 Materials

i. Cement

For plain and reinforced concrete structures cement shall be used according to IS: 456. For PSC structures IS: 1343 shall be used.

ii. Concrete

The minimum grade of concrete shall be as per IS: 456 for Plain and RCC structures and IS: 1343 for PSC structures.

Concrete & Short term modulus of elasticity (Ec) shall be as per IS: 456 in case of Plain and Reinforced Concrete structures and as per IS: 1343 for Pre-stressed concrete structures.

The modular ratio for concrete grades shall be taken as per Annex B of IS: 456.

iii. Density

(a) 25 kN/m^3 for Reinforced concrete & Prestressed concrete

(b) 25 kN/m^3 for Plain concrete

(c) 26 kN/m^3 for wet concrete

For density of strands and all other materials, the densities shall be considered as per IS Codes.

iv. Structural Steel

Structural steel used shall conform to following:

(a) Hollow steel sections as per IS: 4923

(b) Steel for general Structural Purpose as per IS: 2062

(c) Steel tubes for structural purpose as per IS: 1161

(d) Design of steel structure will be governed by IS 800. In case of composite (steel- concrete) structure it will be governed by IS: 11384 & IS: 3935

(e) Fabrication shall be done in accordance with IS: 800

v. Reinforcement Steel (Rebars)

High strength deformed (HYSD) reinforcement bars of Fe-500D grade, conforming to IS 1786 and Clause 4.5 & 7.1.5 of IRS-CBC shall be used.

Young's Modulus = 200,000 Mpa

Yield Stress(fy)	=	500 MPa.
Density	=	78.5 kN/m3

5.4.11 Reinforcement Detailing Reinforcement Detailing

All reinforcement shall be detailed in accordance with IS: 456 & SP: 34 for plain and reinforced concrete structures and IS: 1343 for PSC structures.

The ductile detailing of seismic resisting RC elements shall comply with ductile requirements of IS: 13920.

5.4.12 Durability

Durability of concrete shall be as per IS: 456 for Plain & RCC, as per IS: 1343 for PSC elements and as per IS: 800 for steel structures.

5.4.13 Cover to Reinforcement

From durability consideration, exposure condition is assumed to be moderate. The clear cover to main reinforcement shall be considered in the design, satisfying durability & 2 hrs. fire rating requirement, which shall be as follows (clause No. 26.4.2, Clauses 21.4-,26.4.3 and Fig 1 of IS 456-2000)

A	Footing	50 mm
B	Columns	40 mm
C	Floor/Roof Beams	30 mm
D	Floor /Roof Slab	25 mm
E	Lintel Beams, Chajja & Loft	15 mm
F	Staircase Waist Slab & Landing	25 mm
G	Plinth Beam	40 mm
H	Walls	25 mm

5.4.14 Fire Resistance Period

All the structural elements shall be designed for a minimum period of fire resistant of 2 hour. The minimum element thickness for fire resistance shall be as per IS: 456 for concrete structures and as per IS: 800 for steel structures.

5.4.15 Crack width Check

All structural concrete elements shall be designed to prevent excessive cracking due to flexure, early age thermal and shrinkage. Flexural crack width shall be checked in accordance with IS: 456 for Plain and RCC structures and IS: 1343 for PSC

structures. Crack width should not exceed 0.25 mm unless otherwise specified. Crack width for water retaining structure 0.2 mm as IS 3370.

5.4.16 Computation Methods – Modelling, Analysis, Design & Detailing

i. Modelling

The structure is idealized as a 3-D space frame model using the software packages STAAD pro/ Midas. The masonry wall is used as filler wall and not cast monolithically with structure. Hence this is not modelled in the analysis. In this packages slab loads are applied as a floor loads. Wall loads are applied as UDL on beams. Self – weight is added in the software to have member loads.

The analysis of the proposed structure would be carried to

(a) Analyse to ensure elastic behaviour and fulfilment of serviceability criteria for un-factored load combination.

(b) Analyse to ensure adequate structural integrity for factored load combinations

(c) Obtain static displacements and rotations at various nodes.

(d) Obtain resultant member forces like bending moments, shear forces and axial forces.

(e) Support reactions (axial force and moment) coming on foundations.

ii. Control of Deflection (Vertical)

The deflections of a structure or part thereof shall not adversely affect the appearance or efficiency of the structure or finishes or partitions. The deflections shall generally be limited to the following (Clause 23.2 of IS 456-2000):

(a) The final deflections due to all loads including heat effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, and all other horizontal members, should not normally exceed span/250.

(b) The deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and applications of finishes should not normally exceed span/350 or 20 mm whichever is less. When deflections are required to be calculated, the method given in Appendix – B of IS: 456-2000 will be used.

5.4.17 Design Philosophy

To meet the design life and durability requirements, codal provisions specified in clause 8.0 and table 5 of IS: 456- 2000 will be followed for reinforced Concrete Elements. All structural elements would be designed according to the Limit State Method as specified in IS: 456: 2000. M 35 grade of concrete shall be considered for design of all structural member. Along with specified analysis package, design sheets in MS Excel format shall be submitted as per Employer's requirement.

i. Design OF FLOOR / ROOF SLAB

All floor/roof slabs be designed in accordance with Annex- D of IS: 456-2000 with corners held down. Cranking of reinforcement at the support will be provided. Torsion reinforcement will be provided at corners of the slab as per clause D-1.8 of Annex-D of IS: 456-2000.

The beams shall be designed for the envelopes of maximum bending moment and shear force for the load combination that gives the maximum stresses using the STAAD Pro2006 software as per the requirements of IS 456-2000. The critical members would be check manually also. Main reinforcement will not be bent-up and hence shear reinforcement shall be in the form vertical stirrups only.

ii. Design Of Columns:

The columns shall be designed for vertical load (reduced in accordance with clause 3.2 of IS: 875 (part-2-1987) and uniaxial or biaxial bending depending on its location. Effective length of the column will be in accordance with Annex- E of IS: 456:-2000, considering fixed end on both ends. Minimum diameter of longitudinal steel is 12mm and that for ties is 8mm. The columns shall be designed for the envelopes of maximum value as per STAAD Pro/Etab. The critical members would be check manually also.

iii. Design Of Footings

Assume 10% of the vertical load from the column as the self-weight of the footing a preliminary step for the design. The same shall be checked after designing the footing dimensions. The plan size of the footing will be determined on the basis of the SBC of the soil. The design pressure at the base of the footing shall be determined by algebraic addition of the pressure due to vertical load and that the due to moment at the base of the column. The design pressure shall be less than SBC of soil except when seismic load are considered, Where SBC can be increased as per Table-1 of IS: 1893-2016.

Base pressure = (P/A)+/-(Mx/Zx) +/- (My/Zy)

Where,

P = Vertical load on the footing;

A = Plan area of the footing;

Mx and My = Bending moment at the base of the column along the X and Y directions;

Zx and Zy = Sectional modules of the footing along the X and Y directions = $ab^2/6$ or $ba^2/6$; and

a & b are the dimensions of the footing.

The footing shall be designed in accordance with clause 34 of IS:456-2000. The footing will be checked for the following:

(a) Bending moment at a section on the face of the column /pedestal

(b) Shear force at a section at a distance equal to effective depth of the footing from the face of the column or pedestal.

(c) Bearing stress on the footing due vertical load of the column.

(d) Punching shear on the footing due to vertical load of the column.

The reinforcement will be determined as a rectangular section in accordance with Annex-G of IS:456-2000 and SP-16.

iv. Design Of Lintel Beams, Chajja & Loft

The lintel beams will be designed for:

(a) Weight of brick masonry above the lintel level

(b) Load from RCC Chajja attached to the lintel.

(c) Torsion moment due to eccentricity of the Chajja/loft.

Lintel beam shall have a minimum bearing equal to the thickness of the wall on which it is supported or the depth of the lintel beam, whichever is greater. It shall be designed as a simply supported rectangular section. Chajja/loft will be designed as a cantilever slab.

v. Design Of Staircase

The Internal staircase shall be designed in accordance with clause 33 of IS: 456-2000. The Staircase is slab type without stringer beam. The waist slab shall be designed as a simply supported rectangular section. The size of main

reinforcement steel shall not be less than 12mm. The staircase would be analysed, designed & detailed as per the provisions of SP-34.

vi. Design Of Overhead Water Storage Tanks

Overhead water storage tanks shall be designed to sustain the water load at full tank condition as per the provisions of IS: 3370 (Part 1- Part4).

vii. Expansion & Construction Joints:

Seismic Expansion joints are recommended when structure exceeds 45m length. The width of the joints is being calculated as per Clause7.11.3 of IS-1893 .

viii. Detailing

The reinforcement layout should take into account the strength requirements as well as the economy of construction.

Following are the requirements of good detailing:

(a) Reinforcement detailing should be simple for fabrication and placing.

(b) Cracking of concrete should be within the permissible limits

(c) There should not be any free paths for propagation of cracks without being traversed by reinforcement

(d) Joints and discontinuities should be capable of withstanding the same forces as the adjoining sections

(e) Reinforcement should not deviate excessively from the direction of tensile stresses

(f) Reinforcement steel of same type and grade shall be used as main reinforcement in a structural member.

(g) Provisions of IS: 456, IS 13920 and IS: SP 34 will be followed for the purpose of detailing of reinforcement.

5.4.18 Design of Underground water storage tanks

Underground water storage tanks at stations shall be designed as a water retaining structure based on IS: 3370. Underground water tank would be designed to sustain the following two cases-

(a) Tank full and No earth fill

(b) Tank empty and active earth pressure acting from outside.

Various types of loadings shall be considered in the design of the underground tank. The side walls shall be subjected to earth pressure. Wherever encountered,

horizontal pressure due to water table shall also be considered. Stability of water tank shall be checked against buoyancy and foundation raft shall be designed for the worst of buoyant force and soil pressure.

The tank shall also be designed for surcharge loading if any. Water proofing treatment shall be done on the external surface as well as in the internal surface.

5.4.19 Masonry Walls

All Masonry walls shall be treated as non-structural infill panels and shall be treated as one way / two way slab panels spanning between adjoining beams and columns to check structural safety. Masonry walls shall be designed as un-reinforced masonry as per IS: 1905 and IS: 4326. Shear connector reinforcement between walls & beams and walls & columns shall be provided for external wall while the internal partition walls shall be connected with roof slabs/beams using dry packing mortar between top of walls and soffit of slab / beam.

5.4.20 Subway And Lift Wells

Subway shall be designed to cater to DFC loading (32.5T) from the tracks along with the other loads from the platform. The requirements/criteria laid down in clause 4.1 & 4.2 for the design of Box bridges shall be followed for the design of Subway. Subways and lift wells shall be placed on firm strata. Conceptual base arrangement has been shown in Tender drawings.

5.5 Codal Preference

The design shall be carried out as per provision of these design specifications. Reference shall be made to the following codes for any additional information:

Order of preferences of codes shall be as follows:

(a) Bureau of Indian Standard codes

(b) Indian Railway standard

(c) National Building Code

(d) IRC

(e) BS or Euro Codes

(f) AASHTO

(g) Any international code with approval of HRIDC.

6 OUTLINE DESIGN SPECIFICATIONS: RETAINING WALLS

6.1 General

This part lays down criteria for design of Retaining Wall.

6.2 Details of Structures to be designed

The Contractor shall design the retaining walls of various heights that are required in this Package.

Retaining wall is required to be provided at some of the locations along the alignment due to limited availability of ROW. On DFC side (i.e. on RHS) of main line or connectivity line, no retaining wall shall be provided except at locations where private land/any structure falls between HORC ROW and DFC/KMP ROW.

Minimum grade of concrete for cast in-situ retaining wall shall be M 35. Reinforced Earth wall (RE wall) shall not be permitted in railway embankments.

6.3 Design Criteria

a) The earth retaining structures, if required, shall be designed as per IRS Bridge Substructure and Foundation Code as per the following criteria:

   i. In case the location of the earth retaining structure is within Axle Load Impact Line, it shall be designed for earth pressure as well as surcharge due to DFC loading (32.5T axle load).

   ii. In case the location of the earth retaining structure is beyond the Axle-Load Impact Line, it shall be designed for retaining the earth.

b) Joints between the segments shall be properly designed for required lap length also.

c) Expansion joints shall be provided at an interval not exceeding 30m.

d) Benefit of passive earth pressure shall not be considered upto foundation bottom level while checking for stability of retaining wall.

7 REINFORCED EARTH WALLS (RE WALLS)

7.1 General

Reinforced Earth Walls shall be designed as per IRC: SP:102-2014. In addition to normal principles of design of earth retaining structure, Reinforced Soil Structures shall consider the interaction between soil and reinforcement.

Properties of retained soil/fill and test to classify the reinforcement shall be determined before proceeding with design. Angle of internal friction of reinforced earth fill shall not be less than 30degree. Lateral earth pressure shall be evaluated based upon the category of reinforcement as extensible or inextensible.

Soil reinforcement to be used shall be of Polymeric strip elements or metallic strip type.

Facing elements shall be of precast reinforced concrete panels with good architectural finish.

7.2 Analysis

The analysis shall be conducted in two parts:

i. External Stability
ii. Internal Stability

External Stability shall address the stability of the reinforced block as a unit, while Internal Stability shall address the transfer of lateral pressures to reinforcement and related mechanisms involved. "Tie back wedge method" and the "coherent gravity method" shall be used for analysing internal stability. Reduction in lateral pressure and tension due to cohesion shall not be considered and neglected since cohesion may be lost under certain conditions.

Limit state approach using partial safety factors shall be used for design of reinforced soil structures and structural elements also.

7.2.1 External Stability

External stability of the reinforced soil mass/block is checked for three different conditions: -

i. Bearing and tilt failure

The design of a Reinforced Soil Wall must ensure sufficient margin against bearing and tilt failure, with a Factor of Safety of at least 1.4. If bearing capacity is not adequate, ground improvement measures must be undertaken. Excavation in front of walls after construction is prohibited. Beam and anchor rods at the toe of the wall shall be adopted, if required, to ensure adequate lateral resistance towards sliding.

ii. Sliding and overturning

Factor of Safety towards sliding and overturning due to lateral pressures imposed should be adequate. FS of at least 1.2 in the limit state should be achieved.

iii. Global stability

The design of a Reinforced Soil Wall must ensure global stability, with a Factor of Safety (FS) of at least 1.30 under static conditions and 1.10 under dynamic/earthquake loads, considering un-factored load. The analysis shall check for possible failure modes, including the possibility of deep-seated failure. Global stability analysis shall be carried out using standard software capable of modelling reinforcement, different wall geometries, and failure modes.

7.2.2 Internal Stability

i. Tie Back Wedge Method

The maximum ultimate limit state tensile force T to be resisted by a particular layer of reinforcement is the summation of lateral pressure arising due to self-weight of the fill, surcharge caused by external loading, strip loading applied on top of the fill, and shear applied at the contact of the strip loading. Tensile force per running length can be calculated using the expression in IRC:SP:102-2014.

ii. Coherent Gravity Method

For the ultimate limit state and serviceability, the lateral earth pressure coefficient K is taken as Ko at the top and linearly reducing to Ka at 6.00 m and below this depth. In case of inextensible reinforcement, the lateral earth pressure coefficient Ko at top should be taken as 1 - sin (ø) to Ka at 6 m depth. Tensile force per meter adherence capacity of the reinforcement and long-term rupture should be checked.

For both the methods described, global stability checks should be carried out in addition to local stability checks. As far as rupture is concerned, it should be ensured that the strength of the reinforcement at the end of the design life is greater than the tensile force to be resisted.

The check for rupture should be carried out for both methods (tie-back and coherent gravity). The minimum length of reinforcement shall be 0.7 H or 3 m, whichever is more, where H is the design height of the RS Retaining Wall.

Some reinforced soil walls use a passive block at the end of the reinforcement to derive the benefit of passive resistance in resisting tension. However, full passive resistance should not be taken in design since the strain required to mobilize it is large. Only 20% of passive resistance may be included in design calculations.

7.3 Partial Safety Factors for Material and Load

Partial safety factors for material and load shall be as per Clause 5.3 of IRC: SP102-2014.

7.4 Serviceability and Settlements

Settlement of the founding soil and compression of the reinforced mass contribute to the total settlement of a reinforced soil structure. Settlement of the founding soil can be estimated by conventional theories. Post construction settlement should not exceed 100 mm for discrete panels/blocks.

Facing should be able to cope with internal compression. The fascia should resist safe vertical movements of 1 in 150. Differential settlement of 1 in 100 is considered safe for discrete concrete panel facings (1 in 500 for full height panels).

7.5 Spacing and Layout of Reinforcement in Reinforced Soil Walls

The spacing of reinforcement in reinforced soil walls should be established based on design principles and adhere to the guidelines provided in Clause A2 of MORTH-2013.

The vertical spacing of primary reinforcement should not exceed 800 mm for all types of reinforcement. The maximum height of facing above uppermost reinforcement layer and below the lowermost reinforcement layer does not exceed 400mm in case of panels.

While the primary reinforcement carries tensile forces in the reinforced fill, secondary reinforcement may be required to protect the slope face from local sloughing and instability depending on the facia configuration. If secondary reinforcement is used, stability near the slope face should be checked separately.

8 OUTLINE DESIGN SPECIFICATIONS: BALLASTLESS TRACK (BLT)

8.1 General

i. HORC proposes to adopt BLT systems, which are proven and successful operation worldwide in railways. The proven design may require some modifications to suit HORC conditions.

ii. Operating Regime on HORC:

a) Axle load and Speed

Traffic Type	Axle Load	Speed
Goods Train	25T	100 kmph
Passenger Train	22.5T	*200* kmph

b) Electric Traction (Minimum) : 2 x 25 kV AC.

c) Track Circuits : AFTC/DC.

d) Gauge : Broad Gauge BG, Nominal (1673mm)

e) Ambient Temperature : (-) 15˚C to 50˚C.

f) Rail Temperature : (-) 15˚C to (+) 76˚C.

g) Humidity : 100%

Note: The temperature range shall be commensurate with other provisions / guidelines through codes / manuals / specific circulars.

8.2 Design Requirements

Designing of ballastless track for straight and curved track on HORC shall be as per Indian Railways Permanent Way Manual (IRPWM)-2020 including all updated correction slips published by IR with latest amendments. However, for guidance purpose, the following parameter shall be considered.

i) BLT shall be designed for the following:-

a. Goods Traffic - 25T axle load & speed 100 kmph

b. Passenger Traffic- Main line for 22.5T axle load & speed 160 kmph (for passenger traffic)

ii. Dynamic augment may be taken as 2.5 (as prevailing on IR).

iii. Spacing of supports to rails – preferably at every 60 cm (wherever rails are supported on sleepers/ discrete supports) so that the permissible bending stress in rails are not exceeded beyond stipulated values. No joint shall be permitted in track on BLT and the transition portion. The values of permissible bending stress

are as under:-

For LWR section – 25.25 km/mm².

For SWP Section – 30.25 N/mm²

For FP Section – 36.0 N/ mm²

iv. Upward reaction / pressure from support base shall be clearly mentioned in design.

v. Design shall be as per relevant codes of practice such as BIS, EN, IRS, IRC and UIC with latest revision/ edition. If for any item/work, above mentioned codes are not relevant, best available Engineering practice / International codes shall be mentioned.

vi. Design & detail of suitable Transition System for smooth transition from ballasted track to BLT on both ends shall be part of the design of ballastless track.

vii. Design and detail of Expansion / Construction Joints in BLT at suitable intervals shall be part of the design of ballastless track.

viii. Technical parameters required for foundation of BLT shall be suitably considered for site conditions and shall be mentioned in the design along with their test code & procedure, A design monograph of varying sub-grade characteristics, if applicable, to be provided by the firm / designers.

ix. Concrete for RCC structures shall comply with relevant para of Indian Standard IS: 456-2000 & IRS-Concrete Bridge Code taking care of relevant durability clause for expected life of RCC structures as per clause 15.1.3 of IRS-Concrete Bridge.

x. BLT may get submerged during heavy rainfall. Suitable arrangement shall be provided for ensuring that BLT functions properly under submerged conditions. Provision of adequate cross slope for drainage purposes and suitable measures to prevent ingress of water must be considered. Design of proper drainage arrangements, preferably sub-surface drains for BLT shall also be part of design. Top surface of BLT shall have surface finish with proper cross slope such that there is no stagnation of water over it.

xi. No appreciable cracks or settlements or separation of parts shall be developed during service in the BLT leading to impaired service or failure.

xii. BLT shall be designed for almost maintenance free conditions except replacement of worn-out fastening components after their service life is over. *05%* of the fastening components and other replacement items which are likely to be worn out / damaged, shall be supplied as spares for need based replacement in this work. The offer shall be inclusive of the cost of *05%* fastening components as spare. No additional cost shall be paid for the spares.

xiii. Stable formation is required to be provided below BLT as per the RDSO guidelines (No. RDSO/2020/GE: IRS-0004). Minimum bearing capacity at

subgrade top level of 10 tons/sq.m shall be ensured.

xiv. The proposed system shall be easy to repair and expeditious to restore in case of damage due to derailment. The time & material requirement for repair shall be clearly defined along with detailed procedure of repair.

xv. A scheme giving details of the curing arrangements shall be submitted by the designer to ensure curing in conformity to the IRS- concrete Bridge Code and best international practices.

xvi. Adequate corrosion protection measures must be included in design to minimize corrosion of fastening components of proposed system for ballastless track. Test report of the proposed fastening system shall be submitted as per EN 13146-6: 2012 –Test methods for fastening system – Effect of severe environmental conditions and corrosion test shall be done as per EN ISO 9227/ASTM B117-11, Corrosion tests in artificial atmospheres – salt spray tests or as per international standards in practice.

xvii. The design shall be cost-effective, serving all functional requirements expected of BLT.

xviii. Any other factor considered necessary by the designer.

Changes in the above parameters (ii) and (iii) may be considered, in case the Contractor is able to support it with the relevant documents and codes as per practice in other Railways.

8.3 Track Details

BLT for HORC shall be designed for following track details:-

i. Rail section: Rail profile shall conform to UIC 60 (110 UTS)/60 E1 and Rail material shall conform to IRS-T-12-2009 class-'A' including manufacturing and testing in accordance with IRS-T-12-2009 with latest amendments.

ii. Schedule of Dimensions (SOD) and Maximum Moving Dimension (MMD) of Indian Railways for BG shall be followed.

iii. *Ruling gradient: 1:150*

iv. Rail cant at Rail seat (inward): 1 in 20.

v. *Maximum permissible cant: as per IRPWM with latest amendments.*

vi. *Speed potential: 200Kmph*.

vii. Traffic: Mixed – passenger & freight.

viii. During service if some parameter goes out in case of any unforeseen circumstances, the leeway / margin available to correct the parameter. Vertical: +10 mm / - 3mm, Horizontal: ± 3 mm.

ix. Design temperature range: 70 degree celsius variation of rail temperature as per zone & chart of Indian Railway Permanent Way Manual and 40 Degree variation of ambient temperature.

x. Long welded rails (LWR) are to be used. The entire ballastless track shall be designed as LWR including viaduct/ bridges and its approaches. The

proposed design of BLT shall take into consideration the forces due to LWR and interaction of LWR.

xi. It should be possible to do in-situ AT/Flash Butt welding as per the Indian Railways welding manuals.

xii. Track tolerances: Track tolerances over BLT when installed and later during service under floating condition shall be as under.

TABLE NO: 1

S. No.	Parameter	Installation	Service
1	Gauge (with reference to 1673 mm measured below 14 mm rail top) for straight track and for curve up to the radius of 350 m.	± 1mm	± 3mm
2	Cross level on straight and curved track	± 1 mm	± 3mm
3	Variation in versine on curved track(20 m chord with half overlapping)	± 3 mm	± 6mm
4	Vertical alignment over a 3.6 m chord	± 1 mm	± 6 mm
5	Lateral alignment over a 7.2 m chord	± 1 mm	± 3 mm
6	Twist on 3.6 m base	± 1mm	± 5mm

The above installation parameters are not sacrosanct and the Contractor can also advise their own limits for the above parameters along with basis for suggesting the changes. Variation in horizontal alignment, vertical alignment, versine, twist and gauge shall not exhibit cyclic pattern.

8.4 Traction Details

HORC has Overhead Electric (2x25kV) traction. The BLT design shall have adequate electrical insulation for correct performance of signalling and traction equipment even in flooded condition during monsoon and the design should take care of return current as per traction.

8.5 Signalling Details

For signaling, the track circuiting is provided through the rails. The BLT system should take care of the same with adequate insulation. A minimum electrical resistance of 4 Ω per km as per Indian railway signaling manual needs to be ensured.

8.6 Derailment Guards

Suitable arrangements for prevention of derailment in viaducts as per instructions issued by Indian Railway from time to time in the form of derailment slab/ block shall be provided to keep the derailed wheels in confined space and prevent damage in case of derailment. The derailment guard should be constructed between the rails so that it permits less sway of the rolling stock away from the track. The lateral clearance between derailment guard and face of running rail should be as per IRPWM-2020including all updated correction slips published by IR with latest

amendments and clear of fastenings to permit installation, replacement and maintenance. Derailment guard shall be designed such that in case of derailment:

i. The wheels of a derailed vehicle under crush load, moving at maximum speed are retained on the viaduct etc.
ii. Damage to track and supporting structures is minimum.

8.7 Ballastless Track Structure

Track shall be laid on cast in situ/precast reinforced plinth or slab or sleepers, herein after referred to as the "Track slab". The track slab shall be designed as plinth beam or slab type ballastless track structure with derailment guards. It shall accommodate the base plates of the fastening system. The minimum depth of concrete below the base plate should be decided based upon characteristics of underlying base and the design of the fastening system in general, track slab/sleeper on which the fastening and rail are to be fitted shall:

i. Resist the track forces.
ii. Provide a level base for uniform transmission of rail forces.
iii. Have geometrical accuracy and enable installation of track to the tolerances laid down.
iv. Ensure drainage.
v. Resist weathering.
vi. Be construction friendly, maintainable and quickly repairable in the event of a derailment. The Repair and Maintenance methods shall be detailed in the Maintenance Manual.

Ensure provision for electrical continuity between consecutive plinths/slabs/sleepers by an appropriate design.

8.8 Performance Required of Fastening System

The supplier shall furnish the 'Installation and Maintenance Manual' which shall be approved by the Engineer.

8.8.1 General

i. The fastening shall be designed to hold the two rails of the track strongly to the supporting structure in upright position by resisting the vertical, lateral and longitudinal forces (including thermal forces) and vibrations.
ii. The fastening shall provide insulation to take care of return current *of* traction system.
iii. Fastening shall satisfy the required performance norms as stated in the following paragraphs.

8.8.2 Technical Performance Requirements of Fastening

The fastening shall-

i. Have design service life of 15 years in general. However, individual components of the fastening system can be designed for 500 GMT or 15 years whichever is less.

ii. Anchor bolts or studs used for fixing base plate to the concrete should not be required to be replaced during service life. Its components must not suffer any degradation during service life to a degree so as to affect the performance and safety of the track. Full service life is to be attained under the following condition-

   a. Atmospheric ultraviolet radiation

   b. Proximity of track up to 10 km from salt water source

   c. Contact with oil, grease or distillate dropped from track vehicles

   d. Continuous exposure to water/toilet droppings from rail coaches.

iii. Hold the rails to gauge and at the correct inclination within, tolerances laid down against horizontal forces generated by vehicles in motion especially on curves, and wheel set hunting, alignment irregularities and thermal forces.

iv. Permit quick and easy installation and replacement with special tools.

v. Be capable of vertical adjustment during service life up to 12mm using shims.

vi. Given severe corrosive environment, fall of distillate matter from trains over track, requirement of ease of cleaning of concrete slab and fasteners in platform section, it is preferable to have fastening system with fewer parts/components and less creeping surface.

vii. Detailed calculations for the number of anchor bolts required on tangent and curved tracks shall be furnished by the contractor and approved by the Engineer.

viii. For all the fastening components as per approved assembly, the contractor shall furnish detail drawings, specifications and inspection & test plan to the Engineer.

ix. Deleted.

8.9 Testing of fastening system

The testing of fastening system including its components is to be done for Cat "C" requirement as specified in EN-13481- part-1 & EN-13481-Part-5 (Latest Version) to suit HORC project requirements with 60 kg rail section. The test plan and testing criteria of Fastening system should meet the permissible values in IRPWM 2020 including all updated Correction slips published by IR. The test report should be accompanied with the drawing of the fastening system including its component which have been tested and reported upon *and shall be exactly same as the fastening system including its components that has been submitted for fulfilling the eligibility by the Contractor as per Clause 13, Section VII-3: Employer's requirements- Design*

(Civil & BLT).

8.10 Random Testing of fastening system

The Engineer shall get the random testing of the fastening system after it has been supplied from a reputed test lab and system should be able to meet the requirements as mentioned in this document. Cost of the same shall be borne by the Contractor.

8.11 RSI studies for Viaduct proposed to be laid with BLT

The Contractor should submit RSI studies for viaduct proposed to be laid with BLT as per IR instructions for assessment of the continuity of LWR proposed over viaduct as per UIC 774-3R, BS 114 & Indian Railway Bridge Rules and design the BLT accordingly as per RSI studies.

8.12 Spares

The Contractor shall supply spare track fastening components equal to *05%* of the total requirement for the permanent works.

8.13 Maintenance and Performance Monitoring

The defect liability period will be 3 years from the date of opening of traffic.

After construction of ballastless track, Engineer/Employer will monitor the performance jointly with the Contractor on a quarterly basis & for three years. The performance monitoring will be based broadly upon following parameters:

i. Efficacy of fastening: Fastening system should be able to maintain track geometry (gauge, cross level, loose fittings etc.) at all times within track tolerances during services without any components breakage, excessive wear & tear.
ii. Track tolerances to be maintained at the time of construction & during trial/service should be as per para *8.3*.
iii. Any track settlement which impairs the functionality of track.
iv. Any visible crack of width more than as stipulated in IRS Concrete Bridge Code-para 10.2.1 in concrete/ RCC portion of slab which impairs the functionality of ballastless track.
v. Efficacy of drainage system e.g. the slope and drains constructed should function properly even during monsoon period.
vi. Any special observation.

8.14 Third Party checking of BLT design

The design of BLT system shall be got checked by the third party engaged by the Contractor and approved by the Engineer. Duly proof checked design and drawings shall be submitted to the Engineer for final approval. The cost of third party checking shall be borne by the Employer.

Third party engaged by the Contractor shall has experience of designing/proof checking for atleast 5years of BLT which is in operation for a minimum length of 10km, with minimum operational axle load of 22T and operational speed of 100km/h.

9 RAILS

9.1 General Requirements

All the rails to be laid in the track structure shall be Flat Bottom Rails as per specifications: IRS T12-2009 including up to date correction slips. Only new rails will be used for the permanent works. The broad requirements are as below:

Rail Steel Grade: R350

Rail Section Profile: As per Appendix-II (Revised) of IRS T12-2009 for 60E1

Class of Rail: A

Length of Rails: 13m/26m

Rail Ends: Undrilled

Colour Code: As per Appendix IV of IRS T12-2009

9.2 Class of Rails

All running rails shall be brand new Class 'A' rails.

Guard rails may be new Class 'IU' rails

9.3 Rail Manufacturer

The rails shall be procured from RDSO approved manufacturer.

9.4 Rail Steel Parameters

Rail steel of Grade R350 and of 60E 1 section shall conform to the chemical composition & mechanical properties as specified in IRS T12-2009 specifications of Indian Railways.

9.5 Rail Section, Marking & Dimensions

Rails of 60E1 as per Appendix-II (revised) of IRS T12-2009 shall conform to the dimensions, dimensional tolerances including geometrical defe**cts,** markings and shall be subjected to **t**he measurements and tests specified therein.

While handling and transportation of rails, guidelines issued by IR on this important aspect shall be strictly followed. This, among other things includes providing suitable dunnage/spacers to protect rails against point contact and the protection of rail ends. Availability of proper facilities for handling of rails at rehandling points shall be ensured.

A method statement describing in detail the precautions that will be taken during handling and transport of rails and the supervision that will be exercised in ensuring compliance of the right procedures, will be submitted to the engineer for his approval.

The engineer at his discretion will inspect the rails on arrival at site against any bruising, rubbing nicks and any other damage, reject them and order for their removal from site, if found damaged.

The guidelines issued vide RDSO drawing no. RDSO/T-6219 will be strictly followed.

Normally only standard-length rails should be used for the permanent works. The shorter rails may be permitted, if they are not more than 2m shorter than the standard length subject to the proviso that such rails should be supplied in pairs to be used opposite each other. However, number of such rails should not exceed 10% of the total requirement for permanent works.

9.6 Defect Free Rails

The rails must be free from all detrimental defects having an unfavourable effect on the behaviour of the rails in service, such defects include, among others, surface defects & internal defects like cracks of all kinds, flaws, piping, or lack of metal, hot or cold marks, seams, scabs, protrusions etc.

The rails having defect beyond the specified limits, shall be rejected.

9.7 Inspection and Acceptance

M/s RITES shall be the inspecting agency for rails. Inspection/testing charges shall be borne by the Contractor.

The representative(s) of the Engineer and the Employer shall be entitled to observe, by day or night, the method of manufacture and to be present at all tests relating to all batches of casting for this project and to examine the results obtained from such tests.

The manufacturer shall, at his own expense or at the expense of the Contractor, supply all templates & gauges, prepare and supply test pieces and sample of steel, sample of rails, and supply labour and apparatus/equipment, for testing which may be required by the inspecting agency for carrying out all tests as specified in IRS T12-2009 specs, and render reasonable assistance in execution of such tests as desired by the inspecting agency.

9.8 Method of Payment

Calculated weight of rails as given in appendix II (revised) of IRS-T12-2009 shall be regarded as actual weight of rails and payment shall be made as per these weights.

9.9 Warranty

The Contractor shall provide warranty as per the provisions of IRS-T12-2009.

10 CONTINUOUSLY WELDED RAIL (CWR) OVER VIADUCT

10.1 General

Rail panels, after laying in track, shall be welded to make Continuously Welded Rail (CWR) track for as much length as possible, for which the Contractor shall prepare the CWR plans for the approval of the Engineer in advance under design submission schedule in accordance with the design principles/provisions contained in IRPWM.

10.2 Rail Laying Temperature

10.2.1 The project length falls in temperature zone IV in India as per fig.3.6 in IRPWM. The de-stressing temperature will be determined on the basis of the data furnished in figure 3.6 of IRPWM.

10.2.2 CWR track lengths installed outside this temperature range shall be de-stressed.

10.2.3 Neutralization of the stresses in the rails during construction shall be carried out as required by the provisions of the IRPWM.

10.2.4 Rails after de-stressing shall be checked by a non-destructive rail stress measuring equipment to verify the correctness of the de-stressing temperature. The Contractor shall arrange such testing equipment in adequate numbers on its own, which shall also be made available to the Engineer for this purpose. The details of the equipment and its performance characteristics will be submitted to the Engineer and his approval obtained before it is put to use.

10.2.5 The Contractor shall submit detailed process of neutralisation of stresses in the rails during construction ensuring that the rails in track remain de-stressed in the prescribed temperature range and shall form part of CWR plans submitted by the Contractor in accordance with 10.1 above.

10.3 Welding of Rails

10.3.1 Only rail panels having a length of not less than 260m except approved by the Engineer would be installed in the track which shall be converted to CWR through in-situ welding. In-situ welding shall also be carried through mobile flash butt welding plants. Conversion of single rails to 260m long panels would be done on cess using flash butt welding plant. Rails would be welded as per the provision of Indian Railway's Manual for Flash Butt Welding of Rails-2012 (herein after referred as FBW Manual).

Locations where the use of Mobile Flash Butt welding is not practical, Alumino Thermic (A.T) SKV process may be used with prior permission of the Engineer. AT welding will be done as per the procedure and specifications laid down in the latest edition of Manual for Fusion Welding of Rails by the Alumino-Thermic Process read along with the latest amendment slips.

10.3.2 The use of rails with holes shall not be allowed unless specifically permitted by the Engineer for specific locations. Drilling of holes of different sizes would be required for the purpose of earthing, bonding etc. These holes would be drilled by the System

Contractor. All the interfacing requirements required for drilling holes shall, however, be part of the contractor's responsibility. Wherever holes in the rails are made, they shall be suitably hardened for their fatigue improvement by the Contractor using well established cold rail hole expansion technology. The methodology for the same shall have the prior approval of the Engineer.

11 CODES & STANDARDS

11.1 General

The Contractor shall carry out the design on the basis of the codes and specifications given below. The list of codes mentioned herein is only for guidance. The Contractor may supplement these codes and standards with the consent of the Engineer if in his opinion it is essential to do so to comply with the Employer's Requirements.

The Contractor shall be responsible for detailing in his design report and specifications the standards on which his materials and workmanship will be based and these will be of similar or higher standard than those listed below.

The Contractor shall also be responsible for getting the approval from the Engineer for the standards which he intends to apply for the detailing of his design and specifications additionally.

Apart from the basic data and specific requirements listed in the Employer's Requirement, all items of the Works shall be governed by the latest versions of the following codes and specifications as revised/corrected/amended (with latest correction slip) till the date of opening of the Tender. In case of contradiction in various codal provisions, the order of precedence shall be as follows:-

i. Specific provisions in the Employer's Requirements.
ii. IRS Codes and specifications
iii. IS Codes
iv. IRC Codes and specifications
v. International Codes

However, in case of ROBs and other highway loading related structures, IRC Codal provisions shall prevail over IRS Codal provisions. Notwithstanding the precedence specified above, the Contractor shall always seek advice from the Engineer in the event of any conflict for a final decision.

a) Loading Standards shall be as given in Design Requirements Criteria

b) Indian Railway Standard Codes and Specifications (IRS)

i. Bridge Rules
ii. Indian Railways Schedule of Dimensions (BG)
iii. Concrete Bridge Code
iv. Steel Bridge Code
v. B1- Specification for fabrication and erection of Steel girder bridges
vi. Welded Bridge Code
vii. Indian Railways Bridge Manual

viii. Indian Railways Permanent Way Manual

ix. Indian Railways Works Manual

x. Bridge Substructure & Foundation Code

xi. Well and Pile Foundation Code

xii. Seismic Code for Earthquake Resistant Design of Railway Bridges

c) RDSO Guidelines

i. BS-113 Guidelines for providing Arrangements for Bridge Inspection

ii. Comprehensive Guidelines and Specifications for Railway Formation: RDSO/2020/GE: IRS 0004

iii. BS-11 4 RDSO guidelines for carrying out rail-structure interaction studies on Indian Railways

iv. BS-126 Guidelines for continuation of LWR/CWR over ballasted deck bridges on Indian Railways

v. Report No. GE: R-50: Transitional System on approaches of bridges issued by RDSO.

vi. Report No. BS-111: Guidelines for use of High Strength Friction Grip (HSFG) bolts on bridges on Indian Railways.

vii. Guidelines for design of Spherical and Cylindrical bearings (in case of Steel Bridges).- Letter No.: RDSO/CBS/Bearing dated 22-06-2011

viii. RDSO drawing for H beam sleepers

ix. BS110 (R) - RDSO guidelines for steel girders

d) Indian Road Congress (IRC) Codes and Specifications

i. IRC: 5 Standard Specifications and Codes of Practice for Road Bridges Section – I – General features of design.

ii. IRC: 6 Standard Specifications and Codes of Practice for Road Bridges –Section – II – Loads and Stresses – Seismic provisions of this standard are to be adopted for the bridge design.

iii. IRC:112 Code of Practice for Concrete Road Bridges

iv. IRC: 22 Standard Specifications and Codes of Practice for Road Bridges Section – VI – Composite Construction.

v. IRC: 24 Standard Specifications and Codes of Practice for Road Bridges – Section V, Steel Road Bridges.

vi. IRC: 54 – Lateral and Vertical Clearances for Vehicular Traffic.

vii. IRC: 83 (Part – III) – Standard Specifications and Codes of Practice for Road Bridges – Section – IX – Bearings Part – III, Pot, POT cum PTFE Pin and Metallic Guide Bearings.

viii. IRC: 83 (Part – IV) – Standard Specifications and Codes of Practice for Road Bridges – Section – IX- Bearings Part – IV, Spherical and Cylindrical

ix. IRC-78: Sub-structure for Road Bridges.

x. IRS-87: Design and erection of false work for road bridges.

xi. Specifications for Road and Bridge Works issued by Ministry of Road Transport & Highways (MORTH).

e) Indian Standards Codes and Specifications (IS)

i. IS: 456 Plain and reinforced concrete - code of practice

ii. IS: 800 Code of practice for General Construction Steel

iii. IS: 875 Code of Practice for Design Loads Part 1, 2 3, 4& 5 (Other than Earthquake)

iv. IS: 1080 Design and construction of shallow foundations in soils (other than raft ring and shell)

v. IS: 1364 Hexagon Head Bolts, Screws & nuts of product grades A & B Part 1 (part 1 Hexagon, Head Bolts (size range M 1:6 to M64)

vi. IS 1367 Threaded Steel Fasteners

vii. IS: 13920 Ductile detailing of reinforced concrete structures subjected to seismic forces code of practice

viii. IS: 1489 Specification for Portland pozzolana cement (Fly ash based)

ix. IS: 1786 High strength deformed steel bars and wires for concrete reinforcement

x. IS: 1893 Criteria for Earthquake Resistant Design of structures

xi. IS: 1904 Design and construction of Foundations in soils: general requirements.

xii. IS: 2062 Specifications for weldable Structural steel

xiii. IS: 2502 Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement

xiv. IS: 2911 Design and Construction of Pile Foundation- Code of practice Part 1Concrete Pile- Section 2 Board Cast-in-situ-piles

xv. IS 2911 Design and Construction of Pile Foundation- Code of practice Part 4 Load test on piles

xvi. IS: 2950 Design and construction of raft foundations

xvii. IS: 3935 Code of Practice for Composite Construction

xviii. IS: 4326 Code of practice for Earthquake resistant design and construction of Buildings

xix. IS: 4923 Hollow steel sections for structural use -specification

xx. IS: 8009 Calculation of settlements of shallow foundations

xxi. IS: 269 Specifications of OPC cement

xxii. IS: 9103 Specifications of Concrete admixtures

xxiii. IS: 11384 Code of practice for Composite Construction in Structural Steel and Concrete

xxiv. IS: 12070 Code of practice for Design and construction of shallow foundation on Rocks

xxv. IS: 14593 Design and Construction of Bored Cast-in-Situ Piles Founded on Rocks.

xxvi. IS 455Specifications for Portland Slag cement

f) International Standards

i. UIC Code 774-3 (R) Track and Bridge Interaction

ii. UIC Code 772-2 (R) Code for the use of rubber bearings for rail bridges

The list of standards given above is only indicative. The Contractor shall follow provisions of appropriate codes and standards in force for items which are not covered in the codes mentioned in foregoing paras.

{XXXX}

Section VII: Employer's Requirements
Section VII-6: Outline Construction Specifications (OCS) -Civil & BLT

Chapter 1. GENERAL-CIVIL

1.1 GENERAL:

1.1.1 These Specifications contained herein shall be read in conjunction with other tender documents.

1.1.2 All Materials, works and construction operations for civil works shall conform to the following manuals**:**

a) Indian Railways Permanent Way Manual

b) Indian Railway Bridge Manual

c) Indian Railway Works Manual

d) Indian Railway Schedule of Dimensions

e) Indian Railways Unified Standard Specification (Formation Works, Bridge Works and P.Way Works), Indian Railways Unified Standard Specification for Works and Material 2010, Indian Railways Unified Standard Schedule of Rates 2019 and , Indian Railways Unified Standard Schedule of Rates -2010

f) The relevant IRS Specifications referred to in the above documents listed at (a), (b), (c), (d) & (e)

g) CPWD Specifications, Vol 1&2 – 2019 for building works and Delhi Schedule of Rates (DSR) 2021

h) In case of any contradiction in the various codal provisions, the order of precedence shall be as follows:-

i. IRS Codal provisions

ii. IRC Codal provisions

iii. IS (BIS) Codal provisions

1.1.3 The Work shall be carried out in accordance with the "Good for Construction" drawings and designs as would be issued to the Contractor by the Engineer duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing Engineer's signature and stamp. Similarly, the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Engineer in writing.

1.1.4 The work shall be executed and measured as per metric units given in the Schedule of Quantities, drawings etc. (FPS units where indicated are for guidance only).

1.1.5 Absence of terms such as providing, supplying, laying, installing, fixing etc in the descriptions does not even remotely suggest that the Contractor is absolved of such providing, supplying etc. unless an explicit stipulation is made in this contract. The Employer shall bear no costs of materials, labour, equipment, duties, taxes, royalties etc.

1.1.6 The specifications may have been divided into different sections / sub-heads for convenience only. They do not restrict any cross-references. The Contractor shall take into account inter-relations between various parts of works/trades. No claim shall be entertained on the basis of compartmental interpretations.

1.1.7 Reference to the Standard Codes of Practice:

a) The contractor shall make available at site all relevant Codes of practice as applicable.

Legends	**Definition**
IRS	Indian Railway Standards
IR specifications	Indian Railways Unified Standard Specification (Formation Works, Bridge Works and P.Way Works) and, Indian Railways Unified Standard Specification for Works and Material 2010
IS	Indian Standards
IRC	Indian Road Congress
CPWD	Central Public Works Department
RDSO	Research Designs and Standards Organisation
UIC	International Union of Railways (UIC, French: Union international des chemins de fer)
MORTH	Ministry of Road Transport and Highways
EN	European Standard
ISO	International Organization for Standardization
ASTM	American Section of the International Association for Testing and Materials
BS	British Standard

1.1.8 Alternative or additional codes and standards proposed by the contractor shall be internationally recognized codes and shall be equivalent to or better than, Indian Standards issued by the Bureau of Indian Standards or any other Indian professional body or organization, subject to being, in the opinion of the Employer's Representative, suitable for incorporation or reference into the specifications.

1.1.9 Contractor to Provide:

The Contractor shall provide and maintain at site throughout the period of works the following at his own cost and without extra charge, except for the items specified in the Bill of Quantities the cost being held to be included in the Contract Rates:

a) General works such as setting out, site clearance before setting out and on completion of works. All weather approach roads to the site office should also be constructed and maintained in good condition.

b) All labour, materials, plant, equipment and temporary works, Overhead charges as well as general liabilities, obligations, insurance and risks arising out of GCC, required to complete and maintain the works to the satisfaction of the Engineer.

c) Adequate lighting for night work, and also whenever and wherever required by the Engineer.

d) Temporary fences, barricades, guards, lights and protective work necessary for protection of workmen, supervisors, engineers, General public and any other persons permitted access to the site. Contractor shall provide proper signages as directed. All fences, barricade shall be painted with colour shades as specified by the Engineer. The barricading should be of adequate height to ensure visual obstruction of work from public view.

e) All equipment, instruments, labour and materials required by the Engineer for checking alignment, levels, slopes and evenness of surfaces measurements and quality etc.

f) Design mixes and testing them as per relevant clauses of specifications giving proportion of ingredients, sources of aggregates and binder along with accompanying trial mixes. Test results to be submitted to the Engineer for his approval before adoption on works.

g) Cost of Preparation and compliance with provision of a quality assurance control program.

h) Cost of safeguarding the environment.

i) A testing laboratory as specified *in Appendix 12, Section VII-9: Appendices, Part 2-Employer's Requirements* by the Engineer equipped with the ISI marked *apparatus*, materials and competent trained staff required for carrying out tests, as specified in the relevant sections of the specifications.

1.1.10 Quality Assurance & Quality Control:

a) The work shall conform to high standards of design and workmanship, shall be structurally sound and aesthetically pleasing. The Contractor shall conform to the Quality standards prescribed, which shall form the backbone for the Quality Assurance and Quality Control system.

b) At the site, the Contractor shall arrange the materials, their stacking/storage in appropriate manner to ensure the quality. The Contractor shall provide all the

necessary equipment and qualified manpower to test the quality of materials, assemblies etc., as directed by the Engineer. The tests shall be conducted at specified intervals and the results of tests properly documented. In addition, the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes, and evenness of the surfaces.

c) The Engineer shall be free to carry out such tests as may be decided by him at his sole discretion, from time to time, in addition to those specified in this document. The Contractor may provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.

   i. The test shall be conducted at the Site laboratory that may be established by the Contractor or at any other Standard Laboratory selected by the Engineer.

   ii. The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of the Contractor failing to arrange transportation of the samples in proper time the Engineer shall have them transported and recover two times the actual cost from the Contractor's bills.

   iii. All testing shall be performed in the presence of the Engineer. Testing may be witnessed by the Contractor or his authorised representative if permitted by the Test House. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

d) The Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, all equipment including the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged, and the Engineer's approval obtained prior to starting of the particular item of work. This shall, however, not relieve the Contractor of his responsibilities. All materials which do not conform to these specifications shall be rejected and shall be removed from the site immediately. The Engineer shall have the powers to cause the Contractors to purchase and use materials from any particular source, as May in the Engineer's opinion be necessary for the proper execution of work.

1.1.11 Training

The Contractor shall arrange the following trainings for all his concerned persons and 30 persons of the Engineer and the Employer together:

a) 3 days training for fabrication of welded steel girders for railway including one day for practical demonstration at site.

b) 2 days training for concrete, testing, scaffolding and formwork including one day for practical demonstration at site.

c) 2 days training on embankment construction and testing

The Contractor shall bear all the expenditure for training including boarding, lodging, airfare, transport, and remuneration of trainers. Training place shall be provided by the

Employer free of cost. However, the Contractor shall bear the expenditure for refreshments and meals for all the participants during the training period. The syllabus of training and the names of the trainers shall be submitted to the Engineer for approval. Training shall be imparted only by those trainers who are approved by the Engineer.

1.1.12 Dimensions:

a) Figured dimensions on drawings shall only be followed and drawings to a large scale shall take precedence over those to a smaller scale. Special dimensions or directions in the specifications shall supersede all others. All dimensions shall be checked on site prior to execution.

b) The dimensions where stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc.

c) The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or strata turning out different from what was expected or shown on the drawings.

1.1.13 Setting out of Works:

The Contractor shall set out the Works indicated in the Contract. The Contractor shall provide suitable stones with flat tops and build the same in concrete for temporary benchmarks. All the pegs for setting out the Works and fixing the levels required for the execution thereof shall, if desired by the Engineer, likewise be built in masonry at such places and in such a manner as the Engineer may direct. The Contractor shall carefully protect and preserve all benchmarks and other marks used in setting out the works. The contractor will make overall layout of complete work and get it checked from engineer. The cost of all operations of setting out including construction of benchmarks is deemed to be included in the quoted rates.

a) All the survey work except leveling work shall be carried out using total stations with one second accuracy. The leveling work shall be carried out using Auto level.

b) The triangulations point given by concerned organization before start of work shall be maintained during execution and handed over back to concerned organization after completion of work.

1.1.14 Materials:

a) Source of Materials:

It shall be the responsibility of the contractor to procure all the materials required for construction and completion of the contract. The contractor shall indicate in writing the source of materials well in advance to the Engineer, after the award of the work and before commencing the work. If the material from any source is

found to be unacceptable at any time, it shall be rejected by the Engineer and the contractor shall forthwith remove the material immediately from the site as directed by the Engineer.

b) Quality:

All materials used in the works shall be of the best quality of their respective kinds as specified herein, obtained from sources and suppliers approved by the Engineer and shall comply strictly with the tests prescribed hereafter, or where tests are not laid down in the specifications, with the requirements of the latest issues of the relevant Indian Standards.

c) Sampling and Testing:

All materials used in the works shall be subjected to inspection and test in addition to test certificates. Samples of all materials proposed to be employed in the permanent works shall be submitted to the Engineer at least 45 days in advance for approval before they are brought to the site.

Samples provided to the Engineer for their retention are to be labeled in boxes suitable for storage. Materials or workmanship not corresponding in character and quality with approved samples will be rejected by the Engineer.

Samples required for approval and testing must be supplied sufficiently in advance if required quality and number to allow for testing and approval, due allowance being made for the fact that if the first samples are rejected further samples may be required. Delay to the works arising from the late submission of samples will not be acceptable as a reason for delay in completion of the works.

Materials shall be tested before leaving the manufacturer's premises, quarry or resource, wherever possible. Materials shall also be tested on the site and they may be rejected if not found suitable or in accordance with the specification, notwithstanding the results of the tests at the manufacturer's works or elsewhere or test certificates or any approval given earlier.

The contractor will bear all expenses for sampling and testing, whether at the manufacturer's premises at source, at site or at any testing laboratory or institution as directed by the Engineer. No extra payment shall be made on this account.

d) Dispatch of materials:

Materials shall not be dispatched from the manufacturer's works to the site without written authority from the Engineer.

e) Test certificates:

All manufacturer's certificates of test, proof sheets, etc. showing that the materials have been tested in accordance with the requirement of this specification and of the appropriate Indian Standard, are to be supplied free of

charge on request to the Engineer.

f) Rejection:

Any materials that have not been found to conform to the specifications will be rejected forthwith and shall be removed from the site by the Contractor at his own cost within two weeks or as instructed by the Engineer.

g) The Engineer shall have power to cause the Contractors to purchase and use such materials from any particular source, as may in his opinion be necessary for the proper execution of the work.

1.1.15 Storing of Materials at site:

All materials used in the works shall be stored on racks, supports, in bins, under cover etc. as appropriate to prevent deterioration or damage from any cause whatsoever to the entire satisfaction of the Engineer.

The storage of materials shall be in accordance with IS 4082 "Recommendation on stacking and storage or construction materials on site" and as per IS 7969 "Safety code for handling and storage of building materials".

The materials shall be stored in a proper manner at places at site approved by the Engineer. Should the place where material is stored by the Contractor be required by the Employer for any other purpose, the Contractor shall forthwith remove the material from that place at his own cost and clear the place for the use of the Employer.

1.1.16 Water:

a) Water from approved source:

Potable water only shall be used for the works. Contractor shall have his own source of water duly approved by Engineer. The water shall be free from any deleterious matter in solution or in suspension and be obtained from an approved source. The quality of water shall conform to IS 456.

b) Storage:

The Contractor shall make his own arrangements for storing water, if necessary, in drums or tanks or cisterns, to the approval of the Engineer. Care shall be exercised to see that water is not contaminated in any way.

c) Testing:

Before starting any concreting work and wherever the source of water changes, the water shall be tested for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of all such Tests shall be borne by the contractor.

1.1.17 Workmanship:

a) All works shall be true to level, plumb and square and the corners, edges and

arises in all cases shall be unbroken and neat.

Any work not to the satisfaction of the Engineer or his representative will be rejected and the same shall be rectified, or removed and replaced with work of the required standard of workmanship at no extra cost.

1.1.18 Load Testing on Completed Structures

a) Load Testing of superstructure, in case of major bridges with OWG/ composite girders/ PSC girders and minor bridges with skew shall be done by the Contractor as per the directions of the Engineer. Payment of span load testing shall be made under relevant item of Schedule-D.

b) During the period of construction or within the defect liability period the Engineer may at his discretion order the load testing of any completed structure or any part thereof if he has reasonable doubts about the adequacy of the strength of such structure for any of the following reasons:

i. Results of compressive strength on concrete test cubes falling below the specified strength.

ii. Premature removal of formwork.

iii. Inadequate curing of concrete.

iv. Overloading during the construction of the structure or part thereof.

v. Carrying out concreting of any portion without prior approval of the Engineer.

vi. Honey combed or damaged concrete which in the opinion of the Engineer is particularly weak and will affect the stability of the structure to carry the design load, more so in important or critical areas of the structure.

vii. Loss of camber in OWG beyond permissible range as specified by Railway Board/RDSO.

viii. Any other circumstances attributable to alleged negligence of the contractor which in the opinion of the Engineer may result in the structure or any part thereof being of less than the expected strength.

c) All the loading tests shall be carried out by the Contractor strictly in accordance with the instructions of the Engineer, as per IRS:CBC and IRC:SP-51. Such tests shall be carried out only after expiry of minimum 28 days or such longer period as directed by the Engineer.

d) The structure shall be subjected to the load as approved for SLS condition in the design. This load shall be maintained for a period of 24 hours before removal. Incremental loading shall be done in accordance with IRC: SP-51, unless otherwise directed by the Engineer.

In case the recovery of the structure is not as per codal provisions, the structure shall be considered to have failed the test and shall be deemed to

be unacceptable.

e) In such cases the portion of the work concerned shall be taken down or cut out and reconstructed to comply with the specifications. Other remedial measures may be taken to make the structure secure at the discretion of the Engineer. However, such remedial measures shall be carried out to the complete satisfaction of the Engineer. Again, Load test shall be conducted as per codal provisions.

f) All costs involved in carrying out the tests (except integrity test for piles) and other incidental expenses thereto shall be borne by the contractor regardless of the result of the tests. The contractor shall take down or cut out and reconstruct the defective work or shall take the remedial measures instructed at his own cost.

If the load testing is instructed on any ground other than mentioned in (i) to (ix) of Cl. 1.1.18(b), the cost of the same shall be reimbursed to the Contractor, if the result of the tests are found to be satisfactory.

g) In addition to the load tests mentioned in Sub-Clause 1.1.18 (b), non-destructive test methods such as core test and ultrasonic pulse velocity test shall be carried out by the contractor at his own expense if so desired by the Engineer. Such tests shall be carried out by an agency approved by the Engineer and shall be done using only recommended testing equipment. The acceptance criteria for these tests shall be as per provisions in the relevant Indian/International standards and as approved by the Engineer.

1.2 STRUCTURAL WORK:

1.2.1 Unless specified, only controlled concrete with design mix and weigh batching is to be used for the work.

1.2.2 Minimum cement content specified in the codal specifications is purely from durability point of view. Larger content of cement shall have to be provided if demanded by mix design.

1.2.3 Provision of cement slurry to create bond between plain / reinforced concrete surface and subsequent applied finishes shall not be paid extra.

1.2.4 Mix design using smaller aggregates of 10mm down shall also be done in advance for the use in the junction having congested reinforcement.

1.2.5 Procedure of mixing the admixtures shall be strictly as per the manufacturer's recommendations if not otherwise directed by the Engineer.

1.2.6 All the water tanks and other liquid retaining concrete structures shall undergo hydro-testing.

1.2.7 Special benches shall be provided at site for stacking reinforcement bars of different sizes.

1.2.8 Formwork for beams of RCC areas shall be designed in such a way that the formwork of the adjacent slabs can be removed without disturbing the props / supports of the

beams.

1.2.9 *Deleted*.

1.2.10 Formwork is required for full height at all locations. Special precaution for such tall formwork shall be taken to ensure its safety. Extra costs for such formwork shall be deemed to have been included in the price quoted against relevant items.

1.2.11 In the mobilization period, the contractor shall carry out expeditiously and without delay the following works:

i. Material testing and mix designs of concrete as contemplated in the specifications.

ii. Setting up of full-fledged site laboratory as per the requirements of these specifications.

iii. Any other pre-requisite items required for final execution.

iv. Site office for the use of the Engineer staff.

v. Casting yard with full facilities.

1.2.12 Deleted

1.3 SUPPLY OF PROGRES PHOTOGRAPHS AND ALBUMS (DIGITAL):

The work covers the supply of digital photographs to serve as a permanent record of various stages/facets of work needed for authentic documentation as approved by the Engineer.

The photographs shall be of acceptable quality and they shall be taken by a professionally competent photographer with camera having the facility to record the date of the photographs taken in the soft copy. Each photograph in the album shall be suitably captioned and dated.

The photographs and materials shall form a part of the records of concerned organization and same cannot be supplied to anybody else or published without the written permission of concerned organization.

1.4 SUPPLY OF VIDEO CDs:

The work consists of taking video films of important activities of the works as directed by the Engineer during the currency of the Project and editing them to a video film of playing time not less than 60 minutes. It shall contain narration of the activities in English by a competent narrator. The edition of the film and script of the narration shall be approved by the Engineer.

Drone Survey - of the whole package for inspection and monitoring of structures shall be done by the Contractor once in a month.

The record of progress (photographs and videos) shall be submitted to the engineer on a monthly basis or as directed by engineer.

1.5 SURVEY WORK:

The said work involves at the very start of work taking-over of reference point from the Engineer, establishment of control points, triangulation points, bench marks, grid layout for all the structures maintaining horizontal and vertical control within the permissible limits, incorporating changes (if any), submission of full data in the tabulation form and survey drawings including setting and layout of various works during the progress of work and matching of the station area track alignment with the alignment of the approaches at station ends and incorporating the changes (if any).

1.6 BARRICADING

The work covers barricading for the work done along the median and areas affecting road traffic and other areas like casting yard, batching plant, storage and other working area. All barricading shall be done at own cost by the Contractor. The detailed scope of work is as follows:

i. Providing and installing the barricade of the design and type as shown in the Tender Drawings furnished as per the approved plan firmly to the ground and maintaining it during the progress of work.

ii. Dismantling of barricading and other temporary installations from the site and cleaning the site as per direction of Engineer upon completion and acceptance of work.

iii. Providing earthing of Barricades.

iv. Providing Lighting on the periphery of Barricades for Direction illumination.

1.7 FINISHING WORK:

1.7.1 The Contractor shall incorporate seismic considerations of anchoring and isolation in the design and detailing of the finishes as directed by the Engineer. The element to be anchored shall have its motion suitably restrained whilst at the same time it shall be suitably isolated so as not to be affected by the deformations/ vibrations of the building during Construction.

1.7.2 **Sub-Contractor:**

Works as listed below and those dealing with proprietary materials/ products may be carried out by the Contractor through the Sub-Contractors as may be approved by the Engineer in writing. The Sub-Contractors must be firms of repute and long standing, having adequate experience and complete facilities to carry out all items of work required for completion as per Specifications and expected quality to the satisfaction of the Engineer. The Sub-Contractor must also have personnel experienced in preparing shop drawings. All such works, not limited to the following, shall be carried out under the direct supervision of the manufacturers of the proprietary materials/ products or their trained and accredited licensee.

i. Bearings

ii. Fabrication, assembly and launching of steel OWG & CG

iii. Ballastless track

iv. Fabrication of H beam sleepers and track fittings/fastenings

1.7.3 **Responsibility for Shop drawings, Samples and Mock-ups:**

Approval of shop drawings, samples and mock-ups for the various components shall not absolve the Contractor of his responsibility of completing the work to the specifications, standards, tests for performance and guarantees given in these documents and to a quality of finish as desired by the Engineer.

1.7.4 **Cleaning:**

Surfaces on which finishes are to be provided shall be cleaned with water jets or oil free compressed air or power tools with wire brushes and detergents all as approved by the Engineer.

1.8 Applicable Codes, Standards & Publications for Structural & Architectural Work:

The more important Codes, Standards and Publications to Contract are listed here under:

Any other code/publication, if found necessary by the engineer, may be referred to for such works. The latest revision along with all corrections slip & amendments shall only be followed

Sr. No.	Code No.	Code Name
General		
1.	IS: 875	Code of Practice for design loads (other than earthquake) for buildings and structures
2.	IS: 122 (part 4)	Methods of measurement of buildings and Civil engineering works-Stone masonry
3.	IS:1237	Specification for cement concrete flooring tiles
4.	IS: 1322	Bitumen felts for water proofing and damp-proofing
5.	IS: 1893	Criteria for earthquake resistant design of structures
6.	IS: 2185 (Part 1)	Concrete masonry units: Hollow and solid concrete
7.	IS: 2185 (Part 2)	Concrete masonry units: Hollow and solid light weight
8.	IS: 2185 (Part 3)	Concrete masonry units: Autoclaved cellular aerated concrete blocks
9.	IS: 2572	Code of Practice for construction of hollow concrete block Masonry
10.	IS: 3414	Code of practice for design and installation of joints in Buildings
11.	IS: 3462	Specification for unbacked flexible PVC flooring
12.	IS: 5318	Code of practice for laying of flexible PVC sheet and tile Flooring
13.	IS: 6408 (Parts 1,2)	Recommendations for modular co-ordination in building

Sr. No.	Code No.	Code Name
		Industry-tolerances
14.	IS: 8183	Bonded mineral wool
15.	IS:10958	General check list of functions of joints in building
16.	IS:11817	Classification of joints in buildings for accommodation of dimensional deviations during construction
17.	IS:11818	Method of test for laboratory determination of air permeability of joints in buildings
18.	IS:12440	Precast concrete stone masonry blocks
19.	CPWD	Specifications with up-to-date correction slips
20.	BS:476 (Part 7)	Method for classification of the surface spread of flame of Products
21.	BS:476 (Part 20)	Method of determination of the fire resistance of elements of construction (general principles)
22.	BS:476 (Part 22)	Methods for determination of the fire resistance of non-load bearing elements of construction
23.	BS: 1245	Specification for metal door frames (steel)
24.	BS: 3261	Specification for unbacked flexible PVC flooring
25.	BS:3261: Part 1	Homogeneous flooring
26.	BS:5215	Specification for one-part gun grade polysulphide-based Sealants
27.	BS:5606	Guide to accuracy in building
28.	BS:5725 (Part 1)	Specification for panic bolts and panic latches mechanically operated by a horizontal push-bar
29.	BS:6093	Code of practice for the design of joints and jointing in building construction
30.	BS:8200	Code of practice for the design of non-load bearing external vertical enclosure of building
31.	ASTM C 332	Specification for light weight aggregate for insulating Concrete
32.	ASTM C 635	Specification for the manufacture, performance and testing of metal suspension systems for acoustical tile and lay-in panel ceilings
33.	SP 7	National Building Code of India
34.	SP 23 (S&T)	Hand Book on Concrete Mixes
Bitumen		
35.	IS:702	Industrial Bitumen
36.	IS:3384	Specification for bitumen primer for use in waterproofing and damp-proofing
Building Construction Practices		
37.	IS: 1838 Parts I and II.	Specifications for preformed fillers for expansion joint in concrete pavements and structures

Sr. No.	Code No.	Code Name
38.	IS: 1946	Code of Practice for use of fixing devices in walls, ceilings, and floors of solid construction.
39.	IS: 3414	Code of Practice for design and installation of joints in buildings.
40.	IS: 6509	Code of Practice for installation of joints in concrete pavements.
41.	IS: 11134	Code of Practice for setting out of buildings.
42.	IS: 11433	Parts I and II. Specifications for one part Gun grade polysulphide based joint sealant
43.	IS: 12200	Code of Practice for provision of water stops at transverse construction joints in masonry and concrete dams
44.	NBC-2016	National Building Code
Cement		
45.	IS:269	33 grade ordinary Portland cement
46.	IS: 455	Portland Slag Cement
47.	IS: 650	Specification for standard sand for testing cement
48.	IS: 1489 (Part 1)	Portland pozzolana cement: Fly ash based
49.	IS: 1489 (Part 2)	Portland pozzolana cement: Calcined clay based
50.	IS: 3535	Method of Sampling Hydraulic Cements
51.	IS: 4031	(Parts 1 to 13) Methods of physical tests for hydraulic cement
52.	IS:4032	Methods of chemical analysis of hydraulic cement
53.	IS: 6925	Methods of test for determination of water-soluble chlorides in concrete admixtures
54.	IS:8042	White Portland Cement
55.	IS: 8112	Specification for 43 grade ordinary Portland cement
56.	IS:12269	Specification for 53 grade ordinary Portland cement
57.	IS: 12330	Specification for sulphate resistant Portland cement
58.	IRS: T40	Indian Railways standard specification for special grade cement for use in concrete sleepers
Concrete		
59.	IS:456	Code of practice for plain and reinforced concrete
60.	IS: 457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures
61.	IS: 460 (Part I TO III)	Specification for Test Sieves
62.	IS: 516	Methods of tests for strength of concrete
63.	IS: 1199	Methods of sampling & analysis of concrete
64.	IS: 1200	Methods of measurement of building and civil engineering
65.	IS: 1343	Code of practice for prestressed concrete

Sr. No.	Code No.	Code Name
66.	IS: 1607	Methods of Test Sieving
67.	IS:2386	Parts I-VIII. Methods of tests for aggregates for concrete.
68.	IS:2430	Methods of Sampling of Aggregates of Concrete
69.	IS:2438	Specification for roller pan mixer
70.	IS:2514	Specification for concrete vibrating tables
71.	IS:2571	Code of practice for laying in-situ cement concrete Flooring
72.	IS:2645	Specifications for integral cement water proofing Compounds
73.	IS:2722	Specifications for portable swing batchers for concrete (double bucket type)
74.	IS:2770	Methods of testing bond in reinforced concrete part I pull out test
75.	IS:3025	Methods of sampling and test (physical and chemical) for water & waste water
76.	IS:3370	Code of practice for concrete structures for storage of Liquids
77.	IS:3935.	Code of practice for composite construction
78.	IS:4326	Code of practice for earthquake resistant construction of Building
79.	IS:6925.	Methods of test for determination of water soluble chlorides in concrete Admixtures
80.	IS:7242	Specifications for concrete spreaders
81.	IS:7251	Specifications for concrete finishers
82.	IS:7861	Parts I & II. Code of practice for extreme weather concreting
83.	IS:7969	Safety code for handling and storage of building materials
84.	IS:8989	Safety code for erection of concrete framed structures
85.	IS:8142	Methods of test for determining setting time of concrete by penetration resistance
86.	IS: 9103	Specification for admixtures for concrete
87.	IS: 9013	Method of making, curing and determining compressive strengths of accelerated cured concrete test specimens
88.	IS: 9284	Method of test for abrasion resistance of concrete
89.	IS:10262	Recommended guidelines for concrete mix design
90.	IS: 4926	Code of Practice ready mixed concrete needs to be included in list

Sr. No.	Code No.	Code Name
91.	MORTH	Specifications for Road and Bridge Works, Ministry of Road Transport and Highways (Roads Wing)
92.	SP 34	Handbook on Concrete Reinforcement and Detailing
93.	IRS	Concrete Bridge Code
94.	IRC 112	Code of Practice for Concrete Road Bridge
95.	IRC 83 (Part 4)	Standard Specifications and code of practice for road bridges Section IX Bearings (Spherical & Cylindrical)
96.	ASTM-C-94	Ready Mix Concrete
Construction Plant and Machinery		
97.	IS: 1791	Specification for batch type concrete mixers
98.	IS: 2505	General requirements for concrete vibrators: Immersion type.
99.	IS: 2506	General requirements for screed board concrete vibrators.
100.	IS: 3366	Specification for pan vibrators
101.	IS: 3558	Code of Practice for use of immersion vibrators for consolidating concrete
102.	IS: 4656	Specifications for form vibrators for concrete.
103.	IS: 4925	Specification for concrete batching and mixing plant.
104.	IS: 11993	Code of Practice for use of screed board concrete vibrators.
Formwork		
105.	IS: 4990	Specifications for plywood for concrete shuttering work
106.	IRC: 87	Guidelines for the design and erection of false work for road bridges.
107.	IS: 806	Code of practice for use of steel tubes in general building construction.
108.	IS: 1161	Specification of steel tubes for structural purposes.
109.	IS: 1239	Specification for mild steel tubes, tubular and other wrought steel fittings
Gypsum and Gypsum Board		
110.	IS: 2095	Gypsum plaster boards
111.	IS: 2542 (Part 1/Sec to 12)	Methods of test for gypsum plaster, concrete and products: plaster and concrete

Sr. No.	Code No.	Code Name
112.	IS: 2542 (Part 2/Sec 1to 8)	Methods of test for gypsum plaster, concrete and products: Gypsum products
113.	IS: 2542 (Part1)	Gypsum building plaster: Excluding premixed lightweight plaster
114.	IS: 2547 (Part 2)	Gypsum building plaster: Premixed lightweight plaster
Handling and Storage		
115.	IS:4082	Recommendation of Stacking and Storage of construction materials
116.	IS:8348	Code of practice for stacking and packing of stone slabs for transportation
117.	IS:8759	Code of practice for maintenance and preservation of stones in building
Instruments for Testing Cement and Concrete		
118.	IS:5513	Specification for vicat apparatus.
119.	IS:5514	Specification for apparatus used in Le-Chatelier test.
120.	IS:5515	Specification for compaction factor apparatus.
121.	IS:7320	Specification for concrete slump test apparatus.
122.	IS:7325	Specification for apparatus to determine constituents of fresh concrete.
123.	IS:10080	Specification for vibration machine.
124.	IS:10086	Specification for moulds for use in tests of cement and concrete.
125.	IS:10510	Specification for vee-bee consistometer.
	Joint Fillers	
126.	IS:1838 (Part 1)	Preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type): Bitumen impregnated fibre
Paints and Coatings		
127.	IS:102	Ready mixed paint, brushing, red lead, non-setting, priming

Sr. No.	Code No.	Code Name
128.	IS:109	Ready mixed paint, brushing, priming, plaster, to Indian Standard Colour No. 361 and 631 white and off white.
129.	IS:218	Creosote and anthracene oil for use as wood preservatives
130.	IS:347	Varnish, shellac, for general purpose
131.	IS:348	French Polish
132.	IS:2074	Ready mixed paint, air drying, red oxide-zinc chrome, priming
133.	IS: 4833	Methods of field testing of preservatives in wood
134.	IS:10013 (Parts 1 to 3)	(Part -1) Water soluble type wood preservatives
135.	IS:10013 (Parts 1 to 3)	(Part-2) Acid-copper-chrome preservative
136.	IS: 10013 (Part 1 to 3)	(Part-3) Copper-chrome-boron wood preservative
137.	BS:6496	Specification for powder organic coatings for application and stoving to aluminium alloy extrusions, sheet and preformed sections for external architectural purposes, and for the finish on aluminium alloy extrusions, sheet and preformed sections coated with powder organic coatings
138.	BS:EN:10152	Specification for electrolytically zinc coated cold rolled steel flat products. Technical delivery conditions
139.	ASTM A 164-71	Specification for electrodeposited coatings of zinc on steel
Pigment for cement		
140.	BS:1014	Specification for pigments for Portland cement and Portland cement products
Reinforcement & Structural Steel		
141.	IS:206	Code of Practice for use of Steel Tubes in General Building Construction
142.	IS:210	Grey Iron Castings
143.	IS:280	Mild steel wire for general engineering purposes

Sr. No.	Code No.	Code Name
144.	IS:432	Part I. Mild steel and medium tensile steel bars. Part II Hard drawn steel wire.
145.	IS:451	Technical Supply conditions for Wood Screws
146.	IS:806	Code of practice for use of steel tubes in general building construction
147.	IS:815	Classification coding of covered electrodes for metal arc welding of structural steels
148.	IS:1239	Specification for mild steel tubes, tubulars and other wrought steel fittings
149.	IS 1343	Code of Practice for Prestressed Concrete
150.	IS:1363	Black hexagon bolts, nuts and lock nuts and black hexagon screws.
151.	IS:1365	Slotted countersunk screws.
152.	IS:1566	(Part I) Specifications for hard-drawn steel wire fabric for Concrete reinforcement
153.	IS:1786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
154.	IS:2502	Code of Practice for bending and fixing of bars for concrete reinforcement.
155.	IS:2629	Recommended practice for hot-dip galvanising of iron and steel.
156.	IS:2751	Code of Practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
157.	IS 4000	Code of practice for high strength bolts in steel structures
158.	IS:4759	Hot-dip zinc coating on structural steel and other allied products.
159.	IS:5525	Recommendations for detailing of reinforcement in reinforced concrete works
160.	IS:9417	Recommendations for welding cold-worked steel bars for reinforced concrete construction.
161.	IS:14268	Uncoated stress relieved low relaxation steel class 2 for Prestressed concrete

Sr. No.	Code No.	Code Name
162.	IS:226	Structural steel (Standard Quality)
163.	IS:800	Code of practice for use of structural steel in general building construction.
164.	IS:813	Scheme of symbols for welding
165.	IS:814	Covered electrodes for metal arc welding of structural steel. (Part I & Part II)
166.	IS:816	Code of practice for use of metal arc welding for general construction in mild steel.
167.	IS:822	Code of practice for inspection of welds.
168.	IS:961	Structural steel (High Tensile)
169.	IS:1024	Code of practice for use of welding in bridges and structures subject to dynamic loading.
170.	IS:1030	Carbon steel casting for General Engineering Purposes
171.	IS:1120	Coach Screws
172.	IS:1367	Technical Supply Conditions for Threaded Fasteners
173.	IS:1161	Steel tubes for structural purposes.
174.	IS:1182	Recommended practice for radiographic examination of fusion welded butt joints in steel plates.
175.	IS:1915	Code of Practice for Steel Bridges
176.	IS:2016	Plain Washers
177.	IS:2062	Structural steel (Fusion welding quality)
178.	IS:3063	Single Coil Rectangular Section Sprint Washers for Nuts, Bolts and Screws
179.	IS:3443	Crane Rail Sections
180.	IS:3757	Specification for high tensile friction grip bolts
181.	IS:5624	Specification for foundation bolts
182.	IS:3600	Code of practice for testing of fusion welded (Part I) joints and weld metal in steel
183.	IS:4923	Hollow steel sections for structural use.

Sr. No.	Code No.	Code Name
184.	IS:6227	Code of practice for use of metal arc welding in tubular structure.
185.	IS:801	Code of practice for use of cold formed light gauge steel structural members in general building construction.
186.	IS:811	Specifications for cold formed light gauge structural steel sections.
187.	IS:8500	Structural steel Micro alloyed (Medium and high strength qualities)
188.	IS:8910	General requirements of supply of weldable structural steel
189.	IS:9595	Recommendations for metal arc welding of carbon & carbon- manganese steels.
190.	IS 16172	Reinforced Couplers for Mechanical Splices of Bars in Concrete
Sand		
191.	IS:383	Coarse and fine aggregates from natural sources for concrete.
Scaffolding		
192.	IS:2750	Specification for steel scaffoldings
193.	IS:3696 (Part 1)	Safety Code of scaffolds and ladders: Scaffolds
194.	IS:3696 (Part 2)	Safety Code of scaffolds and ladders: Ladders
195.	IS:4014 (Part 1)	Code of practice for steel tubular scaffolding: Definition and Materials
196.	IS:4014 (Part 2)	Code of practice for steel tubular scaffolding: Safety regulations for scaffolding
197.	IRC:87	Guidelines for the design and erection of falsework for Road bridge
Sealants		
198.	IS: 10959	Glossary of terms for sealants for building purposes
199.	IS: 11433 (Part 1)	One part grade polysulphide base joint sealant: General requirements
200.	IS: 11433 (Part 2)	One part grade polysulphide base joint sealant: Methods of test

Sr. No.	Code No.	Code Name
201.	IS: 13055	Methods of sampling and test for anaerobic adhesives and sealants
202.	BS: 5889	Specification for one part gun grade silicone based sealants.
Wood		
203.	IS: 303	Plywood for General Purposes
204.	IS: 848	Synthetic resin adhesives for plywood (phenolic and aminoplastic)
205.	IS: 1141	Seasoning of Timber – Code of Practice
206.	IS:1328	Veneered decorative plywood
207.	IS: 1659	Blocks Boards
208.	IS: 2046	Decorative thermosetting synthetic resin bonded laminated sheets
209.	IS: 2202 (Part 1)	Wooden flush door shutters (solid core type): Plywood face panels
210.	IS: 2202 (Part 2)	Wooden flush door shutters (solid core (type): Particle face panels and hardboard face panels
Bearing		
211.	IRC: 83 Part-II	Standard specifications and code of practice for road bridges Elastomeric Bearings
212.	IRC: 83 Part-III EN 1337gh	Standard specifications and code of practice for road bridges Pot Bearings
213.	IRC: 83 Part-IV	Standard Specifications and Code of Practice for Road Bridges (Section – IX) Bearings (Spherical and Cylindrical)
Piling		
214.	IS: 2911 (All Parts)	Bored Cast in-situ Concrete Piles
215.	IRC: 78	Standard specifications and code of practice for road bridges Foundation And Substructure
All Indian Railway & RDSO Standards, any other code or publication as approved by engineer in-charge		
Metal		
216.	IS: 276	Austenitic manganese steel castings
217.	IS: 733	Wrought aluminium and aluminium alloy bars, rods and sections for general engineering purpose.
218.	IS: 737	Specifications for wrought aluminium and aluminium alloy sheet and strip for general engineering purpose.

Sr. No.	Code No.	Code Name
219.	IS: 3614 (Part 1)	Specification for fire check doors: Plate metal covered and rolling type
220.	IS: 3614 (Part 2)	Specification for metallic and non-metallic fire check doors: Resistance test and performance criteria
221.	IS: 7196	Specification for Hold Fasts
222.	ASME set 2 Part A	Ferrous Material Specification
223.	ASTM B 221	Specification for aluminum-alloy extruded bars, rods, wires, shapes, and tubes
224.	BS: 4873	Specification for Aluminum alloy windows
225.	BS: 7352	Specification for strength and durability performance of metal hinges for side hanging applications and dimensional requirements for template drilled hinges.
226.	BS EN: 10143	Specification for continuously hot-dip metal coated steel sheet and strip. Tolerances on dimensions and shape
Stone and Facings/Linings		
227.	IS:1121-(Parts 1 to 4)	Methods of test for determination of strength properties of natural building stones
228.	IS:1121-(Parts 1 to 4)	(Part-1 Compressive strength)
229.	IS:1121-(Parts 1 to 4)	(Part-2 Transverse strength)
230.	IS:1121-(Parts 1 to 4)	(Part-3 Tensile strength)
231.	IS:1121-(Parts 1 to 4)	(Part-4 Shear strength)
232.	IS:1122	Method of test for determination of true specific gravity of natural building stones.
233.	IS:1123	Method of identification of natural building stones.
234.	IS:1124	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones.
235.	IS:1125	Method of test for determination of weathering of natural

Sr. No.	Code No.	Code Name
		building stones
236.	IS:1126	Method of test for determination of durability of natural building stones.
237.	IS:1127	Recommendations for dimensions and workmanship of natural building stones for masonry work.
238.	IS:1128	Specification for Limestone (Slabs and Tiles)
239.	IS:1129	Recommendation for dressing of natural building stones.
240.	IS:1130	Specification for marble (blocks, slabs and tiles)
241.	IS:1597 (Part 2)	Code of practice for construction of stone masonry Ashlar masonry
242.	IS:1706	Method for determination of resistance to wear by abrasion of natural building stones
243.	IS:1805	Glossary of terms relating to stones, quarrying and dressing
244.	IS:3620	Specification for laterite stone block for masonry
245.	IS:3622	Specification for Sandstone (slab & tiles)
246.	IS:4101 (Part 1)	Code of practice for external facing and veneers: stone Facing
247.	IS:4101 (Part 2)	Code of practice for external facing and veneers: Cement concrete facing
248.	IS:4101 (Part 3)	Code of practice for external facing and veneers: Wall tiling and mosaics
249.	IS:4121	Method of test for determination of water transmission rate by capillary action through natural building stones
250.	IS:4122	Method of test for surface softening of natural building stones by exposure to acidic atmospheres
251.	IS:4348	Method of test for determination of permeability of natural building stones
252.	IS:5218	Method of test for toughness of natural building stones
253.	IS:8381	Recommended practice for quarrying stones for construction purposes
254.	IS:14223 (Part 1)	Polished building stones: Granite

Sr. No.	Code No.	Code Name
255.	BS: 8298	Code of practice for design and installation of natural stone cladding and lining
256.		All Indian Railway & RDSO Standards, any other code or publication as approved by Engineer in-charge

Chapter 2. EARTHWORK IN FORMATION, HUME PIPES AND RETAINING WALLS

2.1 FORMATION IN EMBANKMENT/CUTTING

a) Earthwork in formation and blanketing shall be carried out as per RDSO specification No. RDSO/2020/GE: IRS-004 September 2020 "Comprehensive Guidelines and Specifications for Railway Formation" and in accordance with the approved drawings.

b) The contractor shall arrange suitable borrow areas at his own cost and get them approved from the Engineer before using soil from such borrow areas.

c) Soils mentioned in Clause 3.7 (a) of the RDSO Guidelines shall not be used.

d) SQ-1 type of soils shall not be used in prepared subgrade and top layer of subgrade.

e) MDD in laboratory shall be determined by using Heavy Proctor test as per IS 2720 Part- 16.

f) MDD achieved in the field compaction trial shall not be less than 98% of the MDD achieved in laboratory.

g) Degree of compaction of soil in prepared subgrade/top layer of subgrade shall not be less than 98% of MDD achieved in field as a result of Field Compaction Trial.

h) Degree of compaction of soil in lower layer of subgrade shall not be less than 97% of MDD achieved in field as a result of Field Compaction Trial.

i) Before undertaking turfing, extra earthwork on slopes of embankment shall be cut to final design profile, dressed and compacted with vibratory rollers of approved capacity and make as per RDSO guidelines.

j) Blanketing material shall be as per RDSO Guidelines.

k) The type of tests, frequency and acceptance criteria for quality check of earthwork and blanketing shall be as given in Chapter 7 of RDSO Guidelines.

2.2 Utility Pipes

MS pipe of 323.9 mm outer diameter conforming to IS:3589, shall be provided at about 500m interval throughout the alignment in embankments for crossing future utilities. Pipe shall be laid as per RDSO Report NO. BS-105 of October'2009 "Guidelines on Pipe Line Crossing Under Railway Track".

2.3 Retaining Walls and Side Slopes

Dimensional tolerance shall be +/- 2 mm. Shuttering/formwork for cast-in-situ retaining wall shall be adequate to permit construction of retaining walls upto 3 m height in single pour. In case, construction of retaining wall upto 3 m height in single pour is found impracticable, the Contactor shall take specific approval of the Engineer for the proposed Shuttering/form work. Wherever retaining wall is required to be constructed for retaining formation slope, retaining wall shall be constructed first. Thereafter, earthwork in formation shall be done behind the retaining wall (in layers with mechanical compaction leaving space for backfill) up to the height of retaining wall. Extra earthwork on slope

towards retaining wall shall be cut in 1:1 slope and backfill shall be provided behind retaining wall in layers with mechanical compaction as per RDSO Guidelines. Thereafter, earthwork above the height of retaining shall be taken up as per approved method statement. *Concrete and reinforcement used in construction shall comply with the provisions of Annexure OCS-1 & OCS-2 of these specifications.*

Chapter 3. BRIDGES

3.1 General

3.1.1 Scope of Specifications

This specification shall be applicable for carrying out bridge works. *All concrete works shall be carried out in accordance with Annexure OCS-1 and Annexure OCS-2 of these Specifications.*

3.1.2 Applicable Standards

The applicable standards shall be as follows:

a) Indian Railway Standard Codes and Specifications (IRS)

i. Bridge Rules

ii. Concrete Bridge Code

iii. Steel Bridge Code

iv. Well and Pile Foundation Code

v. Fabrication Specification No. B1-2001

vi. Specification No. B-2 for Steel Structures (other than Girder Bridges)- Part 3.

vii. Welded Bridge Code

viii. Bridge Sub-structure & Foundation Code

ix. Specification No.M-28, Classification, testing and approval of metal arc welding electrodes for use-Indian Railway

x. Specification No.M-29, Classification, testing and approval of submerged arc welding with flame combination.

xi. Indian Railways Unified Standard Schedule of Rates - 2019

xii. Indian Railways Unified Standard Specification (Formation Works, Bridge Works & P.Way Works) - 2019

xiii. Indian Railways Permanent Way Manual (IRPWM)

xiv. Indian Railways Works Manual (IRWM)

xv. Indian Railways Bridge Manual (IRBM)

xvi. Indian Railways Engineering Code

xvii. Manual on the design and construction of Well and Pile foundations

xviii. Indian Railways Schedule of Dimensions (BG)

xix. IRS Seismic code for Earthquake Resistant Design of Railway bridges.

b) RDSO Guidelines

i. BS-113 Guidelines for providing Arrangements for Bridge Inspection

ii. Comprehensive Guidelines and Specifications for Railway Formation: RDSO/2020/GE: IRS 0004.

iii. Report No. GE: R-50: Transitional System on approaches of bridges

iv. Report No. BS-111: Guidelines for use of High Strength Friction Grip (HSFG) bolts on bridges on Indian Railways

v. Guidelines for design of Spherical and Cylindrical bearings (in case of Steel Bridges).- RDSO/CBS/Bearing dated 22-06-2011

vi. RDSO drawings for H-beam sleepers

vii. Report No. BS 115 : Guidelines for Composite Construction Including Stud Shear Connectors

c) Indian Standards Codes and Specifications (IS)

i. IS: 456 Plain and reinforced concrete - code of practice

ii. IS: 800 Code of practice for General Construction Steel

iii. IS: 875 Code of Practice for Design Loads Part 1, 2 3, 4& 5 (Other than Earthquake)

iv. IS: 1080 Design and construction of shallow foundations in soils (other than raft ring and shell)

v. IS: 1367 Technical Supply Conditions for Threaded Steel Fasteners

vi. IS: 13920 Ductile detailing of reinforced concrete structures subjected to seismic forces code of practice

vii. IS: 1489 Specification for Portland pozzolana cement (Fly ash based)

viii. IS: 1786 High strength deformed steel bars and wires for concrete reinforcement

ix. IS: 1904 Design and construction of Foundations in soils: general requirements.

x. IS: 2062 Specifications for weldable Structural steel

xi. IS: 2502 Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement

xii. IS: 2911 Design and Construction of Pile Foundation - Code of practice Part1 Concrete Pile- Section 2 Bored Cast-in-situ-piles

xiii. IS: 2911 Design and Construction of Pile Foundation- Code of practice Part1 Concrete Pile- Section 4 Precast Concrete Piles in Prebored Holes

xiv. IS 2911 Design and Construction of Pile Foundation- Code of practice Part 4 Load test on piles

xv. IS: 2950 Design and construction of raft foundations

xvi. IS: 3935 Code of Practice for Composite Construction

xvii. IS: 4923 Hollow steel sections for structural use -specification

xviii. IS: 1161 Steel Tubes for Structural Purposes- specifications

xix. IS: 8009 Calculation of settlements of shallow foundations

xx. IS: 269 Specifications of OPC cement

xxi. IS: 9103 Specifications of Concrete admixtures

xxii. IS: 12070 Code of practice for Design and construction of shallow foundation on Rocks

xxiii. IS: 14593 Design and Construction of Bored Cast-in-Situ Piles Founded on Rocks.

xxiv. IS 455 Specifications for portland slag cement

d) Other Standards

i. CPWD specifications, (Vol 1 & 2) -2019

ii. Delhi Schedule of Rates, (Vol 1 & 2) - 2021

iii. UIC Code 772-2 (R) Code for the use of rubber bearings for rail bridges

iv. IRC:83-2018 (Pt. II) - Standard Specifications and Code of Practice for Road Bridges (Section – IX) Bearings (Elastomeric Bearings)

v. IRC:83-2014 (Pt. IV) - Standard Specifications and Code of Practice for Road Bridges (Section – IX) Bearings (Spherical and Cylindrical)

vi. ISO 6892 – Tensile Testing of Metallic Materials

vii. ISO 13918-2008 – Welding- Studs and Ceramic Ferrules for Arc Stud Welding

3.2 Bridge Works: Substructure

3.2.1 GENERAL

a) Coverage

The Specifications given in this chapter deal with items pertaining to all types of foundations for bridges and bridge superstructure viz., Piers, abutments, wing walls, bed blocks and ballast walls / dirt walls.

3.2.2 Setting out for foundations

a) Setting out for Minor Bridges and Culverts

Shall be carried out by a competent / qualified engineer, employed by the Contractor and checked by the Engineer's representative for all bridges and culverts. Contractor shall provide necessary instruments, linear tapes, pegs etc.

The setting out for foundations and sub-structure shall be carried out with a theodolite and steel tapes / Invar tapes in case of works not involving deep foundations or standing water.

All levels will be measured using a precise levelling instrument. Errors in location of piers / abutments and fixing levels shall be within following limits.

Linear Measurements	±5 mm
Levels	±3 mm

b) Setting out for Major Bridges and Viaduct

i. Locations of piers and abutments along with the centre line of the bridge should be accurately laid out by establishing one or more base lines as directed and a system of pegs and posts. Also sufficient reference pegs and pillars should be established for checking the positions with ease during progress of work. Reference Bench Marks for levelling should be established nearby on a permanent structure or on a pillar to be built up in vicinity.

ii. The principal reference lines and level pegs should be established at easily accessible locations. They include-

1) Longitudinal Centre line

2) Transverse Centre lines of abutments and piers

3) Tangent points of the curve at either end, if alignment is on a curve.

iii. For Bridge Works involving deep excavations, pile driving or well sinking and / or where there is standing water, use of base line is obligatory. They should be preferably at right angle to centre line of bridge, with one on either end on high bank in case of long bridges or on one side bank of bridge for shorter ones.

iv. In case of major bridges and viaduct of length exceeding 1000 m, base lines and reference towers will have to be established. Provision of all assistance in form of measuring instruments, linear tapes as may be required by the surveyor, technical and skilled staff and labour required to assist them, fixing pegs, pillars and towers including all building materials and maintaining and guarding them including supply of all materials, tools and plant shall be done by the Contractor at his cost. Nothing extra will be payable to them on this account. Important points to be observed in this activity are:

1) Linear Measurement shall be carried out with invar tape or electronic distance measuring instruments

2) Spring balances shall be used for giving specified tension to the tape. Tape readings shall be corrected for tension, temperature and slope.

3) Concrete pillars with steel plates fixed over them shall be located at intermediate points (at tape lengths) and ends.

4) Reference pillars at pier and abutment position along centre lines and reference pillars on base lines shall be to standards to be prescribed by the Engineer. During construction, since centre line pillars at abutment / pier locations will be disturbed, reference pillars and lines shall be fixed around each structure by the Contractor under Site Engineer's supervision. Reference

diagrams at Annexures 4/1 and 4/2 and Clause 401 of IRBM shall be referred to for more details.

3.3 Soil Exploration

Soil exploration and test shall be carried out conforming to Indian Railways Codes and Specifications according to soil type, foundation type and site requirement.

3.4 Earthwork in excavation

Excavation shall be made only to the exact depth as approved by the Engineer. In the event of excavation having been made deeper than that shown on the drawing or as ordered by the Engineer, the extra depth shall be made up with M10 concrete in case of foundation resting on soil and with concrete of the same grade as that of the foundation, in case of foundation resting on rock.

3.4.1 Method Statement

The Contractor shall submit Method Statement for carrying out the work of excavation in foundations and flooring etc. suiting to local ground conditions and safety measures conforming to IS: 3764 (Excavation Work- Code of Safety) to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement and drawings.

3.4.2 Site Clearance

Site clearance shall be done as per the Contract.

3.4.3 Setting Out

After the site has been cleared, the limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer. The Contractor shall be responsible for the setting out of works and the establishment and maintenance of benchmarks, other marks & stakes as long as in the opinion of the Engineer, they are required for the work.

a) Excavation shall be carried out in all types of soil encountered at site and to the lines, levels and profiles shown on the drawings that have NONO from the Engineer. The Work shall be carried out by the Contractor in such a way as to avoid soil erosion and groundwater pollution, accidents in habitational or frequented places, disturbance to the surrounding ground or structures, accident to workmen and any other untoward incident. Fencing, caution signages with red lights and other safety measures shall be employed to avoid accidents. Where necessary, signal men shall be employed to guide the movement of people, vehicles and equipment.

b) The work shall be carried out in a careful manner to ensure that the exposed surfaces are as sound as the nature of the material permits and that no point shall protrude inside the lines shown on the Drawings.

c) The Contractor shall be responsible for the safety and stability of all excavations performed by him or under his control. In case of any slips or blows in the excavation, the same shall be cleared by the Contractor at his own cost.

d) The Contractor shall notify the Engineer without delay of any permeable strata, joints, faults, fissures or unusual ground conditions encountered during excavation and any excavation instability and/or collapse.

e) The Contractor shall ensure that no air pollution takes place during excavation, storage and transportation of earth/spoil by providing suitable measures such as appropriate cover and the like.

f) The Contractor shall carry out ground stabilization measures without delay before and/or after excavation, if required.

g) The Contractor shall make provision for all shoring, de-watering, dredging, bailing out or draining water whether subsoil or rain or other water and the excavation shall be kept free of water while concrete work is in progress until the Engineer considers the work well set. The sides of trenches shall be kept vertical and the bottom level throughout or properly stepped as directed by the Engineer. No extra payment shall be made on this account.

h) De-watering shall be carried out by suitable means with adequate stand-by arrangements as may be approved by the Engineer. The Contractor shall be deemed to have satisfied himself with regard to feasibility of all aspects of de-watering including site constraints due to existing structures. Though the method of de-watering is left to the Contractor, he shall be required to submit method statement of de-watering scheme including requisite justifications to obtain approval from the Engineer.

i) Approval of the Engineer, however, shall not relieve the Contractor of the responsibility of adequacy and appropriateness of de-watering and protection arrangements for the quality and safety of the work.

j) The Contractor shall erect and maintain during progress of works temporary fences/ barricading around the work area with all safety measures as shown in Reference Information/Reports. The excavations near habitations, public movement areas and all works along the roads shall be provided with proper caution signs and marked with red lights, reflectors at night to avoid accidents. The Contractor shall take all adequate protective measures to see that excavation operations do not affect or damage adjoining structures.

k) Disposal of muck: The surplus excavated material (that cannot be used in the Works), shall be treated as contractor's property. The contractor shall be free to take away and make use of this surplus excavated material in the manner he wishes to, including disposal in spoil dumps or elsewhere as approved by the Engineer/concerned parties and regulating authorities. The employer takes no responsibility for the arrangement of dumping areas and these will have to be arranged by the Contractor at his own cost. The Contractor is required to carry out detailed survey to identify dumping areas, clearances required, leads involved etc. The quoted rates shall be deemed to have taken all these factors into account. The excavated material that can be used in the Works, shall be temporarily stockpiled, if required, in a dump site as proposed by

the contractor and agreed by the Engineer and the concerned regulating authorities. Any royalty, if to be paid to local authorities on the excavated material, is to be borne by the Contractor at his own cost irrespective of whether the excavated material is used for the Works or being used for any other purpose or being disposed off as surplus. Truck drivers shall be trained and educated by the Contractor to follow the traffic rules.

l) The Contractor shall ensure that traffic management on roads and railways is carried out in accordance with *Appendix 10, Section VII-9: Appendices, Part 2-Employer's Requirements.*

3.4.4 Excavation beyond True Lines and Levels

If due to any cause whatsoever excavations are carried out beyond their true line and level, the Contractor shall make good excavation at his own cost to the required line and level with the appropriate grade of filling or with concrete subject to the NONO from the Engineer.

3.4.5 Backfill to Structures

a) Prior to commencement of backfill, the Contractor shall submit Method Statement for carrying out work such that the optimum use may be made of excavated material and obtain approval from the Engineer. The proposals shall include details of the compaction plant and methods for adjusting the moisture content of the material.

b) No filling shall commence until approval has been received from the Engineer.

c) The Contractor shall not backfill around structures until the structural elements have attained adequate strength.

d) The backfill material shall be selected excavated material, thoroughly compacted mechanically in layers not exceeding 300mm loose thickness to achieve a density of at least 90% of the maximum dry density.

3.4.6 Tolerance

Permissible Tolerance for excavation

Item	**Standard value (mm)**
Finished depth of excavation	±25
length/width	0 to +50

3.5 Ground Improvement

Based on the subsoil details obtained from GT investigations and the loading expected to be applied by the structure, foundation design shall be carried out including sizing and settlement analysis. Ground improvement may be required in the following cases:

a. The net loading intensity of the foundation exceeds the allowable bearing capacity.
b. Resultant settlement exceeds the acceptable limits for the structure.
c. Loose cohesionless subsoil susceptible to liquefaction during earthquakes specially under high water table condition.

3.5.1 Ground Improvement by Soil Replacement method:

Soil up to the depth prone for liquefaction shall be cut below the founding level in required width. Upon completion of the excavation, bottom surface shall be levelled and compacted with heavy vibratory roller. All necessary safety precautions shall be ensured during excavation to protect the cut slopes.

Thereafter it shall be refilled with clean coarse sand/gravel in layers with mechanical compaction using heavy vibratory roller until the design founding level is reached. The sand/gravel layers used for filling shall be compacted to a minimum of 70% of the Density Index (Relative Density) as obtained in accordance with IS 2720 Part- 14. After ground improvement by soil replacement, safe bearing capacity shall be assessed by conducting Plate Load test. Sand/gravel for soil replacement shall be well grade-C_u>7 and fines (passing 75 micron) shall be less than 5%.

3.6 Bored cast in-situ Piling

Piling shall be carried out by hydraulic piling rig.

3.6.1 Method **Statement**

The Contractor shall submit Method Statement for carrying out the work of piling. The work shall be carried out strictly in accordance with the approved Method Statement, Manual on the design and construction of Well and Pile foundations, the Specification and the Drawings.

3.6.2 Materials

a) **Concrete**

Piles shall be constructed in accordance with the details shown in the drawings using the grade of concrete indicated, produced and placed in accordance with provisions of Annexure OCS-1 of these specifications.

b) **Reinforcement Steel**

Reinforcement steel shall comply with the provisions of Annexure OCS-2 of these specifications.

c) **Temporary Casings**

Temporary casings, as approved by the Engineer, shall be used to maintain the stability of pile bore hole. Temporary casings shall be free of distortion and shall be of uniform cross-section throughout each continuous length. During concreting, they shall be free of internal projections and encrusted concrete which may prevent proper formation of the pile.

d) **Stabilizing Material**

Natural drilling mud like bentonite shall not be used. The stabilizing fluid having polymer as approved by the Engineer shall be used.

3.6.3 Pile Installation

a) General

i. Bored cast-in-situ concrete piles shall conform to IS 2911 (Part 1/ Section 2), where not contravening to the following provisions. Based on borehole reports and drawings, installation of piles shall be carried out as per pile layout drawings, installation criteria, approved Method Statement and instructions of the Engineer. Any changes to the pile design, based on test-piles results, bore-hole data or soil conditions encountered during boring, shall be as instructed by the Engineer.

ii. The equipment and accessories for installation of piles shall be selected giving the due consideration to the sub-soil conditions, ground water conditions and type of founding material. These shall be of standard type and shall have been approved by the Engineer.

iii. Before installing the initial test pile, the Contractor shall finalise the pile testing arrangement and obtain approval of the Engineer.

iv. It is envisaged that the working piles shall be installed after the successful completion of the initial pile load test.

v. In case the Contractor desires to install the working pile, pending successful completion of initial pile load test, he may be permitted to do so, provided he gives undertaking to the Engineer to bear all associated risks and costs involved to make up for the short falls in the pile capacity, in the event of the failure of the initial pile load tests to establish specified 'Design Ultimate Load' carrying capacity of initial test pile.

vi. The Engineer reserves the right to reject any pile which in his opinion is defective on account of less carrying capacity, structural integrity, position, alignment, concrete quality etc. Piles that are defective shall be pulled out or left in place as judged convenient by the Engineer, without affecting the performance of adjacent piles. The Contractor shall install additional piles to substitute the defective piles, as per the directions of the Engineer, at no additional cost to the Employer. Further, the cost of additional piles and increase in the pile cap size, if any, on account of additional piles, shall be borne by the Contractor.

vii. Each pile shall be identified with a reference number and shall be as shown in the Drawings. The convenience of installation may be considered while scheduling the sequence of piling in a group.

viii. In a pile group, the sequence of installation of piles shall normally be from the center to the periphery of the group or from one side to the other.

ix. Level marks shall be accurately painted on each pile immediately after its installation. Subsequently, if any pile displays any tendency to heave up due to installation of other piles or due to any other reasons, the same shall be reinstalled firmly as per the

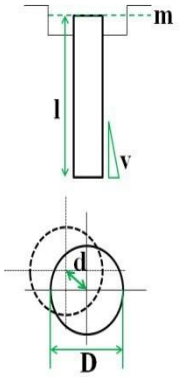
directions of the Engineer without any additional cost.

x. The Contractor shall record all the information during installation of piles, including pile-bore observations before concreting each pile. The data sheet for recording pile data shall be as approved by the Engineer. On completion of each pile installation, pile record shall be submitted to the Engineer within two days of completion of concreting of the pile.

b) Control of Position and Alignment

Piles shall be installed as accurately vertical as possible. The permissible tolerances with respect to position and inclination/alignment are as shown below:

Tolerances

No	Item	Permissible tolerance	Figure
1	Level of top i.e. Cut-off-Level (m)	-25mm to 25mm	
2	Position of the head in plan at Cut-off-Level (d)	75mm or less	
3	Embedded depth in bearing stratum (l)	Design value or more	
4	Diameter of the pile (D)	Design value or more	
5	Variation from vertical at Cut-off-Level (v)	1.5% or less	

c) Pile Boring

i. Boring Operation:

- Boring operations shall be done by rotary hydraulic feed drilling rigs with reverse mud circulation or other suitable boring methods that have been approved by the Engineer. The boring or drilling equipment shall have suitable and adequate accessories for boring or drilling through all types of strata expected at site.
- The size of cutting tools shall not be less than the diameter of the pile by more than 75 mm. However, the pile bore shall be of the specified size.
- The boring centre shall be aligned with the pile centre and the boring machine shall be installed so as not to move or incline. The sides of the bore-hole shall be stable throughout.
- Working level shall be above the Cut-off-Level. After the initial boring of about 1.0 m, temporary guide casing of suitable length shall be lowered in the pile bore for vertical pile. The diameter of guide casing shall be such as

to give the necessary finished diameter of the concrete pile. The centre line of the guide casing shall be checked before continuing further boring. Guide casing shall be minimum of 3.0 m length. Additional length of casing may be used depending on the condition of the strata, ground water level etc.

- The temporary guide casing (if provided) shall be withdrawn cautiously, after concreting is done up to the required level. While withdrawing the casing, concrete shall not be disturbed.
- For providing permanent MS liner, Clause 709.1.4 of IRC:78 shall be complied with. Whenever stricter provision has been given in the drawings, the same shall be followed.
- If boring operation becomes difficult before reaching the predetermined depth, further plan of action shall be submitted by the Contractor and approval shall be obtained from the Engineer for the same. The piles shall be founded on rock or other suitable strata as approved by the Engineer.

ii. Maintaining the bore hole:

- For maintaining bore hole wall while boring, a stabilizing material, according to the soil shall be used and the level of the stabilizing fluid shall be maintained at not less than 3.0 m above the ground water level or at such other level as will ensure that the fluid pressure is at all times in excess of pressures exerted by the soils and external groundwater. The stabilizing fluid shall be under constant circulation till start of concreting. The level of stabilizing fluid for all piles shall be recorded by the Contractor and reported to the Engineer, including the confirmation of the bore-hole wall shape after boring. Where temporary casings or an alternative method for maintaining stability of a boring are used, these shall be subject to the Engineer's approval.
- Consistency of the stabilizing material suspension shall be controlled throughout concreting operations in order to keep the bore stabilized, as well as to prevent concrete getting mixed up with the thicker suspension of the mud.
- When the boring is done by rotary drilling rigs, the verticality of Kelly bar shall always be maintained. In the soil layer such as sandy soil layer where the bore hole tends to collapse, care shall be taken to ensure the drilling bucket does not hit the hole wall. While boring in the founding soil layer, the drilling bucket shall be raised at appropriate speed to prevent loosening of the soil by suction.

iii. Stabilizing material management:

In addition to the requirements that are already stated, the following shall be considered:

- The stabilizing material shall be controlled so as to prevent pile-bore wall collapse and ensure the quality and shape of the concrete.
- While boring, the Contractor shall periodically check the properties of the stabilizing material and control the management items (specific gravity, marsh funnel viscosity, pH, etc.) to be within the values set in the Method Statement that has been approved by the Engineer.
- Stabilizing fluid shall be approved by the Engineer, thoroughly mixed with clean fresh water along with the required Polymer like CMC, to form a suspension meeting the specification requirements as submitted to and consented by the Engineer.
- The frequency of testing stabilizing material and the method and procedure of sampling shall be proposed by the Contractor and approved by the Engineer prior to the commencement of piling work.
- Prior to concreting a pile, the Contractor shall take measures to remove any heavily contaminated stabilizing material which could impair the free flow of concrete from the tremie pipe. Placing of concrete shall proceed only with due modification as per consent of the Engineer.
- All reasonable steps shall be taken to prevent the spillage of stabilizing fluid in areas outside the immediate vicinity of boring.

iv. Confirmation of bearing stratum for termination level:

- Confirmation of the support layer shall be carried out by boring depth and comparing excavated soil and soil survey material. Also, the pile designated as per approved Method Statement or by the Engineer shall receive necessary confirmation.
- The boring depth shall be measured at two or more places to the bottom of the hole immediately after completion of boring operations. The results shall be reported promptly.
- A protocol shall be maintained regarding the strata at the founding level, Standard Penetration Test (SPT) value, percent core recovery, Unconfined Compressive Strength (UCS) from the nearest borehole, socketing horizon, flushing of pile bore, time interval between end of boring and start of concreting, bentonite density prior to the commencement of concreting.

v. Cleaning of pile bore just after boring:

- After completion of the pile bore up to the required depth, the pile bore shall be cleaned of loose, disturbed or re-moulded soil from the base of the pile.
- The cleaning shall preferably be achieved by three stages flushing of slurry using airlift technique, as per approved Method Statement. The bottom of the pile bore shall be thoroughly cleaned by airlift technique. Cleaning shall ensure that the pile bore is completely free of sludge or bored material, debris of rock or boulder etc. Necessary checks shall be made to ensure the thorough cleaning of the pile bore.
- Concreting operations shall not proceed if the contaminated stabilizing material at the bottom of the pile bore possesses a density of more than 1.12 g/ml. The stabilizing material sample shall be collected from the bottom of pile bore. For this a solid cone shall be lowered by a string to the bottom of pile bore. A sampler tube closed at top with a central hole (hollow cylinder) is lowered over the cone, then a top cover shall be lowered over the cylinder. Care shall be taken for proper fittings of assembly to minimise the leakage, while lifting the cone assembly to the ground surface. The slurry collected in the sampler tube shall be tested for density and sand content.
- When the boring is done by rotary drilling rigs, cleaning-bucket attached to the Kelly shall be used for cleaning the bore. Wherever stabilizing material is used, after using the cleaning-bucket, the bore shall be flushed with fresh slurry.
- The Contractor shall measure the final depth after this cleaning and confirm its effect by comparing with the depth at the end of boring.

vi. Cleaning of pile bore just before concreting:

- Pile bore shall be cleaned by fresh stabilizing material through tremie pipe or as specified in the Method Statement, before (in case delay in concreting after the completion of bore) and after placing the reinforcement cage and just before the start of concreting. Pile boring shall be inspected and approved by the Engineer, in accordance with approved Method Statement, before concreting.
- The Contractor shall measure the final depth after this cleaning, when there is a delay in concreting after completion of the bore, for knowing the casting pile length, and confirm its effect by comparing with the depth at the end of boring.

vii. Other relevant considerations for pile boring:

- Care shall be taken not to harm a recently concreted pile due to driving the casing nearby before the concrete has sufficiently set in that pile. The danger of doing harm is greater in compact soils than in loose soils.

- For bored holes, the finishing and cleaning of the bore, lowering of reinforcement cage and concreting of the pile for full height must be accomplished in one continuous operation without any stoppage.
- Pumping from a boring shall not be permitted unless approval has been issued by the Engineer.
- A pile excavation shall be backfilled without delay where a rapid loss of drilling fluid occurs and no further excavation at the location of that pile shall be carried out until the Engineer's approval is obtained.
- After each pile has been cast, any empty bore which may remain shall be protected and carefully backfilled as soon as possible to the satisfaction of the Engineer.
- Carriage and Disposal: The bored spoil material and contaminated mud and bentonite slurry shall be disposed at the designated areas identified by the Contractor and as per the procedure approved by the Engineer and as mandated by other relevant Contract provisions.

d) Concreting

i. Cast-in-Situ pile concreting shall conform to provisions of Annexure OCS-1 of these Specifications and the relevant provisions of IS 2911 (Part 1/ Sec 2), where not in contravention to the following provisions.

ii. Concreting shall not be done until the Engineer is satisfied that the termination level of pile, is as per the installation criteria and the Method Statement that has been approved by the Engineer.

iii. Concrete in the pile shall be coherent, rich in cement with high slump and restricted water cement ratio. The slump of concrete shall vary between 150 mm to 180 mm for bored piles. For long or large diameter piles, use of retarding plasticiser in concrete is desirable.

iv. The time interval between the completion of boring and placement of concrete in pile bore shall not exceed 6 hours. In case the time interval exceeds 6 hours, the pile bore shall be abandoned. However, the Engineer may allow concreting provided the Contractor extends the pile bore by 0.5 m beyond the termination level and clean the pile bore. The entire cost of all operation and materials for this extra length shall be borne by the Contractor.

v. The concrete shall be properly graded, self-compacting and shall not get mixed with soil, excess water, or other extraneous matter. Special care shall be taken in silty clays and other soils which have the tendency to squeeze into the newly deposited concrete and cause necking. Adequate head of green concrete shall be maintained to prevent inflow of soil or water into the concrete.

vi. Concreting shall be done by tremie method. The operation of tremie concreting shall be governed by IS 2911 (Part 1/ Sec 2). Stabilizing material shall be

maintained sufficiently above the ground water level, as specified elsewhere in this Specifications.

vii. Concreting by tremie shall continue to allow the initial pours of concrete, mixed with stabilizing fluid, sludge and cut spoils from the bore to overflow and the consistency and quality of the overflowing concrete is comparable to that of design mix. The length of overflow shall be decided by the Engineer.

viii. It shall be ensured that the volume of concrete poured is at least equal to the theoretically computed volume of the pile shaft being cast.

ix. The tremie shall have uniform and smooth cross-section inside. The tremie shall be water-tight throughout its length and have a hopper attached at its head by a water-tight connection. All tremie tubes shall be scrupulously cleaned before and after use.

x. While concreting the tremie shall be withdrawn slowly ensuring adequate height of concrete outside the tremie pipe at all stages of withdrawal.

xi. An adequate quantity of concrete within the pipe shall be maintained at all times to ensure that the pressure from it exceeds that from the water or drilling fluid.

xii. The tremie pipe shall be lowered to the bottom of the bore-hole, allowing water or stabilizing material to rise inside it before pouring concrete. The tip of the tremie pipe shall not be separated from the bottom of the hole more than necessary (when plunger is used, it is about 0.2 m or less from the hole bottom)

xiii. The tremie pipe shall always be kept full of concrete and shall penetrate well into the concrete in the borehole, at least 2 m or more, with adequate margin of safety against accidental withdrawal if the pipe is surged to discharge the concrete.

xiv. During concreting, the cycle time of concreting, concreting volume, concrete placement height and the height of the tremie pipe tip in concrete shall be checked for all the piles and reported in a format that has been approved by the Engineer.

xv. To prevent the reinforcement cage from floating during placement of concrete, appropriate countermeasures shall be made in advance, as per the Method Statement that has been approved by the Engineer. The same shall be monitored for all piles and reported.

xvi. Temporary casings, when used, shall be extracted carefully to the satisfaction of the Engineer, whilst the concrete is sufficiently workable to ensure it is not disturbed or lifted, and the reinforcement cage does not get disturbed. During extraction, sufficient quantity of concrete shall be maintained inside the casing to overcome the pressure from external water, soil or stabilizing material and to ensure that no reduction in section by way of necking or shearing of concrete and contamination of the pile takes place.

xvii. Segregation of the ingredients shall be prevented. The displacement or distortion

of reinforcement during concreting shall be avoided. If the concrete is placed inside precast concrete tubes or consists of precast sections, subject to the approval of the Engineer, these shall be free of cracks or other damage before being installed.

xviii. While concreting uncased piles, voids in concrete shall be avoided and adequate head of concrete shall be maintained to prevent inflow of soil or water into the concrete. It is also necessary to take precautions during concreting to minimise the softening of the soil by excess water. Uncased cast- in-situ piles shall not be allowed where mudflow conditions exist.

xix. Where concrete is placed in dry borings, measures, subject to approval of the Engineer, shall be taken to avoid segregation and bleeding and to ensure that the concrete at the bottom of the pile is not deficient in grout.

xx. Where enlarged bases are required, as per site conditions and as approved by the Engineer, these shall be mechanically formed and shall be concentric with the pile shaft within a tolerance of 10% of the shaft diameter and shall not be smaller than the required dimension. The sloping surface of the frustum forming the enlargement shall make an angle of not less than 55° to the horizontal.

xxi. Grouting at base of pile shall be done wherever the results of proof coring (in case of rock), sonic logging and/or loading test etc. confirm that there is a void/ sludge at the pile base. The grouting shall be done with cement slurry under suitable pressure after concrete in the pile attains the desired strength, if required by the Engineer. For this purpose, conduit pipes with easily removable plugs at the bottom end shall be placed in the bore along with reinforcement cage before concreting

3.6.4 Top of Concrete in Pile, Cut-off-Level (COL):

a) Cut-off-Level of piles shall be as indicated in the drawings.

b) The top of concrete in pile cast shall be above the Cut-off-Level by 1.0 m (minimum) and as per the Method Statement, to remove all laitance and weak concrete and to ensure good concrete at Cut-off-Level, for the proper embedment into the pile cap. Any exceptions, due to contingent situation, will be subject to the approval of the Engineer.

c) Preparation of pile head: The area surrounding the piles shall be excavated up to the bottom of the pile caps. After seven days of concreting of pile, the exposed part of concrete above the COL shall be removed or chipped off and made rough at COL. In case a part of extra-pile concrete before curing is handled, the Contractor shall obtain prior approval from the Engineer. The projected reinforcement above COL shall be properly cleaned and bent carefully, only where required, to the required shape and level to be anchored into the pile cap as per the drawing. While finishing the pile head, care shall be taken to ensure no harmful damage, such as cracks, occurs in the concrete. The pile top shall be embedded into the pile cap as per the Drawings. All loose material

on the top of pile head after chipping to the desired level shall be removed and disposed as per contractual procedure and as directed by the Engineer.

3.6.5 Reinforcement Steel

a) Reinforcement steel, along with its inspection and testing shall conform to Annexure – OCS-2 of these Specifications, along with IS 2911 (Part 1/ Sec 2) and used as per the drawings.

b) The reinforcement shall be assembled before placing in the moulds and all hoops and links shall be of uniform length firmly wired into position. Ends of helical reinforcement, if used, shall be firmly secured. Diagonal fork spacers shall be of a pattern that has been approved by the Engineer.

c) Lap joints in main longitudinal bars will be permitted only when, in the opinion of the Engineer, each bar cannot be supplied in one complete length. Where permitted, joints shall be provided at agreed centres, designed to develop the full strength of the bar across the joint, provided with adequate links or stirrups and staggered in position from those of adjacent longitudinal bars or as indicated in the drawings, subject to the approval of the Engineer.

d) The 'L' bends in the reinforcements at the bottom of the piles shall not be provided to avoid the formation of soft toe.

e) Jointing of Reinforcement Steel for Piles: Only lap joints shall be provided as shown in the drawings.

f) Lowering of the reinforcement cage:

i. The reinforcement cage shall be properly aligned with the pile core and kept vertical without collapsing the hole wall. In lowering of the reinforcement cage, it shall avoid deformations, damages, etc. by using reinforcing material as necessary. In the lap joint part of the reinforcement cage, the upper and lower cages shall be in a straight line, with the joints tightly bound.

ii. Proper cover to reinforcement and central placement of the reinforcement cage in the pile bore shall be ensured by use of suitable concrete spacers or rollers cast specifically for the purpose, as directed by the Engineer. The longitudinal reinforcement shall project above Cut-off-Level as indicated in the drawings.

iii. After lowering of the reinforcement cage, the height of the top end of the reinforcement shall be measured and reported. The axes of the reinforcement cage and the pile core shall be matched, checked and reported.

3.6.6 Breaking off of Piles

If any pile already cast requires breaking due to subsequent change of Cut-off-Level, then the same shall be carried out, not before seven days of casting without affecting the quality of existing pile, such as loosening, cracking etc., and to the satisfaction of the Engineer.

3.6.7 Pile Caps

The ground shall be excavated, levelled, prepared and then layers of coarse aggregate and blinding concrete shall be constructed below pile cap. The pile cap shall then be cast as per the Drawings and conforming to Annexure OCS-1 and Annexure OCS-2 of these Specifications, subject to tolerances mentioned therein.

3.6.8 Tests on Piles

a) General

When preparing for conducting a pile test, the Contractor shall follow the requirements of the various acts, orders, regulations and other statutory instruments that are applicable to the work for the provision and maintenance of safe working conditions and shall in addition make such other provision as may be necessary to safeguard against any hazards that are involved in the testing or preparations for testing.

b) Load Test on Piles

i. Sub-Clause 3.6.8 (e) to Sub-Clause 3.6.8 (g) of these Specifications covers the requirements for initial vertical load and routine vertical load tests on reinforced concrete single vertical piles of specified diameter to assess their vertical load carrying capacities. All pile load testing shall conform IS 2911 (Part 1/ Sec 4)

ii. Full details of the equipment proposed to be used, the test setup and pile testing scheme along with detailed design, drawings shall be submitted to the Engineer, before making arrangements to carry out the tests, for obtaining his approval. Approval of the Engineer shall also be obtained after the test setup is complete, prior to commencement of loading.

iii. The work shall include mobilization of all necessary equipment, kentledge, anchor piles and rock anchors, or combination of kentledge and anchor piles and rock anchors, providing necessary engineering supervision and technical personnel, skilled and unskilled labour as required, to carry out the complete pile testing and submission of test reports.

iv. In all cases, the Contractor shall ensure that when the hydraulic jack and load measuring device are mounted on the pile head the whole system will be stable up to the maximum load to be applied.

v. Necessary means shall be provided to enable dial gauges to be read from a position clear of the kentledge stack or test frame in conditions where failure in any part of the system due to overloading, buckling, loss of hydraulic pressure and so on might constitute a hazard to personnel.

vi. The hydraulic jack, pump, hoses, pipes, couplings and other apparatus to be operated under hydraulic pressure shall be capable of withstanding a test pressure of one and a half times the maximum working pressure without leaking.

vii. The maximum test load or test pressure expressed as a reading on the gauge in use shall be displayed and all operators shall be made aware of this limit.

viii. Where kentledge is used, the Contractor shall construct the foundations for the

kentledge and any cribwork, beams or other supporting structures in such a manner that there will not be differential settlement, bending or deflection of an amount that constitutes a hazard to safety or impairs the efficiency of the operation. The kentledge shall be adequately bonded, tied or otherwise held together to prevent it falling apart, or becoming unstable because of deflection of the supports. The weight of kentledge shall be greater than the maximum test load and if the weight is estimated from the density and volume of the constituent materials, an adequate factor of safety against error shall be allowed.

ix. It is essential that all the equipment and instruments are properly calibrated both at the commencement and immediately after the completion of tests, so that they represent true values. If the Engineer desires, the Contractor at his own cost shall arrange for calibration of the instruments in presence of the Engineer, at a laboratory having Engineer's approval, and the test report and calibration certificate shall be submitted to the Engineer.

x. The complete jacking system including the hydraulic jack, hydraulic pump and pressure gauge shall be calibrated as single unit. The complete unit shall be calibrated over its complete range of travel for increasing and decreasing loads same as that of test loads. The calibration certificate shall be submitted to the Engineer.

xi. The reaction load to be made available for the test shall be at least 25% greater than the maximum jacking force. The reaction system as relevant shall be designed for the total reaction load. All reaction loads shall be stable and balanced during all operations of testing. During testing, stability of reaction system shall be ensured.

xii. The vertical displacement of pile shall be measured using dial gauges having a least count of 0.01 mm.

xiii. Load test shall be conducted at pile Cut-off-Level (COL). If the water table is above the COL, the test pit shall be kept dry throughout the test period by suitable dewatering methods.

xiv. In case of initial vertical load test, where the water table level is higher than the COL, the Contractor may use anchor piles and rock anchors for testing purposes. The Engineer, at his discretion, may decide to raise the COL above water table.

xv. All operations in connection with pile load test shall be carried out in a safe manner to prevent exposure of the people to hazard and also to ensure the safety of manpower and material.

xvi. Test record and report for pile load tests shall be as per IS 2911 (Part 1/ Sec 2) and as approved by the Engineer. The reports shall be submitted to the Engineer immediately on completion of each test.

xvii. Two fixed independent benchmarks shall be established as reference points at least 15 m from the test pile to monitor the settlements.

xviii. If any initial pile load test gets abandoned and is not successfully completed, then

the Contractor shall install another test pile and repeat the initial test after correcting the fault, at his own cost.

xix. On completion of a test all equipment and measuring devices shall be dismantled, checked and either stored so that they are available for use in further tests or removed from the Site.

c) Test Pile Installation

i. Piles shall be installed as per Sub-Clause 3.5.3 herein above.

ii. Pile installation data as applicable shall be furnished along with the load test results to the Engineer.

d) Types of Tests

i. Initial vertical (compression) load test and lateral load test shall be carried out on test piles, which are not to be incorporated in the work, to assess the 'Ultimate Load Capacity of Pile' before the commencement of the installation of working piles.

ii. The test piles shall have the same design details as of the working piles typically adopted in the predominant soil profile in that area.

iii. Routine vertical (compression) load test and lateral load test shall be conducted to verify the load carrying capacity of working pile.

iv. Pile integrity test shall be carried out *as follows*:

a. The Low Strain Method as per IS 14893 *for 60 % Piles* to verify the structural integrity, shape and continuity of pile as detailed in Sub-Clause 3.6.8(i).

b. Cross Hole Sonic Logging test as per ASTM D 6760 *for 40% Piles.*

e) Number of Tests:

i. **Initial pile-load tests:** The number of load tests shall be as per IS 2911 (Part 4). Number of tests shall be minimum 1% of total number of piles at each bridge location but not less than one (01) test at each bridge. The number may be increased up to 2% depending upon the nature, type of structure and sub-strata condition.

ii. **Routine pile-load tests:** The number of load tests shall be as per IS 2911 (Part 4). Number of tests shall be minimum 1% of total number of piles at each bridge location but not less than one (01) test at each bridge. The number may be increased up to 2% depending upon the nature, type of structure and sub-strata condition.

iii. Initial and routine tests shall be suitably increased for important structures or cases with large variation in the subsurface strata as directed by the Engineer.

iv. Pile load tests shall be carried as per IS 2911 (Part 4).

f) Testing-Piles

i. The testing-piles for routine load test shall be identified by the Engineer. For initial load test, testing-pile shall be installed as a test-pile, separate from working piles,

as directed by the Engineer.

ii. A minimum time period of four weeks shall be allowed between the time of pile casting and testing. Testing-pile head shall be prepared for testing purposes only, one week after casting the pile.

iii. Testing-piles shall be cut off at the proper level and provided with a proper cap, to provide a plane bearing surface for the test plate and for proper arrangements for seating of the jack and dial gauges.

g) Static Vertical Load Test

i. The tests shall conform to IS 2911 (Part 4).

ii. Equipment and Test Setup

- A steel plate of adequate thickness and not less than 50 mm shall be centered on the pile cap to prevent it from getting crushed under applied load. The size of the circular test plate shall not be less than the pile size nor less than the area covered by the base of the hydraulic jack(s).
- The datum bars shall be supported on immovable supports, preferably of concrete pedestals or steel sections, placed sufficiently far away from the test pile. The distance shall not be less than 3 times the diameter of testing-pile and in no case less than 2 metres from the edge of testing-pile. These supports shall be placed at an adequate depth below ground to be unaffected by ground movements.

iii. Loading System

The test load on pile shall be applied by means of hydraulic jack(s) which obtain reaction in one of the ways mentioned in Cl.7.1.3 of IS 2911 (Part 4).

The measurement of strains for load monitoring may also be done by load cell connected to a digital read out unit.

iv. Test Procedure

- Application of Load:- The test should be carried out by applying a series of vertical downward incremental load each increment being of about 20 percent of safe load on the pile. For testing of raker piles it is essential that loading is along the axis.
- This is applicable for both initial and routine test. In this method application of increment of test load and taking of measurement or displacement in each stage of loading is maintained till rate of movement of the pile top is not more than 0.2mm/h or until 2 h has elapsed, whichever is earlier subject to a minimum of 1 h. The test load shall be maintained for 24 h.
- Duration of vertical loading shall be as per Cl. 7.2 of IS 2911 (Part 4)
- Settlement:- Settlement shall be recorded as per Cl. 7.1.4 of IS 2911 (Part 4).

- The safe vertical load on single pile for the initial test shall be as per Cl. 7.1.5 of IS 2911 (Part 4).
- Items to be measured:

  The following items shall be measured:

  - Time;
  - Applied pressure;
  - Applied load;
  - Displacement at the pile head;
  - Movement of reaction devices;
  - Others, as decided by the Engineer.
- Commencement, interruption and completion of the test:
  - The test shall be commenced after ensuring the conditions surrounding the site, preparations of all equipment and the suitability of the weather condition.
  - If any abnormal conditions are noticed during the test, the test shall be interrupted promptly. The test can only be resumed when the cause of the abnormal condition has been detected and rectified.
  - The test shall be completed when the objectives of the test shall have been achieved, or when it is judged that abnormal conditions make it impossible to continue the test.
- Loading on the pile shall be continued till as given in IS 2911 (Part 4).

h) Lateral load tests – Lateral load tests shall be carried out on test pile as well as on working pile safe load capacity determined as per Clause 8 of IS 2911 (Part 4).

i) Pile Integrity Test :

a) Low Strain Method-

i. Pile integrity test shall be carried out on each pile by The Low Strain Method as per IS 14893:2001. In case of large diameter piles, the tests shall be conducted at 5-6 places to cover the entire section of the pile.

ii. The tests shall be conducted on piles whose length is correctly recorded or on test piles where available, to determine the value of stress wave velocity and characteristic or reference signal for comparing the signals for testing subsequent piles.

iii. The area surrounding the pile should be free from standing water and kept dewatered during the tests. The pile head should be accessible.

iv. Testing should be free of work likely to cause disturbance. The cast-in-situ piles should not be tested normally before 14 days of casting.

v. The test piles, if available at site, can be used to determine the pulse velocity and characteristic or reference signal generated. Where no test pile is available information can be obtained from cast piles whose length is accurately recorded.

vi. Methodology for Low Strain Integrity test:

- This is a system of assessing the integrity of piles by the use of low stress wave imparted to the pile shaft and is also known as Sonic Integrity or Sonic Echo Test. A small metal/hard rubber hammer is used to produce a light tap on top of the pile. The shock traveling down the length of the pile is reflected back from the toe of the pile and recorded through a suitable transducer/accelerometre (also held on top of the pile close to the point of impact) in a computer disk or diskette for subsequent analysis. The primary shock wave which travels down the length of the shaft is reflected from the toe by the change in density between the concrete and sub-strata. However, if the pile has any imperfections or discontinuities within its length these will set up secondary reflections which will be added to the return signal.
- The reflected stress wave can be monitored using either processing technique, the observed signals are amplified and converted into digital display as velocity versus length or frequency versus mobility records, providing information on structural integrity of piles. The stress wave velocity and approximate pile lengths are provided as input for the integrity testing. The stress wave velocity is dependent on the Young's modulus and mass density of pile concrete. This value generally lies between 3000-4000 metre per second depending on the grade of concrete used (M15-M25).

b) Cross Hole Sonic Logging Test-

i. Pile integrity test by Cross Hole Sonic Logging test as per ASTM D 6760 shall be carried out on each pile.

ii. Following methodology shall be adopted for Cross Hole Sonic Logging test:

1) **Sonic Logging Tubes**

i) All piles shall be provided with sonic logging tubes cast into it.

ii) The tubes shall be manufactured from steel and shall extend 0.5m above the pile head and 0.5m above the pile toe. The tube shall have an internal diameter not exceeding 50mm, except for one tube in each pile, where it shall be of internal diameter 150mm minimum in order to allow for coring of the concrete at the base of the pile.

iii) Four tubes shall be required for each pile.

2) **Proof Coring**

i) For piles founded in rock, proof coring shall be done, for all piles. At least 7 days after the pile has been cast, but before carrying out any sonic logging test, a core of concrete and rock from the founding materials shall be taken.

ii) For piles founded in soil, proof coring shall be done only for piles with anomalous sonic logging test results. The core shall be taken from the base of the 150mm diameter sonic logging tube using a triple tube core barrel and shall have a minimum diameter of 50mm.

iii) The scanning of the pile toe for its integrity by measuring the propagation time of transmitted waves between the vertical tubes and the pile toe/founding strata shall also be carried out.

3) **Sonic Logging Equipment**

i) The equipment shall be properly maintained and calibrated.

ii) Where necessary, means shall be provided to centralize the probes within the tubes, so that variation in the separation of the emitter and receiver resulting from clearance between the probes and the tubes does not occur.

4) **Test Procedure**

The tubes shall be filled with water. The tests shall be repeated for each pair of tubes, i.e. three runs for a pile with three tubes and six runs for a pile with four tubes.

5) **Analysis of Test Results**

i) A report shall be prepared for each pile tested. The photographic record of the oscilloscope displays shall be analysed in detail.

ii) A deviation from the record to be expected from a pile constructed entirely of sound concrete and without defect shall be reported. The report shall indicate the nature, location and severity of the defect and recommendations shall be made for further testing. The implication of the existence of the defect on the performance of the pile shall be evaluated.

6) **Submission of Results**

Immediately after testing, a signed copy of all the raw data of a pile shall be given to the Engineer. A test report shall be submitted to the Engineer within 3 days after testing.

7) **Anomalous Sonic Logging Test Results**

i) The piles with anomalous sonic logging results shall be rejected at the Engineer discretion unless the Contractor is able to demonstrate that the pile integrity is acceptable through proof coring.

ii) In case of piles founded on rock, if the results of sonic logging test and/or proof coring (and/or pile load test) confirm or indicate the existence of void, sludge or the like between the pile toe and rock, the Engineer shall reject such piles or pile group, or alternatively, as per geotechnical expert's advice, shall require the Contractor to clean and grout between the pile toe and rock.

8) **Grouting of Pile after Testing**

Upon completion of sonic logging test, the access tubes and sonic coring holes, if any, shall be grouted using an approved concrete mix or an approved grout mix.

9) **Others**

Anything not specified hereinabove shall be referred to in the most current version of ASTM D6760.

3.6.9 Sampling, Testing, Inspection, and Acceptance Criteria Including Construction Tolerances of Piles

i. Frequency of sampling, testing and quality assurance including the method of conducting the tests, acceptance criteria and construction tolerances shall be as mentioned herein above and included in the Method Statement that has been approved by the Engineer. The tests shall be performed and reported as per the Method Statement that has been approved by the Engineer.

ii. Forcible corrections for any deviations shall not be made to concrete piles.

iii. Data Reporting and processing

- The assessment of structural integrity is based on two equally important aspects:
  - Quality of signals, and
  - Accurate analysis and interpretation of signal.
- Piles requiring remedial measures should be so marked immediately on completion of the field integrity testing and rectification measures selected.
- The final report should include signals of each integrity test and structural condition of piles.

iv. Submission of Results: Immediately after testing, a signed copy of all the raw data of a pile shall be given to the Engineer. A test report shall be submitted to the Engineer within 3 days after testing.

3.6.10 Safety

The Contractor shall adopt appropriate method and practice conforming to IS 5121 (Piling and other deep foundation - Code of Safety) suiting to local ground characteristics.

3.7 WELL FOUNDATIONS

3.7.1 General

i. In case of larger than 12m in diameter and for wells to be sunk by using special equipment, supplemental instructions/ specifications will be necessary. For basic items of work such as Concrete (Plain or RCC) brick work, stone masonry etc which are incidental relevant items may be referred to.

ii. To facilitate sinking of well, steel cutting edge is fabricated and connected to a concrete well curb of required shape. Minimum grade of concrete for well curb shall be M 35 unless otherwise specified in Drawing or directed by Engineer. On top of the well curb, adequate height of well steining is cast and the process of sinking is carried out. After a portion of the well has been sunk, another height of well steining is cast on top of the previous section and further sinking carried out. This process is continued till the bottom level of the well reaches the founding level.

iii. At the top of the well steining, an adequately designed "well cap" is laid which transmits the loads and forces from the sub-structure (piers or abutments) to the foundations.

3.7.2 Equipment for sinking wells

Equipment shall be deployed for construction of well foundation as required and as directed by the Engineer in quality, performance and quantity. Generally, the following equipment's may be required for the work:

i. Crane with grab buckets capacity 0.5 to 2.0 cum.

ii. Submersible pumps

iii. Air compressors, air locks and other accessories where pneumatic sinking of well is anticipated.

iv. Chisels of appropriate sizes

v. Aqua header for cutting rocky strata

vi. Driving helmets and accessories

vii. Concrete Mixer or Batching Plant; Pumps or skips and hoists; vibrators etc.

viii. Pre-arrangements for blasting equipment in case of unforeseen circumstances.

3.7.3 Well Steining

i. The dimensions, shape, concrete strength and reinforcement of the well `steining shall strictly conform to those shown on the drawings. The form work shall preferably be of MS sheets shaped and stiffened suitably. In case timber forms are used, they shall be lined with plywood or M.S. sheets.

ii. Steining built in the first lift above the well curb shall not be more than 2 metres high and in subsequent lifts it shall not exceed the diameter of the well or the depth of well sunk below the adjoining bed level at any time. For stability, the first lift of steining shall be cast only after sinking the curb at least partially for stability. Concreting of steining may be carried out in subsequent lifts of about 1.2, or 2 to 2.5 metres. Attempts should be made to minimise the number of construction joints. The concreting layers shall be limited to about 450 mm restricting the free fall of concrete to not more than 1.5m. Laitance formed at the top surface of a lift shall be removed to expose coarse aggregates before setting of concrete at the proposed construction joint. As far as possible, construction joints shall not be kept at the location of laps in the vertical steining bars.

iii. The steining of the well shall be built in one straight line from bottom to top such that if the well is tilted, the next lift of steining will be aligned in the direction of the tilt. The work will be checked carefully with the aid of straight edges of lengths approved by the Engineer. Plumb bob or spirit level shall not be used for checking verticality alignment. After sinking of a stage is complete, damaged portions if any, of steining at top of the previous stage shall be properly repaired before constructing the next stage.

iv. The height of steining shall be calibrated by making at least 4 gauges (two in traffic direction and two in a direction normal to traffic direction) distributed equally on the outer periphery of the well. Each gauge should be in the form of a 100mm wide strip painted on the well, with every metre mark shown in black paint and sub-mark at 10 cm intervals. The gauges shall start with zero at the bottom of the cutting edge. It will be in black or a white background. Marking of the gauges shall be done carefully with a steel tape.

v. After reaching the founding level, the well steining shall be inspected to check for any damage or cracks. The Contractor shall execute the remedial measures as directed by the Engineer before acceptance of the well steining. In case the well cannot be accepted even with any remedial measures, then the well shall stand rejected.

vi. Blasting may have to be resorted to in order to facilitate sinking through difficult strata, such as boulders and rocks etc. In case blasting is anticipated, protective / strengthening measures specified in clause 710.6 (IV) of IRC: 78 shall be taken. The grade of concrete and / or Bridge Sub-structure in bottom 3 metres of steining shall not be leaner than M 25 or as shown on the drawings.

vii. In case the bore hole data shows the presence of steeply dipping rock, chiseling may have to be resorted to so as to obtain proper seating of the foundation. For this purpose, the well may require to be dewatered completely under high air

pressure inside the well. This process is known as pneumatic sinking. Pneumatic sinking may also have to be resorted to in cases where obstacles such as tree trunks, large sized boulders or hard strata etc. cannot be removed by open dredging. The necessity of adopting pneumatic sinking shall be decided by the Engineer.

viii. The curb and steining have to be specifically designed for special loadings when pneumatic sinking is adopted. Minimum grade of Concrete should, preferably be M 25.

ix. The specifications given in this chapter deal only with such items of work as are peculiar to the construction of wells. For the basic items of work such as concrete (pain and reinforced), brickwork, stone masonry, earthwork, etc which are also incidental to the construction of wells, the relevant specifications shall be followed.

3.7.4 Sinking wells for foundations

This specification pertains to the actual operation of sinking the well through various kinds of strata to the reduced level shown on the drawing, or to any other level as ordered by the Engineer, to enable it to be founded on a suitable foundation stratum.

a) Programme

The programme for sinking shall be so arranged that every well started during a working season is completed, plugged and sealed at top, and the pier or abutment over it built to a suitable height, within the same season, so as to be safe during the mansoon. In the event of the Contractor's failure to ensure this, any protective measure or other extra work involved in completing the unfinished portion in the next working season shall be done by the Contractor at his own cost.

b) Strata Variation

i. The Contractor may, at his own expense, make trial bores to ascertain the exact depth to which each well may have to be sunk. If any boring data are indicated at the tender stage, these may be taken as a general guide only, and the Contractor shall not be entitled to any compensation on account of variations in the strata as actually met with during sinking.

ii. The Contractor shall, during the course of the work, collect and hand over to the Engineer's representative samples of all the different strata passed through, including undisturbed samples, where so required by the Engineer. The cost of collection of these samples shall be paid by the Contractor.

iii. Cost for the sinking of wells through (a) Hard Rock, and (b) Soft rock & all soils are inclusive, and nothing extra shall be paid due to variation in the strata.

c) Level of commencement: Excavation

i. Where the existing ground level is higher than the level of commencement as specified above, open excavation shall be carried out to that level by the contractor at his own cost.

ii. If, for his own convenience, the Contractor commences sinking of a well from any level higher than that specified in sub-para (i) above, no payment shall be made to him for the extra depth of sinking resulting therefrom.

iii. When the well curb is ready for sinking, it shall be "pitched" by careful removal of the blocking timbers on which the cutting edge was so long supported. The timbers shall be removed after loosening the sand around each, and the removal shall be so phased as to maintain equality of pressure and thereby avoid tilting of the curb.

iv. After all the blocking timbers are removed, the soil from within the curb shall be excavated evenly over the whole internal area, excavating first in the centre and then working towards the circumference. In the case of double-D wells or twin octagonal wells, the excavation in both dredge holes shall progress simultaneously. The sinking shall be stopped when the top of the curb is about 15 cm above the ground, after which the building up of the initial lift (of say 1.5m height) of the steining shall be taken up.

d) Methods of Sinking:

i. All possible care shall be taken to ensure perfect verticality of sinking of the well curb and the first two lifts (or say 3m.) of the steining, since by doing so, the subsequent sinking to plumb becomes easier. The manner of sinking shall continue to be as followed for the well curb. The operation of sinking will, naturally, alternate with that of adding further lifts of steining, which may be done for two lifts in a sequence, except for the first two lifts which shall be done in two stages, with sinking done in between.

ii. The maximum depth of excavation below the level of the bottom of cutting edge of the well at any stage shall not generally exceed the internal diameter of the well.

iii. Where dewatering is resorted to and it gives rise, at any stage, to "blowing" of the surrounding soil into the bottom of the well, the dewatering shall be stopped forthwith and the water levels balanced to prevent further blowing, before attempting to remove the blown material from inside the well.

iv. In deep water, excavation shall be carried out with the use of grabs operated by winches, or preferably by cranes. Harder strata upto soft rock may be loosened by the use of heavy chisels, slung at a suitable angle. Removal of obstructions such as boulders and logs shall be done by employing divers.

v. Small charges of approved explosive may be used, with the written permission of the Engineer in the following circumstances: (1) To blast through rock or to break boulders, which cannot be done by any alternative method; and (2) To effect sinking, especially in the final stages, when the usual formation of a sump at the bottom of the dredge hole does not result in sinking. In the latter case, the charge of explosive shall be placed at the centre of the dredge hole and exploded to set up a tremor which will serve to help sinking of the well. Any damage caused to the well or to adjoining structure by the use of explosives shall be made good by the Contractor at his own expense.

vi. Where a considerable depth of rock is to be pierced through, and dry sinking i.e. without much water except what can be pumped out is not possible, it will be necessary to resort to pneumatic sinking. This requires the use of proper air locks and ancillary equipment, with special precaution observed for safety and certain modifications to the structure of the well to fit the air locks. Sinking of wells by such method shall be a matter of special agreement and covered by special specifications.

vii. Where two or more separate wells in a group are to be sunk, and the clear distance between any two wells is less than the diameter of the well, such wells shall be sunk alternately, each not having a lead of more than half the diameter over the other at any stage.

e) Use of Kentledge as Sinking Load

Kentledge shall be placed in an orderly and safe manner on the loading platform and in such a way that it does not interfere with the excavation of the material from inside the dredge hole and also does not in any way damage the steining of the well. Where tilts are present or there is a danger of well developing a tilt, the position of the kentledge load shall be regulated in such a manner as to provide greater sinking effort on the higher side of the well.

f) Use of Water Jetting

Water jetting, on the outside of the well may be employed for well sinking wherever necessary. Where stiff clayey strata is anticipated, small diameter water pipes are encased in the well with jet ends on periphery during casting of steining for this purpose.

g) Use of Explosives

Mild explosive charges may be used as an aid for sinking of the well only with prior permission of the Engineer. Blasting of any sort shall only be done in the presence of the Engineer and not before the concrete in the steining has hardened sufficiently and is more than 7 days old. When likelihood of blasting is predicted in advance, protection of the curb and the bottom portion of the well shall be done as per these specifications. After blasting operations are completed, the well curb and steining should be examined for any cracks and remedial measures taken.

i. The charges shall be exploded well below the cutting edge by making a sump so as to avoid chances of any damage to the curb or to the steining of the well. A minimum sump of 1 metre depth should be made before resorting to blasting. Use of large charges, 0.7 kg or above, may not be allowed except under expert direction and with the permission from the Engineer. Suitable pattern of charges may be arranged with delay detonators to reduce the number of charges fired at a time. The burden of the charge may be limited to 1 metre and the spacing of holes may normally be kept as 0.5 to 0.6 metre. All prevalent laws concerning handling, storing and using of explosives as per "Indian Explosives Act" shall be strictly followed.

ii. All safety precautions shall be taken as per IS:4081 "Safety Code for Blasting and related Drilling Operations", to the extent applicable, whenever blasting is resorted to. There should be no equipment inside the well nor shall there be any labour in the close vicinity of the well at the time of exploding the charges.

iii. If rock blasting is to be done for seating of the well, the damage caused by flying debris should be minimised by covering blasting holes by rubber mats before blasting.

iv. If blasting has been used after the well has reached the design foundation level, normally 24 hours shall be allowed to lapse before the bottom plug is laid.

Daily records of tilt and shift, with reference to the principal axes of the well, shall be maintained at the site, separately for each well, on the Proforma prescribed by the Engineer. Tilts shall be measured along the two axis of the bridge and RL (Reduced Levels) of the marks painted on surface of steining shall be taken. For determination of shift, locations of the ends of the two diameters shall be precisely measured along the two axis, with respect to the fixed reference points. A pair of wells close to each other will have a tendency to come closer during sinking (Tilting towards each other). Timber struts may be introduced in between the steining of these walls to prevent tilting. The Contractor shall further be responsible for maintaining a continuous record of the depth sunk in each working shift and of the types of strata passed through at the various depths, as well as any obstruction met with.

It shall be the Contractor's responsibility to sink the wells to the correct alignment, spacing and levels, based on the reference pillars and bench mark provided by the Railway. Unless otherwise specified the completed well shall not have a tilt of more than 1 in 80 in any direction or a shift of more than 5 per cent of the overall diameter or width of the well, as measured in either of the principal directions or 150mm in resultant direction, whichever is less. Where these tolerances are exceeded, the orders of the Engineer shall be sought. These tolerances shall be further subject to the condition that the stability of the foundation is not affected and that any modification thereby necessitated in the design of the substructure or superstructure shall be done at the cost of the Contractor.

Such acceptance shall be subject to

i. Calculations for foundation pressures and steining stresses after accounting for the tilt and shift and consequent relocation of superstructure on top being safe

ii. Remedial measures required for bringing stresses within permissible limits such as increasing dimension of well cap, providing dummy weights on well cap as well as redesign of structure above shall be carried out by the Contractor at no extra cost to the Employers and

iii. The Contractor shall agree to any reduction in rate for such defective work.

Tilt observed may, during the sinking, be corrected by one or more of the following methods, as approved by the Engineer:-

i. Loading kentledge eccentrically

ii. Carrying excavation at the bottom of the well deeper on the side which is higher.

iii. Providing heavy inclined struts bearing against the face of the well steining on the side towards which it leans.

iv. Jetting to reduce skin friction on the higher side, on the well periphery.

v. Pulling or pushing the well by approved methods.

vi. If the well is rejected, the Contractor will dismantle the defective well to the extent desired by the Engineer, at his cost. Further, the Contractor, at his risk and cost, will complete the bridge with modified span arrangements.

h) Seating of Well

When the well approaches the final depth of sinking, the exact height to which the last lift of steining is to be made up shall be decided before it is completed and sunk. When the well has reached the required level and stratum, it shall be properly seated by levelling, the area under the cutting edge. In the case of rock also, every effort shall be made to ensure even seating of the cutting edge, with the use of divers for cutting or benching the rock, as required. No extra payment shall be admissible for the bedding of wells in this manner. Any portion of the rock stratum where the cutting edge cannot be bedded shall be got cleared of the overlying material and filled subsequently with the concrete of the bottom plug.

On completion of the bedding of the well, the bottom of the dredge hole shall be got cleared of all spoil and left in a fit condition for laying of the bottom plug.

3.7.5 **Cutting edges for well curbs**

Unless otherwise specified, the cutting edges shall be fabricated out of new structural steel. The fabrication shall be done strictly in accordance with the detailed drawings and shall conform to the specifications.

Before being taken to the site, the cutting edge shall be assembled on level ground and verified for the accuracy of its shape and size. If in sections, the individual sections shall be match marked before being dismantled.

At the place for laying, necessary reference points to site the well accurately shall be fixed in advance, based on the permanent reference pillars on either bank or the base line provided on either or both banks. The ground shall be prepared by leveling to an even surface at the level from which sinking of the well is to be commenced.

On the prepared bed the cutting edge shall be placed and positioned accurately with respect to the reference points fixed. It shall be supported evenly and to true level on a series of blocking timbers, spaced sufficiently close together to withstand and distribute to the soil below the full weight of the cutting edge plus the weight of shuttering and concrete, without

any unequal settlement. Where the cutting edge is in sections, any welding or riveting required shall be done after the cutting edge has thus been assembled to the correct lay out and level.

The cost for the cutting edge shall, include the cost of supply, fabrication, transporting and placing the cutting edge as specified above, to its correct lay out and level including site joining by welding or bolting / riveting with cover/ fish plates.

3.7.6 **Well curbs and steining**

Concrete and reinforcement shall comply with the provisions of Annexure OCS-1 and OCS-2 of these specifications.

Concrete steining shall generally be cast in "lifts" not exceeding 2.0m in height, for the convenience of placing and consolidation without segregation. Sinking shall not be started till the depth of masonry or concrete to be sunk has set properly. In the case of concrete steining and RCC well curbs, the minimum periods as specified below shall be observed, unless any different period is prescribed by the Engineer, taking into account the local conditions or in the Contract.

For well curbs	**Minimum period**
Removal of outer shuttering	12 hours
Removal of inside shuttering	6 days
Commencement of sinking	7 days
For Steining	
Removal of outer or inside shuttering	6 hours
Resumption of sinking	48 Hours

In any case, the sinking shall not commence until the work that has been added on has been passed by the Engineer's representative and the commencement of sinking approved.

Bond Bars, bond flats, bottle nuts etc which are built into the steining will not be paid for separately, but no extra payment will be made for keeping these in the concrete or masonry work.

3.7.7 **Plugging and finishing of wells**

a) Bottom Plug

The concrete used for the bottom and top plugs of foundation wells shall be of the specified mix, conforming to Specification for Cement Concrete

Where the bottom plugging is to be done under water, the special provisions of "Under Water Concreting" shall be observed carefully; and it shall further be ensured that the water inside the well has first been brought to a steady level, and there is no flow of water into the well.

Before the concrete is placed, the bottom of the well shall be inspected carefully and cleaned of any debris etc. The concreting shall be done in such a manner as to ensure thorough and even filling to the desired level. In under-water work, divers shall be engaged for the purpose, as may be required.

After the concrete has set fully, water shall be pumped out completely or partially, as directed by the Engineer, to test whether the plugging has been satisfactory. If complete dewatering is done, any kentledge required to counteract buoyancy shall be provided before pumping out. In case appreciable leakage of water into the well is observed, the Contractor shall, at his own cost, arrange for its rectification by grouting etc.

b) Sand Filing

Sand filling shall commence after a period of 3 days of laying of bottom plug. Also, the height of the bottom plug shall be verified before starting sand filling.

Sand shall be clean and free from earth, clay clods, roots, boulders, shingles etc and shall be compacted as directed. Sand filling shall be carried out upto the level shown on the drawing, or as directed by the Engineer.

c) Top Plug

After filling sand upto the required level a plug of concrete of specified mix shall be provided over it as shown on the drawing, or as directed by the Engineer.

d) Well Cap

A reinforced cement concrete well cap will be provided over the top of the steining in accordance with the drawing. Form work will be prepared conforming to the shape of well cap. Concreting shall be carried out in dry condition.

The bottom of the well cap shall be laid preferably as low as possible, taking into account the water level prevalent at the time of casting. Bond rods of steining shall be anchored into the well cap.

3.7.8 **Tolerances**

The permissible tilt and shift shall not exceed 1 (horizontal) in 80 (vertical) and the shift at the well base shall not be more than 150mm in any resultant direction or 5% of the overall diameter or width as measured in the principal directions, whichever is less.

For the well steining and well cap the permissible tolerances shall be as follows:

i.	Variation in dimension	:	+50mm–10mm
ii.	Misplacement from specified position in plan	:	15mm
iii.	Surface irregularities measured with 3m straight edge:		5mm
iv.	Variation of levels at the top	:	+ 25mm

3.7.9 **Tests and Standards of Acceptance**

The materials shall be tested in accordance with these Specifications and shall meet the prescribed criteria.

The work shall conform to these Specifications and shall meet the prescribed standards of acceptance.

3.8 Formwork

Form work for bridge foundations, sub structure and superstructures shall be as per IS-3696, IS-4014 and Annexure OCS-1. It includes all temporary or permanent forms required for forming the concrete of the shape, dimensions and surface finish as shown on the drawing or as directed by the Engineer, together with all props, staging, centering, scaffolding and temporary construction required for their support.

3.9 Substructure

3.9.1 Piers and Abutments

a) Concrete and reinforcement for piers and abutments shall conform to relevant sections of these specifications and drawings. In case of concrete piers, minimum grade will be M 35 unless otherwise specified / approved. The number of horizontal construction joints shall be kept to a minimum. Construction joints shall be avoided in splash zones unless specifically permitted by the Engineer and provided they are treated in accordance with special provisions. No vertical construction joint shall be provided. Shear connectors in the form of dowels or bond bars shall be provided at all horizontal joints as directed by the Engineer. The work shall conform strictly to the drawings or as directed by the Engineer.

b) In the case of tall piers and abutments, use of slipform will be preferred. The design, erection and raising of slip form shall be subject to special specifications which will be furnished by the Contractor. All specifications and arrangements shall be subject to the approval of the Engineer.

c) The surface of foundation / well cap / pile cap shall be scraped with wire brush and all loose materials removed. In case reinforcing bars projecting from foundations are coated with cement slurry, the same shall be removed by tapping, hammering or wire brushing. Care shall be taken to remove all loose materials around reinforcements. Just before commencing masonry or concrete work, the surface shall be thoroughly wetted.

d) In case of solid (non-spill through type) abutments, weep holes as shown on the drawings or as directed by the Engineer, shall be provided.

e) The surface finish shall be smooth, except the earth face of abutments which shall be rough finished or left as form finished.

f) In case of abutments likely to experience considerable movement on account of backfill of approaches and settlement of foundations, the construction of the abutment shall be followed by filling up of embankment in layers simultaneously with filter backing behind to the full height to allow for the anticipated movement during construction period before casting of superstructure.

g) *Transitional system as per guidelines of RDSO Report No. GE: R-50 shall be provided in railway bridge approaches of ballasted and non ballasted deck bridges having span equal to or more than 12.0m.*

3.9.2 Pier Cap and Abutment Cap (Bed Blocks)

a) Form work, Concrete and reinforcement shall conform to relevant paras of Concrete work & RCC of these specifications and the Drawings. Unless otherwise specified, minimum grade of concrete mix shall be M 35.

b) The locations and levels of pier cap / abutment cap / pedestals and bolts for fixing bearings shall be checked carefully to ensure alignment in accordance with the drawings of the bridge.

c) The surface of cap shall be finished smooth and shall have a slope for draining of water as shown on the drawings or as directed by the Engineer. For short span slab bridges with continuous support on pier caps, the surface shall be cast horizontal. The top surface of the pedestal on which bearings are to be placed shall also be cast horizontal.

d) The surface on which elastomeric bearings are to be placed shall be wood float finished to a level plane which shall not vary more than 1.5mm from straight edge placed in any direction across the area. The surface on which other bearings (steel bearings, pot bearings) are to be placed shall be cast about 25mm below the bottom level of bearings and as indicated on the drawings. Specified rich levelling mortar shall be provided over this at the time of placing of bearing.

3.9.3 Dirt / Ballast Wall, Return Wall and Wing wall

a) Dirt / ballast walls ,return wall & wing walls shall be in RCC. Minimum grade of concrete will be M35 unless otherwise specified. In case of cantilever return walls, no construction joint shall generally be permitted. Wherever feasible, the concreting in cantilever return walls shall be carried out in continuation of the ballast wall.

b) For concrete return and wing wall, the surface of foundation shall be prepared in the same manner as prescribed for construction of abutment. No horizontal construction joint shall be provided. If shown on drawing or directed by the Engineer, vertical construction joint may be provided. A vertical expansion gap of 20mm shall be provided in return wall / wing wall at every 10 metre intervals or as directed by the Engineer. Weep holes shall be provided as prescribed for abutments or as shown on the drawings.

c) Form work, reinforcement and concrete in dirt / ballast wall shall conform to relevant sections of these specifications.

d) The finish of the surface on the earth side shall be rough/form finish while the front face shall be smooth finished.

e) Architectural coping for wing wall / return wall in brick masonry shall conform to Drawings.

3.9.4 **Tests and Standards of Acceptance**

The materials shall be tested in accordance with these specifications and shall meet the prescribed criteria.

The work shall conform to these specifications and shall meet the prescribed standards of acceptance.

3.9.5 **Tolerances in Concrete elements**

a) Variation in cross-sectional dimensions: + 10mm, -5mm

b) Misplacement from specified position in plan: 10mm

c) Variation of levels at the top: + 10mm

d) Variations of reduced levels of bearing areas: + 5mm

e) Variations from plumb over full height: + 10mm

f) Surface irregularities measured with 3m straight edge

- All surfaces except bearing areas: 5mm
- Bearing areas: 3 mm

3.10 Bridge Work: Superstructure

3.10.1 **GENERAL**

a) Coverage

This chapter covers specifications for the following types of superstructures:

a) Viaduct

b) Bridges with superstructure of Composite Plate Girders (CG)

c) Bridges with superstructure of Open Web Girder (OWG) with concrete deck for providing Ballastless/ ballasted track

d) Bridges with superstructure of PSC U- slab

e) RCC Box bridges

(f) RCC Pipe Bridges

3.10.2 **RCC BOX Bridges**

All concrete works for RCC box shall conform to **Annexure OCS-1 & 2**.

3.10.3 **STEEL Open Web Girders (OWG) and Composite Plate Girders**

Fabrication and erection of steel girders shall conform to Annexure OCS-3.

Concrete and reinforcement for composite girders shall conform to **Annexure OCS-1 & 2.**

3.10.4 **PRE-STRESSED CONCRETE SLABS**

All prestressed works for bridges shall be carried out in accordance with Annexure OCS-1 to 4.

3.10.5 **Linking of Track**

Open web girders shall be provided with ballastless track & LWR/CWR. Rails and fastening systems shall be procured and provided by the Contractor. Concreting of deck slab and BLT shall be carried out as per Annexure OCS-2 and Annexure OCS-3.

In case, it is decided to adopt standard RDSO spans with track on H-beam sleepers, Galvanised H-beam bridge sleepers shall be as per RDSO Drawing No. B-1636/4/R, 5 & 9. Zero toe load fastening shall be as per RDSO Drawing No. T-8759 to T-8765 for 60kg running rail and 52 kg guard rail. Both H-beam bridge sleepers and track fittings/fastenings shall be procured from RDSO approved source. Inspection of material shall be done by the Engineer or any other agency nominated by the Employer at factory premises before dispatch. The Contractor shall arrange for necessary inspection/testing of material at factory premises.

Chapter 4. STATION- CIVIL

4.1 General

Specification for various activities involved in station shall generally be in accordance with CPWD specification-2019 for Civil Works Volume 1 & 2, as amended up to date unless stated otherwise in these specifications. In case of any contradictory instruction in the specification, Engineer's decision shall be final & binding.

4.1.1 Earthwork

Earthwork in excavation and filling/backfilling in station buildings shall be carried out as per CPWD specifications. Soil for filling shall be arranged by the Contractor from outside the ROW. No Earth is to be taken from the Railway/HORC premises except surplus earth from excavation for the building.

4.1.2 Concrete Work

All plain and reinforced concrete works shall be carried out as per IS 456:2000 and Annexure OCS-1 and 2. Design Mix concrete as approved by the Engineer shall only be used.

4.1.3 Anti-Termite Treatment

Pre-Construction Anti-Termite Treatment shall be done as per clause 2.28 of CPWD specification 2019 Vol.-1. The chemical shall be approved by the Engineer and used as per the manufacturer's instructions/specification.

4.1.4 Plinth Protection

Plinth protection shall be 1000 mm wide all around the building, it comprises of 50mm thick M-25 concrete over 75 mm thick bed of dry brick aggregate of 40mm nominal size, grouted with fine sand. The outer edge or face edge shall be lined with with 2nd class bricks laid on the edge and joints laid in cement mortar 1:4. It shall be laid to the required width and slope in outward direction.

4.1.5 Damp Proof Course (DPC)

Unless otherwise mentioned in the drawings, DPC will consist of 40 mm thick M25 CC with two coats of bitumen over it shall be provided as per clause 4.4 of CPWD Specification 2019 Volume-1.

4.1.6 Masonry Work

Fly ash bricks or cement concrete blocks (hollow/solid) confirming to the BIS or *brick* masonry *will* be used. All outer and load bearing walls shall be of minimum 230 mm thickness or more as per design, in cement mortar 1:6, all partition walls shall be 115 mm thick in cement mortar 1:4 as per Clause 6 of CPWD Specification Volume-I 2019.

4.1.7 Plaster

Plaster of 15-19mm thick in cement mortar 1:4 on all outer and inner walls except in ceiling. Inner walls shall be finally finished with POP. The underside of slabs shall be

rendered smooth wherever required and finished with POP as per Clause 3 of CPWD Specification Volume-I 2019.

4.1.8 Painting

Two coats of synthetic enamel paint of 1st quality over a priming coat of Asian, Berger, Nerolac or equivalent brand and shade as approved by the Engineer, on all exposed steel and wooden surfaces.

4.2 Sanitary fittings/sewerage system:

4.2.1 Manholes

Manholes and junction chambers to be constructed by Contractor as per the design by the Contractor & approved by the Engineer and to be connected with RCC pipes of 150/200 mm dia. with each other and to septic tank or to existing sewerage arrangement (up to 30m from extreme outer wall of building in the direction of source to be connected), including obtaining necessary clearance from concerned authorities required from the same. In case sewage system is not be connected with trunk sewer, contractor will furnish appropriate design of septic tank for required number of users to be approved by the Engineer and will construct the Septic Tank accordingly.

4.2.2 Rainwater pipes

Adequate number of rainwater pipes of min 125mm dia, uPVC of approved quality and make as approved by the Engineer to be provided. Inlet of the rainwater pipe to be provided with shoe and CI gratings and at the outlets necessary protection to be done to prevent erosion of soil.

4.2.3 Soil and vent pipes

uPVC pipes of min 100 mm dia to be provided for soil and vent pipes including all branches of required degree, access door and other accessories as necessary for laying the pipes of approved quality and make as approved by the Engineer to be provided. Before embedding the pipes under the floor/platform the same will have to be tested against any leakage. Necessary floor traps, gully traps as essential will be provided. Storm water drain of suitable size to be provided as approved by the engineer.

4.2.4 Wash Basins, Sink and Water closet

Wash basins (Ceramic) of approved size, colour and make as per IS: 2556 (Part 1) and IS: 2556 (Part 4) shall be provided in ladies and gents toilet with shelf, looking glass and towel rails (CP Brass). Urinal in gent's toilet shall be of Bowl type with flushing rim & partition slab and in ladies toilet Squatting plate type (ceramic) of approved size and make as per IS: 2556 (Part 6) with ceramic flushing cisterns as shown in tender drawings. Water closet shall be Indian (Orissa type) as per IS: 2556 (Part3) / European type as per IS: 2556 (Part1) and IS: 2556 (Part2) with ceramic flushing cisterns as shown in tender drawings. Stainless steel/Ceramic sinks as per IS: 771 (Part2) of approved size and makes to be provided in battery rooms. All water services and sinks will be connected through bottle traps to concealed outlet pipe.

4.2.5 Water supply

a) Bore well shall be constructed as per IS 2800 Part 1 & Part 2. Chlorinators using common salt shall be provided at each tube well for chlorination of water.

b) Necessary layout for water supply distribution in the water booth, toilets and bathroom to be designed by the contractor and submitted for approval of the Engineer. All internal pipes shall be laid concealed in walls and tested for leakages for minimum 12m head of water. All GI pipes shall be of minimum class 'B.' All necessary taps, stop valve etc. of approved size and make to be provided by Contractor to make the toilets and kitchens functional including provision of RCC underground & overhead water tanks of designed capacity. This will include provision of float valve, copper/brass rod and plastic ball with inlet, outlet, overflow, washout connections etc. for the water tank complete in all respect. Taps in platform toilets & water booths shall be self-closing type.

4.2.6 Water proofing of roofs:

Water proofing of roof shall be carried out by the Contractor as approved by the Engineer.

4.2.7 Drip courses

Drip course of approved design shall be provided all around the building, chajjas etc.

4.3 Station cum S&T and Electric service building, S&T huts, Auto Location hut:

4.3.1 Finishes

a) **Interior finish**

Two coats of 1st quality oil bound distemper of approved shade over POP coating to make the surface smooth. 3rd coat may be done before handing over of assets.

b) Exterior finish

Two coats of 1st quality cement paint of approved shade over POP coating to make the surface smooth. 3rd coat shall be done before handing over of assets.

4.3.2 Flooring

a) **Substation room, Maintenance, Metering room, Store room etc.**

40mm thick, cement concreate flooring with M-25 CC laid in one layer finished with cement slurry to a true smooth surface with joints provided with glass strips of 4mm thick to form panels not exceeding 1200x1200mm, laid over 100mm thick CC M-10 over 100mm thick sand filling over well rammed and consolidated earth filling as per Clause 11.2 of CPWD Specification Volume-I 2019.

b) **Battery Room**

Acid proof tiles of size 198.5x198.5 mm & 10 mm thick conforming to IS 4457-1967 as approved by the Engineer over 10 m thick cement sand mortar 1:4(1 acid proof cement: 4 coarse sand), laid over 100mm thick CC M-10 over 100 mm thick sand filling laid over well rammed consolidated earth filing. Acid proof tiles shall also be

provided in dado as per requirement up to minimum 1.5 m height as per Clause 11.14 of CPWD Specification Volume-I 2019.

c) **Staircase**

Kota Stone 25 mm thick to be provided in risers, treads and landings of steps laid on with neat cement slurry mixed with pigment to match the shade of kota stone including rubbing polishing complete on 20mm thick cement sand mortar 1:4. Skirting of same Kota Stone shall be provided upto minimum150 mm height. The work shall be done as per Clause 11.22 of CPWD Specification Volume-I 2019. Kota stone provided on riser & tread of steps shall be minimum 1.8 m long & shall cover full height/width of the step. Exposed end of kota stone on treads shall be rounded to provide nosing. Kota stone tile at other places shall be of minimum 600 mm x 600 mm size. Stone at edges can be cut in smaller sizes to fill up the residual areas.

d) **Verandah Flooring**

Kota Stone 25 mm thick flooring and 150 mm height skirting laid on with neat cement slurry mixed with pigment to match the shade of kota stone including rubbing polishing complete on 20mm thick cement sand mortar 1:4 over 100 mm thick CC M-10 over 100 mm thick sand filling laid over well rammed consolidated earth filing as per Clause 11.21 of CPWD Specification Volume-I 2019. Kota stone tiles shall be of minimum 600 mm x 600 mm size. Stone at edges can be cut in smaller sizes to fill up the residual areas.

e) **Toilets**:

Finished floor to be kept 25mm below the normal floor of the building. Minimum 300x300 mm size ceramic anti-skid floor tiles of minimum 12 mm thickness, 1st quality conforming to IS 13630-1993 of Kajaria, Nitco or similar make and shade and approved by Engineer laid over 20mm thick bed of cement sand mortar 1:4 using neat cement slurry and pointing of joints done with white cement mixed with pigment to match the shade of tiles over a base of 100mm thick CC M-10 laid over 100mm thick sand filling on well rammed and consolidated earth filling on ground floor as per Clause 11.15 of CPWD Specifications Volume-I 2019. On subsequent floors the tiles shall be laid directly on mortar bed. Glazed tiles of suitable size (300mmx300mm or 300mmx450mm) and minimum 06mm thickness confirming to IS 13630-1993 of Kajaria, Nitco or similar make, quality and shade as approved by the engineer to be provided on wall for full height up to ceilings over 13mm thick cement mortar 1:3. All the tiles to be laid with zero gap between them.

f) **Interlocking cum Axle Counter Rooms**

Interlocking/Axle counter room, Panel Room, IPS room, Tele/OFC room and other S&T structures-1st quality 600 x 600 mm vitrified floor tiles of minimum 12 mm thickness conforming to IS 15622 of Kajaria, Nitco or similar make and shade as approved by Engineer laid over 20 mm thick bed of cement sand mortar 1:4 using neat cement slurry and pointing of joints done with white cement mixed with pigment to match the shades of tiles over a base of 100mm thick CC M-10 over 100 mm thick

sand filling on well rammed and consolidated earth filling for ground floor. On subsequent floors tiles shall be laid directly on mortar bed. Glazed tiles of suitable size (300mm x 300mm or 300mm x 450mm) and minimum 06mm thickness confirming to IS 15622 of Kajaria, Nitco or similar make, quality and shade as approved by the Engineer to be provided on walls in dado up to 90cm height from floor level or up to the window sill. All the tiles to be laid with zero gap between them as per Clause 11.15 & 11.16 of CPWD Specification Volume-I 2019.

Note:-

Color and make of all the flooring shall be as per the direction of the Engineer.

4.3.3 Door, Windows and Ventilation

a) **Door frames:**

Door frame shall be pressed steel door frames manufactured from mild steel sheets of specified thickness conforming to IS:2062 & 4351. Each frame shall consist of hinge jamb, lock jamb, head and angle threshold of size 50 x 25mm as per Clause 10.12 of CPWD Specification Volume-I 2019.

b) **Door Shutter**:

35 mm thick flush door shutter conforming to IS:2202 (Part1), non-decorative type, core of block board construction with stiles, rails & lipping of hard wood timber and well-matched commercial 3 ply veneering with vertical grains on both faces of shutters as per IS:710 with brass fittings of approved size and make as per requirement.

c) **Windows/Ventilators**

The frames of windows and ventilators shall be of powder coated aluminum (coating thickness 60-80 micron) with extruded built up standard tubular sections/ Z sections of approved make conforming to IS: 733 and IS:1285 fixed with dash fasteners of required dia and size with fully glazed shutters of 5 mm thick float glass provided with EPDM rubber/ neoprene gasket with complete fittings as per CPWD specifications Vol.-II.

d) Windows in relay room shall be of sliding type to provide insulation for effective air conditioning.

e) Anodised aluminium grills (minimum anodic coating of grade AC 15 as per IS:1868) of approved design/pattern, manufactured from standard sections shall be provided in the windows and ventilators. The grill shall be fixed to the window/ventilator frame with C.P brass/ stainless steel screws.

f) Necessary exhaust fan opening to be provided as required.

4.4 Station Building

4.4.1 Doors, Windows & Ventilators

a) **Exterior Doors**

Main entrance from circulating area to the station building shall be provided with fully glazed Aluminum Door. The remaining portion of entrance shall be provided with fixed glazing with aluminum frames as per approved drawing. The frames shall be manufactured from extruded aluminum alloy sections of standard sizes and designs as per IS 1948 and IS 1949 or as manufactured by Indian Aluminum Co. Ltd or approved equivalent. The alloy used shall conform to the IS designation HE9-WP of IS:733. Glazing shall be of 10 mm thick clear glass, horizontally tempered (toughened) as per DIN:1249 Part-12 with no tong or suspension mark and edges machined with no burrs or sharp surfaces. All Toughened Glass shall be heat soak test certified as per BS EN-14179-1.

b) **Door frames** of office of Station Master/SS//Waiting Rooms/Booking Office shall be of well-seasoned steam beech/2nd class of teak wood of minimum section 65mmx100mm.

c) **Door Shutter**

35 mm thick flush door shutter conforming to IS:2202 (Part1), non-decorative type, core of block board construction with stiles, rails & lipping of hard wood timber and well-matched commercial 3 ply veneering with vertical grains on both faces of shutters as per IS:710. These door shutters may be partially glazed as per requirement, as per drawing approved by the Engineer. Glazing shall be of glass pane of 5 mm thickness. Doors shall be finished with duco paint of desired shade and colour of melamine polished complete with all fittings including door closures.

d) **Windows/Ventilators**

The frames of windows and ventilators in the station building shall be of powder coated aluminum (coating thickness 60-80 micron) with extruded built up standard tubular sections/ Z sections of approved make conforming to IS: 733 and IS:1285 fixed with dash fasteners of required dia and size with fully glazed shutters of 5 mm thick float glass provided with EPDM rubber/ neoprene gasket with complete fittings as per CPWD specifications Vol.-II. Windows and ventilators shall be provided with anodised aluminium grills (minimum anodic coating of grade AC 15 as per IS:1868) of approved design/pattern & manufactured from standard sections. The grill shall be fixed to the window/ventilator frame with C.P brass/ stainless steel screws.

e) **Door/Window fittings**:

These shall be chromium plated brass, of size and make as approved by the Engineer.

4.4.2 Finishes

a) **Interior finish**

Two coats of 1st quality oil bound distemper of approved shade over POP coating to make the surface smooth. 3rd coat may be done before handing over of assets.

b) **Exterior finish**

Two coats of 1st quality cement paint of approved shade over POP coating to make the surface smooth. 3rd coat shall be done before handing over of assets.

4.4.3 Flooring and Dado

a) 1st quality 600 x 600 mm vitrified floor tiles of minimum 12 mm thickness conforming to IS: 15622 of Kajaria, Nitco or similar make and shade as approved by Engineer laid over 20mm thick bed of cement sand mortar 1:4 using neat cement slurry and pointing of joints done with white cement mixed with pigments to match the shade of tiles over a base 100mm thick CC M-10 laid over 100mm thick sand filling on well rammed and consolidated earth filling. On subsequent floors tiles shall be laid directly on mortar bed. Same floor tiles shall also be provided on walls in dado up to 200 mm height from floor level. All the tiles to be laid with zero gap between them over 13mm thick cement mortar 1:3. as per Clause 11.15 & 11.16 of CPWD Specification Volume-I 2019.

b) Toilets

Finished floor to be kept 25mm below the normal floor of the building. 300x300mm 1st class ceramic antiskid floor tiles of minimum 12 mm thickness conforming to IS 15622 of Kajaria or similar make and shade as approved by Engineer laid over 20mm thick bed of cement and sand mortar 1:4 using neat cement slurry and pointing with white cement mixed with pigment to match the shade of tiles laid over 100mm thick CC M-10 over 100mm thick sand filling on well rammed and consolidated earth filling. Glazed tiles of suitable size (300mm x 300mm or 300mm x 450mm) and minimum 06mm thickness conforming to IS 15622 of Kajaria or similar make, quality and shade as approved by the Engineer to be provided on walls for full height up to ceilings over 13mm thick cement mortar 1:3. Tiles shall be laid with zero gaps between them as per Clause 11.15 & 11.16 of CPWD Specification Volume-I 2019.

4.4.4 Ticketing Room

a) Booking Counter & Facia

Counters & facia to be made with Granite Top of approved shade 18mm thick laid with neat cement slurry and pointing with white cement mixed with pigment to match the shade of Granite slab including rubbing polishing complete on 20mm thick cement and sand mortar 1:3 on RCC shelf as per approved design.

b) Flooring & Skirting

1st quality 600 x 600 mm vitrified floor tiles of minimum 12 mm thickness conforming to IS: 15622 of Kajaria, Nitco or similar make and shade as approved by Engineer laid over 20mm thick bed of cement sand mortar 1:4 using neat cement slurry and pointing of joints done with white cement mixed with pigments to match the shade of tiles over a base 100mm thick CC M-10 laid over 100mm thick sand filling on well rammed and consolidated earth filling. On subsequent floors tiles shall be laid directly on mortar bed. Glazed tiles of suitable size (300mm x 300mm or 300mm x 450mm) and minimum 06mm thickness confirming to IS 15622 of Kajaria,

Nitco or similar make, quality and shade as approved by the Engineer to be provided on walls in dado up to 90cm height from floor level or up to the window sill. All the tiles to be laid with zero gap between them over 13mm thick cement mortar 1:3. as per Clause 11.15 & 11.16 of CPWD Specification Volume-I 2019.

c) **Booking Window**

Booking window shall be of toughened sheet glass 10mm thick with a hole for intercommunications at suitable height above the countertop and a suitable gap between the partition and counter for collection of fare and issue of tickets, the partition being protected on the passenger side by aluminum grill of approved design.

d) **Portico**

At subway entrance a RCC portico of 12 m x 8.5 m size shall be provided as per approved drawing and Annexure-OCS-1 & OCS-2.

4.4.5 Subway & inter platform connectivity

a) **Flooring**

Flamed finish granite stone flooring in required design & pattern 18 mm thick to be provided in flooring jointed with neat cement slurry and pointing with white cement mixed with pigment to match the shade of granite stone including rubbing polishing complete on 20mm thick cement and sand mortar 1:4 as per Clause 11.31 of CPWD Specification Volume-I 2019. Granite stone tiles shall be of minimum 600 mm x 600 mm size. Stone at edges can be cut in smaller sizes to fill up the residual areas.

b) **Dado**

Glazed tiles of suitable size (300mm x 300mm or 300mm x 450mm) and minimum 06mm thickness confirming to IS 13630- 1993 of Kajaria, Nitco or similar make, quality and shade as approved by the Engineer to be provided on walls in dado up to 2.5 m height from floor level.

c) **Stairs & Ramps**

Flamed finish granite Stone 25 mm thick to be provided in risers, treads and landings of steps laid on with neat cement slurry and pointing with white cement mixed with pigment to match the shade of kota stone including rubbing polishing complete on 20mm thick cement and sand mortar 1:4 and 150 mm height skirting of same granite Stone as per Clause 11.31 & 11.22 of CPWD Specification Volume-I 2019. Granite stone provided on riser & tread of steps shall be minimum 1.8 m long & shall cover full height/width of the step. Exposed end of granite stone on treads shall be rounded to provide nosing. Granite stone tile at other places shall be of minimum 600 mm x 600 mm size. Stone at edges can be cut in smaller sizes to fill up the residual areas

d) **Railing**

Assembly and erection as per approved drawing on stairs, ramp & subway of Stainless steel of material grade SS 304 as per CPWD specification Vol.-1 2019.

e) **Covering for Stairs & Ramp**

Self-supported roofing system of colour coated Galvalume sheet shall be provided as approved by the Engineer. Material shall be of following specification, BMT 0.90mm to 1.00mm, APT 0.95mm Tolerance +/- 0.02mm thick, 605 mm width or as approved by the Engineer (Tolerance +/- 2mm).

The roofing system shall be without trusses, purlins or any ancillary support and shall be designed by the contractor and shall be got proof checked at his own cost from Govt. approved agencies.

f) **Waterproofing of Subway**

1) Waterproofing of subway shall be carried out by a manufacturer having minimum 10 years of experience in manufacturing waterproofing product of the type specified, able to provide test report showing compliance with the specifications, and able to provide on -site technical representation to advise on installation.
2) The installation shall be carried out either by the manufacturer or his approved applicator having experience of minimum 05 years in application of waterproofing products in underground structures. The waterproofing shall be carried out by manufacturer's applicators strictly in accordance with the recommendation of the manufacturer.
3) All components and elements, which are required to make the structures watertight, shall be demonstratable and proven to work together. There shall be a single source of responsibility and performance of the material and products. Specifically, material and water stops shall be manufactured out of virgin raw material and only form the same formulation of raw material. The manufacturer shall confirm full, demonstratable and proven compatibility of the entire waterproofing system in writing. The waterproofing system provided shall be installed without damage and protected against construction operations. The contractor shall carry out a trial application of the waterproofing and submit the report containing the details and method statement to obtain approval from the Engineer.
4) Waterproofing shall be provided on outside side of vertical walls and top slab.
5) Waterproofing scheme
   i. Outside of vertical walls and top slab shall be provided with spray applied liquid coating of minimum thickness 2.0 mm as per IS 16471 (Type A).
   ii. Construction joints in vertical walls shall be provided with PVC water stops as per IS 16471 (Type B).
   iii. Use of waterproofing admixture to the concrete of slabs and walls of subway
6) Spray applied liquid coating on external side of vertical walls and top slab
   i. System and properties of materials

      Fully bonded spray-applied liquid polymer two component, solvent free, hybrid polyurea polyurethane/ polyurea/ polyurethane applied elastomeric seamless membrane of minimum 2 mm Dry Film Thickness (DFT) shall be used. DFT shall be achieved in minimum 2 coats (of two different contrasting colors), over and above one coat of a solvent free two component epoxy primer which shall be compatible with the liquid polymer and from the same manufacturer. No sand broadcast layer is permitted in the system. The system must be such that it is thixotropic, can be applied by airless

spray; as well as the same product shall be capable of being applied manually only for local detailing and patch repairs (maximum area 1 m^2). The product shall be applied in accordance with the manufacturer's instructions.

ii. The waterproofing membrane shall have following minimum properties:
   a. Tensil strength> 15MPa as per ASTM D 412.
   b. % Elongation>300% as per ASTM D 412.
   c. Bond strength on concrete > 2 MPa as per ASTM D 7234.
   d. Minimum crack bridging capability of over 2.0 mm.
   e. Specific Gravity of 1.15 (+/-10%)

iii. Code and standards for reference:

Code and standard Number	Code and Standard Title
ASTM D 412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 7234	Standard Test Methods for Pull-off Adhesion Strength of Coating on concrete Using portable Pull – off Adhesin Testers.

iv. Inspection
The thickness of spray applied liquid coating waterproofing membrane shall be checked for every 20 m^2 area of water proofing. The thickness at the point of checking shall not be less than 2 mm.

7) Construction joints in vertical walls
   i. The contractor shall construct his concrete works so as to minimize the likelihood of water penetration.
   ii. Before placing new concrete against concrete that has already hardened, the face of the old concrete shall be treated in accordance with manufacturer's recommendation.
   iii. Inside rendering shall not be accepted as a method of making joints watertight.
   iv. Water stops shall be of PVC strips. The water stops shall be installed so that they are securely held in their correct positions whilst the concrete is being placed. No holes shall be made through any water stop except were provided for by the manufacturer. Water stops shall be provided as per manufacturer recommendations. The contractor shall submit the method statement for providing water stops to the Engineer for approval.

8) Use of waterproofing admixtures in concrete of slabs and vertical walls of subway
Waterproofing admixtures shall be used in conjunction with other waterproofing components supplied by the same manufacturer, for example, water stops, achieve watertight structures.

9) Surface preparation
Waterproofing work shall commence only after obtaining approval from the Engineer. Application of waterproofing system shall only commence upon the completion of curing of concrete. All cracks on the exposed concrete surfaces of external structural members shall be effectively sealed before applying any waterproofing system. The Contractor shall ensure that surfaces to which

waterproofing is to be applied, shall be clean, dust-free and dry and shall be prepared fully in accordance with the manufacturer's recommendation. The waterproofing shall be carried out by the manufacturer's applicators strictly in accordance with the recommendations of the manufacturer and with accepted best practice in the trade.

4.4.6 Platform Covering

a) **Main Platform Shelter**

Main Platforms Shelters shall be fabricated from rolled steel sections conforming to IS:2062/4923. Roof shelter shall have arrangement for collection and safe outlet of rainwater. Shelter roofing shall be of aluminum sheet of 0.9 mm thickness.

b) **Mini Shelter**

All mini shelter shall be with seating capacity of 6 passenger as shown in Tender drawings. Roofing shall be with 6MM thick multiwall translucent Polycarbonate sheet both side UV protected bent in curved shape as shown in tender drawing.

c) **Shelter Flooring**

VDC flooring shall be provided under PF shelter as per Sub-Clause 4.4.7 of these specifications.

4.4.7 Platform Surfacing-

a) **VDC Flooring**

100mm thick fiber reinforced Vacuum Dewatered Concrete (VDC) flooring of grade M25 of stone aggregate 20 mm and downsize laid as specified in CAMTECH/2021/C/VDF/1.0 2021 of RDSO publication over 100mm thick CC M-10 over 100mm thick fine sand filling over well rammed and consolidated earth filling.

The area to be paved with VDC should be divided into suitable panels by fixing screed strips. The depth of screed strips should be equal to the combined thickness of base concrete and topping. Generally, no dimension of panel shall exceed 4 m in case of floor finish laid monolithically with the base concrete and 2m in case finish laid separately on a hardened base. Length of panel shall not exceed 1.5 times its breadth. Reinforcement shall be provided as per design. Before placement of base concrete sub-base shall be properly wetted.

Tactile path shall be provided at 1.8 m from the coping edge along the entire length of platform and at entrance & exit points of platform to station as per direction of the Engineer. Tactile floor tile shall have a minimum thickness of 10 mm excluding the flat top blister like domes or flat topped bars and shall conform to IS 4457 and IS 15622 and "Handbook for barrier free accessibility"-CPWD.

Note: The position of trenches and pipes for services such as water, drainage, electric, S&T etc. must be fixed before floor concreting starts.

b) **Platform slope**

For End platform cross slope of 1 in 60 to be provided away from the track while on island platform cross slope 1 in 60 to be provided from center of track towards the end of coping/Track side.

c) **Joints**

At panel interfaces groove of about 3-5 mm wide shall be cut in top surface in both lateral & longitudinal direction for prevention of cracks as per instruction of the Engineer. These grooves shall be filled with suitable sealant.

4.4.8 Water Booth-

a) **Water Booth Platform**

Granite Stone cladding with Granite Top of 20mm thick on with neat cement slurry mixed with pigment to match the shade of Granite including rubbing polishing complete on 20mm thick cement and sand mortar 1:3.

b) **Drainage & its covering-**

On island platform an underground drain of 125 -150 mm dia with manhole at suitable interval shall be provided to safely carry the effluent from water booths, PF shelters, toilets etc and on end platform underground/open drain with removable MS grating cover shall be provided on the far end of the platform as shown in the tender drawings.

c) **Duct For Utilities- HDPE pipes for Electrical and S&T**

These pipes shall be provided by the side of the drains. HDPE pipes shall conform to IS 4984.

d) **Taps**

Self-closing Taps with CP Brass/PTMT bib cock provided with quarter turn ceramic cartridges.

Miscellaneous items shall be as given below-

Item No.	Description of items	Material Spec.
1.	Orissa WC Pan (Indian Style) with low level dual flushing ceramic cistern	Ceramic
2-	European Type Wall Hung/Floor Mounted WC with seat, lid and low level dual flushing ceramic Cistern	Ceramic
3-	Water Jet/Health Faucet with European WC	CP Brass
4-	Ceramic Wash Basin with CP brass pillar Tap / with Quarter Turns Ceramic Cartridges.	Ceramic
5-	Tap (Toilet, Bath & WC) CP Brass/ bib cock provided with quarter turn ceramic cartridges	CP Brass
6-	Mirror (600 x 450mm) with each wash basin with PTMT glass shelf	PTMT
7-	Towel rail	CP Brass

Item No.	Description of items	Material Spec.
8-	Soap Rack for each wash basin	CP Brass

4.4.9 Waterproofing Application

Waterproofing materials shall be installed only by the manufacturer of the products or his approved applicator.

Application of waterproofing system shall only commence upon completion of curing of the concrete. The contractor shall ensure that surfaces to which waterproofing is to be applied shall be clean, dust free and dry and shall be prepared fully in accordance with the manufacturer's recommendation.

All cracks on exposed surfaces of external structural members shall be effectively sealed in accordance with the relevant clauses of the M & W specification before applying any waterproofing system. Inside rendering shall not be accepted as a method of making the joint watertight.

The Engineer may require the Contractor to carry out a trial application of the waterproofing materials for the proposed waterproofing system. No waterproofing works shall commence without the written consent of the Engineer. In case of liquid applied polymer membrane applied to roof slabs, the membrane shall be protected with 25mm thick extruded polystyrene boards, which shall be spot bonded to the membrane. A 6-mill polyethylene separating membrane. shall then be laid before covering with a protective concrete slab of lean concrete mix of minimum 75mm thickness.

Where the roof slab has been cast against a diaphragm or other face, the protective slab shall be provided with an up stand at the perimeter to provide a minimum 75mm concrete protection over the turned-up membrane. This is to ensure that the membrane termination is protected from damage or dislodging prior to backfill. Damaged or non-compliant sections of membrane shall be repaired in accordance with the manufacturer's recommendations and as accepted by the Engineer.

WATERPROOFING AT CONSTRUCTION JOINTS

Construction joints are to be constructed as follows

a. All construction joints in external slab and wall will be provided with PVC water stop located at the center of the element.
b. In the top surface of base and roof slabs at junction with diaphragm walls, a 25x25mmrecess will be cast in the slab and subsequently filled with a high performance water stop grout of the crystalline growth type.
c. All construction joints in external slab and walls will be cast with a25x25 recess on the outer face (expect the base slab where it will be provided on the upper face). The recess will be filled with a high performance water stop grout of the crystalline growth type.
d. All construction details and material are to be submitted to the Engineer for the approval.

4.4.10 WATERPROOFING TO BASE SLAB OF UNDERGROUND STRUCTURES

a. General

Concrete waterproofing admixture shall of the crystalline growth type. The admixture shall have a proven track record of successful application in similar conditions.

This admixture shall be applied to the full thickness of the base slab and extend to the sidewall of sumps and similar depression of the base slab to form a continuous water light surface.

b. Trials

Prior to construction, trial mixes are to be conducted under the supervision of the Engineer or his Representative and with the manufacturer present to confirm that the proposed mix conforms to strength, w/c ratio, slump, and other requirements. The trial mix concrete shall further have an average water permeability coefficient when tested at 28 days of not greater than 5x10-13 m/s under 5kgf/cm2 and an average penetration depth not greater than 15mm as measured by DIN 1048 Part 5:1991.

4.4.11 WATERPROOFING TO ROOF SLABS

The spray applied liquid polymer membrane shall be suitable for use in an ambient temperature range not greater than 40°C. It shall allow diffusion of water vapors to prevent any buildup of pressure between the membrane and substrate. The membrane shall meet or surpass the following requirements:

Total membrane thickness	2.5mm minimum dry film thickness and sprayed in a minimum of two coats of contrasting colors, with the second coat applied to the first coat only after the first coat has cured.
Tensile strength	4.0MPa minimum in any of the three orthogonal planes of the membrane
Membrane elongation at break	130% minimum
Peal adhesion to concrete (ASTMD4541)	2.0MPa minimum
Static crack bridging (tested to recognized international standard acceptable to the Engineer)	2mm minimum

The cured membrane shall be chemically resistant to the effects of hydraulic fluids, diesel fuel and diluted mineral acids etc.

The substrate shall be prepared and primed in strict accordance with the manufacturer's recommendations and requirements. The membrane shall be of a thixotropic nature and cold applied to ensure consistent thickness is achieved over all substrate irregularities.

The materials used must be based upon resin systems that do not react with moisture although the substrate should be dry during application.

The liquid polymer membrane shall be continued 1 meter down the vertical side of the roof slab where the roof is cast by bottom up sequence.

All components of waterproofing system shall be provided by one manufacturer. All materials must be supplied to site in unopened packaging, with batch numbers marked and

corresponding manufacturer's certificates of conformity and must be used within the product's shelf life. All components of the system exposed to rain within the curing period shall be replaced unless agreed otherwise by the Engineer.

The membrane wet film thickness should be checked every 10 square meters during application of of each layer, using a pin or comb gauge. Destructive testing to measure dry film thickness shall be carried out on the cured membrane at every 100 square meters or at every working shift, whichever occurs sooner, and shall be made good to the satisfaction of the Engineer.

Tests to the acceptance of the Engineer shall be carried out on the cured membrane to identify any discontinuities in the membrane and to prove the integrity of the membrane.

Chapter 5. STATION- PLUMBING AND FIRE FIGHTING

5.1 Water Supply and Plumbing Works

5.1.1 Applicable Standards

The Contractor shall ensure the compliance to the following codes and standards:

IS 458	Specification for Precast Concrete Pipe
IS 783	Code of Practice for Laying of Concrete Pipes
IS 1172	Code of Basic Requirements for Water Supply, Drainage & Sanitation
IS 1239 (Part-1)	Steel Tubes, Tubulars and Other Wrought Steel– 2004 Fittings, Part 1: Steel Tubes
IS 1239 (Part-2)	Steel Tubes, Tubulars and Other Steel Fittings– 2011, Part 2: Steel Pipe Fittings
IS 1726	Specification for Cast Iron Manhole Covers & Frames
IS 3624	Specification for Pressure and Vacuum Gauges
IS 4984	Specification for Water Supply HDPE pipes
IS 7634 (Part 2)	Specification of Installation for Water Supply HDPE Pipes
IS 8110	Well screens and slotted Pipes.
IS 8329	Centrifugally Cast (spun) Ductile Iron Pressure Pipes for Water, Gas and Sewage
IS: 9439	Glossary of terms used in Water-well drilling technology.
IS 9523	Ductile Iron Fittings for Pressure Pipes for Water, Gas and Sewage
IS:11189	Method of Tubewell Development
IS 12288	Specification for Laying Ductile Iron Pipes
IS:12818	Unplasticized polyvinyl chloride (PVC-U) Screen and casing pipes for Borewell/tubewell specification
IS 16098 (Part-2)	Structured-wall Plastics Piping Systems for Non-Pressure Drainage and Sewerage
BIS - SP (QAWSM) 56	Location, operation and Maintenance of tube/bore wells - Guidelines

5.1.2 Storage Tanks for Water Supply

Storage tanks for water supply shall be constructed in accordance with IS 3370 (Part 1 &

Part 2) and as per drawings approved by the Engineer.

5.2 Plumbing and Firefighting

5.2.1 General

a) General Requirements

i. The workmanship shall be as per best industrial practices and shall conform to the specifications and Indian Standard Specifications in every respect and shall be as approved by the Engineer.

ii. All relevant certificates shall be submitted by the Contractor to show that the materials comply with the requirements and technical data specified in this document. The Engineer may require additional testing of materials to verify the compliance as per specifications for which the costs shall be borne by the Contractor.

b) Testing and Commissioning

i. Hydrostatic Pressure Testing of Pressure Pipes

ii. All pressurized pipelines shall be tested as specified in Sub-Clause 4.15, Part 9, Section 1 of NBC 2016.

iii. Testing of Non-Pressure Pipes

iv. All non-pressure pipelines shall be tested as specified in 'Manual on Water Supply and Treatment", CPHEEO.

c) Flushing

The Contractor shall be responsible to check that the water pipework is flushed and chemically cleaned against unwanted substances. Contamination may occur during storage of materials, due to surface oxides and mill scale, or the application of protective grease and oils. During the installation period, the pipework can become further contaminated by construction material debris such as welding and jointing materials, swarf and dust. The Contractor responsible for installing the system shall ensure that care is taken to limit the amount of dirt entering the system during installation.

d) Site Acceptance Test, Commissioning and Inspection

i. The Contractor shall submit the schedule and Method Statements for testing and commissioning of all plumbing & fire-fighting equipment, materials, goods and systems to the Engineer, as soon as possible after the award of the Contract. Tests shall be conducted in the presence of the Engineer to his satisfaction. The Contractor shall submit these to obtain approval from the Engineer.

ii. The Contractor is responsible to ensure that all testing equipment, materials and personnel are available at the appropriate time for testing. The Contractor shall prepare forms to record all test procedures and results for the review of the Engineer. These forms shall constitute a record of testing and they are aimed for assisting the Engineer in giving his review of operations, performances and functions for

equipment, materials, goods and systems.

iii. During the installation phase of the project, the Contractor shall carry out initial testing and pre-commissioning of all plumbing and fire-fighting services and systems, followed by final commissioning. This shall include the pressure testing, flushing and cleaning of pipework,

iv. Method Statements shall be submitted for review to the Engineer allowing enough time for review, comment and re-issue.

v. The Contractor shall be responsible to take date stamped photographic records of testing and commissioning; in case the Engineer is unavailable to attend a test demonstration. These shall be produced by the Contractor and submitted to the Engineer along with testing and commissioning records for review or request to re-demonstrate.

5.2.2 Plumbing

a) Qualification

The plumbing works shall be carried out by the plumbing sub-contractor / plumber who holds a valid plumbing license issued by the Municipal authority or other competent authority as per Clause 3.3 under Section-2 Part -IX of NBC-2016. The Contractor shall keep constant liaison with all relevant authorities and shall be responsible for obtaining all approvals related to water supply, sewerage and drainage system. He shall also be responsible for co-ordination with other Interfacing Contractors.

b) Materials

i. Piping Materials

All materials shall comply with the following specifications, unless otherwise specified. If after tests, any materials, work or portions or work are found defective, the Contractor shall remove the defective material from the site, pull down and re-execute the works at his own cost to the satisfaction of the Engineer. To prove that the materials used are as specified, the Contractor shall furnish the Engineer with original invoice on demand.

1) Water supply pipes

Pipes for water supply shall be as follows –

(A) Ductile Iron (DI) shall conform to IS 8329 and fittings to IS: 9523. All pipe joints shall be with couplers or jointing fixtures as per respective IS codes and manufacturers recommendations

(B) HDPE pipes shall conform to IS 4984.

(C) GI pipes shall conform to IS 1239.

2) Sewage and drainage pipes

Sewage and drainage pipes shall be as follows –

(A) Non pressure HDPE pipes shall conform to IS 16098 Type B. Typical classification of pipes shall be double wall corrugated (DWC)SN8.

(B) RCC pipes shall be socket & spigot centrifugally spun conforming to IS 458 of NP-3 Class.

ii. Water supply pipeline

The Contractor shall install all piping and fittings in their final position in accordance with approved trial assemblies and as per drawings that have been approved by the Engineer. The installation shall be done as per CPHEEO/CPWD/IS specifications

1) DI pipes shall be laid as per IS 12288.

2) HDPE pipes shall be laid as per IS 7634 Part 2.

3) GI pipes

iii. Sewer and drainage pipeline

1) Structured wall plastic piping system shall be laid as per IS 16098.

2) Concrete pipes shall be laid as per IS 783.

3) Soil, waste water and drainage pipes from buildings shall be connected with sewerage and drainage systems through manholes to be constructed by the Contractor.

iv. Manholes

1) Manholes shall be constructed as specified in Part-9, Section-2 of NBC-2016.

2) Manholes shall be provided with cast iron covers and frames embedded in RCC slab or SFRC precast concrete covers as per drawing approved by the Engineer.

v. Disinfection of Storage Tanks

The Contractor shall arrange to disinfect the water storage tanks before commissioning. The water storage tanks shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Adequate amount of chlorine shall be used to give water a dose of 50 parts of chlorine to one million parts of water

5.2.3 Sourcing of water

i. Borewells

1) Location of bore-well shall be proposed by the Contractor for the Engineer's approval.

2) The Contractor shall provide borewells including borewell room, pumps,

pipeline and electric wire rope hoist for lifting and lowering of pumps as per drawings approved by the Engineer. The Contractor shall provide pipe line with valves, fittings and accessories from borewell to storage tank as shown in the drawings. The well screen and slotted pipe shall conform to IS 8110 Type D. Material of wire of screens shall be stainless steel (SS) of designation XO4Cr18Ni10 of IS 6528. The housing and casing pipe shall conform to IS 4270 or IS 12818. Borewell shall be provided with sluice valve, pressure gauge, non-return valve and flow meter. Borewell shall be constructed and tested as per IS 2800 Part 1 and Part 2. The Contractor shall furnish information after completion of the borewell as per IS 2800 Part 2 to the Engineer for approval. Provisions of IS:SP(QAWSM) 56 shall be followed for ground water exploration, siting, construction and development of borewell.

5.2.4 Storage tanks for water supply

The Contractor shall construct underground and overhead water storage tanks as per the drawings approved by the Engineer.

5.2.5 Water Supply distribution system

The Contractor shall provide water supply distribution system including piping, pumping, valves and fittings to the required gradients and profiles as the drawings approved by the Engineer. The Contractor shall follow provisions of "Manual on Water Supply and Treatment" published by the Central Public Health and Environment Engineering Organization, Ministry of Urban Development, Govt. of India, (CPHEEO), CPWD Specifications (Vol. 2) and NBC 2016 for carrying out and testing the works of water supply distribution system.

5.2.6 Yard Drainage System

The Contractor shall provide yard drainage as per the drawings approved by the Engineer. The Contractor shall follow provisions of "Manual on Storm Water Drainage Systems" published by CPHEEO, CPWD Specifications (Vol. 2) and NBC 2016 for carrying out the works of yard drainage system.

5.2.7 Sewage Disposal System

The Contractor shall provide sewage disposal as per the drawings approved by the Engineer. The Contractor shall follow provisions of "Manual on Sewerage and Sewage Treatment Systems" published by CPHEEO, IS SP-35 "Handbook on Water Supply and Drainage" and NBC 2016 for carrying out and testing the works of sewage disposal system.

5.3 Firefighting System

5.3.1 Handheld Fire Extinguishers

The firefighting extinguishers works shall consist of the following:

i. Distribution or installation of fire extinguisher shall be in accordance with IS 2190 or IS 15683.

ii. Hand appliances shall be installed in easily accessible locations with the brackets fixed to the wall by suitable anchor fasteners by skilled workmen.

iii. Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

iv. The extinguishers shall be treated for anti-corrosion internally and externally and painted with fire red paint. The paint shall be stove enamelled.

v. The description of extinguishers shall be marked with 2.5cm height in block letters within a triangle of 5cm each side.

vi. Fire extinguishers shall be counted in numbers and shall include installation of all necessary items required as given in the specifications.

5.3.2 Clean Agent Extinguisher

i. Clean agent type fire extinguishers i.e. stainless-steel body made shall be placed as per approved drawing.

ii. Clean agent fire extinguishers capacities as per city chief fire officer's recommendations & other suggestions shall be followed as per IS 15683.

iii. Clean agent extinguishers shall cover A, B & C type fire.

5.3.3 Dry Chemical Powder Extinguisher

i. The extinguisher shall be filled with grade 40 Mono Ammonium Phosphate (40%) from any approved manufacturer.

ii. The capacity of the extinguisher when filled with dry chemical powder as first filling as per IS 4308, Part II shall be 5 Kg ±2% or 10 Kg ±3%.

It shall be operated upright with a squeeze grip valve to control discharge. The plunger neck shall have a safety clip fitted with a pin to prevent accidental discharge. It shall be pressurised with dry nitrogen as expellant

and shall be charged at a pressure of 15 Kg/cm^2.

5.3.4 Water Type Extinguisher (Gas Pressure Type)

i. The extinguishing medium shall be primarily water stored under normal pressure, and the discharge shall be by release of carbon dioxide gas from a cylinder.

ii. The capacity of extinguisher when filled up to the indicated level, shall be 9L±5%.

5.3.5 Mechanical Foam Type Fire Extinguisher

Mechanical foam fire extinguisher suitable for Class A and Class B fire shall be used for fire extinguishing. Foam being an effective smothering agent is used for liquid fires mainly. It shall react by flowing over the liquid fuel oil surface and isolating the fire from the air and shall also prevent re-ignition due to the foam stability.

Chapter 6. ROADWORK

6.1 CONTROL OF TRAFFIC

The contractor shall take all necessary precautions in co-ordination with and to the requirements of all the competent authorities concerned to protect the work from damage until such time as the seal coat or surface treatment has developed sufficient strength to carry normal traffic without any damage to it.

The new work shall be opened to traffic only after it is authorised by the Engineer.

The contractor shall submit a detailed traffic diversion/or control and regulation plan taking all safety measures during the course of work permitted by the concerned authorities to the Engineer for his consent before start of work.

The contractor shall take all precautions to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or side tracks are available, traffic shall be temporarily diverted while the work is in progress depending on volume of traffic and subject to approval by Traffic Police. Adequate signs, signals, barriers and lamps for the warning and guidance of traffic shall be provided at all times during the course of the work till it is opened to traffic.

The Contractor shall take all reasonable precautions to protect traffic against accident, damage or disfigurement by construction equipment, tools, and materials, splashes and smirches of bitumen/ bituminous material or any other construction materials and shall be responsible for any claims arising from such damage or disfigurement.

Traffic signs erected shall be in accordance with the IRC Standards and/or as prescribed and approved by the Traffic Police Department.

6.2 GRANULAR SUB-BASE (NON-BITUMINOUS)

This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these specifications or as per MORTH standards. The material shall be laid in one or more layers according to lines, grades and cross-sections shown on the drawings.

6.2.1 Material

The Material to be used for the work shall be natural sand, moorum, gravel, crushed stone, or combination thereof depending upon the grading specified in MORTH specifications for Roads and Bridges. The material shall be free from organic or other deleterious constituents.

6.2.2 Physical requirements

The material shall have a 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS:812 (Part III). The water absorption value of the coarse aggregate shall be determined by IS:2386 (Part 3); if this value is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS:383. CBR Value shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent.

Table 6.2.1: Grading for Close-Graded Granular Sub-base Material

S.N.	IS Sieve Designation	Percentage by weight passing the IS Sieve		
		Grading I	Grading II	Grading III
1	75.0 mm	100	-	-
2	53.0 mm	80-100	100	-
3	26.5 mm	55-90	70-100	100
4	9.5 mm	36-65	50-80	65-95
5	4.75 mm	25-55	40-65	50-80
6	2.36 mm	20-40	30-50	40-65
7	0.425 mm	10-25	15-25	20-35
8	0.075	3-10	3-10	3-10
9	CBR Value (Minimum)	30	25	20

Note- Material passing 0.425 mm sieve for all the three gradings when tested according to IS:2720 (Part 5) shall have liquid limit and plasticity index not more than 25 and 6 percent respectively.

6.2.3 Strength of sub-base

It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished.

6.2.4 Construction Operations

(i) Preparation of sub-grade

Immediately prior to the laying of sub-base, the sub-grade already finished or existing surface shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water if necessary and rolled with two passes of 80 – 100 KN smooth wheeled roller. Damage to the subgrade shall be made good before sub base is laid.

(ii) Spreading and compacting

The approved sub-base material shall be spread on the prepared sub-grade by a grader of suitable type and adequate capacity.

When the sub-base material consists of combination of materials, mixing shall be done mechanically by the mix-in-place method.

The equipment used for mix-in-place construction shall be approved equipment capable of mixing the material to the desired degree.

Moisture contents of the loose material at the time of compaction shall be checked in accordance with IS: 2720 (Part 7) and suitably adjusted.

Rolling procedure shall be as described under relevant Subsection except stated herein.

Rolling shall be continued till the density achieved is at least 98% of the maximum dry density for the material determined as per IS:2720 (Part 8).

6.3 WATER-BOUND MACADAM SUB-BASE/ BASE (NON-BITUMINOUS)

6.3.1 Description

The work shall consist of furnishing, placing, watering and compacting sub-base material mechanically interlocked by rolling and bounded together with screening and/ or binding material to the required degree on a prepared sub-grade/ sub-base or the existing surface as the case may be in accordance with these Specifications, and to the lines, levels, grades, dimensions and cross sections as shown on Drawings and/ or required by the Engineer.

6.3.2 Materials

a) Coarse aggregate

The coarse aggregates shall be hard and durable crushed stones, free from deleterious matter conforming to one of the gradings as set forth in Table 6.3.1, the physical requirements given in Table 6.3.2 subject to the Engineer's consent.

Table 6.3.1 Grading requirements of coarse aggregates

Grading	Size Range	IS Sieve Designation	Percent Passing by weight
1.	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5

Grading	Size Range	IS Sieve Designation	Percent Passing by weight
2.	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3.	53 mm to 22.4 mm	63 mm	100
		53 mm	95-100
		45 mm	65-90
		22.4 mm	0-10
		11.2 mm	0-5

Note: The compacted thickness for a layer with Grade 1 shall be 100 mm while for a layer with Grade 2, it shall be 75 mm.

Table 6.3.2

Physical requirements of coarse aggregates or water-bound macadam sub-base and base courses

S. No.	Test	Test Method	Requirement (Maximum)
1.	* Los Angeles Abrasion value	IS 2386 (Part-4)	50 per cent
2.	* Aggregate Impact value	IS 2386 (Part-4)	40 per cent
3.	Flakiness Index	IS : 2386 (Part-1)	15 per cent

* Aggregate may satisfy requirements of either of the two tests

b) Screenings

Screenings to fill voids in the coarse aggregate shall generally consist of the same material as the coarse aggregate or of gravel (other than round material) or moorum as approved by Engineer. However, where permitted non-plastic material such as moorum may be used for this purpose provided liquid limit and plasticity index of

such material are below 20 and 6 respectively and fraction passing through 75 micron sieve does not exceed 10 percent.

As far as possible screenings shall conform to the gradings set-forth in Table 6.3.3 Screenings of type A shall be used with coarse aggregate of grade I of Table 6.3.1 Screenings of type A or B as specified shall be used with coarse aggregates of grading 2. Type B screenings shall be used with coarse aggregates of grading

TABLE 6.3.3

Grading for Screenings

Grading Classification	Size of Screenings	IS Sieve Designation	Percent by Weight Passing Sieve
A	13.2 mm	13.2 mm	100
		11.2 mm	95 -100
		5.6 mm	15 - 35
		180 micron	0 – 10
B	11.2 mm	11.2 mm	100
		9.5 mm	80-100
		5.6 mm	50 - 70
		180 micron	05 - 25

Binding material

Binding material to be used for water-bound macadam as a filler material meant for preventing ravelling, shall be a suitable material and having a Plasticity Index (PI) value of less than 6 as determined in accordance with IS : 2720 (Part-5).

6.3.3 Construction Method

a) Preparation of Sub-grade/ sub-base

(i) The surface of the sub-grade/ sub-base or existing surface shall be shaped and prepared to the lines, levels, grades, dimensions and cross sections as shown in drawings. Damage to or deterioration of sub-grade/ sub-base shall be made good before sub-base/ base is overlaid.

(ii) Inverted Choke

If water bound macadam is to be laid directly over the sub grade, without any intervening pavement or soling course, a 25 mm course of screenings or coarse sand shall be spread and compacted on the prepared subgrade before application of the coarse aggregate. In case of fine sand or silty or clayey sub grade, a 100 mm insulating layer of screenings or coarse sand shall be laid, the gradation of which will depend on drainage requirements. Alternatively, appropriate geosynthetics performing

functions of separation and drainage layer may be used over the prepared sub-grade subject to the satisfaction of the Engineer.

(b) Spreading coarse aggregates

i. The coarse aggregates of specified size and grading shall be spread uniformly to proper profile in layers with each compacted layer thickness not more than 100mm for Grading 1 and 75 mm for Grading 2 and in a manner that prevents segregation into fine and coarse materials.

ii. Immediately following at spreading of the coarse aggregate, it shall be compacted to the full width by rolling with either the three- wheel- power -roller of 8 to 10 tonnes capacity or an equivalent vibratory roller. Initially, light rolling is to be done, which shall be discontinued when the aggregate is partially compacted with sufficient void space in them to permit application of screenings. The rolling shall begin from the edges and progress gradually towards the centre, only slight sprinkling of water may be done during rolling, if required.

iii. After the coarse aggregate has been lightly rolled to the required true surface, screenings shall be applied gradually over the surface to completely fill the interstices.

iv. The screenings shall be applied at a slow rate (in three or more applications) so as to ensure filling of all voids. Rolling and brooming shall continue with the spreading of the screenings. Damp and wet screenings shall not be used under any circumstances.

v. After spreading the screening and rolling the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screening into the voids and to distribute them evenly. Additional screenings applied where necessary until the coarse aggregates are well bonded and firmly set for the entire depth.

vi. After the application of screenings and rolling, a suitable binding material shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in with brooms so as to fill the voids properly. The surface shall then be rolled by a 8-10 tonne roller.

(c) Tolerance

The finished sub-base/ base at any point shall not vary more than 15mm below and 12mm above the planned grade or adjusted grade with 3m straight edge applied to the surface parallel to the centreline of the road. With the template laid transversely

the maximum permissible variation from specified profile shall be 12mm and 8mm respectively.

The sub-base/ base course completed in each day's work shall have an average thickness not less than the required thickness. Sub-base/ base course which does not conform to the above requirements shall be reworked.

6.4 B ITUMINOUS MATERIALS

6.4.1 Materials

Materials shall meet the requirements of the relevant IS Codes. These shall be of the following types.

a) Cut back Bitumen

Cut back bitumen shall be Rapid Curing (RC), Medium Curing (MC) or Slow Curing (SC) conforming to IS : 217.

b) Cationic Emulsion

Bitumen emulsions of the cationic type for roads shall conform to IS: 8887. Emulsified bitumen shall be Rapid Setting (RS), Medium Setting (MS), or Slow Setting (SS).

The physical and chemical requirements of the three types emulsions shall comply with the requirements specified in Table 1 of IS: 8887.

c) Paving Bitumen

Paving bitumen shall be conforming to IS: 73 and of the following two types:

Type 1 Paving bitumen from non-waxy crude shall satisfy the requirements given in Table 1 of IS: 73.

Type 2 Paving bitumen from waxy crude shall satisfy the requirements given in Table 2 of IS: 73.

The temperature at application of bituminous materials shall be maintained as per manufacturer's instructions and/or as directed by the Engineer's Representative.

An anti-stripping and bonding agent should be used in all final restoration road works. It should confirm to IS: 14982-2001 Specifications. The percentage can be from 0.5% to 1.25% by weight of bitumen content. The optimum dose can be ascertained using M.O.S.T. / BIS guidelines.;

6.4.2 Methods of Storage and Handling

Asphaltic material shall be handled and stored with due regard for safety and in such a way that at the time of use in the work the material conforms to the Specifications. Following precautions shall be taken while using these materials:

a) Work with these materials shall be carried out in good weather conditions and it shall be carried out in warm and dry weather, and not in wet or extremely cold weather.

b) Emulsified asphalt shall be handled with care and not subjected to mechanical shocks or extremes of temperature likely to cause separation of the asphalt. Emulsified asphalt showing sign of separation shall not be used.

c) During heating, no water or moisture shall be allowed to enter the boiler.

d) Heating of bitumen shall be done to the correct temperature range, as prescribed by the manufacturer for the grade used. The temperature shall be controlled with the use of a suitable thermometer, and the material shall be drawn and used while still at such temperature as is prescribed by manufacturer or in accordance with MOST specifications.

e) It shall be ensured that mixing of ingredients is through and all particles of aggregates are coated uniformly and fully.

6.5 TACK COAT

6.5.1 Description

This work shall consist of furnishing and applying bituminous material to a new WBM surface or to an existing road surface before laying another premix carpet layer over it.

6.5.2 Materials

Bitumen: This shall be straight-run bitumen of grade VG- 10 conforming to IS 73 specifications

(a) 0.75 kg/sqm on W.B.M./ W.M.M. Surface

(b) 0.50 kg/sqm on bitumen surface

6.5.3 Construction Methods

a) Cleaning Surface

Prior to the application of bitumen, all vegetation, loose sealing compound, caked mud, dust, dirt and foreign material shall be removed from the entire surface of the pavement by means of mechanical sweepers and blowers,

otherwise with steel wire brushes, small picks, brooms or other implements as approved by the Engineer-in-Charge.

b) Weather Limitation

The tack coat shall not be applied nor any bitumen work done during rainy weather or when the surface is damp or wet or when the atmospheric temperature in the shade is not more than 16o C.

c) Application of tack coat material

Bitumen shall be heated in a boiler to a temperature of 165 deg. C to 175 deg. C and maintained at that temperature.

Hot bitumen shall be applied evenly to the clean, dry surface by means of a pressure sprayer at specified rate. Even and uniform distribution of bitumen shall be ensured. Bitumen shall be applied longitudinally along the length of the pavement.

6.6 B ITUMINOUS MACADAM

6.6.1 Description

The work shall consist of one or more applications of compacted crushed aggregates premixed with bituminous binder (suitable grade) to a primed non-bituminous surface or previously constructed bituminous surface and in conformity with the lines, grades, dimensions and cross-sections shown on the Drawings This shall comprise of a single course of 50mm to 75mm thickness as specified in the approve or as Directed by Engineer.

6.6.2 Materials

a) Bitumen

The bitumen shall be paving bitumen of suitable grade approved by the Engineer and conforming to IS: 73.

b) Additives

Adhesion and Ant-stripping agent shall be added to the bitumen subject to Engineer's consent at the required percentage of additive. The additive shall be thoroughly mixed with the bituminous material in accordance with the manufacturer's instructions.

c) Aggregates

Aggregates shall consist of clean and hard crushed stone free from dust, clay, dirt and any other deleterious matter. The physical requirements shall be as given in Table 6.6.1.

Aggregates shall conform to one of the two gradings given in Table 6.6.2 depending on the compacted thickness; the actual grading shall have the consent

of the Engineer.

Table 6.6.1

Physical requirements of aggregates for bituminous macadam

S.No	Test	Test Method	Requirement (maximum)
1.	* Los Angeles Abrasion value	IS :2386 (Part-4)	40 per cent
2.	* Aggregate Impact value	IS :2386 (Part-4)	30 per cent
3.	Flakiness and Elongation Index Indices (Total)	IS : 2386(Part-1)	30 per cent
4.	Coating and Stripping of Bitumen aggregate mixtures	AASH T-182 TO	Minimum retained coating 95%
5.	Soundness : (i) Loss with Sodium Sulphate 5 cycles (ii) Loss with Magnesium Sulphate 5 cycles		12 percent 18 percent
6.	Water absorption	IS : 2386(Part-3)	2 per cent

* Aggregates may satisfy requirements for either of the two tests.

Table 6.6.2

Aggregate grading for bituminous macadam

IS Sieve Designation	Per cent by weight passing the sieve	
	Grading 1	Grading 2
45.0mm	100	-
26.5mm	75-100	100
22.4mm	60-95	75-100
11.2mm	30-55	50-85

IS Sieve Designation	**Per cent by weight passing the sieve**	
	Grading 1	**Grading 2**
5.6mm	15-35	20-40
2.8mm	5-20	5-20
90.0 micron		

Bitumen content for pre mixing shall be 4% by weight of total mix unless otherwise approved by Engineer.

6.6.3 Construction Methods

a) Weather and Control of Work

The work of laying shall not be undertaken during rainy or foggy weather or when the base course is damp or wet, or during dust storm or when the atmospheric temperature in shade is 15 degree C or less.

The Engineer may order work to cease temporarily on account of adverse weather, unsatisfactory condition of materials, equipment or any conditions which he considers may affect the work adversely.

b) Cleaning and Preparation of Surface

Prior to the application of binder, loose dirt and other objectionable material shall be removed from the surface to be treated by means of the power broom or blower or both. If this does not provide a uniformly clean surface, additional sweeping shall be done by hand, using stiff brushes or similar brooms. The areas inaccessible to the cleaning means shall be cleaned manually. The sweeping shall extend 200mm beyond each edge of the area to be treated.

Adherent patches of objectionable material shall be removed from the surface by steel scraper or other approved method and where the Engineer so directs the scraped area shall be washed down with water and hand brooms.

No application of bituminous material shall be undertaken until the surface has been cleaned to the satisfaction of the Engineer.

Before application of the bituminous material any necessary preliminary patching of the surface of the road (To fill in potholes.) shall be done to the complete satisfaction of the Engineer.

Tack coat shall be applied in accordance with these Specifications. Prime coat if required, shall conform to Subsection 6.5.

c) Plant and Equipment

All plant used by the Contractor for the preparation, hauling and placing of

asphalt mixtures shall be subject to the consent of the Engineer and shall minimise smock, dust and noxious emission and odours. These shall generally meet the following requirements:

i. The mixing plant shall be a batching plant and shall have adequate capacity sufficient to supply the finisher on the road continuously when spreading the asphaltic mix at normal speed and required thickness.

ii. Scale for any weigh box shall be designed to be accurate to within 1% of the maximum load required and shall be fully automatically controlled.

iii. The Contractor shall provide and have at hand not less than ten 25 kilograms weights for frequent testing of all scales.

iv. Weigh box or hopper shall include a means for accurately weighing each bin size of aggregate in a weight box or hopper, suspended on scales, ample in size to hold a full batch without running over.

v. The asphaltic materials shall be stored in storage tanks designed to keep the temperature of the asphaltic material at maximum temperature of 110 degree C. The properties of the asphaltic material kept in that storage tanks shall be in good condition before mixing.

vi. The plant shall be provided with a circulating system to ensure continuous circulation between the storage tank and the mixer.

vii. The plant shall be provided with a cold bin for feeding the aggregates. Bin shall have a calibration gate and a mechanical means to insure uniform feeding of the aggregates into the drier as required by the Engineer.

viii. The rotary drier shall be capable of drying and heating the aggregates to the specified temperature.

ix. The plant shall be provided with plant screens capable of screening all aggregates to the specified sizes.

x. The plant shall include at least 3 hot bins for storing the aggregates fed from the drier after passing through the screen. Each bin shall be provided with an overflow pipe to prevent any backing up of material into other bins.

xi. The plant shall be provided with asphaltic control unit by weighing to obtain the proper amount of asphaltic material in the mix within the tolerance specified for the job-mix.

xii. The batch mixer shall be an approved twin pugmill type and capable of producing a continuous uniform mixture within the job-mix tolerances.

The mixer capacity shall not be less than 1000 kilogram batch.

xiii. An armoured thermometer reading from 50 degree C to 200 degree C shall be fixed in the asphaltic feed line at a suitable location near the discharge valve at the mixer unit.

xiv. The plant shall be further equipped with an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.

xv. The plant shall be equipped with a dust collector.

xvi. The plant shall be equipped with accurate positive means to govern the time of mixing and to maintain it constant. The time of mixing shall be divided into two steps, dry mixing and wet mixing. For dry mixing, the aggregate from hot bins shall be mixed for a period of 5-15 seconds. For wet mixing, the mixing time shall begin with the start of the asphalt spray after dry mixing. The wet mixing shall take about 30-45 seconds. The mixing time shall be extended if in the consideration of the Engineer the material obtained is not homogeneous.

d) Equipment for Hauling and placing

i. Trucks for hauling asphaltic mixtures shall have tight, clean, and smooth metal beds that have been sprayed with soapy water, thinned fuel oil, or lime solution to prevent the mixing from adhering to the beds (The amount of sprayed fluid shall however be kept to the practical minimum. Each load shall be covered with a canvas or other suitable material of such size as to protect the mixture from the weather). Any truck causing excessive segregation of material by its spring suspension or other contributing factors, or that shows oil leaks in detrimental amounts, or that causes undue delays, shall upon direction of the Engineer be removed from the work until such conditions are corrected.

ii. The equipment for spreading and finishing shall be mechanical, self powered pavers, capable of spreading and finishing the mixture true to the lines, grades, dimensions and cross sections.

The pavers shall be equipped with hoppers and distributing screws of the reversing type to place the mixture evenly.

The pavers shall maintain trueness of grade and confine the edges of the pavement to true lines without the use of stationary side forms. The equipment shall include blending or joint levelling devices for smoothing and adjusting longitudinal joints between lanes. The assembly shall be adjustable to give the cross-section shape

prescribed and shall be so designed and operated as to place the thickness or weight per square metre of material required.

Pavers shall be equipped with activated screeds and devices for heating the screeds to the temperature required for the laying of the mixture without pulling or marring.

The term "screed" includes any cutting, crowing, or other practical action that is effective in producing a finished surface of the evenness and texture specified, without tearing, shoving, or gouging.

If, during construction, it is found that the spreading and finishing equipment in operation leaves in the pavement surface tracks or indented areas or other objectionable irregularities, the use of such equipment shall be discontinued and other satisfactory spreading and finishing shall be provided by the Contractor forthwith.

e) Preparation and transport of mix

Bituminous macadam mix shall be prepared in a hot-mix plant either owned by the Contractor or it may be taken from an approved hot mix plant before supply of mix for the work, consent for the use of the mix shall be taken from the Engineer. The hot-mix plant should be of adequate capacity of batch mix type with the features as described under Subsection 6.7.3 or otherwise approved by Engineer unless some work specific features are required and capable of yielding a mix of proper and uniform quality with thoroughly coated aggregates. The plant shall meet the overall requirements through stringent quality control practices.

The mineral aggregates shall be dried and heated to a temperature between 150 degree C and 163 degree C

The contractor shall submit for consent the exact temperature to the Engineer. Surfaces of aggregates shall be clean and free of carbon and unburnt fuel oil. The aggregates, immediately after heating, shall be screened into three or more fractions and conveyed into separate bins ready for combining and mixing with asphaltic material.

The dried mineral aggregates prepared as prescribed above, shall be combined in the plant in the amount of each fraction of aggregate required to meet the job-mix formula for the particular mixture. The proper amount of asphaltic material shall be distributed over the mineral aggregate and the whole thoroughly mixed for a period of at least 30 seconds, or longer if necessary to produce a homogeneous mixture in which all particles of the mineral aggregates are coated uniformly. The total mixing time shall be regulated by a suitable locking means.

The mixture shall when emptied from the mixer be at a temperature between 150degree C and 163degree C even for tolerances.

The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Subsection 6.7.3 unless otherwise approved by the Engineer.

f) Application of the Pre-mix

The application of the mix shall proceed immediately after application of tack coat. The mix shall be spread immediately by means of self-propelled mechanical paver with suitable screeds capable of spreading, tamping, and finishing the mix true to lines, levels, dimensions and cross-sections specified. Any bare or insufficiently filled areas shall be re-treated by the mechanical spreader or covered by hand as necessary to give uniform and complete coverage. Any aggregate spread in excess of the agreed rate shall be scattered and evenly distributed on the road or otherwise removed and stockpiled.

The temperature of the mix at the time of laying shall be in the range of 120 or 160degree C.

g) Rolling

After the spreading of the mix, the rolling shall be done by road roller of suitable type and capacity. Rolling shall start as soon as possible after the material has been spread and it shall be completed within limited time frame, and to meet this, the Contractor shall deploy a set of rollers. Rolling shall be done with care to avoid unduly roughening of the pavement surface. It shall commence at the edges and progress towards the centre longitudinally except that on super-elevated and unidirectional cambered portions, it shall progress from the lower to the upper edge parallel to the centre line of the pavement.

The speed of the rollers shall not exceed 5 kilometre per hour for steel wheeled rollers and 7 kilometre per hour for pneumatic tired rollers and shall be at all times slow enough to avoid displacement of the hot mixture. Any displacements occurring as a result of reversing the direction of the roller or from any other cause shall at once be corrected with rakes and fresh mixture where required. Care shall be exercised in rolling not to displace the line and grade of the edges.

Rolling shall progress continuously as may be necessary to obtain uniform compaction while the mixture is in a workable condition and until all roller marks are eliminated.

Heavy equipment or rollers shall not be permitted to stand on the finished surface until it has thoroughly cooled or set.

Any petroleum products dropped or spilled from the vehicles or equipment employed by the Contractor upon any portion of the pavement under construction is cause for the removal and replacement of the contaminated pavement by the Contractor.

When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding premixed material. Rolling shall then be continued until the entire surface has been rolled to 95 % of the average laboratory density, and there is no crushing of aggregates. and all roller marks are eliminated. In each pass of the roller, preceding track shall be overlapped uniformly by at least 1/3rd width. The roller wheels shall be kept damp to prevent premix from adhering to the wheels and being picked up. In no case shall fuel/ lubricating oil be used for this purpose.

Along kerbs, man-holes etc., and at any other locations where proper consolidation by rollers is not practicable, alternative means such as steel rammers shall simultaneously be used to secure adequate consolidation.

6.6.4 Surface Control

a) Surface Regularity

Maximum permissible undulation in longitudinal profile with 3m straight edge shall be as 12mm.

Maximum permissible variation from specified cross profile under camber template shall be as 8mm.

Surface evenness requirements in respect of both longitudinal and cross profiles should be simultaneously satisfied.

Tests for conformity with the specified crown and grade shall be made immediately after initial compaction, and variations shall be corrected by removing or adding materials as may be necessary. Rolling shall then be continued as specified. After final rolling, the smoothness of the course shall be checked again and any irregularity of the surface exceeding the permissible limits corrected as agreed by the Engineer's Representative, including removal and replacement.

b) Surface Finish

The bituminous macadam shall be covered with either the next pavement course or wearing course, as the case may be, without any delay. If there is to be any delay, the course shall be covered with the seal coat. The seal coat in such cases shall be considered incidental to the work and shall not be paid separately.

6.7 PPE-MIX CARPET

6.7.1 Description

This work consists of applying a tack coat on the prepared base followed immediately by spreading aggregates pre-coated with specified binder to camber and

consolidated. The consolidated thickness of this type of treatment shall be 2 cm or 2.5 cm as specified.

Premix carpet shall not be laid during rainy weather or when the base course is damp or wet or, when the atmospheric temperature in the shade is not more than 16^0 C.

6.7.2 Materials

a) Binder

Binder shall be bitumen paving asphalt grade VG-10/VG-30 of suitable grade meeting the requirements of the work and other environmental conditions. This shall be conforming to the requirements of IS : 73.

b) Coarse aggregates

Coarse aggregates consist of crushed stones and shall be clean, strong, durable, and free from organic or other deleterious materials. The aggregates shall be hydrophobic and of low porosity.

The aggregates shall meet the requirements given in Table 6.7.1 except that the water absorption shall be limited to 1 per cent. The Stone Polishing Value as measured by BS : 812-(Part-114) shall not be less than 55.

c) Proportioning of Materials

They shall comprise of a mix of stone chipping 13.2mm size (passing 22.4 mm sieve and retained on 11.2 mm size) and 11.2 mm size (passing 13.2 mm sieve and retained on 5.6 mm sieve.) The contractor shall propose material proportions to the Engineer for his consent.

6.7.3 Construction Methods

a) Tack Coat

This shall be applied as per Subsection 6.5.

b) Preparation and transport of Premix

The binder shall be heated to a temperature appropriate to the grade of bitumen in boilers of suitable design avoiding local overheating and ensuring a continuous supply.

The aggregates shall be dry and suitably pre-heated to the required temperature before they are placed in a mixer. After about 15 seconds of dry mixing, the heated binder shall be distributed over the aggregates at the rate specified. Mixing shall be continuous and thorough to ensure a homogeneous mixture in which all particles are coated uniformly and the discharge temperature shall be within the specified range.

The mixing of binder with chippings shall be continued until the chippings are thoroughly coated with binder. The mix shall be discharged and immediately transported from mixer to the point of use in suitable vehicles or wheel barrows. The vehicles employed for transport shall be clean and the mix being transported

should be covered in transit and protected from any kind of damage.

c) Spreading and Rolling
Immediately after the application of tack coat, premixed material shall be spread by means of mechanical paver finisher truly to lines, levels, dimensions and cross section as specified. The areas not covered by the mechanical means shall be treated with manual means for which the Engineer has given his consent.

d) Rolling
This shall be carried out as per Subsection 6.6.3

6.8 BITUMINOUS CONCRETE

6.8.1 Description

This work shall consist of a surfacing of single-layer bituminous concrete of specified thickness on previously prepared bituminous surface to the lines, grades, dimensions and cross section as shown on Drawings. It shall be 25mm/40mm thick as required by Engineer.

6.8.2 Materials

a) Bitumen
The bitumen shall be paving bitumen of suitable penetration grade within the range S 35 to S 90 or A 90 to IS: 73. The actual grade of bitumen to be used shall be appropriate to the requirements of the work and environmental conditions.

b) Coarse aggregates
The aggregates shall satisfy the physical requirements given in Table 6.7.1. Flakiness index shall not exceed 30% and water absorbed not more than 1%

c) Fine aggregates
Fine aggregates shall be the fraction passing 2.36 mm sieve and retained on 75 micron sieve, consisting of crushed run screenings, natural sand or a mixture of both. These shall be clean, hard, durable, uncoated, dry and free from any injurious, soft or flaky pieces and organic or other deleterious substances.

d) Filler
Filter shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement. The filter shall be graded within following limits:

IS Sieve	Per cent passing by weight
600 micron	100
300 micron	95 – 100
75 micron	85 – 100

The filter shall be free from organic impurities and have a Plasticity Index not greater than 4. The Plasticity Index requirement shall not apply if filter is cement or lime. When coarse aggregate is gravel, 2 per cent of mass of total aggregate of Portland cement or hydrated lime shall be added and percentage of fine aggregate reduced accordingly. Cement or lime is not required when the gravel is lime stone.

e) Aggregate gradation

Mineral aggregates, including filler shall be so graded or combined as to conform to gradings set forth in Table 6.8.1 below.

Table 6.8.1

Sieve Designation	**Per cent by weight passing through sieve for**		
	25mm thick Grade 1	**25-40mm thick Grade 2**	**>40mm thick Grade 1**
26.5mm	--	--	100
22.4mm	--	100	75-100
13.2mm	100	80-100	--
11.2mm	90-100	75-95	50-85
5.6mm	60-80	55-75	20-40
2.8mm	40-55	40-55	5-20
710micron	20-30	20-30	--
300micron	15-25	15-25	--
180micron	10-20	10-20	--
90micron	5-11	5-11	0-5

6.8.3 Mix Design

a) Requirement of Mix

Apart from conformity with grading and quality requirements of individual ingredients, the mix shall also meet the requirements set forth in Table 6.8.2.

Table 6.8.2

Requirements of Bituminous Concrete Mix

S.NO	Description	Requirements
1.	Marshall stability (ASTM Designation: D-1559) determined on Marshall specimens compacted by 75 compaction blows on each end	820 Kg (1800 pounds)
2.	Marshall flow (mm)	Minimum 2-4
3.	Per cent air voids in mix	3-5
4.	Per cent voids in mineral aggregate (VMA)	Minimum 11-13
5.	Percent voids in mineral aggregates filled by bitumen (VFB)	65-75
6.	Binder content, per cent by weight of mix	Minimum 4.5
7.	Water sensitivity (ASTM : D-1075) loss of Stability on immersion in water at 60 deg. C	Minimum 75% Retained strength
	Swell Test (Asphalt Instt. MS-2, No. 2)	Maximum 1.5%

b) Binder content

Binder content shall be so determined as to achieve the requirements of the mix set forth in Table 6.8.2. Marshall method for arriving at binder content shall be adopted.

c) Job Mix Formula

Before starting work the Contractor shall submit to the Engineer for his consent. The job mix formula for the mixture shall fix a single percentage of aggregate passing each required sieve size, a single percentage of asphalt to be added to the aggregate, and a single temperature at which the mixture is to be delivered on the road, all of which shall fall within the ranges of the composition and the temperature limits. The formula shall give the following details:

I. Source and location of all materials

II. Proportions of all materials as described under :

III. Binder- as percentage by weight of total mix Coarse aggregate/Fine aggregate/ Mineral Filler- as percentage by weight of total aggregate including Mineral Filler

IV. A single definite percentage passing each sieve for the mixed

aggregate (Vide Table 6.8.1)

V. The results of test as per specifications obtained by the contractor

VI. Test results of physical characteristics of aggregates to be used

VII. Mixing temperature and compacting temperature

d) Application of job-mix formula and Allowable Tolerances

The approved job mix formula shall remain effective unless and until modified. Each day as many samples of the materials and mixtures shall be taken and tested considers necessary for checking the required uniformity of the mixture. All mixture furnished shall conform to the job-mix formula within the range of tolerances set in forth in Table 6.8.3.

Table 6.8.3

Permissible variations from the job-mix formula

S. No	Description of Ingredients	Permissible Variation by Weight of Total mix in Percentage
1	Aggregate passing 13.2mm sieve and larger	± 8
2	Aggregate passing 9.5mm sieve and 4.75mm sieve	± 7
3	Aggregate passing 2.36mm sieve & 1.18mm sieve	± 6
4	Aggregate passing 600 micron sieve & 300 micron sieve	± 5
5	Aggregate passing 150 micron sieve	± 4
6	Aggregate passing 75 micron sieve	± 3
7	Binder	± 0.3
8	Mixing Temperature (Centigrade)	± 10

When unsatisfactory results or changed conditions make it necessary, a new job mix shall be submitted to the Engineer.

Should a change in a material be encountered or should a change in a source of material be made, a new job mix formula shall be submitted before the mixture containing the new material is delivered.

6.8.4 Construction Methods

a) Weather Limitation
The control over the weather conditions shall be as described under Subsection 6.5.3 above.

b) Progress of Work
No work shall be performed when there is insufficient hauling, spreading or finishing equipment, or labour to ensure progress at a rate not less than 75% of the capacity of the mixing plant.

c) Preparation of Existing Surface
The surface on which the mix is to be laid shall be swept thoroughly and cleaned of all loose dirt and other objectionable material using mechanical broom immediately before start of work. In portions where mechanical means cannot reach, the surface shall be prepared, shaped and conditioned to specified levels, grade and cross-fall (camber).

d) Preparation of Mix
A Hot-mix plant of adequate capacity and capable of producing a proper and uniform quality mix shall be used for preparing the mix. The plant may be either a weigh batch type or volumetric proportioning continuous or drum mix type. The plant shall have co-ordinated set of essential units capable of producing uniform mix as per the job-mix formula. The temperature of the binder at the time of mixing shall be in the range of 150 to 163 degree C and of aggregates in the range of 155 to 163 degree C, provided also that at no time shall the difference in temperature between the aggregates and binder exceed 14 degree C. The Contractor shall submit the exact temperatures and total mixing time for the consent of the Engineer. Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particle of mineral aggregates are coated uniformly.

e) Transportation and Delivery of Mix.
The mix shall be transported from the mixing plant to the point of use in suitable tipper vehicles. The vehicles employed for the transport shall be clean and be covered in transit.

f) Spreading and Finishing
The mix transported from the hot mix plant to the site and shall be spread by means of a self- propelled mechanical paver with suitable screeds capable of spreading, tamping and finishing the mix to specified grade, elevation, and cross-section. However, in restricted locations and narrow widths, where available equipment cannot be operated, other suitable means shall be employed subject to the consent of the Engineer. The mixture shall be laid upon an approved surface and only when weather conditions are considered suitable. The

temperature of the mix, at the time of laying, shall be in the range of 120 degree C to 160 degree C.

The prime coat and tack coat to be applied shall be as per Subsections 6.4 and 6.5 respectively.

Spreading, finishing and compacting of the mix shall be carried out during daylight hours only, unless satisfactory illumination is provided by the Contractor.

g) Compaction of Mixture

Immediately after spreading of mix by paver, it shall be thoroughly and uniformly compacted by rolling with a set of self-propelled rollers moving at a speed not more than 5 km per hour, immediately following close to the paver. Generally with each paver, two steel wheeled tandem rollers and one pneumatic tired roller will be required. The initial or breakdown rolling shall be with 8 to 10 ton static weight smooth three wheeled steel roller and finish rolling with 6 to 8 ton tandem roller. The breakdown rolling shall preferably be followed by an intermediate rolling with a smooth wheel pneumatic roller of 10 to 25 ton having a tire pressure of 7kg/sqcm moving with a speed not more than 7 km per hour and shall be at all times slow enough to avoid displacement of the hot mixture. Means shall be provided for checking and adjusting the tire pressure on the job at all times. All compaction operations, i.e., breakdown rolling can be accomplished by using vibratory roller of 8 to 10 ton static weight. During initial or breakdown rolling and finished rolling, the vibratory shall be switched off. The joints and edges shall be rolled with a 8 to 10 ton three wheeled static roller.

No delays in rolling the paved surface shall be tolerated, the breakdown roller must be right up to the paver at all times and the intermediate pneumatic roller right up to the breakdown roller. The compaction of the asphaltic concrete shall be controlled by temperature as follows:

Roller	Temperature
Breakdown	120˚C - 135˚C
Pneumatic	95˚C - 115˚C
Finishing	< 65˚C

Rolling procedure shall be as specified under Subsection 6.6.3

Rolling shall be continued till the density achieved is at least 98% of that of laboratory Marshall specimen. Rolling operations shall be completed in all respects before the temperature of the mix falls below 100 degree C.

h) Joints

Both longitudinal and lateral joints in successive courses shall be staggered so as not to be one above the other. Longitudinal joints and edges shall be

constructed true to delineating lines parallel to the centre line of the road. Longitudinal joints shall be offset by at least 150mm from those in the lower course.

Longitudinal and transverse joints shall be made in a careful manner so that well bonded and sealed joints are provided for the full depth of the course.

i) Surface regularity

Surface shall be tested for undulations in longitudinal and cross profiles with 3 m straight edge and crown template respectively. Crown template shall conform to the typical cross section.

Maximum permissible undulation in longitudinal profile with 3m straight edge shall be as 8mm.

Maximum permissible variation from specified cross profile under camber template shall be as 4mm.

Surface evenness requirements in respect of both longitudinal and cross profiles should be simultaneously satisfied.

j) Protection of the pavement from traffic

Subsection 6.1 shall apply except as stated below.

Section of the newly finished works shall be protected from traffic of any kind until the mixture

has cooled to approximately ambient air temperature and well set.

6.9 SEAL COAT

6.9.1 Description

This work shall consist of application of a seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade, and cross fall. Seal coat used shall be of premix type unless otherwise approved by the Engineer.

6.9.2 Materials

a) Binder

The binder shall be bitumen of a suitable grade appropriate to the requirements of the work and other environmental conditions as directed by the Engineer and satisfying the requirements of IS : 73, 217, 454 or other cut back as applicable.

b) Aggregates

The aggregates shall be sand or grit and shall consist of clean, hard, durable, dry particles and shall be free from dust, soft or flaky/ elongated material, organic matter or other deleterious substances. The aggregates shall pass 2.36mm sieve and be retained on 180 micron sieve. The quantity used for premixing shall be 0.06 cum per 10 sq m area.

6.9.3 Construction Methods

a) Preparation of base

The seal coat shall be applied immediately after laying of bituminous course which is required to be sealed. Before application of seal coat materials, the surface shall be cleaned free of any dust or other objectionable matter.

b) Preparation and Application of Mix

Mixtures of approved type shall be employed for mixing aggregates with suitable bituminous binder.

The binder shall be heated in boilers of suitable design, to a temperature appropriate to the grade of bitumen. The aggregates shall be clean, dry and suitably heated to a temperature before the same are placed in the mixture. Mixing of binder with aggregates to specified proportions shall be continued till the latter are thoroughly coated with the former.

The mix shall be immediately transported from the mixing plant to the point of use and spread uniformly on the bituminous surface to be sealed.

c) Rolling

As soon as sufficient length has been covered with pre-mixed material, the surface shall be rolled with 8-10 ton smooth wheeled steel, suitable vibratory or other equipment.

As regards procedure for rolling it shall be as specified under Subsection 6.7.3.

d) Control of Traffic Subsection 6.1 shall apply.

6.10 C EMENT CONCRETE PAVEMENTS

6.10.1 General

This work shall consist of constructing Plain/ or Reinforced Cement Concrete Pavements as required in accordance with these Specification and in conformity with the lines, levels, grades and dimension in accordance with the design.

6.10.2 Materials

a) General

The concrete materials viz. cement, aggregates, water, steel reinforcement, admixtures shall be in accordance with Annexure OCS -1 (Concrete: Plain and Reinforced) except as specified herein.

b) Dowel and Tie bars

Dowel bars shall be plain round bars. They shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the Works, one half of the length of each dowel bar shall be painted with one coat of bituminous material.

Tie bars shall be deformed bars free from oil, dirt, loose rust and scale.

These shall conform to the requirements of IS : 432, IS : 1139 and IS : 1786 as relevant.

c) Sleeves

The sleeves for dowel bars of expansion joints shall be of plastic material. This shall be designed to cover the dowels specified by the Designer, with a closed end, and with a suitable stop to hold the end of the sleeve a distance equal to the thickness of joint filler or at least 30mm from the end of the dowel bar. These shall be of such design that they do not deflect or collapse during construction, and the arrangement of sleeves shall be in accordance with these Specifications.

d) Waterproof Membrane

Where Waterproof membrane is to be provided, it shall be an impermeable polythene plastic sheeting. Where an overlap of underlay material is necessary this shall be at least 300mm. Water shall not be allowed to pond on the membrane which shall be completely dry when the concrete is laid.

e) Jointing Materials

i. Joint Filler

The expansion joint fillers shall conform to the requirements of IS: 1838. They shall be punched to admit the dowels where called for as specified by the Designer. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened closely together securely and accurately to shape by stapling or other satisfactory positive fastening.

ii. Joint Primer

Joint primer shall be fully compatible with the joint sealant and shall be applied strictly in accordance with the manufacturer's instructions.

iii. Joint Sealing Compound

The Sealing Compound of hot poured, elastomeric type shall conform to AASHTO M282 and cold applied sealant shall be in accordance with BS 5212 (Part 2).

6.10.3 Equipment and Tools

a) General

The concrete paving shall be carried out by use of mechanised method. Equipment and tools necessary for handling materials and performing the work shall have the consent of the Engineer as to design, type, capacity and mechanical, condition shall be at the site of the work before work is started. In special cases like a very short length of road to be laid at a location, other methods may be approved by Engineer.

b) Batching and Mixing Plant

This shall be of suitable type, capacity and make meeting the requirements of work.

i. Paving Equipment

The concrete shall be placed with an approved fixed form or slip form paver with independent units designed to (i) spread, (ii)consolidate, screed and float finish, (iii)texture and cure the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary and so as to provide a dense and homogeneous pavement in conformity with the plans and Specifications.

Vibrators for full width vibration of concrete paving slabs may be either the surface pan type or the internal type. They may be attached to the spread finisher. They shall not come in contact with the joint, sub base or side forms.

The frequency of the surface vibrators shall not be less than 3500 impulses per minute and for the internal type not less than 5000 impulses per minute. The variable vibration setting shall be provided in the machine.

At least two spare vibrators and one generating unit shall be on hand in case of any breakdown of the vibrating equipment being used.

ii. Concrete Saw for joint cutting

The mechanical saw for cutting concrete shall be adequately powered to cut rapidly with a water-cooled diamond edge saw blade to the depth required. A water tank with flexible hoses and pump shall be made available in this activity on priority basis. The Contractor shall have at least one standby saw in good working condition.

iii. Forms

Straight side forms shall be metal forms having a thickness of at least 5mm and have a depth equal to the prescribed edge thickness of the pavement slab. Curved forms shall be of the radius called for as specified by the Designer and acceptable flexible forms shall be installed with that radius. Built-up forms with horizontal joints shall not be used. Forms shall be free from kinks, bend or wraps. Forms shall not deflect more than 6 mm when tested as a simple beam with a span of three metres under a load equal to that which the finishers or other construction equipment will exert on them. The top of the form shall not vary from a three metre straight edge by more than 3mm at any point and the side by more than 6mm at any point. The forms shall contain provision for locking together tightly the ends of abutting from sections and for secure setting.

iv. Curing Compounds

The curing compounds shall have a water retention efficiency index of 90% in accordance with BS 7542.

6.10.4 Construction Methods

a) Preparation of Sub-base

The sub-base, which shall generally be of water-bound macadam (WBM) conforming to Subsection 6.3.3. The sub base shall be wetted adequately or provided with a water proof membrane so that it dose not absorb any water from the concrete to be laid over it. Concrete shall not be placed on any portion of the sub-base until the consent of the Engineer is given.

b) Setting Forms

The sub-base under the forms shall be compacted and cut to grade so that forms, when set to the position are within + 3mm of a straight line formed by the top of the forms. If the sub-base is found to be below the required grade at the form line, the grade line shall be lifted by placing lean concrete mix 1:4:8 beneath the form and

setting the form when it is set. Imperfections and variations above grade shall be corrected by tamping or cutting to the degree required.

The alignment and grade elevations of the forms shall be checked and the necessary corrections made by the Contractor immediately before and after placing the concrete. When any form has been disturbed or any roadbed has become unstable, the form shall be reset and rechecked.

On final setting of the forms, these shall be checked for at least half the length of pavement to be concreted in a particular day before concreting commences on that day. While concreting long lengths, the setting up of forms to the exact grade and alignment shall be in advance of the concreting operation by at least 60 m.

Forms shall be cleaned and oiled prior to the placing of concrete. The forms shall be removed not earlier than 24 hours after the concrete has been laid.

c) Preparation of Concrete

i. Trial Mix / Mix Design Subsection 6.2.1 shall be followed Minimum grade of concrete to be used is M25.

ii. Batching, Mixing and Transporting Materials Subsection 6.2.4 shall apply. The Ready-Mixed Concrete (RMC) shall conform to Subsection Annexure OCS-1.

d) Placing Concrete

Concrete shall be placed only on a prepared sub-base as specified in Subsection 6.3.3. No concrete shall be placed around structures until they have been brought to the required grade and alignment nor until expansion joint material has been placed around them.

The concrete shall be spread, compacted and finished by a mechanical paver and in accordance with Subsection 6.10.3. The mixing and placing of concrete shall progress only at such a rate as to permit proper finishing, protecting and curing of the pavement.

The truck mixers, truck agitators and other approved hauling equipment shall be equipped with means for discharge of concrete into the hopper of the paver without segregation of the materials. In all cases, the temperature of the concrete shall be measured at the point of discharge from the delivery vehicle.

The acceptance criteria regarding level, thickness, surface regularity, texture, finish, strength of concrete and all other quality control measures for hand laid concrete shall be the same as in the case of machine laid work.

The concrete shall be thoroughly consolidated against and along the faces of all forms

by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the sub-base or a side form. In no case shall the vibrator be operated longer than 30 seconds in any location. The vibrator shall be inserted in the concrete and worked along the full length and both sides of a joint.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket on to a joint assembly.

Except at construction joints, concrete shall be shovelled against both sides of the joint simultaneously, maintaining equal pressure on both sides. It shall be deposited to a height of approximately 5 cm more than the depth of the joint, and shall be vibrated so that all honeycombing and voids are prevented. The vibrator shall be inserted in the concrete and worked along the full length and both sides of the joints.

e) Initial strike-off and Placement of Reinforcement

Where the concrete is laid in two layers, the bottom layer of concrete shall be struck off for the full width between longitudinal construction joint true to crown at the required distance below the finished surface elevation, for placement of reinforcement or for placement of a top layer of the required thickness.

The striking-off shall be accomplished by use of the finishing machine, unless some other approved device is allowed. The reinforcement shall be placed as called for by the Designer and pouring of concrete over it shall only be allowed after placement of reinforcement is proper in all respects and approved by the Engineer.

f) Joints

i) General

Joints shall comply with the design approved for the construction.

A strip of the preformed expansion joint filler shall be placed around each structure which extends into or through the pavement before concrete is placed.

ii) Transverse Expansion Joints

These shall be formed at the design spacings. The material for a transverse joint shall be assembled at the roadbed, and placed into position as a unit.

i) Transverse Contraction Joints

Transverse Contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. Transverse contraction joints shall also include load transfer dowel-bars where these are specified by the Designer.

The contraction joints shall be cut as soon as the concrete has undergone initial hardening and is hard enough to take up the load of joint sawing machine without causing damage to the slab. Grooves shall be at right angles to the centreline of the pavement and shall be true to line, subject to a tolerance of 5 mm in the width of the slab.

Any procedure for sawing joints that results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete and cutting of the joints.

Load transfer assemblies for transverse contraction joints shall consist of dowel bars without sleeves and an approved auxiliary spacing and supporting element.

The assembly shall be placed into position so that the dowels are parallel to the centreline and shall be staked into position in such a way as to hold the assembly securely in position throughout construction.

ii) Longitudinal Joints

Longitudinal joints shall be constructed in conformity with the design. Planes of weakness shall be created by forming or cutting grooves in the surface of the pavement in accordance with the applicable provisions of this Section.

When adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint. The bars may be bent at angles against the form of the first lane constructed and straightened into final position before the concrete of the adjacent lane is poured.

iii) Transverse Construction Joint

Transverse construction joints shall be placed whenever concreting is completed after a day's work or is suspended for more than duration permissible for continuous pouring of concrete.

Joints shall be formed by placing installing bars or suitable bulkhead material so that a vertical face with approved key is formed or shall be butt joints formed with suitable material so that a vertical face is formed with no key. No tie bars shall be necessary when key joints are formed but dowel bars of the same dimensions and at the same spacing as for contraction joints shall be necessary at all butt joints.

g) Finishing

i. Machine Finishing

As soon as the concrete has been placed, it shall be struck off and screeded by an

approved finishing machine or tools to the grades and cross sections specified by the Designer and to a level slightly above grade so that when properly consolidated and finished the surface of the pavement will be at the exact level and grade. The machine or tool shall go over each area of pavement as many times and at such intervals as necessary to give the proper compaction and to leave a surface of uniform texture, true to grade and cross section.

Excessive operation over a given area shall be avoided. The tops of the forms shall be kept clean by an effective device attached to the machine and the travel of the machine on the forms shall be maintained true without lift, wobble or other variation tending to effect the precision finish.

After concrete has been placed on both sides of the joint and struck off, the installing bar or channel cap shall be slowly and carefully withdrawn, the concrete shall be carefully spaded and additional freshly mixed concrete worked into any depression left by the removal of the installing bar.

A diagonal finishing machine shall be used if available.

ii. Hand Finishing

A portable screed shall be provided for use. The screed shall be at least 60 cm longer than the width of the slab to be struck off and consolidated. It shall be of approved shape, sufficiently rigid to retain its shape and constructed either of metal or of other material shod with metal. (If necessary, a second screed shall be provided for striking off the bottom layer of concrete).

The screed shall then be placed on the forms and slip along them, without lifting, in a combined longitudinal and transverse shearing motion moving always in the direction in which the work is progressing. If necessary this shall be repeated until the surface is of uniform texture, true to grade and contour, and free from porous areas.

h) Edging at Forms and Joints

After the concrete's initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, planes of weakness except when sawed transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to a radius of 5 mm. A well defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

All joints shall be tested with a straight edge before the concrete has set, and correction shall be made if one side of the joint is higher than the other or if they are higher or lower than the adjacent slabs.

i) Surface Texture

The surface of the carriage-way shall be textured by wire brushing in a direction at right angles to the longitudinal axis of the carriage-way. The pavement shall be given this broomed texturing as soon as surplus water has risen to the surface.

The wire brushes shall be either mechanically operated or manual methods may be allowed depending upon the type of paver being used on the Work. In either case the wire broom shall be not less than 450 mm wide with two rows of spring steel. At least two brooms in working order shall be on the site at all times.

The surface texturing shall be completed before the concrete is in such condition that the surface is torn or unduly roughened by the brooming. The broomed surface shall be free from rough areas, porous areas, irregularities, or depressions.

j) Surface Requirements

After the concrete has hardened sufficiently, the surface shall be given a further test for tureens, using an approved 3 m straight edge laid on the surface. Any portion of the surface, when tested in the longitudinal direction, which shows a variation or departure from the testing edge of more than 3.5mm but not exceeding 7mm shall be marked and immediately ground down with an approved grinding tool until the variation does not exceed 3.5mm.

Whenever the variation or departure from the testing edge is more than 7.0mm the pavement shall be removed and replaced. Such removal shall be of the full depth and width of the slab and at least 3m long.

k) Curing

Immediately after the surface texturing, the surface and sides of the slab shall be cured by approved curing method for not less than 7 days. During this period measures shall be taken to prevent the loss of moisture.

The concrete shall not be left exposed between stages of curing.

The surface shall be inspected regularly to ascertain the earliest time at which it is able to withstand the spreading of moisture retaining material. This shall be by ponding of water or spreading and wetting either two layers of burlap or two mats of cotton / jute or a layer of sand or other approved highly absorbent material. Whatever material is used it shall be kept continuously moist for not less than 7 days and to a degree which will ensure that 100% humidity is maintained adjacent to the concrete

surface. A membrane curing compound meeting the requirements of BS 7542 may be used subject to the consent of the Engineer.

Concrete surfaces which are subjected to heavy rainfall within three hours after the curing compound has been applied shall be resprayed by the method and the coverage specified above.

Concrete surfaces to which membrane curing compounds have been applied shall be adequately protected for the duration of the entire curing period from the pedestrian and vehicular traffic, except as required for joint sawing operations and surfaces tests, and from only other cause which will disrupt the continuity of the membrane. The curing membrane so formed shall be maintained intact for a period of not less than 14 days. The entire surface shall be protected from the effects of solar radiation and in addition by the use of frames covered with material with heat and light reflecting properties.

Concrete liable to be affected by running water shall be adequately protected from the damage during the setting period.

l) Removing Forms

Forms shall be removed only after stipulated period and carefully so as to avoid damage to the pavement.

m) Protection of Pavement

The Contractor shall erect and maintain suitable barricades and shall employ watchmen to exclude public traffic and that of his employees and agents from the newly constructed pavement until opened for use. These barriers shall be arranged as not to interfere with public traffic on any lane intended to be kept open and necessary signs and lights shall be maintained by the Contractor clearly indicating any lanes open to the public.

Where any stipulated public traffic lane is contiguous to the slab or lane being placed, the Contractor shall provide, erect, and subsequently remove a substantial temporary guard fence along the prescribed dividing line, which shall be maintained there and protected by signages until the slab is opened to traffic. The Contractor's plan of operation shall be such as to obviate any need for encroachment on the public traffic lane or lanes under use.

The same shall be approved by the local competent authority. Any part of the pavement damaged by traffic or other cause prior to its final acceptance shall be repaired or replaced by the Contractor.

n) Sealing Joints

Before the pavement is opened to traffic, and as soon after the curing period as is feasible, all joints both longitudinal and transverse, shall be filled with the material approved for use as seal.

Both primer and sealing compound shall be treated and applied strictly in accordance with the manufacturer's specifications/ instruction and by use of approved equipment.

The sealing material shall be poured into each joint opening as directed by the Engineer. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned.

Chapter 7. ITEMS INCLUDED IN SCHEDULE-B

7.1 Sub-Schedule B1, B2, B5, B6, B8, B9, B10, B11 & B13

These Schedules include items of work based on North Western Railways Unified Standard Schedule of Rates (NWR USSOR)-2019 and Non-Schedule (NS) items.

The scope of work, specifications, method of measurement and payment for items based on NWR USSOR-2019 shall be governed by NWR USSOR and Indian Railway Unified Standard Specifications (Formation works, Bridges and P.way Works) – 2019 and for NS items shall be as detailed in Sub-Clause 7.3 below.

7.2 Sub-Schedule B12

Thess Schedules include items of work based on Delhi Schedule of Rates (DSR), 2021 and Non-Schedule (NS) items.

The scope of work, specifications, method of measurement and payment for items included in Schedule B12 shall be governed by DSR 2021 and CPWD Specifications - 2019 and for NS items shall be as detailed in Sub-Clause 7.3 below.

7.3 Non-Schedule (NS) items

7.3.1 NS Item No.1: Reinforced Cement Concrete M35

Supplying and laying in position M-35 RCC as per approved design mix with admixtures and manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lifts & leads, having continuous agitated mixer, pumping concrete from transit mixer to site of laying, compacting, finishing & curing, with all labour, material, tools, plants, machinery and equipment, taxes, cess etc., as a complete job ,but excluding supplying & fixing form work (centering & shuttering), in accordance with the specification and drawings.

Notes: –

(i) Cost of cement is included in the above item.
(ii) Cost of Reinforcement steel is not included in the above item and will be paid separately under relevant item of Sub-Schedule B2.
(iii) Cost of supplying & fixing form work (centering & shuttering) is not included in the above item (except pile cap & open foundation) and will be paid separately under relevant item of Sub-Schedule B11.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work of bridges to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specification and the

Drawings. RCC work shall comply with the provisions of Annexure OCS -1 & 2 of Section VII-6: Employer's requirements-OCS-Civil & BLT.

II. Method of Measurement

Measurement for payment of this item shall be the quantity of RCC worked out/measured in cum from the Drawings. Payment will be made at the Unit Price per cubic meter entered in the Priced Bill of Quantities**.**

7.3.2 NS Item No.2: Bored cast in-situ Piling

Boring 1200 mm diameter piles using Hydraulic Rig in all kinds of strata including boulder studded soil, underground structure like channel, sewer manholes, old foundation or any other obstruction, irrespective of sub-soil water level in all conditions whether dry or under water, shoe and temporary casing pipe, if required, with contractor plant, machinery & equipment for pile boring, use of bentonite slurry including all operations, cleaning of bore holes, supplying and laying in-situ with tremie pipe M-35 RCC in piles as per approved design mix with admixtures and manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lifts & leads, having continuous agitated mixer, pumping concrete from transit mixer to site of laying including supplying & fixing form work (centering & shuttering), compacting, finishing, curing, chipping off pile top to remove laitance concrete above cut off level, removal and disposal of surplus excavated earth/debris/muck outside ROW including all lead, lift, ascends, descends, loading, unloading handling, re-handling, crossing of stream, nallahs, railway track, level crossing etc. with all labour, material, tools, plants, machinery and equipment, taxes, cess etc. as a complete job in accordance with the Specification and the Drawings.

Notes:

i. Cost of cement is included in the above item.
ii. Cost of Reinforcement steel is not included in the above item and will be paid separately under relevant item of Sub-Schedule B2.
iii. Cost of temporary casing pipe is included in the above item. However, the cost of permanent casing pipe is not included in this item and shall be paid separately under relevant item of Sub-Schedule B13, if required and approved by the Engineer.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work of piling. The work shall be carried out strictly in accordance with the approved Method Statement, Manual on the design and construction of Well and Pile foundations, Sub-clause 3.5.3 to 3.5.9 of Section VII-6: Employer's requirements-OCS-Civil & BLT and Annexure OCS-1 & 2 of Section VII-6: Employer's requirements-OCS-Civil & BLT and the Drawings.

II. Method of Measurement

The method of measurement for payment of piles shall be the length of pile in running metres from founding level to bottom of pile cap as established at the Site by the Engineer. Payment will be made at the Unit Price per running metre, entered in the Priced Bill of Quantities**.**

7.3.3 NS Item No. 3: Protection work using Precast CC blocks

Casting, supplying and laying of Pre-cast CC blocks of size 25x25 x20cm. or of required size as directed by the Engineer for protective works at bridges & banks like pitching, flooring, etc. using M20 design concrete mix with 20mm aggregate size including Contractor's shuttering, leading to bridge site from casting depot, including dressing and levelling of surface, providing gravel backing, laying & jointing blocks with cement mortar 1:3 with Contractor's labour and as directed by Engineer-in-charge (All labour and material including cement by contractor).

Notes:

i. Cost of cement is included in the item

ii. Payment for gravel backing will be paid under. NS item No. -06 of Sub-Schedule B11.

iii. 60% Payment shall be made after casting of pre-cast concrete blocks and bringing them at work site. The balance 40% will be made on completion of laying and finishing.

iv. Measurement is based on quantity calculation of blocks used only (no. of blocks x volume of one block).

I. Method Statement

The Contractor shall submit Method Statement for, supplying and laying of precast concrete blocks for protective works at bridges to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement and Tender drawings (GC-HRIDC-SK-GEN-015) given in Section VII-8: Tender Drawings and Documents, Part-2 Employer's Requirements.

II. Material

The work shall consist of precast cement concrete blocks in M-20 grade of size 25 cm x 25 cm x 20 cm in a casting yard. The Contractor shall establish a casting yard for manufacture of precast cement concrete blocks. The casting yard shall have facilities for casting, compaction by mechanical vibration, curing and loading of cement concrete block into trucks/tractor trollies. Concrete shall conform to Annexure OCS -1 of Section VII-6: Employer's requirements-OCS-Civil & BLT.

III. Execution

a) Before laying the pitching, the sides of banks shall be trimmed to profile and compacted by vibratory roller to the required slope and profiles marked by means of line and pegs at intervals of 3 metres to ensure regular straight work and a uniform slope throughout. Depressions shall be filled and thoroughly compacted.
b) A layer of 150 mm thick well graded gravel/ stone aggregate shall be laid over prepared earth slope, watered and compacted.
c) Over the compacted gravel/stone aggregate layer, a RCC grid frame of size 1750 mm x 1750 mm of M-35 grade concrete shall be laid. After these grids have attained sufficient strength pre-cast CC block shall be placed inside the grids. The joints of CC blocks shall be sealed with cement mortar 1:3.
d) Toe wall shall invariably be provided at the location of pitching. The pitching shall proceed from toe wall towards the top. Payment of toe wall shall be made separately under relevant items of Schedule 'B'.

IV. Method of Measurement

Measurement shall be in cubic meter based on quantity calculation of only the blocks used (i.e. number of blocks x volume of one block). Payment of RCC used in grid frame shall be done under Item No. NS-1 of Sub-Schedule B3**.**

7.3.4 NS Item No. 4: Earthwork in Railway Embankment

Earthwork in embankment for 32.5t axle load and as per RDSO specification No. RDSO/2020/ GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation" with Contractor's own earth from borrow areas including all lead, lift, ascent, descent, royalty, taxes, cess, compensation, crossing of nallahs /stream and other obstructions including mechanical compaction in layers with watering, handling, re-handling, dressing of banks to the final profile with all labour, material, tools, plant, machinery and equipment, taxes, cess etc. as a complete job in accordance with the specification and drawings.

Note: 10% of payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory slope rollers as per RDSO guidelines.

I. Method Statement

The Contractor shall submit Method Statement for carrying out earthwork in embankment to the Engineer for approval.

II. Execution

Earthwork in embankment shall be carried as per Clause 3 of Section VII-5: Employer's requirements-ODS-Civil & BLT and Chapter 2 of Section VII-6: Employer's Requirements-OCS-Civil & BLT

III. Method of Measurement

Measurement for payment for earthwork in embankment shall be in-situ volume as measured in cubic meter (cum) from the levels recorded prior to any filling work and the lines and grades shown on the Drawings or established at the Site by the Engineer. Payment shall be made at the Unit Price per cubic metre, entered in the Priced Bill of Quantities. 10% payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory slope rollers as per RDSO guidelines.

7.3.5 NS Item No. 5: Blanketing material

Supplying and laying blanketing material produced through mechanical means using crushers and pug mill for 32.5 T axle load as per RDSO specification No. RDSO/2020/GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation" over the top of subgrade including all lead, lift, ascent, descent, royalty, taxes, cess, crossing of nallahs /stream and other obstructions including mechanical compaction in layers not exceeding 200 mm thick with vibratory rollers, watering, handling, re-handling and dressing of formation to the final profile with all labour, material, tools, plants, machinery and equipment, taxes, cess, etc. as a complete job in accordance with the specification and drawings.

Note: 10% of payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory rollers as per RDSO guidelines.

I. Method Statement

The Contractor shall submit Method Statement for providing blanketing to the Engineer for approval.

II. Execution

i. After conducting necessary tests and field trials the Contractor shall get the blanket material approved from the Engineer.

ii. The work of blanketing shall be carried out in accordance with RDSO specification No. RDSO/2020/GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation".

III. Method of Measurement

Measurement for payment of blanketing shall be as per the cross section shown in the Drawings or established at the Site by the Engineer. Payment will be made at the Unit

Price per cubic metre, entered in the Priced Bill of Quantities. 10% payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory slope rollers as per RDSO guidelines.

7.3.6 NS Item No. 6: Gravel Base Layer Below Pre-Cast CC Block

Supplying and laying of 150mm thick well graded stones aggregate/gravel as base layer over the embankment slopes with manual dressing, watering & compaction including the cost of supply of all material, labour, lead, lift, tools, plants, crossing of tracks etc. complete as per approved drawings and technical specifications.

I. Method Statement

The contractor shall submit method statement for laying of stone aggregate/gravel layer to the Engineer for approval.

II. Material

Stone aggregate/gravel for base layer shall be hard & well graded. Maximum particle size shall be limited up to 40 mm and fines (particle <75micron) shall be limited upto 5%.

III. Execution

Stone aggregate/gravel shall be laid in uniform layer over levelled and compacted embankment slopes. Base layer shall be watered and compacted manually before laying of CC blocks.

IV. Method of Measurement

Measurement shall be in cubic meter based on the area and thickness of layer.

7.3.7 NS Item No.7: Boulder Backing

Providing Boulder Backing behind wing wall, return wall, retaining wall with hand packed boulders & cobbles not less than 15cm in any direction & not less than 15kg (except smaller boulders required for filling voids) including all lead, lift, labour & other incidental charges as complete work in all respect. Cost of boulder/cobbles is included in this item.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement.

II. Method of Measurement

Measurement for payment of this item shall be the quantity of boulder backing worked out/measured in cum from the Drawings/site. Payment will be made at the Unit Price per cubic meter entered in the Priced Bill of Quantities.

7.3.8 NS Item No.8: 75 mm dia PVC Weep Holes

Providing and fixing of 75mm dia PVC pipe for weep holes in abutments, Wing Wall, Return Wall, Face wall, retaining wall etc. at suitable intervals as directed by the Engineer-.

I. Method Statement.

The method statement for providing and fixing of weep holes shall be submitted by the Contractor to the Engineer for approval. The pipes for weep holes shall be UPVC pipe, Type 'A' conforming to IS:13592

II. Execution

Pipe for weep holes shall be placed at the specified locations and spacing in abutment, return walls and retaining walls etc. as shown in the Drawings.

III. Method of Measurement

Measurement for payment for weep holes shall be in running metres as shown in the Drawings.

7.3.9 NS Item No.9: Precast RCC Drain with Cover

Manufacturing, transportation (including loading & unloading) and installation in position (including joining and grouting) M-35 or higher grade precast reinforced cement concrete U-shaped drain with cover as per the directions of the Engineer. Precast reinforced U-shaped drain shall be factory-made, and steam cured in a controlled environment with inserts for handling/transportation. Dimensional tolerances shall be as per IS: 6408 (part 2) for PC Class 6.

Notes: -

1. This item includes cost of all the materials, labour, machinery, tools & plant etc. complete required for manufacture of precast segments except Steel Reinforcement which shall be paid separately under relevant item of Sub-Schedule B2.
2. Excavation of soil for foundation shall be paid separately under item (USSOR item No. 022010) of Sub-Schedule B11.
3. Before placing drain/duct segments, 20 mm thick stiff 1:3 cement mortar bedding layer shall be laid over a levelling course of 50 mm thick of M20 concrete. Payment for M20 concrete shall be made under relevant item (USSOR-2019 item 022040)

of Sub-Schedule B11 and for mortar under relevant item (DSR Item no. 3.8) of Sub-Schedule B12.

4. 60% of the rate shall be paid on receipt of the precast drain/duct segments at site and the balance of 40% will be paid on fixing the same in position in satisfactory condition.

I. Method Statement

The Contractor shall submit detailed design & drawings and Method Statement for carrying out the work to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement and the Drawings. RCC work shall comply with the provisions of Annexure OCS -1 & 2 of Section VII-6: Employer's requirements-OCS-Civil & BLT. Special care shall be taken in lifting and transportation of precast segments to avoid impact and damage.

II. Method of Measurement

Measurement for payment of this item shall be the quantity of concrete in precast segment worked out/measured in cum from the Drawings. Payment will be made at the Unit Price per cubic meter entered in the Priced Bill of Quantities.

7.3.10 NS Item No.10: Precast RCC Facia Panels of RE Wall

Designing, Providing and erection of specified grade precast RCC Facia Panel of thickness 180 mm made with M-35 Grade Concrete Batching plant, Transit Mixer, Concrete Pump and Vibrator for retaining earth with all element and accessories including reinforcing element complete as per approval drawing and Section 3100 of MORT&H specification including all material labour machinery etc. (Scope of work including designing, getting approval, casting in yad, curing, storing, Transporting, lifting, placing in position, erection with all necessaries fasteners etc complete). The cost of cement & steel are include in this item & no separate payment shall be paid whatsoever. The rate also include cost for excavation, foundation, reinforcing element, fasteners, drainage layer, drain pipe, coping beam and other accessories for which nothing extra shall be paid.

Mode of Payment:

1- **Casting of RE Panel: 60%**
2- **Erection & fixing: 35 %**
3- **Completion in all respects: 5%**

I. Method Statement

The Contractor shall submit detailed design & drawings and Method Statement for carrying out the work to the Engineer for approval. The work shall comply

with the provisions of Section 3100 of MORTH Specifications for Road and Bridge Works. Geogrid shall be used as reinforcing element. The work shall be carried out strictly in accordance with the approved Method Statement and the Drawings. RCC work shall comply with the provisions of Annexure OCS -1 & 2 of Section VII-6: Employer's requirements-OCS-Civil & BLT. Special care shall be taken in lifting and transportation of precast segments to avoid impact and damage.

II. Method of Measurement

Measurement for payment of this item shall be the area of precast facia panels worked out/measured in Sqm from the Site/Drawings. Payment will be made at the Unit Price per Square meter entered in the Priced Bill of Quantities.

7.3.11 NS Item No.11: Back Fill in RE Wall

Providing Placing & Compacting to desired density approved backfill material in layers as per approved methodology including testing of reinforced fill portion in approaches between reinforced soil (RS) wall panels as per approved drawing as per Section 3103 of MORT&H Specification. The soil should be predominantly coarse grained, not more than 10 % of particles should pass 75 micron sieve. The item shall be measured and paid for the finished volume of backfill and sub-grade placed in position excluding the volume of filter media at base and behind the RE Wall.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall comply with the provisions of Section 3100 of MORTH Specifications for Road and Bridge Works. Geogrid shall be used as reinforcing element. The work shall be carried out strictly in accordance with the approved Method Statement and the Drawings.

II. Method of Measurement

Measurement for payment of this item shall be the quantity of back fill worked out/measured in cum from the Drawings/site. Payment will be made at the Unit Price per cubic meter entered in the Priced Bill of Quantities.

7.3.12 NS Item No.12: RCC Crash Barrier

Providing & constructing of RCC Crash Barrier of M35 at the edge of road , approaches to bridge structures and medians, constructed with specified grade of concrete using batching plant , transit mixer, concrete pump and vibrator with 450 mm long at expansion joint filled with premolded asphalt filler board, keyed to the structure on which it is built and installed as per design and dimension in the approved drawing

and at location directed by the engineer, all as specified as per Section 809 of MORT&H Specification including all material labour, scaffolding etc.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement and the Drawings. RCC work shall comply with the provisions of Annexure OCS -1 & 2 of Section VII-6: Employer's requirements-OCS-Civil & BLT.

II. Method of Measurement

Measurement for payment of this item shall be the quantity of concrete in crash barrier worked out/measured in cum from the Drawings/site. Payment will be made at the Unit Price per cubic meter entered in the Priced Bill of Quantities.

7.3.13 NS Item No.13: Earthwork in Filling

Earthwork in filling with contractor's own earth of approved quality from borrow areas including all lead, lift, ascent, descent, royalty, taxes, cess, compensation, crossing of nallahs /stream and other obstructions including mechanical compaction in layers with watering to 95% of MDD (as per IS 2720 part 8), handling, re-handling, dressing to the final profile with all labour, material, tools, plant, machinery and equipment, taxes, cess etc. as a complete job in accordance with the specification and drawings.

I. Method Statement

This item will be used for earthwork in filling for other than Railway embankment. The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement.

II. Method of Measurement

Measurement for payment for earthwork in filling will be the in-situ volume as measured in cubic meter (cum) from the levels recorded prior to any filling work and the lines and grades shown on the Drawings or established at the Site by the Engineer. Payment will be made at the Unit Price per cubic metre, entered in the Priced Bill of Quantities. 10% payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory rollers

7.3.14 NS Item No.14: Supply and laying of MS Pipe

Supply and laying of Mild Steel pipe conforming to IS: 3589 of outer dia 323.9 mm & plate thickness 5.6 mm in railway formation as per approved Drawings.

(i) Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall comply to provisions of Sub-Clause 3.3.5 Section VII-5: Employer's requirements-ODS-Civil & BLT and Sub-Clause 2.2 Section VII-6: Employer's requirements-OCS-Civil & BLT.

(ii) Method of Measurement

Measurement for payment of this item shall be the length of pipe measured in running meter. Payment will be made at the Unit Price per running meter entered in the Priced Bill of Quantities.

7.3.15 NS Item No.15: Pathway on Open Web Girder & Composite Girder

Supplying, fabrication and fixing pathway on Open Web Girder & Composite girder bridges with hollow steel, rolled and chequered plate including welding / bolting, priming painting with one coat of ready mix Zinc Chromate primer conforming to IS: 104 with DFTof 25-30 microns, followed by one coat of Zinc Chrome red oxide conforming to IS: 2074 with DFTof 25 with all material, labour, T&P and material as a complete job as per RDSO drawing No. CBS 0045 & CBS 0046

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work of pathway on OWG and composite girder bridges to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specifications and the Drawings. The work shall comply with the provisions of Annexure OCS-3 of Section VII-6: Employer's Requirements-OCS-Civil & BLT. Hollow steel sections shall conform to IS: 4923, steel tube sections to IS: 1148, chequered plate to IS:3502 and rolled sections to IS:2062.

II. Method of Measurement

Measurement for payment of this item shall be the weight of metal in the fabricated structure worked out/computed on the basis of nominal weight of materials and exact cut size of the member used in the structure as per drawing in MT. No additional payment shall be made for welds, bolt & nuts etc. Payment will be made at the Unit Price per MT entered in the Priced Bill of Quantities.

7.3.16 NS Item No.16: MS angle expansion Joint

Supplying and fixing M.S. Angles 100 mm x 100 mm x 10mm size conforming to IS:2062 in expansion joint of Composite girder bridges including provision of 10mm dia dowel bar & 12mm dia anchor bolts at 150 mm centre to centre, and 250mm wide GI plate over the top of angles as per relevant RDSO standard drawing with all material, labour, T&P as a complete job.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work of expansion joint in composite bridge girders to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specifications and the Drawings. The work shall comply with the provisions of Annexure OCS-3 of Section VII-6: Employer's Requirements-OCS-Civil & BLT. Mild steel bolt and nuts shall conform to IS: 226 & IS: 1148 but shall have minimum tensile strength of 44 Kg/sqm and minimum percentage elongation of 14.

II. Method of Measurement

Measurement for payment of this item shall be the length of the expansion joint across the track measured/worked out in meter as per the Drawings. Payment will be made at the Unit Price per meter entered in the Priced Bill of Quantities.

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7.3.17 NS Item No. 17: H- beam sleeper

Supplying, fabricating, transportation and fixing galvanized H-Beam sleepers as per RDSO drawing RDSO/B/1636/4/R & RDSO/B/1636/5 with latest alteration and specifications thereto complete with all fittings and fixtures including the cost of all steel sections, all fittings and fixtures ,elastomeric pad, galvanized bolts, nuts, washer, split pin, fish plates 1m and 0.6m long along with fish bolts and nuts for 60Kg running rail and 52Kg guard rail respectively, track fittings and fastenings (Zero Toe Load Fastening) for 60 kg running rail and 52 Kg guard rail as per RDSO drg -RDSO/T-8759 to RDSO/T8765. labour, lead, lift, plants and equipment including galvanized work of full steel components complete in all respects as per approved drawing and technical specifications & as per direction of Engineer on Open Web Girder (OWG) bridges. The rate is also inclusive of the cost of supply of approved quality of epoxy/adhesive and fixing of elastomeric pads with different components of steel sleepers & girder in accordance with approved drawings. The steel to be supplied by the contractor for fabrication of steel H-Beam sleepers shall conform to IS-2062-2006, Grade B0 only. The rate is also inclusive of inspection charges of components of sleepers including all fixtures & fastening, galvanization etc. from the reputed laboratory/organization. Elastomeric pad plate and other track fittings shall be procured from RDSO approved source.

Notes: Payment under this item shall be made in following manner;

i. 75% of the rate shall be paid after fabrication, galvanization and transportation of H beam sleepers to the site and submission of material test certificate of manufacturer and inspection certificate of the agency nominated by the Engineer.

ii. 15% of the rate shall be paid after supply of fittings to the site and submission of inspection certificate of the agency nominated by the Engineer.

iii. iii. 10% of the rate will be paid after fixing H Beam sleepers to the girder in satisfactory manner.

iv. In case fixing is not required, then balance payment will be released on handing over of the sleepers after making recovery @ Rs.850/- per sleeper.

I. Method Statement

The Contractor shall submit Method Statement for fabrication and inspection/testing of steel-H beam sleeper and its fittings/fixtures to the Engineer for approval.

II. Execution

i. Steel used for fabrication of H-beam sleepers shall be of grade E-250 B0 quality as mentioned in para 8.2 of IRS B 1-2001.

ii. H-beam sleepers shall be fabricated as per RDSO drg. RDSO/B-1636/4/R & RDSO B-1636/5 & RDSO specification No. BS: 45 and other relevant specifications.

iii. Tie angle on H-beam sleepers can be dispensed with.

iv. All track fittings shall be procured from RDSO approved source. H- beam sleeper and fittings shall be inspected and passed by agency approved by the Engineer at the fabricator's/ manufacturer's works before supply.

III. Measurement

Measurement of H-beam sleepers shall be done in number. Payment under this item shall be made in following manner.

i. 75% of the rate shall be paid after fabrication, galvanization and transportation of H beam sleepers to the site and submission of material test certificate of manufacturer and inspection certificate of the agency nominated by Engineer.

ii. 15% of the rate shall be paid after supply of fittings to the site and submission of inspection certificate of the agency nominated by Engineer.

iii. 10% of the rate will be paid after fixing H Beam sleepers to the girder in satisfactory manner. In case fixing is not required, then balance payment will be released on handing over of the sleepers after making recovery @ Rs.850/- per sleeper.

The rate also include supply of 10% of spare fittings as per Annexure F-8, Section VII-2: Employer's Requirements- Functional.

7.3.18 NS Item No. 18: Stainless Steel Railing

Providing and fixing stainless steel (Grade 304) railing made of hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, including fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement as per approval of the Engineer, (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.)

I. Method Statement

The Contractor shall submit Method Statement for fixing of stainless steel (Grade 304) for railing in staircase, balconies, pedestrian subway, Enquiry/Reservation counters to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method statement and the Drawings.

II. Material

The stainless steel (304 grade) shall conform to IS 6911: 2017. Fabrication of railing shall be done as shown in the Drawings. Fabrication of all stainless-steel sections should be done only with tools dedicated to stainless steel materials. Tooling and work surfaces must be thoroughly cleaned before use.

Following items shall be ensured:

i. Removal of all moisture by blowing with dry air or heating with a torch.
ii. Elimination of organic contaminates like oil, paints, anti-spatter compounds, grease, pencil marks, cutting compounds, adhesive from protective paper, soap used for leak testing etc.
iii. Plasma cutter to be used for cutting stainless steel.
iv. Zinc contamination to be avoided.
v. Brushes or tools previously used on galvanized steel not to be used.

III. Fixing

The railing shall be fixed with necessary accessories and stainless-steel dash fasteners & stainless-steel bolts etc. of required size, on the top of the floor or the

side of waist slab with suitable arrangement as per approval of the Engineer.

IV. Method of Measurement

Only weight of stainless-steel members shall be considered in kg for the purpose of measurement. Fixing accessories such as nuts, bolts, fasteners etc. shall be deemed to be included in this item and shall not be paid separately. The rate shall include the cost of materials and labour involved in all the operations described above. Nothing extra shall be paid for fixing arrangements i.e. drilling, providing nuts & bolts etc

7.3.19 NS Item No.19: Bed Plate

Supply, fabrication and erection of bed plate of approved sizes as per relevant RDSO drawing No. RDSO/B-11751/4R2, B-11753/5R1, B-11754/3R2 with upto date corrections, in exact position over bed block on pier/abutments by giving full and even bearing, setting them on the layer of free flow non-shrinkable grouting compound, scrapping or chipping of bed block, if required, fabrication and fixing of HD bolts of suitable sizes along with nuts, washers etc., grouting of holes by epoxy mortar after fixing HD bolts with all labour, material, T & P as a complete job.

NS 19 A - More than 12.2 m and Up to 18.3 m clear span.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specifications and the Drawings. The work shall comply with the provisions of Annexure OCS-3 of Section VII-6: Employer's Requirements-OCS-Civil & BLT.

II. Method of Measurement

Measurement for payment of this item shall be the weight of metal in the fabricated structure worked out/computed on the basis of the drawing in Kilogram. No additional payment shall be made for bolt & nuts etc and no deductions shall be made for holes. Payment will be made at the Unit Price per kg entered in the Priced Bill of Quantities. Payment will be made at the Unit Price per unit entered in the Priced Bill of Quantities.

7.3.20 Item No.20: Metallic Guided bearing

Supply and fixing of Metallic Guided Bearing in position true to line and level as per RDSO drawing No. RDSO/B-11754/3R2 and IRC:83 pt. III-2018 including supply &

grouting of anchor bolts with approved non-shrinking epoxy grout with all material, labour, T&P as a complete job.

I. Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specifications and the Drawings.

II. Method of Measurement

Measurement for payment of this item shall be in number. Payment will be made at the Unit Price per unit entered in the Priced Bill of Quantities.

7.3.21 NS Item No.21: Ballastless Track (BLT) On Bridges

Construction of ballast less track (BLT) on bridges in straight/curve including linking of track with 60 Kg rails in LWR, supply and fixing of rail fittings/ fastening, Construction of derailment guard , as per approved Design & Drawing. The item includes supply and leading of all material, labour, tools & plants including welding of track in LWR, destressing, drainage arrangement as per the approved drawing complete in all respect. Nothing extra shall be paid.

Note:-

(1) 60 Kg 350 R Rails shall be paid under item no NS-25 of this Sub-Schedule.

(i) Method Statement

The Contractor shall submit Method Statement for carrying out the work of bridges to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specifications and the Drawings. Ballastless track work shall comply with the provisions of Clause 8 of Section VII-5: Employer's requirements-ODS-Civil & BLT and Chapter 8 & **Annexure OCS -1 & 2** of Section VII-6: Employer's requirements-OCS-Civil & BLT.

(ii) Method of Measurement

Measurement for payment of this item shall be the length of BLT worked out/measured in running meter for each track separately. Payment will be made at the Unit Price per running meter entered in the Priced Bill of Quantities.

7.3.22 NS Item No.22: Transition of Ballastless Track (BLT) To Ballasted Track On Bridge Approaches

Construction of Transition system of ballastless track to ballasted track on bridge approach including linking of track with 60 Kg rails in LWR including, supply and fixing of rail fittings/ fastening, Construction of derailment guard as per approved Design & Drawings. The item includes supply and leading of all material, labour and tools & plants, welding of track in LWR, destressing, drainage arrangement as per the approved drawing complete in all respect. Nothing extra shall be paid.

Note:-

60 Kg 350 R Rails shall be paid under item no NS-25 of this Sub-Schedule.

(i) Method Statement

The Contractor shall submit Method Statement for carrying out the work of transition system of ballastless track to ballasted track on bridge approaches to the Engineer for approval. The work shall be carried out strictly in accordance with the approved Method Statement, the Specifications and the Drawings. Ballastless track work shall comply with the provisions of Sub-Clause 4.2 of Section VII-5: Employer's Requirements-ODS-Civil & BLT and Sub-Clause 7.3.17 & Annexure OCS -1 & 2 of Section VII-6: Employer's Requirements-OCS-Civil & BLT.

(ii) Method of Measurement

Measurement for payment of this item shall be the number of transitions of Ballastless track to Ballasted track for each bridge approach for one track. Payment will be made at the Unit Price per transition entered in the Priced Bill of Quantities.

7.3.23 Item No. 23: Linking of Track on H- beam sleeper

Linking of track on H- beam sleepers on Open Web Girder (OWG) bridges with 60 Kg running rail and 52 kg guard rail with track fittings/fastenings including leading of Running and guard rails from bridge approach and fixing of running rails & guard rails, bending of guard rails, notching, drilling of holes, cutting of rails etc., as directed and making track structure fit for normal speed. (Rails will be supplied by the Employer free of cost)

Note:-

(1) 60 Kg 350 R rails and 60 Kg Class 'IV' rails for guard rail shall be paid under for running rail item no NS-25 and item no NS-26 respectively.

I. Method Statement

The Contractor shall submit Method Statement for linking of track to the Engineer for approval.

II. Execution

i. Running rail and guard rail shall be fixed on H- beam sleeper as per assembly drawings (No. RDSO/T-8759 to RDSO/T-8765 with latest alterations/corrections) and provisions of IRPWM.

ii. Holes in the flange of guard rail shall be drilled after fixing the sleeper and running rail in position.

iii. Track shall be fit for normal speed and tolerances shall be as per permissible limits specified in IRPWM.

III. Measurement

Measurement for payment of linking of track shall be done in running track meter.

7.3.24 NS Item No.24: Supply of Special PSC Wide Base Sleeper For Bridge Approaches

Supplying at site of work including leading, loading, unloading and stacking of special PSC wide base sleepers for bridge approaches with provision of guard rails as per RDSO Drawing No. T-8673 to T-8680 for 60 Kg Rail.

(i) Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The sleepers shall be procured from RDSO approved source/plant. Before dispatch sleepers shall be inspected & passed by the concerned railway authority in whose jurisdiction the plant is located or by any other agency nominated by the Employer/Engineer. Sleepers shall invariably be handled mechanically to avoid damage.

(ii) Method of Measurement

Measurement for payment of this item shall be the sets of bridge approach sleeper for one side approach of one track. Payment will be made at the Unit Price per set entered in the Priced Bill of Quantities.

7.3.25 NS Item No.25: Supply of 60 Kg, R350 Class 'A' Rails

Supplying, Transporting of Rail 60 kg, Class 'A', R350 rails of 13/26 meter length as per IRS:T-12/2009 Specifications with latest amendments issued by RDSO.

(i) Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The rails shall be procured from RDSO approved source/plant. Supply of rails shall comply with the provisions of Clause 8 of Section VII-5: Employer's requirements-ODS-Civil & BLT. Before dispatch rails

shall be inspected & passed by the M/s RITES or any other agency nominated by the Employer/Engineer.

(ii) Method of Measurement

Measurement for payment of this item shall be the length of rail measured in running meter. Payment will be made at the Unit Price per running meter entered in the Priced Bill of Quantities.

7.3.26 NS Item No.26: Supply of 60 Kg Class 'IU' Rails

Supplying, Transporting of Rail 60 kg Class 'IU' as per IRS: T-12/2009 Specifications with latest amendments issued by RDSO.

(i) Method Statement

The Contractor shall submit Method Statement for carrying out the work to the Engineer for approval. The rails shall be procured from RDSO approved source/plant. Supply of rails shall comply with the provisions of Clause 8 of Section VII-5: Employer's requirements-ODS-Civil & BLT. Before dispatch rails shall be inspected & passed by the M/s RITES or any other agency nominated by the Employer/Engineer.

(ii) Method of Measurement

Measurement for payment of this item shall be the length of rail measured in running meter. Payment will be made at the Unit Price per running meter entered in the Priced Bill of Quantities.

Chapter 8. BALLASTLESS TRACK

8.1 GENERAL

a) Deleted.

b) The opposite electrical continuity between rail bases shall be checked by means of a low resistance continuity apparatus (10V-100 amp) in presence of the Engineer.

c) Detailed specification for RCC to be used in construction shall be as per **Annexure OCS-1** & **Annexure OCS-2.**

8.2 BALLASTLESS TRACK INSTALLATION

8.2.1 GENERAL

i. The track gauge throughout shall be 1673 mm (nominal) measured between the running edge gauge point of each rail and normal to the Centre line of the track 14 mm below top of rail.

ii. All main line track shall be laid with 1:20 inward rail slope.

8.2.2 RAIL JOINTING

i. All rail joints throughout the main lines glued insulated joints, switch expansion joints etc. shall be welded.

ii. The welding of nominal rail lengths into long welded rail panels for main lines shall be done with Mobile Flash butt welding machine approved by RDSO. Wherever the Mobile Flash Butt welding is practically not possible the Alumino-thermit welding can be done in accordance with RDSO specification.

8.2.3 RAIL EXPANSION JOINTS

i. Particular attention shall be given to ensure that rail expansion joints are assembled and installed in accordance with the Drawings and correctly located with relation to the type of Rail Expansion joint and the direction of traffic.

ii. Immediately prior to completion of a section, all sliding surfaces of rail expansion joint shall be cleaned and greased.

8.2.4 RAIL TEMPERATURE

Rail temperatures shall be measured using appropriate dial type magnetic thermometers placed on the web of the rail on the shaded side. A minimum number of thermometers required to be used per rail for measuring average rail temperature of a segment of track shall have the prior approval of Engineer.

8.2.5 CLEANING OF TRACK

The track from structure (including the rail surface) as installed shall be thoroughly cleaned to an acceptable standard as approval by the Engineer immediately after

installation and as required thereafter maintaining the standard until the arrangement of service trails so as to provide adequate levels of electric insulation and rail surface quality for correct performance of train control and signaling equipment under prevailing climate and environment conditions.

8.2.6 RAIL INSULATION

The track as installed shall be thoroughly cleaned immediately after insulation. This shall be necessary to provide adequate levels of electrical insulation for the correct performance of the signaling and traction equipment under the prevailing climatic and environment condition.

8.2.7 CUTTING OF RAILS

i. Rails shall only be cut by using abrasive rail cutting machines. The proposed method and equipment for the cutting of rails shall have the prior approval of the Engineer.

ii. Rails required to be cut shall be cold sawn square and vertical across the rail. A deviation from square or vertical of more than 0.5mm measured about the rail head, shall not be permitted. All burrs shall be removed from the rail ends.

iii. Quality of cutting shall be such as to ensure tolerances specified in Alumino-thermit welding manual.

8.2.8 STAGES OF REQUEST FOR INSPECTION DURING CONSTRUCTION OF SLAB TRACK.

A. The ballastless track system consists of:

i. Support structure done as a part of bridge civil works

ii. Reinforced concrete slab track

iii. Rail fastening system (design and drawing shall be submitted by the bidder/contractor for approval).

"Request for inspection" shall be submitted to the Engineer, Complete with all necessary information to allow assessment, after the following activities and approval must be received prior to the commencement of any follow-on activity.

a) Acceptance of support structure including specified surface treatment

b) Acceptance of the slab track reinforcement

c) Acceptance of temporary/false works shuttering, jigs, fixtures and supporting arrangements

d) Acceptance of the track for concreting

e) Acceptance of the track for the movement of construction of plant equipments and machinery

f) Acceptance of the track for in-situ welding / cess welding.

g) Acceptance of the track for destressing

B. All third party (RDSO/RITES/Any other nominated agency) inspection charges, if any, for Ballastless Track system shall be paid by the Employer.

8.2.9 REINFORCED CONCRETE SLAB TRACK

a) The ballastless tracks shall be laid with reinforced concrete slab track on supporting structures.

b) The ballastless track shall be constructed by Top down method of construction. The laying tolerance for various parameters for the installed Ballastless track shall be strictly achieved in accordance with the relevant clauses in these specifications. For achieving these tolerances the tenderer may propose the method/scheme of construction of ballastless track for review before start of work. However, the sole responsibility of achieving the stipulated track laying tolerances lies with the Contractor.

c) The Contractor shall be responsible to calculate the height of the slab track at each location to maintain the desired rail level as shown in the relevant drawings and submit the same for the approval of the Engineer. The reinforced concrete slab track shall be laid on support slab duly making the provision for cant and vertical curves.

d) Suitable construction joints shall be provided in the slab track as per approved Design & Drawing. Location of the joints shall be in conformity with the location of other joints in the bridge super structure.

e) The handling and transport arrangement of rails shall ensure no damage to the rails.

f) Resilient pads placed under the metal base plates shall be coated with silicon or any suitable product, on their underside and lateral side, to stop them adhering to the slab track concrete, as approved by Engineer.

g) During the concreting phase, the track fastening device, the running rails and the expansion joints templates shall be protected by movable covers against possible splattering of concrete.

h) Conduits required for crossing of signaling wires shall have to be provided before concreting as directed by the Engineer.

i) Immediately after concreting of slab track the assembly consisting of the rails and the plinth segments shall be covered by wet cloths to prevent damage due to rise in temperature.

j) These cloths shall be damped constantly for 8 hours from the time of pouring the concrete.

k) The rail fastening between the metal base plates and running rails base shall then be removed to authorize differential movement in the longitudinal direction between the rails and structures.

l) Twenty-four (24) hours after pouring of the slab track concrete, the formwork shall be removed.

m) The concreted surfaces of the slab track below the base plates shall be smooth, devoid of any inclusions, roughness cracks and without showing any aggregate at the surface.

n) Temporary rails shall not be used for constructions, slab track shall be constructed using the permanent rail to be finally fastened.

8.3 TEST FOR RAIL FASTENING SYSTEM COMPONENTS

The following tests are required to be conducted for fastening system-

a) Pull out strength test of anchor bolts.

b) Longitudinal creep resistance test of rail seat assembly.

c) Fatigue test of tension clamp.

d) Fatigue test of helical spring.

e) Stiffness test (static & dynamic) of elastic base plate pad & the ratio of dynamic to static stiffness at various frequencies.

f) Fatigue tests of assembly as a whole. These tests shall cover as minimum heat generated in pads in terms of temperature, records of gauge, rotation of rail head, slippage of rail foot, and lateral & vertical movement of base plate and vertical deflection of rail head.

g) Installation procedure tests.

8.4 RAIL INSULATION TO EARTH TEST

a) All track work shall be subjected to a rail insulation to earth test. The track shall have a minimum rail to earth value of 40 Ω/km of single track for ballastless tracks.

b) The rail to earth test shall be undertaken after the track has been completed and cleaned but before it is finally formed into a continuously welded system and before all the bonding is installed.

c) Junctions shall be isolated and tested prior to their final connection into the track.

d) The test shall be undertaken on rail lengths up to maximum lengths of 1000 m. The tracks shall not be finally formed into a continuous length, nor shall the junctions be joined to the adjacent tracks, until the rail insulation to earth tests have been undertaken and approved.

8.5 BALLASTLESS TRACK BASE RESISTANCE TESTS

a) A ballastless track base resistance test shall be undertaken on all track lengths over 50 meters as a check of the leakage of current through the track base and rail fastening system from one rail to the other.

b) The ballastless track base resistance test shall be undertaken after the track has been complete and cleaned but before it is finally formed into a continuous length and all the bonds are attached.

c) The testing procedure and the minimum resistance shall comply with the requirements proposed by the engineer.

8.6 RAIL INCLINATION INSPECTION

a) Both rails of all ballastless running line tracks shall be checked, at maximum 10m intervals, for inclination using an approved equipment/method in the presence of the engineer.

b) Should any reading show the inclination to be outside the specification limits every alternate fastening assembly shall be further checked either side of the non-compliant reading until compliant readings are consistently obtained.

8.7 RAIL WELDING:

a) The main line track shall be welded into LWR/CWR using mobile flash butt welding machine approved by RDSO. Wherever the mobile flash butt welding is practically not possible the Alumino-thermit SKV process welding shall be done with the approval of the Engineer through agencies approved by RDSO and as per provision of manual for fusion welding of rails by the Alumino-thermit process supply of portion must be and procurement is from sources approved by RDSO.

b) Welding shall be supervised by trained welding supervisor and carried out by trained welder having competency certificate from RDSO/Lucknow in his possession.

c) The preparation of rail ends to be ensured before welding.

d) The Contractor shall arrange for test welds and their testing done as per manual.

e) The welds shall be finished to final profile by grinding and the finished weld shall be within the specified tolerance.

f) Each joint shall have distinctive marks as per details in the manual.

g) Weld collar shall be painted against corrosion as per specification given in manual.

h) All the recorded welds shall meet the acceptance tests including ultra-sonic test.

i) Rail joints welded by the Contractor shall be guaranteed against failure for a period of 2 years from date of starting of rail traffic. Any such welded joint which fails

within guarantee, the joints shall be rewelded free of cost.

j) In case of failure of sample test joint, the period of guarantee for 100 joints represented by the sample joint shall be extended for a further period of 1 year. In case of failure of joints exhibiting sign of failure by cracking within extended period of guarantee, the joints shall be rewelded free of cost.

k) When one bad joint is required to be replaced by two new joints, the entire cost of both the joints shall be borne by the Contractor.

l) Drilling of holes in the 60kg rails is strictly not permitted.

8.8 DESTRESSING OF CWR:

a) Destressing must be done as per provisions of Indian Railway Permanent Way Manual.

b) Destressing of rails shall not be undertaken until it has been demonstrated to Engineer's satisfaction that the track has been completed to the specified standard specifications and the method of working for destressing of the relevant track has been approved by the Engineer.

c) Destressing must be done in accordance with temperature conditions stated in the Railway Manual.

d) The stress free temperature condition of LWR shall be achieved naturally or artificially by the use of hydraulic rail tensors as approved by the Engineer.

8.9 CONSTRUCTION PROCESS

Tenderers are advised to visit local sites location as specified in tender to get familiar with typical local environment like drainage system, rainfall etc.

Procedure of construction process of BLT should be mentioned in details suitable to local site conditions. Clearly demonstrating how it can be constructed & installed within a reasonable time frame.

8.10 Deleted

Annexure OCS-1

PLAIN AND REINFORCED CEMENT CONCRETE

1 MATERIALS

a. Before bringing to the site, all materials for concrete shall be approved by the Engineer. All approved samples shall be deposited in the office of the Engineer before placing orders for the materials with suppliers. The materials brought on to the works shall conform in every respect to their approved samples.

b. Fresh samples shall be deposited with Engineer whenever type or source of any material changes. The contractor shall check fresh consignment of materials as it is brought on to the works to ensure that they conform to the specifications and/or approved samples.

c. The Engineer shall have the option to have any of the materials tested to find whether they are in accordance with specifications at the contractor's expense. All bills vouchers and test certificates which in the opinion of the Engineer are necessary to convince him as to the quality of materials or their suitability shall be produced for his inspection when required.

d. If fly ash is used in concrete, the contractor shall demonstrate the quality control procedure including source of fly ash, its properties, handling as per the relevant IS & international codes etc. and shall use in slabs and walls only after "no objection" to the same has been obtained from the Engineer.

e. Any materials which have not been found to conform to the specifications and not approved by the Engineer shall be rejected forthwith and shall be removed from the site by the contractor at his own cost within the time stipulated by the Engineer. The Engineer shall have the powers to cause the contractors to purchase and use materials from any particular source, as may in his opinion be necessary for the proper execution of work.

f. Contractor shall also ensure that all constituents of exposed concrete shall be taken from same sources to achieve a uniform colour and texture.

g. Approved list of Manufacturer's/Suppliers is given in Section VII- 8:Tender Drawings and Documents. In case the Contractor desired to procure the material from any other supplier, it shall be got approved by the Engineer.

2 Cement

2.1. Product and Materials for Cement

a. Cement to be used in the works shall conform to 53-grade OPC (IS 269:2015) or blended cement such as Portland Pozzolana Cement (IS 1489:2015) or Portland Slag Cement (IS 455:2015).

b. The Contractor shall submit to the Engineer the Manufacturer's Certificate to affirm that the cement complies with the relevant standards.

c. Samples of the proposed cement shall be taken and forwarded to an independent laboratory for analysis before the source is approved.

d. Prior to ordering cement, the Contractor shall submit details of the proposed supplier or manufacturer and information on the proposed methods of transport, storage and certification for the Engineer's approval and show that the quantity and quality required can be attained and maintained throughout the construction period. In exposed concrete elements, the cement used in the concrete for entire element shall preferably be from a single manufacturer to ensure uniform colour.

e. Subsequent to obtaining the Engineer's approval, the Contractor shall not change the agreed arrangements without the prior approval from the Engineer. Each delivery of cement shall be accompanied by a certificate which shall be submitted to the Engineer immediately after the delivery showing the place of manufacture and the results of standard tests carried out by the manufacturer.

2.2. **Testing for Cement**

a. Samples shall be tested from every batch of cement delivered on site or once for every 1000 bags whichever is more frequent. The sampling from bulker shall be increased as decided by the Engineer.

b. Samples shall be taken immediately on receipt of cement at site. The methods and procedures for sampling shall be in accordance with IS: 3535.

c. Tests shall be carried out as per IS4031 for physical analysis as fineness, initial and final setting time and compressive strength and results approved by the Engineer before use. The contractor shall provide complete facilities at site for carrying out the following tests:

   i. Setting time by vicat's apparatus as per IS:5513 and IS:4031.

   ii. Compressive strength of cement as per IS: 4031, IS:650, IS:10080.

d. The Engineer may require any other form of sampling and tests including chemical analysis. Total chloride content in cement and total sulphur content calculated shall in no case exceed the requirements of Table 2 of IS 269. In case the cement supplied is of doubtful quality, tests shall be done in accordance with IS 4032. The costs of such additional tests shall be borne by the Contractor.

3 Aggregates

3.1 General

Aggregates shall conform to the provisions specified in IS 383:2016. The contractor shall submit to the Engineer certificates of grading and compliance for all consignments of aggregate. In addition, at site from time to time, the contractor shall allow for carrying out tests and for supplying test records to the Engineer. Prior to commencing any concrete work, the Contractor shall obtain the Engineer's approval of the proposed types and sources of aggregate.

For fair faced concrete, the contractor shall ensure that aggregates are free from iron pyrites and impurities, which may cause discoloration. Aggregates shall be stored on paved areas in different compartments according to their nominal size.

Sampling of aggregates shall be as per IS 2430.

3.2 Fine Aggregates (Sand)

a. The grading of the sand shall conform to IS:2386(Part1). The grading of fine aggregate shall be within the grading zones I, II, III. Sand, if found too coarse, shall be suitably blended with finer sand obtained from approved sources to obtain the desired grading. The provision of two types of sand, their separate stacking and their mixing in the specified proportions shall be at the Contractor's own cost.

b. The sand shall not contain silt, shale, clay and other weak particles for more than a total of 3% by weight. In case of sand containing excess silt, clay and chlorides, the sand shall be washed in screw type mechanical washers in potable water to remove the same. The screening and washing of sand shall be completed at least one day before using it in concrete. The washed sand shall be stored on a sloping platform while ensuring that contamination is avoided.

c. Water absorption shall be less than 3% by weight (ASTM C 117)

d. The sand shall be screened on a 4.75 mm size screen to eliminate oversized particles. The Contractor shall carry out the following tests at Site and ensure that the appropriate provisions of Indian or other standards, as may be applicable, are complied with:

    i. Proportion of clay, silt and fine dust by sedimentation method as per IS 383:2016 and IS 2386 (Part II)

    ii. Moisture content in fine aggregate as per IS 2386(Part III)

    iii. Water absorption shall be worked out as per IS 2386(Part III)

    iv. Bulk Density or bulkage as per IS 2386(Part III)

    v. Grading of fine aggregate asper IS 383:2016 and IS 2386(Part I)

3.3 Coarse Aggregates

a. All coarse aggregate shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386, Parts I to VIII.

b. The maximum size of coarse aggregate shall be such that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of formwork. The grading of coarse aggregate shall be such that not more than 5% shall be larger than the maximum size and not more than 10% shall be smaller than the smallest size. Between these sizes the coarse aggregate shall be well graded. Unless otherwise permitted by the Engineer the nominal maximum size shall not exceed 20 mm.

c. Water absorption shall be less than 3% by weight (ASTM C 117)

d. Coarse aggregates used for the Works shall be crushed stone conforming to IS 383, obtained from approved sources by the Engineer. Only quarries having jaw crushers with choke feeding arrangements producing aggregates of nearly cubical shape shall be applied.

e. Coarse aggregate containing flat or flaky pieces or mica shall be rejected.

f. The Contractor shall carry out the following tests at site and ensure that the appropriate provisions of following Indian standards as may be applicable are complied with:

i. Moisture content in coarse aggregate asper IS 2386(Part III)

ii. Water absorption shall be worked out as per IS 2386(Part III)

iii. Bulk density and voids asper IS 2386(Part III)

iv. Grading of coarse aggregate as per IS 383:2016 and IS 2386(Part I)

4 Water

Water used in the works shall be potable water and free from deleterious materials. Water used for mixing and curing concrete as well as for cooling and/or washing aggregate shall be fresh and clean free from injurious amounts of oil, salts, acids, alkali, sugar other chemicals and organic matter. Mixing and curing with seawater shall not be permitted.

Water shall be from the source approved by the Engineer and shall be in accordance with IRS: CBC(Cl.4.3), IS: 456 (Cl. 5.4) and/or BS 3148.

Water samples from the intended source of supply shall be taken for analysis before any concrete work commences, and at regular intervals throughout the duration of the Works, as approved by the Engineer. Whenever the source of water changes, the water shall be tested for its chemical and other properties or impurities to ascertain its suitability for use

in concrete, subject to the approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of all such tests shall be borne by the Contractor.

5 Chloride Content

The chloride content of aggregates shall be within the recommended limits stated in IS: 383 or BS 882 and the chloride content of the concrete mix shall be within the recommended limit of IS: 456 or BS 8110. Chloride levels shall be determined daily in accordance with the methods described in BS 812.

6 Alkali-Silica Reactivity

If aggregates contain any materials which are reactive with alkalis in any of the constituents of the concrete, or in water which will be in contact with the finished work, then the Contractor shall take samples of these materials every week. The Contractor shall ensure that the concrete mix complies with the requirements of this Specification regarding "Minimising risk of alkali-silica reaction in concrete". The results of the Contractor's weekly monitoring tests shall be submitted in writing to the Engineer-in-charge.

7 Sulphate Content

The total acid soluble sulphate content of the concrete mix, expressed as SO3, shall not exceed the recommended limit in IS: 456 or BS 8110.

8 Reinforcement Steel

The Contractor shall refer to Annexure - C of these Technical Specifications.

9 Binding Wire

GI wires of 1.6mm diameter shall be used for binding of reinforcements. It shall conform to the provisions laid down in IS 280.

10 Concrete Admixtures

a. Admixtures shall conform to the provision laid down in IRS: CBC (Cl. 4.4).

b. Concrete admixtures are proprietary items of the manufacturer and shall be obtained only from established manufacturers with proven track record, quality assurance and full- fledged laboratory facilities for the manufacture and testing of concrete. Naphthalene or melamine-based admixtures that are approved by the Engineer only shall be used in the Works. The admixture shall be non-air entraining type. The Contractor shall provide the following information concerning each admixture after obtaining the same from the manufacturer:

   i. Normal dosage and detrimental effects, if any, of under dosage and over dosage.

   ii. The chemical names of the main ingredients in the admixtures.

iii. The chloride content, if any, expressed as a percentage by weight of the admixture.

iv. Values of dry material content, ash content and relative density of the admixture which can be used for uniformity tests.

v. Whether or not the admixture leads to the entrainment of air when used as per the manufacturer's recommended dosage, and if so, to what extent.

vi. Where two or more admixtures are proposed to be used in any one mix, confirmation of their compatibility.

vii. Whether or not there would be an increase in risk of corrosion of the reinforcement or other embodiments as a result of using the admixture.

viii. Retardation achieved in initial setting time.

c. Physical and chemical requirements of admixtures shall conform to IS 9103. In addition, the following conditions shall be satisfied:

i. Plasticizers and superplasticizers shall meet the requirements indicated for "Water reducing Admixture".

ii. The air content of freshly mixed concrete, in accordance with the pressure method given in IS 1199, shall not be more than 1% higher than that of the corresponding control mix.

iii. There shall be no chloride content in admixture when tested in accordance with IS 6925.

iv. Uniformity tests on the admixtures are essential to compare qualitatively the composition of different samples taken from batch to batch or from the same batch at different times.

v. All tests relating to the concrete admixtures shall be conducted periodically at an independent laboratory and compared with the data given by the manufacturer.

vi. While qualifying the admixture, the infrared spectrograph plot shall be given. Each batch of the supply shall be tested for IR spectrograph and prove the consistency of supply.

11 Minimising the Risk of Alkali-Silica Reaction (ASR) in Concrete

a) Precautions against ASR in Concrete

Concrete mixes for use in the Permanent Works shall comply with one of the Subsections (b), (c) or (d). The Contractor shall notify the Engineer of his proposals for complying with this requirement.

b) The cementitious material shall have a reactive alkali content not exceeding a

maximum value of 0.6% by mass when defined and tested in accordance with Subsections 3.3.1 ((e) to (k) inclusive).

To combat the ASR, Microsilica shall be used in minimum 5% cement and shall not exceed 10% by the wt of cement in order to bind free alkalis early in plastic concrete and to reduce the permeability of concrete to prevent the moisture and external alkalis penetration.

OR

c) The total mass of reactive alkali in the concrete mix shall not exceed 3.0 kg/m^3 of concrete when defined, tested and calculated in accordance with Subsections 3.3.1 ((e) to (k) inclusive) and 3.3.1 ((l) to (o) inclusive).

OR

d) The aggregate shall be classed as non-reactive in accordance with the definition in Subsection (n).

e) Cementitious Material (Hydraulic and Latent Hydraulic Binders):

f) The term alkali refers to the alkali metals sodium and potassium expressed as their oxides. The reactive alkali content of Portland cements shall be defined as the percentage by mass of equivalent sodium oxide (Na_2O) calculated from:- % equivalent Na_2O = % acid soluble Na_2O + 0.658 x (% acid soluble K_2O)

g) The method used in determining the acid soluble alkali content of the materials shall be in accordance with BS 4550: Part 2: Subsection 16.2.

h) The Contractor shall make available the certified average acid soluble alkali content of Portland cement on a weekly basis.

i) The Contractor shall give immediate notice of any change which may increase the certified average acid soluble alkali content above the level used in the mix design for the concrete. A revised mix design for any concrete which would be affected by the increased alkali content shall be submitted for consent with notification of the change.

j) Minimising the Risk by Using Cementitious material Containing less than 0.6% Reactive Alkali

The requirements of Subsection (b) will be met by Subsection (k) provided that the contribution of alkalis from other sources does not exceed 0.2 kg/m3 (see Subsections and (u)). Where alkalis exceed 0.2 kg/m3 the requirements of Subsections (l) to (o) shall apply.

k) The cementitious material shall be Portland cement complying with Indian Standard and shall have additionally a certified maximum acid soluble alkali content not exceeding 0.6%.

l) The Contractor shall provide on request weekly certificates which name the source of the cement and confirm compliance with the Specification.

Minimising the Risk by Limiting the Reactive Alkali content of the concrete to 3.0 kg/m3. The requirements of Subsection (c) will be met provided that Subsections (m), (n) and are satisfied.

m) The reactive alkali content of the concrete contributed by the Portland cement to the concrete shall be calculated from:

Portland cement

$$A = \frac{C \times}{\frac{a}{100}},$$

Where,

A = reactive alkali content of the concrete to the nearest 0.1 (kg/m3) C = target mean Portland cement content of the concrete (kg/m3)

a = certified average acid soluble alkali content of the Portland cement (%).

n) Where reactive alkalis in excess of 0.2kg/m^3 are contributed to the concrete from sources other than the cementitious material the limit of 3.0 kg/m^3 from the cementitious material shall be reduced by the total amount so contributed.

The reactive alkali contributed by sodium chloride contamination of aggregates shall be calculated from:

$$H = 0.76x \frac{(NFxMF)+(NCxMC)}{100} \text{ (kg/m3)}$$

Where H = equivalent alkali contribution made to the concrete by the sodium chloride

NF = chloride ion content of the fine aggregate as a percentage by mass of dry aggregates and measured according to BS 812: Part 4

MF = fine aggregate content (kg/m3)

NC = chloride ion content of the coarse aggregate as a percentage by mass of dry aggregate and measured according to BS 812: Part 4: 1976 (now in draft as Part 117)

MC = coarse aggregate content (kg/m3).

The factor 0.76 is obtained from a consideration of the composition of sea water.

The chloride ion content of aggregate sources containing 0.01% of

chloride ion by mass or more shall be determined weekly in accordance with BS 812 or another approved method. When the chloride ion level is less than 0.01% it shall be regarded as nil.

o) The Contractor shall provide certificates on request confirming compliance with the Specification and stating:

i. The target mean cementitious material content of the concrete.

ii. The names of the works manufacturing the cement.

iii. A weekly report of the cement alkali determinations in accordance with Subsection (f).

iv. The certified average acid soluble alkali content of the Portland cement.

p) Minimising the Risk by Using Selected Aggregates

Fine and coarse aggregate material shall comply with the requirements of IS:383 (and/or AASHTO Standard Specifications M6 and M80 respectively) to be taken out to conform to 512(2).

q) Water

r) Water for use in the manufacture of concrete shall be obtained from a public utility undertaking supply or from a source approved by Engineer and shall be of potable quality, and comply with the requirement of IS:456 and or BS 3148

s) Where a potable mains supply is not available the Contractor shall obtain confirmation of the quality and reliability of the proposed source from the appropriate water authority and shall thereafter seek consent from the Engineer to use the proposed source.

t) Water other than from a public utility undertaking supply shall be sampled at a frequency to be determined by the Engineer and tested in accordance with the relevant provisions of IS:3025 or BS 3148. The sodium oxide and potassium oxide content shall be declared and expressed as equivalent Na_2O and shall be taken into account when calculating the total reactive alkali content of the concrete mix.

u) Admixtures and Pigments

Admixtures and pigments shall comply with the requirements of IS 9103 and IS:6925 or BS 5075 and BS 1014. The manufacturer's declared equivalent acid soluble alkali content and the dosage rate of any admixture or pigment to be incorporated shall be included with details of all concrete mixes submitted for consent.

v) The alkali content of admixtures shall be taken into account when determining the total equivalent alkali content of the concrete mix.

w) Micro silica (silica fume) shall be used in 5% by the weight of cement and shall not exceed 15% by the weight of cement.

12 Storage of Materials

12.1 General

a. Handling and storage of all material shall be as per IS 4082.

b. All materials shall be stored at proper places to prevent their deterioration or intrusion by foreign matter and to ensure their satisfactory quality and fitness for the work. The storage space shall also permit easy inspection, removal and restoring of the materials. All such materials even though stored in approved storage places, will be subjected to acceptance test prior to their immediate use.

c. The procedures to be adopted for transportation and storage of the materials shall obtain prior approval from the Engineer.

12.2 Cement

a. Cement shall be transported, handled and stored on the site in such a manner as to avoid deterioration or contamination. Cement shall be stored above ground level in perfectly dry and watertight sheds and shall be stacked not more than eight bags high. Wherever bulk storage containers are used, it shall be ensured that their capacity is adequate to cater to the requirement at Site and they are cleaned at least once every 3 months. Cement older than 3 months from the date of manufacture shall not be used.

b. Each consignment shall be stored separately so that it may be readily identified and inspected, and cement shall be used in the sequence in which it is delivered at Site. Any consignment or part of a consignment of cement which had deteriorated of any sort during storage, shall not be used in the Works and shall be removed from the Site by the Contractor, without adding any costs to the Employer.

c. The Contractor shall prepare and maintain proper records on site regarding delivery, handling, storage and use of cement. These records shall be available for inspection by the Engineer at all times.

d. The Contractor shall make a monthly return to the Engineer on the date corresponding to the interim certificate date, showing the quantities of cement received and issued during the month and in stock at the end of the month.

12.3 Aggregates

a. Storage areas for aggregates have to be covered, protected against any kind of contamination, avoid the possibility of mix among aggregates and protected also against any water inflow. The floor of the storage for aggregates has to be in concrete and has

to be drained. Storage areas for different size of aggregates have to be independent to avoid any possibility of mix.

b. During rainy and cold weather periods, the aggregates shall be stored undercover for at least 48 hours before being used and kept sufficiently dry.

c. The stockpiling of the processed aggregate and drawl there from shall be such as to ensure that the variation in the free moisture in the aggregate during anyone shift of working, does not exceed 1 percent.

d. The coarse aggregates shall, be stored as per the procedure of relevant IS: codes.

e. Care shall be taken in screening and stocking of the coarse aggregates so as to avoid intermixture of different gauge materials and inclusion of any foreign materials.

f. The stockpiles shall be built up in horizontal or gently sloping layers.

g. Trucks and bulldozers shall be kept off the stockpiles to prevent breakage and impairing the cleanliness of aggregate.

h. A hard base shall be provided to prevent contamination from underlying materials in storage areas in continuous use.

i. Overlap of different sizes of materials shall be prevented with suitable walls or by ample distance between storage piles.

j. Arrangement shall be made to store natural and manufactured sand in a way that shall protect it from being contaminated with dust, organic matter or other deleterious substances.

13 Design Mix Concrete

13.1 General

a. For all items of concrete, only design mix shall be used. Prior to the commencement of construction, the Contractor shall design the mix and submit the proportions of materials, including admixtures to be used to the Engineer for obtaining approval. Suitable water reducing admixtures or super-plasticizing admixtures shall be used for achieving desired workability and strength of the concrete only after obtaining prior approval from the Engineer. No extra payment shall be made for such admixtures.

b. Mix design shall conform to the provisions under IRS: CBC (Cl. 5.5 and 8.7) and IS 10262.

c. Drying shrinkage of concrete shall be 0.03% or less. Drying shrinkage of concrete shall be tested in accordance with IS 1199.

d. When non-bleeding high flow concrete is used, it shall be confirmed that no bleeding occurs under Concrete Bleeding Test specified in IS 9103. The Contractor shall submit

the test results to the Engineer prior to the commencement of concrete works for obtaining approval.

e. Mix design, once approved, must not be altered without obtaining prior approval of the Engineer. However, if the Contractor anticipates any change in quality and/or change in source of future supply of materials than that used for earlier mix design, the Contractor shall inform the Engineer well in advance and bring fresh samples sufficiently in advance, to carry out fresh trial mixes.

f. The total chloride content of all constituents of concrete in mix shall be limited to 0.43 kg/m3 for reinforced concrete works and prestressed concrete works as per IS:14959.

13.2 Workability of Concrete

a. The mix shall have the consistency which allows proper placement and consolidation in the required position. It shall be ensured that uniform consistency is maintained.

b. Workability of concrete shall conform to the provisions of IRS: CBC(Cl.5.3).

13.3 Durability of Concrete

a. Maximum water cement ratio for design mix shall conform to IRS: CBC(Clause5.4.3) as follows:

Plain Concrete	Reinforced Concrete
0.45	0.40

b. Minimum grade of concrete shall conform to IRS: CBC(Clause5.4.4) as follows:

Plain Concrete	Reinforced Concrete
M-20	M-35

c. Maximum and minimum permissible cementitious material shall conform to IRS: CBC (Clause5.4.5) as follows:

Minimum(kg/cum)		Max
Plain Concrete	Reinforced Concrete	
250	350	500

13.4 Trial Mixes

a. The Contractor is entirely responsible for the design of the concrete mixes. However, the design shall have approval from the Engineer. At least 8 weeks before

commencing any concreting in the Works, the Contractor shall make trial mixes using samples of coarse aggregates, sand, water, super plasticiser and cement, typical of those to be used in the Works, and which have been tested in an approved laboratory. A clean dry mixer shall be used, and the first batch shall be discarded.

b. The mix shall be designed to produce the grade of concrete having the required workability, durability and a characteristic strength not less than appropriate value given in IRS: CBC (CL. 5.1, 5.3 & 5.4). Trial mixes shall be prepared under full-scale site conditions and tested in accordance with IS 10262.

c. Whenever there is a significant change in the quality of any of the ingredients for concrete, the Engineer, at his discretion, may order the carrying out of fresh trial mixes. All costs for trial mixes and tests shall be borne by the Contractor's and held to be included in the rates quoted in the priced Bill of Quantities.

d. Before commencing the Works, the Contractor shall submit full details of the preliminary trial mixes and tests to the Engineer for approval.

13.5 Size of Coarse Aggregate

The nominal size of coarse aggregates for concrete shall be as per the Drawings. The proportions of the various individual size of aggregates shall be so adjusted that the grading produces densest mix and the grading curve corresponds to the maximum nominal size adopted for the concrete mix.

13.6 Mixing Concrete

13.6.1 General

a. Production and control of concrete shall conform to IRS: CBC(Cl.5.6).

b. Concrete shall be mixed in an automatic batching and mixing plant as per this Technical Specifications. Hand mixing shall not be permitted. The mixer or the plant shall be at an approved location that shall be selected considering the properties of the mixes and the transportation arrangements available with the Contractor. The mixer or the plant shall be approved by the Engineer. Unless permitted by the Engineer, all concrete shall be produced in computerised automatic weigh batching plant having printing facilities to printout records of each batch and installed at the Site.

c. Mixingshallbecontinuedtillmaterialsareuniformlydistributedandauniform colour of the entire mass is obtained, and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement.

d. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed by the Engineer, the first batch of concrete from the mixer shall contain only two thirds of the normal quantity of coarse aggregate for cleaning purpose only, and the same shall not be

used for concreting purpose. Mixing plant shall be thoroughly cleaned before changing from one type of mix to another.

13.6.2 Batching on site

a. Batching of concrete shall conform to the provision of IRS: CBC (Cl. 5.6.2) and IS 4925.

b. All weighing and measuring equipment shall be tested and calibrated as per IS 4926.The results of these tests and calibration shall be submitted to the Engineer.

c. Addition of water to compensate for slump loss shall not be resorted to nor shall the design maximum water content and maximum water-cement ratio be exceeded. If permitted by the Engineer, additional dose of retarder shall be used to compensate the loss of slump at the Contractor's cost. Re-tempering water shall not be allowed to be added to mixed batches to obtain desired slump.

13.6.3 Ready Mixed Concrete

The Contractor can use RMC, if approved by the Engineer. The source batching plant of RMC shall not change during the course of work. If RMC is used, it shall conform to the provisions laid down in IRS: CBC (CL. 5.7). The batching plant shall have consent to establish and consent to operate permit from Pollution Control Authority. The batching plant shall be operated by trained staff. The batching plant shall have suitable motorable road and a traffic plan to ensure free and safe passage of all vehicles. Waste water and sludge from batching plant shall be at the designated points.

a. Transporting, Placing and Compaction of Concrete

Transporting, placing, compacting and curing of concrete shall be in accordance with IRS: CBC(Cl.8), IS 456 and IS 5892.

i. Transporting

- The method of transporting and placing concrete shall have approval from the Engineer. Transportation of concrete shall conform to IRS: CBC (Cl. 8.1, 5.7), if not in contravention to the following provisions.
- The mix shall be transported by agitating transit mixers, buckets, pumps etc. or asper approval by the Engineer, without causing segregation and loss of cement slurry and without altering its desired properties with respect to water content, water cement ratio, slump, air content, cohesion and homogeneity.
- $1m^3$ of each mix shall be supplied to Site before it is required in the Works to enable the Contractor to carry out workability tests. Under no circumstances shall extra water be added to the concrete after the original mixing is completed.

ii. Pumping

- Pumping of concrete shall conform to IRS: CBC (Cl.8.9), if not in contravention to the following provisions.
- The type of concrete pump, the diameter of transporting pipe, the route of piping etc. shall be determined considering the pumpability of the concrete to obtain the required quality of concrete after pumping.
- The type and the number of concrete pumps shall be determined in consideration of the pumping pressure, the discharge amount, the pumping rate per hour, the environmental conditions of construction site etc.
- Prior to pumping design mix concrete, pumping of mortar with the same proportion as of design mix concrete shall be done to prevent loss of mortar in pump due to adherence.
- The mortar pumped prior to the concrete pumping shall not discharge into the formwork.

iii. Placing

a) Placing General

- Placing of concrete shall conform to the provisions laid down in IRS: CBC(Cl.8.2).
- Prior to concreting, detailed planning on the placing system, the arrangement and the number of pumping cars, the position of the inlet for concrete pump, lighting equipment and arrangements for power supply, the sequence and rate of placing, time interval between concrete lifts etc. shall be specified in the Method Statement and the same shall be submitted to the Engineer for approval. Due allowance shall be made to secure enough clear spacing of reinforcement bars which enables concrete to flow through the spaces between reinforcement bars.
- Concrete shall be transported by means which prevent contamination (by dust, rain etc.) segregation or loss of ingredients, and shall be transported and placed without delay.
- Concrete shall be placed directly in its final position without segregation or displacement of the reinforcement, embedded items and formwork. Concrete shall not be placed in water, except as specified. Concrete shall not be dropped through a height greater than 1.5 metres.
- All formwork shall be thoroughly cleaned to remove debris etc. before concreting. In addition, the Engineer shall inspect that there is no debris etc. in the formwork before concrete is cast. It shall be examined that there

is no abnormality in the formwork and falsework before and during concreting.

- No concrete shall be placed in any part of the structure until approval of the Engineer has been obtained. If concreting did not commence within 24 hours of issuance of approval, then it shall be obtained again from the Engineer. Concreting then shall proceed continuously over the area between the construction joints.
- Except where otherwise agreed by the Engineer, concrete shall be deposited in horizontal layers to a compacted depth of not more than 300 mm.
- Concrete when delivered in the works shall be maintained at a temperature of not more than 35°C as far as possible.
- Clear spacing between reinforcements shall be secured adequately and lighting equipment shall be arranged adequately in order to visually check the position of inlet of the concrete pump and the filling situation of the concrete during concreting works. In addition, suitable measures shall be taken so that the reinforcement bars do not move and clear cover to the reinforcement bars does not change.
- The clear cover shall be uniform and as per the Drawings. Concrete cover blocks used shall be of the same concrete mix as the member and shall contain the binding wire to secure it to the reinforcement. All ends of binding wire shall be carefully turned inside so that they do not project out of concrete cover. Reinforcement bars shall be adequately secured by chairs/ties/hangers so that it maintains its position during casting and vibrating concrete. Ends of the wires used to tie bars shall be bent into the member.
- In case of concreting the horizontal member immediately after the concreting of vertical member is finished, the horizontal member shall be cast after any settlement of concrete of the vertical member ceases in order to prevent settling cracks.
- If bleeding water is present on the surface of concrete during concreting, the bleeding water shall be removed before the following concrete is placed.
- The Contractor shall ensure that the place where concreting is to be done shall be free of water.

b) Extent of Pours

For piers and pier heads, portal columns the concreting is to be carried out

in single stage i.e. in first stage concreting will be from kicker to just below pier head bottom and second stage of concreting will be pier head including shear key and cross girder (in station zone stages as given in drawings for all heights by using tremie/ pumps at the rate not more than 1.5m / hr or as approved by the Engineer.

Floors, roofs and ground slabs shall be placed in a sequence of pours to the approval of the Designer and the consent of the Engineer.

If the use of slip-forms or paving trains is permitted, these limits may be revised. The sequence of pours shall be arranged to minimise thermal and shrinkage strains.

c) Placing Equipment

Concrete shall generally be placed without segregation by pumping or bottom-opening skips. If chutes are used their slopes shall not cause segregation and spouts or baffles shall be provided.

d) Time for Placing

Concrete and mortar must be placed and compacted within 30 minutes of water being added to the mix or otherwise included via damp aggregates, unless admixtures are in use. Partially-set concrete shall not be used in the Works.

e) Continuity of Placing

Placing in each section of work shall be continuous between construction joints. The Contractor shall make provision for standby equipment. If the placing of concrete is delayed due to breakdown then the Contractor shall erect vertical stop-ends and form a construction joint or remove the concrete already placed and restart after repair of the breakdown, as directed.

f) Placing in Inclement Weather

Placing shall not take place in the open during storms or heavy rains. If such conditions are likely to occur the Contractor shall provide protection for the materials, plant and formwork so that work may proceed. If strong winds are prevalent protection from driving rain and dust shall be provided.

g) Placing in High Temperature and Low Temperature

The temperature of concrete shall not exceed 32º nor below 5ºC or the temperature stated in the table of Mixes whichever is the lower at the time of placing concrete. Also the maximum concrete temperature after placing shall not exceed temperature 50oC or 30oC above the concrete temperature

at the time of placing whichever is the lower.

"Concrete in hot countries" published by FIP congress at New Delhi 1986 shall be complied with. The procedures the Contractor wishes to employ shall be subject to the Engineer consent

The Contractor shall supply suitable maximum/minimum thermometers and record the shade and sun temperatures at locations where concrete is being placed. Recommendations for cold weather concrete can be had from IS: 7861 (Part 2).

h) Placing at Night

If consent has been given for placing at night or in dark interiors, adequate lighting shall be provided where mixing, transportation and placing are in progress.

i) Placing Under Water

Underwater concrete shall be placed with minimum disturbance of the water. Running water and wave wash shall be controlled. The specified concrete grade shall be used and the mix design shall provide for good flowing ability.

Tremie pipes, bottom-dump skips or other approved placing equipment shall be used. Segregation shall be avoided.

Placing shall be commenced in approved sections and continued to completion.

The tremie pipe shall be buried in the concrete for at least 1.5m and the pipe must not be emptied until the pour is complete. If a bottom-dump skip is used, the contents shall be covered by canvas or similar before lowering into the water. The doors shall be opened when the skip is resting on the bottom with no tension in the support cable, and the skip shall be lifted gradually so that the concrete flows out steadily.

j) Preparation Before Placing

Before placing concrete for reinforced work on the ground, the formation shall be compacted as specified and a screed of blinding concrete shall be applied to form a surface for construction.

Before placing concrete on or against rock, masonry, brickwork or old concrete, loose material shall be removed and the surface washed down; water seepage shall be stopped or channelled away from the work.

iv. Compaction

1. Compaction of concrete shall conform to the provisions laid down in IRS: CBC (Cl.8.3).

- Additional vibrators in serviceable condition shall be kept at site so that they can be used in the event of breakdowns. Concrete shall be compacted before setting commences and shall not be subsequently disturbed.

2. Internal (needle) and surface (screed board) vibrators of approved make shall be used for compaction of concrete. Internal vibrators shall be inserted in an orderly manner. The distance between insertions shall be 500 mm or less. The vibrator shall be made to operate at a regular pattern of spacing. The effective radii of action will overlap approximately half a radius to ensure complete compaction.

3. Internal vibrators shall be used for compaction of concrete in foundations, columns, buttresses arch section, slabs etc, and if required surface vibrators shall also be used. Depending on the thickness of layer to be compacted, 25 mm, 40 mm, 60 mm and 75 mm dia internal vibrators will be used. The concrete shall be compacted by use of appropriate diameter vibrator by holding the vibrator in position until:

a) Air bubbles cease to come to surface.

b) Resumption of steady frequency of vibrator after the initial short period of drop in the frequency, when the vibrator is first inserted.

- The vibration shall be done till the tone of the vibrated concrete becomes uniform. To achieve an even and dense surface free of aggregate pockets, vibration shall be supplemented by tamping or rodding by hand in the corners of forms and along the form surfaces while the concrete is plastic.

c) Flattened, glistening surface, with coarse aggregates particles blended into it appears on the surface.

d) Use of curing compounds may be permitted with specific approval of Engineer.

4. After the compaction is completed, the vibrator should be withdrawn slowly from the concrete so that concrete can flow in to the space previously occupied by the vibrator. To avoid segregation during

vibration the vibrator shall not be dragged through the concrete nor used to spread the concrete. The vibrator shall be made to penetrate, into the layer of fresh concrete below if any for a depth of about 150mm. The vibrator shall be made to operate at a regular pattern of spacing. The effective radii of action will overlap approximately half a radius to ensure complete compaction.

a) To secure even and dense surfaces free from aggregate pockets, vibration shall be supplemented by tamping or rodding by hand in the corners of forms and along the form surfaces while the concrete is plastic.

b) A sufficient number of spare vibrators shall be kept readily accessible to the place of deposition of concrete to assure adequate vibration in case of breakdown of those in use.

c) Form vibrators whenever used shall be clamped to the sides of formwork and shall not be fixed more than 450 mm above the base of the new formwork and concrete shall be filled not higher than 230mm above the vibrator. The formwork must be made specially strong and watertight where this type of vibrator is used.

d) Care must be taken to guard against over vibration especially where the workability of the concrete mix is high since this will encourage segregation of the concrete.

e) Plain concrete in foundations shall be placed in direct contact with the bottom of the excavation, the concrete being deposited in such a manner as not to be mixed with the earth. Plain concrete also shall be vibrated to achieve full compaction.

5. Construction Joints

a. Construction joints shall be avoided as far as possible and in no case the locations of such joints shall be changed or increased from those shown in the drawings, unless otherwise approved by the Engineer.

b. Where provision of construction joint is unavoidable, the location, direction and construction method of construction joint shall be determined in consideration of the structural strength, durability and appearance of the structure. Concreting shall be carried out continuously upto the construction joints. Construction joints shall conform to the provisions laid down in IRS: CBC (Cl. 8.5 and Annexure - B). The Contractor shall submit Method Statement on

the construction joints which shall be subject to the consent of the Engineer prior to concreting works.

c. The location of the construction joints and their arrangement, procedure for surface preparation of construction joint and sequence of concreting shall be subject to the consent of the Engineer. Construction joints shall be located at locations where the shear force is minimum. The joints shall be provided in a direction perpendicular to the member axis. Sequencing of concrete placement shall be organized in such a way that cold joints are totally eliminated. Properly designed reinforcement shall be provided prior to casting of the next lift for transfer of full tensile stress across the joints.

6. Expansion, Contraction and Movement Joints

Expansion, contraction and other movement joints shall be incorporated in the works as shown on the Drawings.

Where shown on the Drawings approved, expansion joint fillers shall be supplied and installed. Filler material shall be stored flat on a dry surface adequately protected from rain or moisture in such a way that the material does not deteriorate. Filler material which has been damaged or has started to deteriorate shall not be incorporated in the works.

Movement joints shall be sealed with an approved sealant applied in strict accordance with the manufacturer's instructions to the dimensions shown on the Drawings. The surface of the concrete to which the sealant is to adhere shall be straight and cleaned of all filler material, dirt, oil, grease and other matter. The sealant shall be applied by methods recommended by the manufacturer so that the sealant is brought flush to the surface of structure and a smooth surface is achieved. Excess material and spillage shall be properly cleaned off and removed.

Dowel bars shall be installed and cast in across the movement joint where shown on the Drawings. The bars shall be straight with clean cut ends of the diameters and lengths as

shown on the Drawings or in the Schedules. Cutting and cleaning of the dowel bars shall comply with the requirements of this Specification.

The bars shall be firmly supported in the positions shown on the Drawings so that they remain accurately parallel and are not displaced during the casting of the concrete in the first part of the structure. After

the concrete has hardened and the formwork removed, the projecting ends shall be cleaned of all concrete spillage and painted with two coats of an approved bituminous paint and caps shall be fitted to the free ends of the bars. Dowel bar end caps shall be of cardboard or other material, of correct diameter for the dowel bar and of sufficient length to allow the specified movement of the two adjacent concrete structures. They shall be manufactured expressly for this purpose by an approved manufacturer.

The Contractor shall take care to protect the projecting ends of dowel bars from bending or other damage prior to concreting the succeeding bay. The bituminous paint shall be applied as soon as practicable, but end caps shall not be fitted until immediately prior to the succeeding concreting operations.

7. Bolts, Inserts and Openings

All fixing blocks, brackets, built in bolts, holes, chases, etc., shall be accurately set out and formed and carefully sealed prior to the concrete being placed. No cutting away of concrete for any of these items shall be done without the permission of the Engineer-in- Charge.

Bolts and other inserts to be cast into the concrete shall be securely fixed to the formwork in such a way that they are not displaced during the concreting operations, and that there is no loss of materials from the wet concrete through holes in the formwork.

Unless shown otherwise on the Drawings or the Engineer has given consent, reinforcement shall be locally moved so that the minimum specified cover is maintained at the locations of inserts, holes, chases, etc.

Temporary plugs shall be removed and the threads of cast in bolts shall be proved to be free and shall be greased before handing over any part of the Works. Construction joints in all concrete work shall be made as directed by the Engineer. Where vertical joints are required, these shall be shuttered as directed and not allowed to take the natural slope of the concrete.

8. Concreting under Special Conditions

Concreting under special conditions shall conform to the provisions laid down in IRS: CBC.

13.7 Concreting in Extreme Weather Conditions

Concreting in extreme weather conditions shall conform to the provisions laid down in IRS: CBC (Cl. 8.6.1).

13.8 Concreting under Water

a. Concreting underwater and seawater shall conform to the provisions laid down in IRS: CBC (Cl. 8.6.2 and Cl. 8.6.3), where not contravening to the following provisions.

b. When it is necessary to deposit concrete under water, the methods, equipment, materials and proportions of mix to be used shall obtain approval of the Engineer, prior to the commencement of any work.

c. Concrete shall not be placed in water having a temperature below 5°C. The temperature of the concrete, when deposited, shall neither be less than 16 °C nor more than 35°C.

d. All underwater concreting shall be carried out by tremie method as described in IRS: CBC (CL.8.6.2) only, using tremie of appropriate diameter. The number and spacing of the tremie shall be worked out to ensure proper concreting. The tremie concreting when started shall continue without interruption for the full height of the member being concreted. The concrete production and placement equipment shall be adequate to enable the underwater concrete to be completed uninterrupted within the stipulated time. Necessary standby equipment shall be available for emergency situation.

e. In case of withdrawal of tremie out of the concrete either accidentally or to remove a choke in the tremie with the approval of the Engineer, the tremie shall be reintroduced in the following manner to prevent impregnation of laitance or scum lying on top of the concrete deposited in the bore. The tremie shall be gently lowered on to the old concrete with very little penetration initially. A vermiculite plug shall be introduced in the tremie. Fresh concrete of slump between 150 mm and 175 mm shall be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing the laitance or scum. The tremie shall be pushed further in steps making fresh concrete sweep away the laitance or scum in its way. When tremie is buried in for about 0.60m to1.0 m, concreting may be resumed.

f. In case of concreting through tremie or such pipes which are subsequently withdrawn, the concrete shall be placed in adequate quantity to ensure that during withdrawal of the tube, a sufficient head of concrete is maintained to prevent the inflow of soil and water or bentonite slurry.

g. No concrete shall be allowed to come in contact with seawater within 72 hours of casting.

13.9 Concreting under Aggressive Soils and Water

Concreting under aggressive soils and water shall conform to the provisions laid down in IRS: CBC (Cl. 8.6.4).

14. Curing of Concrete

14.1 General

a. Concreting operations shall not commence until adequate arrangements for curing of concrete have been made by the Contractor. Curing and protection of concrete shall commence after the concrete has set hard enough, to with stand stresses due to curing work and does not get damaged, in order to protect it from the following:

   i. Premature drying out, particularly by solar radiation and wind.

   ii. High internal thermal gradients.

   iii. Leaching out by rain and flowing water.

   iv. Rapid cooling during the first few days after placing.

   v. Low temperature.

   vi. Vibration and impact which may disrupt the concrete and interfere with its bond to there reinforcement.

   b. Where members are of considerable size and length, with high cement content, accelerated curing methods may be applied, as approved by the Engineer.

14.2 Curing Procedure

a. In order to ensure the required quality of concrete in terms of parametres such as strength, durability and permeability, concrete shall be cured adequately, being kept at a temperature and humidity necessary to be hardened within a certain period of time after concreting, in order not to be affected by harmful effects such as low or high temperature, rapid temperature change, drying, loading and impact loading.

b. Curing of concrete shall conform to the provisions laid down in IRS: CBC (Cl.8.4). Approved curing compounds shall be used in lieu of moist curing, with the approval of the Engineer, particularly for all vertical faces and inaccessible areas, conforming to IRS: CBC (CL. 8.4.2).

14.3 Finishing

Finishing shall conform to the provisions laid down in IRS: CBC (Cl. 6.2.4), if not in contravention to the following provisions:

a. Immediately after removal of forms, exposed bars or bolt, if any, shall be cut inside the concrete member to a depth of at least 50 mm below the surface of the concrete and the resulting holes shall be filled with cement mortar of dry pack consistency.

b. All construction and expansion joints in the completed work shall be left carefully tooled and free of any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges.

c. The finished surfaces of concrete after removal of form work shall be such that no touching up is required. All finsca used by form joints, if any, shall be ground using electric sur face grinder.

d. Immediate Lyon removal of forms, before any defects are rectified, the concrete work shall be examined by the Engineer.

   i. Exposed concrete surfaces shall be smooth and even, originally as stripped, without any finishing or rendering. The Contractor shall exercise special care and supervision of formwork and concreting to ensure that the cast members are made true to their sizes, shapes and positions. The work that has sagged or contains honeycombing to an extent which is detrimental to structural safety or architectural appearance shall be rejected. Honeycombed parts of the concrete, including other surface defects in the concrete, shall be removed by the Contractor as per the methods which do not affect the strength of adjoining concrete and as per approval of the Engineer. In the final finish, no honeycombing is allowed.

   ii. Part of defective concrete thus removed shall be recast using fresh concrete of same grade, as approved by the Engineer without any additional cost. For that purpose, the Contractor shall prepare a comprehensive work procedure and obtain approval of the Engineer. No additional payment shall be made for repair of the concrete. The Contractor shall ensure that no air bubbles are formed on the exposed surface. Concrete pouring sequence, vibration methodology etc. shall be planned to ensure that air bubbles are not formed. All materials, sizes and layouts of formwork including the locations for their joints shall have approval from the Engineer prior to the commencement of the works.

   iii. After the finishing works, cracks which occurred in the surface of concrete until the concrete starts to set shall be removed by refinishing or tamping.

e. The top face of a slab intended to be surfaced with other material shall be left with a spaded finish.

f. Chemical surface retarders, if approved by the Engineer, shall be used to produce an exposed aggregate finish, provided the Contractor demonstrates that the durability of the concrete surface is not reduced.

15. Inspection, Tests and Standards of Acceptance

a. The Contractor shall submit test certificates from the manufacturer or supplier of materials along with each batch of material(s) delivered to site.

b. The Contractor shall set up a field laboratory with necessary equipment for testing of all materials & finished products to be used in the construction. The laboratory must have riffle divider of adequate capacity as approved by the Engineer for preparation of lab sample for sieve analysis of aggregates.

c. The test in go falls the materials shall be carried out by the Contractor at the field laboratory or from the laboratory approved by the Engineer and in the presence of the Engineer. The Contractor shall make all the necessary arrangements and bear the entire cost for the same.

d. Tests which cannot be carried out in the field laboratory shall be done at the Contractor's cost at any recognized laboratory or testing establishments having NABL certification and duly approved by the Engineer.

e. If materials are brought from abroad, the cost of sampling or testing, whether in India or abroad, shall be borne by the Contractor. The Contractor shall provide and maintain on site, until the works are completed, at all times the equipment and staff required for carrying out these tests.

16. Quality Control of Concrete

a. The Contractor shall carry out the following tests for concrete, at the site of placing, and ensure that they comply with appropriate provisions of Indian and/or other standards, as may be applicable:

i. Slump test for concrete: The frequency of slump test shall be as follows:

ii. Case 1: If the site of placing is at the same area as the concrete plant installed, then it shall be conducted once in every hour, as per IS1199(Cl. 5.0) and IS7320.

iii. Case2: Other than Case1, it shall be conducted once in each delivery of transit mixer, asper IS 1199 (CL. 5.0) and IS 7320.

iv. Tolerance for slump shall conform to IS4926(Cl.6.2.1).

v. Compressive and Flexural strength of concrete: Sampling, Strength tests and Acceptance criteria of concrete shall conform to IRS: CBC (Cl. 8.7) according to the type of concrete grade.

vi. Chloride ion content test: It shall be conducted as per IS:15949 once a week. Chloride ion content shall be0.43kg/m3 or less.

vii. Relative Density and pH value of plasticizer (if used): The test shall conform to IS9103(Cl.7.1, Cl.10.0, Annexure-E) and the tolerances shall be as specified in IS9103(Cl. 9.0, Table-2).

viii. Temperature of concrete shall be verified once in each slump test.

ix. The concrete shall be verified for permeability and the test procedure along with tolerances shall conform to IRS: CBC (Cl. 5.4.2, Appendix - G). The frequency of test shall depend up on the change in design mix or change in source of material used in the work. However, the Engineer shall select random batches of concrete for examination at his discretion, and any time during concreting. Sampling shall generally be done at the point of discharge from the mixer and at placing point. The concrete shall pass the permeability test if it is properly compacted and the water penetration depth in the broken core is less than 25mm.

b. It is the complete responsibility of the Contractor to redesign the concrete mixes as per the standard methods that have been approved and to produce there in forced concrete conforming to the specifications. The Contractor shall have competent staff to carry out this work.

c. After the completion of the quality control checks of concrete, the Contractor shall immediately report the test results to the Engineer by submitting quality control records of the concrete.

17. Inspection of Concrete

a. Inspection shall be carried out by the Contractor, after the removal of form work. Also, additional inspection shall be carried out if instructed by the Engineer.

b. Inspection shall be carried out as per approval of the Engineer for the Method Statement, incorporating the test procedures specified in Table below:

Table: Inspection of Concrete Surface Condition

Measurement Items	Inspection Method	Place to be Inspected
Presence or absence of honey combing, cold joint, discoloration, and cracking	Visual inspection at point-blank range	All parts
Presence or absence of cavity, float, and cracking	Hammering Inspection	As per approved Method Statement, and as directed by the Engineer
Clear cover to the outermost reinforcement	Non-destructive test using a probe	

c. Additional non-destructive tests (NDT) on the hardened concrete in the structure as a whole or any finished part of the structure where necessary, or directed by the Engineer, shall be carried out as laid down in IRS: CBC (CL. 18.3).

d. The Contractor shall report the inspection results along with the location to the Engineer immediately after the inspection. The forms generated from the probes during the inspection shall be attached to the records.

e. If defects such as deleterious cracking, spalling, deformation and finishing defects or damages caused by the Contractor are noticed from the results of the inspection, no repair work shall be commenced without prior permission taken from the Engineer.

f. Counter measures against the defects shall be subject to approval of the Engineer. In this case, "repair work" refers to all actions which make alterations to the surface of concrete after the removal of formwork (including plastering etc.). If repair work is required, the Contract or shall submit Method Statement on the repair work and shall obtain approval of the Engineer for the same, prior to the commencement of repair work. During the repair work, the Contractor shall record about the work, and shall report to the Engineer on the results of the work immediately after the repair work has finished.

g. If cracks develop in concrete construction, which in the opinion of the Engineer may be detrimental to the strength of the construction, the Contractor, at his own cost, shall dismantle the construction, carry away the debris, replace the construction and carry out all consequential work thereto.

h. If any cracks develop in the concrete construction, which in the opinion of the Engineer, are not detrimental to the stability of the construction, the Engineer shall decide whether such cracks are required to be grouted. The Contractor shall grout such cracks as decided by the Engineer with polymer cement grout of approved quality at his own risk and cost.

i. External crack width shall be restricted to 0.2mm or less on all concrete structures, unless otherwise specified in the Drawings/Design.

ADDITIONAL TESTS FOR CONCRETE:

As frequently as the Engineer may require, additional testing shall be carried out for concreting in addition to mandatory test specified in CPWD specifications 1996/2002 / relevant IS Code / MOST/MORTH Specifications.

18. Non-Destructive tests for concrete

1. Ultrasonic pulse velocity test

2. Rebound hammer test

In order to determine the following properties of concrete, non-destructive tests for concrete (ultra-sonic pulse velocity test and rebound hammer test) in accordance with IS 13311(Part 1 and Part 2) shall be carried out.

i. the homogeneity of concrete

ii. the presence of cracks, voids and other imperfections

iii. changes in the structure of the concrete which may occur with time

iv. the quality of the concrete in relation to the standard requirements

v. the quality of one element of concrete in relation to the another, and

vi. the values of dynamic elastic modulus of the concrete

In view of the limitations of each method of the non destructive testing of the concrete, it is essential that the results of tests obtained by one method should be complemented by other tests and each method should be adopted very carefully.

19. Permeability test for Concrete:

The concrete will be verified for permeability by the following procedure and shall confirm to IS: 3085-1965 – „Permeability of Cement Mortar & Concrete", Section 1717.7.5 of MOST Specification and DIN 1048.

a) The Engineer shall select random batches of concrete for examination at his discretion and sampling will generally be done at the point of discharge from the mixer and at placing point.

b) From the batches thus selected two concrete cylinders shall be made in accordance DIN 1048.

c) All cylinders shall be made, cured, stored, transported and tested in accordance with clause 1717.7.5 of MOST Specifications. The tests shall be carried out in a laboratory approved by the Engineer.

d) At least two cylinders shall be made on each day"s concreting until 60 cylinders have been made for each grade of concrete. The cylinders will be tested as per the procedure, given in Clause (e) next.

e) Test Procedure:

The permeability of concrete will be verified by the following procedure:

i. Prepare a cylindrical test specimen 150 mm dia and 160mm high.

ii. After 28 days of curing, test specimen will be fitted in a machine such that the specimen can be placed in water under pressure up to 7 bars. The typical machine shall be similar to one shown in Appendix 1700/II of MOST.

iii. At first a pressure of one bar is applied for 48 hours, followed by 3 bars for 24 hours and 7 bars for next 24 hours.

iv. After the passage of the above period, the specimen is taken out and split in the middle by compression applied on two round bars on opposite sides above and below.

v. The water penetration in the broken core is measured with scale and the depth of penetration assessed in mm (max permissible limit 25 mm).

f) Acceptability Criteria:

The concrete shall pass the permeability test if it is properly compacted and is not considered permeable when tested as per DIN, and the water penetration in the broken core is less than 25mm.

No extra payment shall be made for this test and cost of the same will be included in his rate for concrete work.

20. Chlorides in Concrete

The levels of equivalent acid-soluble chlorides as NaCl (Cl x 1.65 = NaCl) in the constituents of concrete as stated elsewhere are indicative and are subject to the over-riding limits for the mixes.

The total estimated content as a percentage by weight of the cement in the mix shall not exceed the following limits: -

(a) For reinforced concrete

0.5% if made with Ordinary Portland Cement (OPC)

0.1% if made with Sulphate Resistant Portland Cement (SRPC)

(b) For mass concrete

1.0% if made with OPC

0.2% if made with SRPC

The Contractor shall test the constituents of the concrete to establish these contents as provided for elsewhere in this Specification.

In addition, regular tests to BS 1881: Part 6 for chloride content shall be made on the hardened concrete. The following values are acceptable: -

(i) For reinforced concrete made with OPC

95% of the test results less than 0.40% NaCl by weight of cement and no

result greater than 0.50% NaCl by weight of cement.

(ii) For reinforced concrete made with SRPC

95% of the test results less than 0.1% NaCl by weight of cement and no result greater than 0.14% NaCl by weight of cement.

(iii) For mass concrete made with OPC

95% of the test results less than 1.0% NaCl by weight of cement, and no result greater than 1.30% NaCl by weight of cement.

(iv) For mass concrete made with SRPC

95% of the test results less than 0.2% NaCl by weight of cement and no result greater than 0.25% NaCl by weight of cement.

In the event that the SRPC used contains a proportion by weight of tri-calcium aluminate which approaches 4 - 8%, then consent may be sought for an appropriate adjustment of the relevant chloride content limits.

21. Sulphates in Concrete

The level of acid-soluble sulphates (SO_3) in the mix shall be no greater than: Coarse aggregate 0.4% by weight

Fine aggregate 0.4% by weight

Water500 mg/l

The total estimated sulphate content (SO_3) of the mix including that present in the cement shall not exceed 3.7% by weight of cement in the mix.

In addition, regular tests to BS 1881: Part 6 shall be made on the hardened concrete to determine the total sulphate content, which shall not exceed 4% by weight of cement in the mix.

Permissible Level of Chloride and Sulphates

The permissible level of chlorides and sulphates quoted in the above Subsections shall not be considered as mean values for the whole of the Works, but shall apply to any concrete.

Concrete for water-retaining structures shall in addition be as per IS: 3370.

22. CRACKS:

If cracks, which in the opinion of the Engineer may be detrimental to the strength of the construction, develop in concrete construction, the Contractor at his own expense shall test the structure as specified in "Loading Tests" of these Specifications.

If under such test loads the cracks develop further, the Contractor shall dismantle the

construction, carry away the debris, replace the construction and carry out all consequential work thereto.

If any cracks develop in the concrete construction, which in the opinion of the Engineer- in-Charge, are not detrimental to the stability of the construction, the Contractor at his own expense shall grout the cracks with neat cement grout or with other composition as directed by Engineer-in-Charge and also at his own expense and risk shall make good to the satisfaction of the Engineer all other works such as plaster, moulding, surface finish, which in the opinion of the Engineer have suffered damage either in appearance or stability owing to such cracks. The Engineer's decision as to the extent of the liability of the Contractor in the above matter shall be final and binding.

External crack width shall be as per IRS: CBC with latest addendums.

23. DEFECTIVE CONCRETE:

Should any concrete be found honeycombed or in any way defective, such concrete shall be cut out partially or wholly by the Contractor and made good at his own expense. If Engineer feels that repaired structure will not be having same strength or shape or uniformity with other exposed surface as original desired structure / original structure, the same shall be rejected by Engineer and required to be dismantled and disposed by contractor at his own cost as instructed by Engineer-in-Charge. Decision of the Engineer shall be final and binding in this regard.

24. EXPOSED FACES, HOLES AND FIXTURES:

On no account shall concrete surfaces be patched or covered up or damaged concrete rectified or replaced until the Engineer or his representative has inspected the works and issued written instructions for rectification. Failure to observe this procedure will render that portion of the works liable to rejection.

Holes for foundation or other bolts or for any other purposes shall be moulded, and steel angles, holdfasts or other fixtures shall be embedded, according to the drawing or as instructed by the Engineer.

25. FINISHES:

Unless otherwise instructed the face of exposed concrete placed against formwork shall be rubbed down immediately on removal of the formwork to remove irregularities. The face of concrete for which formwork is not provided other than slabs shall be smoothed with a float to give a finish equal to that of the rubbed down face, where formwork is provided. The top face of a slab which is not intended to be covered with other materials shall be leveled and floated to a smooth finish at the levels or falls shown on the drawings or as directed. The floating shall be done so as not to bring an excess of mortar to the surface of the concrete. The top face of a slab

intended to be surfaced with other material shall be left with a spaded finish. Faces of concrete intended to be plastered shall be roughened by approved means to form key.

26. CONCRETE FOR FLOORING ON GRADE:

Concrete for flooring on grade shall be placed in alternate bays not exceeding more than 4m x 6m or as specified in the drawings including forming the joints or adjacent bays. The stiff mix shall be thoroughly vibrated and finished to receive the floor finish.

27. GROUTING OF BASE PLATES & BOLT HOLES:

a) Mixing :

Dry grout should be mixed in a mechanical mixer: the conventional 200/400-litre capacity concrete mixer can be used to mix four bags of dry grout; alternatively, paddle type mortar mixers can be used. The quantity of grout to be mixed at one time should not exceed that amount which can be placed in approximately 10 to 15 minutes.

b) Batching :

Batching of grout by fraction of a bag is not allowed. The quantity of mixing water should be the minimum commensurate with workability, compaction, and filling of the grout in all corners and crevices. Mixing should be done for a minimum of three minutes to obtain a fluid grout of uniform consistency.

c) Cleaning and preparation of the surface :

The base concrete should be clean and strong, and its surface should be properly hacked; all dust should be removed suction or compressed air. The surface should be thoroughly wetted with water for several hours. Before the grout is poured, all free water should be removed and the flat surfaces coated with a thin cement slurry.

d) Restraint :

Heavy back-up blocks of timber or concrete should be fixed on all sided of the base plate to prevent escape of the grout, when poured through the openings provided in the base plate. Adequate restraint must be ensured on all the sides for a period of 7 days to obtain effective expansion and shrinkage compensation.

e) Curing :

The grout should not dry out where external restraint is provided in the form of form- work, the top opening and all stray openings should be covered with wet sack for at least 7 days.

f) Placing and Compaction :

The grout should be placed quickly and continuously either through the holes in the base plates or from one side only to ensure complete filling without entrapment of air. Grout should be properly spread and compacted by rodding. Excessive vibration should be avoided.

Below the bed plates the grout should be compacted using long pieces of doubled-over flexible steel strapping or chains. The forward and backward movement of the strap or chain will assist in the flow of the grout into place. Steps must be taken to keep the grout in full contact with the underside of the bedplate until the grout sets; maintaining a small head of fresh grout in the forms.

g) Shrinkage Compensated Grout:

Shrinkage compensated grout or non-shrinkable grout of Associated Cement Companies Limited or any other approved manufacturer (Fosroc, Roff, Sikka) should be used. The batching shall be as per the manufacturer's specifications, other procedures being as above.

28. Tolerance

Tolerances for the finished concrete structures shall be as specified in the Contract.

29. Mass Concrete

a) Any concrete having minimum dimension of more than 1 m shall be considered mass concrete.

b) In mass concrete core temperature shall not exceed 75^0C and differential temperature between core and surface of concrete shall not exceed 20^0C.

c) For each grade of mass concrete mock up trial shall be carried out of size 2m x 2m x thickness of mass concrete. Mock up trial shall use thermocouples to measure concrete temperature both near surface and at the core. Thermocouples shall be located centrally along the length and width of the mock up. Thermocouple shall be rigidly suspended so that they do not move out of position during casting. The Contractor shall monitor and document the conformance of the trial with the maximum allowable temperature requirement as given above. Result shall be automatically locked at the minimum of hourly intervals and logging shall continue for at least 72 hours or until the core reached ambient temperature, which ever is longer.

d) The scheme of mock up trial shall be submitted by the Contractor to the Engineer for approval. If there is change in brand/ factory of cement, mock up trial will be required again.

e) The Contractor shall carry out temperature monitoring of core temperature and surface temperature of 1st structure of mass concrete to confirm the results of mock up trial.

f) Ply shuttering will be preferred. However, if steel plate shuttering is used, insulation will be provided with thermocol.

g) No water curing should be carried out for 07 days. Concrete top surface shall be covered with plastic sheets after initial setting of concrete and insulation of plastic sheets by thermocol after final setting of concrete. Vertical shuttering shall remain intact till 07 days or as per directions of the Engineer.

h) Detailed report shall be submitted by the Contractor to the Engineer after mock up and 1st structure casting.

i) The contractor shall submit pour plan to the Engineer for approval for each structure of mass concreting. The pour plan shall include pour sequence, infrastructure required (RMC plant, TM, Concrete pump, placing boom), logistic plan, manpower (duties and responsibilities), lab equipment. Mass concrete shall preferably use PPC to reduce core temperature. Concrete placement temperature shall be decided by the results of mock trial and the same shall be followed.

30. Precast Concrete

30.1 Manufacture Off-Site

a. Casting of members shall not begin until a NONO has been given by the Engineer to the shop drawings, required computation and method of manufacture.

b. When the drawings and method of manufacture have been noticed, no changes shall be made without NONO from the Engineer

c. The Contract or shall in form the Engineer in advance of the date of commencement of manufacture and casting of each type of member.

d. Concrete reinforcement and work man ship shall be asper IS: 456.

e. A copy of all cube test results for the precast concrete works shall be sent to the Engineer as soon as these are available.

f. No members to which the tests relate shall be dispatched to the Site until the tests have been satisfactorily completed and noticed by the Engineer.

30.2 Forms

The design and fabrication of the forms and false work as well as their construction shall be the responsibility of the Contractor. Forms shall be inspected prior to authorizing casting operations. Details shown on the Drawings shall be built into the forms. Worn, damaged,

or otherwise unacceptable forms shall be repaired be forecasting of any member is authorized. The forms may be made either of steel or of plywood. If the Contractor elects to use plywood forms, it shall be high quality plywood, 19mm minimum thickness marine grade subject to NONO from the Engineer. Forms shall be structurally adequate to support the members within permissible tolerances. Forms shall be coated with a noticed form-release agent prior to use. Anchor devices may be cast into the concrete for later use in supporting forms provided the arrangement has Notice from the Engineer. Bottom/base should be true level without offsets and kinks of designed supports and shutterings over required PCC base with proper drainage arrangement for proper working and curing.

30.3 Curing

a) Steam curing with approved methodology can be adopted if required, for precast components subject to the approval of Engineer-in-Charge. No extra payment will be made for adopting steam curing. Before concrete products are subjected to any accelerated method of curing, the cement to be used shall be tested in accordance with accepted standards (relevant IS codes) especially for soundness, setting time and suitability for steam curing. In the case of elements manufactured by accelerated curing methods, concrete admixtures to reduce the water content may be allowed to be as permitted by applicable codes of practice subject to the approval of the Engineer-in- Charge. The normal aeration agents used to increase the workability of concrete shall not be allowed. The steam curing of concrete products shall take place under hoods, under chambers or in tunnels. Use of insulated tarpaulin may be permitted. The steam shall have a uniform quality throughout the length of the member. The precast elements shall be stacked with sufficient clearance between each other and the bounding enclosure, so as to allow proper circulation of steam. The surrounding walls, the top cover and the floor of steam curing chamber or tunnel or hood shall be so designed as not to allow more than 1 kcal/m2/h/ deg C. The inside face of the steam curing chamber, tunnel or hood shall have a damp-proof layer to maintain the humidity of steam. Moreover, proper slope shall be given to the floor and the roof to allow the condensed water to be easily drained away. At first, when steam is let into the curing chambers, the air inside shall be allowed to go out through openings provided in the hoods or side walls which shall be closed soon after moist steam is seen jetting out. Preferably, steam should be let in at the top of the chamber through perforated pipelines to allow uniform entry of steam throughout the chamber. In no case shall steam impinge directly on concrete products. The fresh concrete in the moulds shall be allowed to get the initial set before allowing the concrete to come into contact with steam. The regular heating up of fresh concrete product from 20 °C to 35 °C shall start only after a waiting period ranging from 2 to 5 hours depending on the setting time of cement used. The second stage in steam curing

process shall be to heat up the concrete elements, moulds and the surroundings in the chamber. The air-space around the member shall be heated up to a temperature maximum to 70°C at a gradual rate, not faster than 10° per hour. This process shall continue 1 1/2 to 2 1/2 hours depending upon the outside temperature. The third stage of steam curing shall be to maintain the uniform temperature and pressure for a duration depending upon thickness of the section. This may vary from 3 to 5 1/2 hours. The fourth stage of steam curing shall be the gradual cooling down of concrete products and surroundings in the chamber and normalization of the pressure to bring it at par with the outside air. The maximum cooling rate, which is dependent on the thickness of the member, shall not exceed 30° per hour. In all these cases, the difference between the temperature of the concrete product and the outside temperature shall not be more than 60°C for concrete up to M 30 and 75°C for concrete greater than M 45. In the case of light weight concrete, the difference in temperature shall not be more than 60°C for concrete less than M 25. For concrete greater than M 50, the temperature differences may go up to 75°C. After the steam curing is completed, the elements shall be further water cured for about 3 to 7 days.

The curing shall be carried out as per approved Method Statement.

30.4 Storage

When members are stored, they shall be firmly supported only at the points specified.

a. The accumulation of trapped water and deleterious matter in the units shall be prevented.

b. Care shall be taken to avoid rust staining and efflorescence.

c. The area intended for the storage of pre-cast units should be surfaced in such a way that no unequal settlement can occur.

d. To prevent deformation of slender units, they should be provided with supports at fairly close intervals and should also be safeguarded against tilting. Lifting and hand ling positions should conform to the Engineer's directions and drawings. In addition, location and orientation marks shall be put on the members, as and where necessary.

30.5 Handling and Transport

a. Members shall be lifted or supported only at points specified or otherwise given a NONO from the Engineer and shall be handled and placed without impact.

b. The Contractor shall define the method of lifting, the type of equipment and transport to be used, and the minimum age of the members to be handled and shall submit to obtain approval from the Engineer.

30.6 Protection

At all stages of construction, pre-cast concrete units and other concrete associated there with shall be properly protected to prevent damage to permanently exposed concrete surfaces, specially arises and decorative features.

31. Falsework and Formwork

31.1 General

Falsework and formwork shall conform to the provisions laid down in IRS: CBC (CL. 6.1 to6.4) and IRC: 87, if not in contravention to the following provisions.

a. Falsework shall be designed in consideration of appropriate raising (camber) against sinking and deformation due to the weight of the concrete during construction and after completion. Furthermore, the Contractor shall submit the plan of the camber to the Engineer prior to the commencement of works for obtaining approval.

b. Ties shall not be welded to the reinforcement bars. Clear cover to the end of the ties shall not be less than 25mm. Filling of tie locations after removal of form work shall be carried out with dry pack cement mortar.

c. The form work shall be of steel plates of proper thickness to give good finish.

31.2 Design of Formwork

a. The Contractor shall submit the design and drawing of complete formwork (i.e. the forms as well as their supports) to the Engineer, before any erection work commences. If proprietary system of formwork is used, the Contractor shall furnish detailed information to the Engineer. However, the Contractor shall be entirely responsible for the adequacy and safety for formwork.

b. The foundation of all supports shall be designed to suit the bearing capacity of soil to support the designed loads without settlement.

c. The Contractor shall prepare detailed shop drawing showing the arrangement of form work for structural members including shoring system, horizontal and diagonal bracing system, details of foundation etc. The sizes of individual members shall be as per the design calculations.

31.3 Finishing of Formwork

a. Finishing shall conform to IRS: CBC (Cl.6.2.4 and Cl.6.2.5).

b. Formwork shall be made to produce a finished concrete true to shape, line, levels and dimensions.

c. Chamfers shall be provided at all angles of the formwork to avoid sharp corners. The chamfers, bevelled edges and mouldings shall be made in the form work itself, conforming to the Drawings.

31.4 Cleaning and Treatment of Forms

Cleaning and treatment of forms shall conform to IRS: CBC(Cl.6.3).

31.5 Specialized Formwork

a. Specialized form work shall conform to the provisions laid down in IRC:87(Cl.10).

b. Specialized formwork may be required in the case of slip formwork, underwater concreting etc. Such specialized formwork shall be designed and detailed by competent agencies and a set of complete working drawings and installation instructions shall be supplied to the Engineer. The site personnel shall be trained in the erection and dismantling as well as operation of such specialized formwork. If proprietary equipment is used, the supplier shall supply drawings, details, installation instructions, etc. in the form of manuals along with the formwork. Where specialized formwork is used, close coordination with the design of permanent structure is necessary.

c. For slip form, the rate of slipping the formwork shall be designed for each individual case considering various parametres including the grade of concrete, concrete strength, concrete temperature, ambient temperature and concreted mixtures.

d. In order to verify the time and sequence of striking or removal of specialized formwork, routine field tests for the consistency of concrete and strength development are mandatory and shall be carried out before adoption.

31.6 Inspection of Formwork

a. The Contractor shall inspect the formwork and shall submit inspection results by "Formwork Assembly Inspection Record" prior to concreting works.

"Formwork Assembly Inspection Record" describes the results of verification of inspection results of the formwork with design documents in which the shape and dimensions of the formwork, clear cover to the outermost reinforcement, effective height etc. are verified. The proposed form of "Formwork Assembly Inspection Record" shall be submitted by the Contractor for approval of the Engineer.

b. Concreting shall not be allowed unless approved for the formwork by the Engineer.

31.7 Stripping and Removal of Formwork

a. Stripping time shall conform to the provisions laid down in IRS: CBC(Cl.6.4).

b. The scheme for removal of formwork (i.e., de-shuttering and decentring) shall be planned in advance and submitted to the Engineer for scrutiny and approval. No form work or any part there of shall be removed without prior approval of the Engineer.

c. The formwork shall be removed in such a manner that does not cause any damage to concrete. Centring shall be gradually and uniformly lowered in such a manner that it

permits the concrete to take stresses due to its own weight uniformly and gradually to avoid any shock or vibration.

d. Where the rear ere- entrant angles in the concrete sections, the formwork shall be removed at these sections as soon as possible after the concrete has set to avoid cracking due to shrinkage of concrete.

31.8 Reuse of Forms

The Contractor shall not be permitted reuse of timber facing formwork brought new on the works for more than 5 times for exposed concrete formwork and 8 times for ordinary formwork.5 or 8 uses shall be permitted only if forms are properly cared for, stored and repaired after each use. Use of different quality boards or the use of old and new boards in the same form work shall not be allowed. If any other type of special or proprietary form work is used, the number of times they can be used shall begiven a NONO from the Engineer.

Annexure OCS 2

REINFORCEMENT STEEL

1 General

a) High strength deformed steel bars for concrete reinforcement used in the works shall be Fe 500D TMT, conforming to IS 1786 and manufactured by SAIL/TATA STEEL /JSW STEEL/RINL/*JSPL* . No rerolled steel shall be used. The Contractor shall produce copy of original challan or voucher as a proof of having purchased the steel reinforcement from manufacturers or their authorized distributors having approval of the Engineer. Reinforcement steel shall be stored as per IS 4082.

b) Any steel specified for reinforcement shall conform in every respect to the latest relevant Indian Standard Specifications and shall be of tested quality under the ISI Certification Scheme.

c) All reinforcement work shall be executed in conformity with the drawings supplied and instructions given by the Engineer and shall generally be carried out in accordance with the relevant Indian Standard Specifications IS: 2502- Bending and Fixing of Bars for Concrete Reinforcement.

d) No work shall be commenced without the Engineer's approval for reinforcement bar bending schedule. The reinforcement bars shall be bent to conform to the dimensions and shape shown in the Drawings in a manner that will not damage the parent material. Bars shall be bent cold. Any reinforcement, which is bent, shall not be re-bent. However, when it is unavoidable to re-bend the reinforcement, the same shall have approval from the Engineer.

e) Placement of reinforcement shall conform to the provisions laid down in IRS: CBC (Cl. 7.1.3). Cover and spacing of steel shall be uniform and as specified in the specifications and as shown in the Drawings.

f) Uncoated reinforcement steel shall be protected from rusting or chloride contamination. Reinforcements shall be free of rust, mortar, loose mill scale, grease, oil or paint.

g) Procurement of reinforcement steel shall be so phased by the Contractor that the storage period before its actual use in the works is limited to the bare minimum as directed by the Engineer.

h) Steel shall be stored in a rebar yard having proper workflow or a hard surface i.e.100 mm thick concrete over compacted base so that the surface of the rebar yard is not damaged during handling of bars. The yard should enable easy and efficient handling of the reinforcement bar for various stages i.e; receipt of material, cutting and bending stacking and dispatch to site.

2 Inspection and Testing

a) Manufacturer's test certificate shall be submitted for each lot of supply brought at the Site by the Contractor. Physical tests shall conform to IS1387, IS1599, IS1608 and IS1786. Independent test on quality of steel from each lot shall be carried out as per IRS: CBC (Cl.4.5.2).

b) The frequency of tests on reinforcement consignments delivered at site from one manufacturer should be as per IS 1786:2008 (Cl. 11.1).

c) Specimens required for three tensile tests for each of the different size of bar for each consignment delivered shall be sampled and tested by the Contractor before use at Site. Test results shall be duly supported by graph with respect to stress and strain. If first test of three test samples does not give the specified results, two additional tests shall be carried out. Both retests shall conform to the requirements as specified in IS 1786. The steel shall be rejected otherwise.

d) Reinforcement steel shall be inspected prior to the commencement of works and assembly on Site. Defective, brittle, excessively rusted or burnt bar shall be discarded. Cracked ends of bars shall be cut out. All reinforcement steel shall be free of loose small scales, rust and coats of paint, oil, mud etc.

e) The Contractor shall inspect the reinforcement works and submit inspection results by "Reinforcement Assembly Inspection Record". "Reinforcement Assembly Inspection Record" describes the results of verification of inspection results of the reinforcement work with the Drawing in which the diameter, number and length of the reinforcements, position of splices and joints, position and interval of the bent reinforcement bar, type and disposition of cover blocks are verified. The form of "Reinforcement Assembly Inspection Record" shall be proposed by the Contractor for approval of the Engineer.

f) The Contractor shall obtain approval of the Engineer for reinforcement work prior to the commencement of concrete work.

3 Tolerances and Criteria

a) Unless otherwise specified by the engineer, reinforcement shall be placed within the following tolerances:

   i. For overall depth 200 mm or less : ±10mm

   ii. For overall depth more than 200mm : ±15mm

   The cover shall, in no case, be reduced by more than one third of specified cover or 5mm whichever is less.

4 Lapping and Joints

a) Lapped Splices: No splicing of bars shall be permitted without prior approval of the Engineer. Lengths of splice, wherever required, shall be as indicated on the drawings and

approved by the Engineer. Lapped splices shall be staggered and located at points along the span where shear stresses are low.

b) Mechanical Joints: Mechanical coupler shall be used for jointing of reinforcement bars of diameter 25 mm and above. Mechanical coupler shall conform to laid down specification given in Clause 6 below.

c) Welded Joints : Not permitted

5 Coupler Specifications

a) Introduction

Only cold-forged, parallel threaded mechanical coupler system shall be used. All mechanical couplers shall be of Type 2 (or Class H as specified in IS-16172) and should be simple to install and which can be confirmed by quick visual inspection to have been correctly installed and to have achieved the required full strength connection. Any other types of mechanical coupler systems are not permitted.

The couplers shall be of standard parallel thread type. Ends of the reinforcement bars, which are to be joined, shall be enlarged by cold forging, threaded in such a way that root thread diameter is not lesser than the parent bar to be joined. The coupler shall be of TYPE – II and qualified/Certified as per UK CARES, IS code 16172:2014, ACI 318, ASME, Section III, and Div.2, Caltrans.

Couplers shall be installed strictly in accordance with the manufacturer's recommendations. Couplers shall be located away from high stress zones in the various structural elements and shall be staggered and shall conform to provision of IRS: CBC

All the couplers shall be manufactured in a factory which is ISO 9001:2008 (or higher revision) certified for "Manufacturing of Mechanical Steel Rebar Couplers & Accessories" and also be certified for "Site Management of Threading & Processing of Rebar including Sales and Distribution". All the couplers shall undergo quality checks on uniformity of threads, dimensional accuracy etc. Each coupler shall be clearly stamped indicating batch number and diameter. This number shall be traceable to the original cast. The relevant material mill certificate shall be submitted with supply of a particular lot. The certificate shall give salient material properties. The coupler manufacturer shall operate at least an ISO 9000 approved quality assurance programme or equivalent for the manufacture of couplers.

b). Threading of ends of the reinforcing bars:

The threading activity shall preferably be done at Site. The various stages involved in threading are as given below:

i. **Cutting (Rebar End Preparation):**

The ends of reinforcement bars shall be cut by mechanical means to get a perfect

plane surface perpendicular to the axis of the bar.

ii. Cold forging & threading:

After cutting the ends of the bar shall be enlarged by cold forging such that the area of cross section after threading shall not be less than the area of cross section of the parent bar. The length of cold forging shall be adequate for proposed thread length as per manufacturer's design. Threading shall be done on threading machine. The threads shall be square parallel type to suit the couplers. The thread length and depth shall be as per manufacturer's design. After threading is completed, the threaded length of the bars shall be protected by providing plastic end caps before taking the bars out of the shop.

a) Quality control in making of threads:

Double forging of bars is not permitted. In case of improper cold forging the forged of the bar shall be square cut and fresh cold forging shall be undertaken. 100% threading at threaded rebars shall be checked with 'go' and 'no go' gauges for the correctness of the thread profile on the rebar. A proper record for same shall be maintained at site.

b) Qualification tests

The coupler shall be qualified as per IS code 16172:2014, ACI 318, ASME - Section III, and Div.2, Caltrans and must have conducted & qualified for the following tests:

i. Static tensile test

Mechanical connections shall be tested for all reinforcing rebar sizes. For each rebar size, a minimum of three connections (3 joints + 1 Parent bar) in each load direction shall be tested in accordance with ASTM A370 test method to meet code requirement. A tensile test on an unsliced specimen from the same bar used for the spliced specimens shall be performed to establish actual tensile strength. The tensile strength of an individual splice system shall not be less than the 125% of the specified minimum yield strength (fy of rebar) of the spliced bar.

ii. Cyclic tension and compression test

Mechanical connections shall be tested in all reinforcing rebar sizes. For each rebar size, a minimum of three connections shall be tested for cyclic tension & compression test. Each specimen shall withstand cycles of stress variation of the specified minimum yield strength of the reinforcing bar. The test should be carried out as per the table mentioned below:

Loading Stages and Cycles per stage for cyclic load test

Stage	Tension	Compression	Cycles
1	0.95 fy	0.5 fy	20cycles
2	2 εy	0.5 fy	4cycles
3	5 εy	0.5 fy	4cycles

Note:

fy is specified yield strength of the reinforcing bar.

εy is the strength of reinforcing bar at actual yield stress

iii. Cyclic tensile test

Mechanical connections shall be tested in all reinforcing rebar sizes. For each rebar size, a minimum of three connections shall be tested for low cyclic tensile test. Each specimen shall withstand 100 cycles of stress variation from 5% to 90% of the specified minimum yield strength (fy) of the reinforcing bar. One cycle is defined as an increase from the lower load to the higher load & return.

iv. Low cycle fatigue test (for 10,000 cycles)

Fatigue test shall be conducted on splice sample from +173 Mpa to -173 Mpa for 10,000 cycles. A sine wave form @ 0.5 Hz shall be followed for bar dia 36 mm & above and 0.35 Hz shall be followed for bar dia less than 36 mm. Test shall be conducted confirming to IS 16172:2014 & Caltrans specifications. Past certificates for low cycle fatigue test shall be accepted. However these should not be more than 3 years old.

v. High cycle fatigue test (for 2,000,000 cycles)

In high cycle fatigue test, the test specimen is subjected to an axial tensile load which varies cyclically according to the sinusoidal wave form of constant frequency in the elastic range, as accordance with IS-16172. Past certificates for high cycle fatigue test shall be accepted. However these should not be more than 3 years old.

vi. Slip test

Slip Test Shall be performed on each diameter coupler specimen as per ASTM A 370 section 10. Test shall be conducted conforming to IS 16172:2014 & Caltrans specifications. Total slip shall not exceed the max value of 0.1 mm.

vii. Proof loading test

Every cold-forged, threaded bar end shall undergo a proof load test prior to leaving

system supplier's workshop. Every threaded bar must be subjected to proof load testing to a minimum test loading of 75% of the characteristic strength (theoretical fy). The system supplier shall essentially install a proof load tester equipment within its threading workshop premises and ensure to test each and every threaded bar. A positive indication shall be marked on the rebar to indicate that this operation has been carried out.

Note: All three steps involved in the preparation of mechanical joints i.e end cutting of reinforcement, cold forging and threading shall be performed by the coupler manufacturer at site/supplier's workshop. Alternatively, these three steps can also be carried out at site by the Contractor in which case all required machinery shall be procured from the manufacturer and work carried out under the guidance of manufacturer. The manufacturer shall supervise complete operation at site in the initial stage. The manufacturer shall train staff of the Contractor in all activities. However, the manufacturer shall oversee the quality of threading activities through periodical audits and shall give guarantee for the overall quality of preparation of mechanical joints. Contractor shall submit the test certificates of joint strength of samples for static tensile test carried out at NABL approved lab duly certified by the manufacturer.

6 INSTALLATION OF COUPLERS IN THE FIELD:

The installation of couplers in the field, for joining reinforcing bars shall be undertaken by trained manpower and as per manufacturer's instructions. Threads of both the couplers and the bars shall be thoroughly cleaned just before installation. Where couplers are cast-in the concrete, but connection is not to be completed immediately, the couplers shall be internally greased and plastic capped to a protection detail acceptable to the engineer. This cap shall be removed only when next bar is to be attached, then the same to be cleaned before joining the next bar.

The contractor shall arrange for a suitably qualified manufacturer's representative experienced in mechanically connecting reinforcement to be present at site before the start of work for initial training of personnel, and also to demonstrate the equipment and techniques as necessary. The threading workshop is to be fully supervised by the manufacturer's representative.

The contractor shall submit to the Engineer, for his approval a method statement duly approved by the manufacturer for mechanically connecting the reinforcement and for the installation and verification in the field. All activities of manufacture of mechanical joint i.e. cutting, forging and threading shall be carried out under the overall guidance of the manufacturer at the rebar yard with necessary machines and equipment supplied by the manufacturer. The Contractor shall also submit certificate for satisfactory performance of the mechanical joint from the manufacturer for all the coupled bars. This shall take into account any special requirements for horizontal, vertical and inclined couplers and shall include a rectification procedure, if the connection is

incorrectly made. It shall also cover the correct methodology for handling of tools and equipment for mechanical connection on site. The following information shall also be included:

1 Requirements for cleanliness

2 Equipment for threading bars

3 Method of locking the connections on both rebars

4 Method of verification of final rebars alignment and coupler integrity

Each coupler shall be visually examined prior to use to ensure the absence of rust and of any foreign material on the inside surface. All completed couplers shall be inspected and verified in accordance with the approved QAP. The Contractor shall ensure the acceptance of the Engineer for a procedure for documenting the inspection of the couplers. The contractor shall retain inspection records and shall submit copies to the Engineer-in-Charge within 7 days. The Couplers that do not meet the acceptance shall be completely removed and the bars re-connected as required.

7 BAR BENDING AND BAR BENDING SCHEDULE:

All bars will be carefully and accurately bent by approved means in accordance with IS: 2502, and relevant drawings. It shall be ensured that depth of crank is correct as per the bar cutting and bending schedule and bent bars are not straightened for use in any manner that will injure the material.

Prior to starting bar bending work, the Contractor shall prepare bar bending schedule from the structural drawings supplied to him and get the same approved by Engineer. Any discrepancies and inaccuracies found by the Contractor in the drawings shall be immediately reported to the Engineer whose interpretation and decision there to, shall be accepted.

8 SPACING, SUPPORTING AND CLEANING:

a) All reinforcement shall be placed and maintained in the positions shown on the drawings to be prepared by contractor.

b) The Contractor shall provide approved types of supports for maintaining the bars in position and ensuring required spacing and correct cover of concrete to the reinforcement as specified on the drawings. Cover blocks of required shape and size, Chairs and spacer bars shall be used to ensure accurate positioning of reinforcement. Spacers or chairs should be placed at a maximum spacing of 1m and closer spacing sometime be necessary. Cover blocks of approved proprietary should be pre-packaged free flowing mortars (Conbextra HF of Fosroc or equivalent). Cover blocks of concrete (not sand cement mortar) should be of the same strength as that of the surrounding concrete and properly compacted and vibrated on a vibrating table. They shall be cured for a minimum period of 14days

before they are used in the works. The cost of cover block shall be deemed to have been included in the rates.

Cover blocks shall be firmly placed at appropriate intervals to maintain specified concrete cover to the reinforcement. The number of cover blocks to be provided shall generally be about 4 pieces per m2 for the bottom surface of the member and about 2-4 pieces per m2 for the side surface of the member. Cover blocks shall be made of concrete or mortar having quality equal to or higher than that of the parent concrete.

c) Bars must be cleaned, before concreting commences, of all scale, rust or partially set concrete which may have been deposited there during placing of previous lift of concrete. On no account shall the bars be oiled or painted nor shall mould oil used on the formwork be allowed to come in contact with the bars. Cement wash to bars will not be permitted.

d) Only Fe500D TMT bars complying to IS:1786 shall be provided.

e) 1.6mm dia. G.I. wire shall be used for binding reinforcement.

Annexure OCS-3

FABRICATION AND ERECTION OF STEEL BRIDGE GIRDER

1. General

Fabrication of all Steel Bridge Girders shall be performed within the plants and by fabricators having the experience, knowledge, trained manpower, quality controls, equipment and other facilities required to produce the steel work to desired quality. The plants where fabrication works are proposed to be performed shall be duly approved by RDSO for fabrication of OWG. The tenderer shall submit complete details of the plants along with his tender for the approval of the Engineer. Inspection and passing of fabricated elements/girder shall be done by the RDSO/Employer as per codal provisions and specifications.

Fabrication and erection of steel girder bridges shall be in accordance with IRS fabrication specifications (B1).

2. Material

a. Steel: Mild steel for welded/riveted bridge girders subjected to railway loading shall conform to IS: 2062, Quality "B0" Grade Designation E250, fully killed and with normalizing/ normalizing rolling/ controlled rolling. Plates less than 12mm thick need not be with normalizing/ normalizing rolling/ controlled rolling.

b. In case Rolled Steel Standard Sections conforming to IS:2062 Quality "B0" are not available in market, Engineer may permit use of steel conforming to IS:2062 Quality "BR" / "A" on case to case basis.

c. Steel shall have smooth and uniform finish and shall be free from rolling defects such as cracks, flaws, seams, laps, imperfect edges etc. and other defects such as loose mill scale, rust, pitting, or other defects affecting its strength and durability.

d. High Strength Friction Grip (HSFG) bolt assembly including Direct Tension Indicator (DTI)washers shall conform to EN: 14399 series.

e. All the steel sections used in the fabrication must have mill test certificate clearly indicating the specification to which the steel conforms and whether steel is killed and normalized.

f. The materials, on receipt, shall be carefully unloaded, examined for defects, checked, sorted, and stacked securely on a level bed, out of danger from flood or tide and out of contact with water or ground moisture. They will be supported on timber or concrete plinths so that they do not touch the ground.

3. Fabrication of steel work

a. The records of fabrication shall be maintained in the registers as per the formats given in the Appendix I of IRS: B1-2001.

b. The greatest accuracy shall be observed in the design, fabrication, and erection of every part of the work to ensure that all parts will fit accurately together on erection. Components of all the spans shall be fully interchangeable. Same jigs and assembly fixtures duly approved shall be used. The tolerances in manufacture shall be in accordance with as shown in Appendix II of IRS: B1-2001.

c. There should be level, finished concrete floor of sufficient dimensions in the fabrication yard, on which the fabricator will precisely set out the outline of the structure (to full scale) as per drawings for the purpose of preparing templates. Only steel tapes shall be used for all measurements, and they will be held tight and level on the floor while measuring or marking.

d. Steel tapes used for marking out the work shall be calibrated at a temperature of 20° C.

e. The templates throughout the work shall be of steel bushed.

i. Flattening and straightening

All steel materials, plates, bars and rolled sections shall have straight edges, flat surfaces and be free from twist. If necessary, they shall be cold straightened or flattened by pressure before being worked or assembled unless they are required to be of curvilinear form.

ii. Cutting of Steel

Cutting of steel for fabrication may be done by shearing, sawing, or by gas using mechanically controlled torch/torches. All flame cut edges shall be ground to obtain reasonably clean square and true edges. Plasma-arc cutting method may also be employed. This process offers less heat input causing less distortion.

iii. Making of Holes

Marking and drilling of holes in members shall preferably be done with the use of templates/jigs. All bolt holes in members built up by welding shall be drilled after welding.

Holes for turned bolts, should be 1mm under drilled in shop and should be reamed at site to suit the diameter of turned bolt. Jigs shall be periodically checked for tolerances from master plates.

iv. Welding

Welded construction work shall be carried out generally in accordance with the provisions of Indian Railway Standard Welded Bridge Code and subject to further specifications as given below:

i. All welds shall be done by submerged arc welding process in shop. Site welding should not be undertaken except in special circumstances with the approval of the Engineer. Site welding should be confined to connections having low stresses, secondary members, bracings etc.

ii. Suitable jigs and fixtures shall be used to avoid distortion during welding. Components which are mass fabricated in the shop should be proved in master templates.

iii. Class and size of electrode for welding shall conform to IRS Specification M-28. For fabrication of steel bridge girder following class of electrode shall be used-

Class of Electrode as per IRS Specification No. M.28.66	**Type of work to be welded**	**I.S. Specification No.**	**Code (as per IS:815- 66)**
Class B2 (Moderately high ductility)	For welding of mild steel to IS:2062-1962 (Fusion welding quality) or equivalent, for service conditions where the weldment is rigid and subjected to relatively high dynamic stresses	814-63	M 110 to M 997-H, J, K or P.

Brand and make of electrode on approved list of M&C wing of RDSO should be used.

i. No welding operator shall be employed on the work until he has, in the presence of the Engineer, passed the appropriate tests laid down in relevant codes.

ii. All main butt welds shall have complete penetration and shall comply with the requirements of IRS Welded Bridge Code. They shall be made between prepared fusion faces. Where possible they shall be welded from both sides. The ends of the welds shall have full throat thickness. This shall be obtained on all main welds by the use of extension pieces adequately secured on either side of the main plates. Additional metal remaining after the removal of the

extension pieces shall be removed by machining, or by other approved means and the ends and surfaces of the welds shall be smoothly finished.

iii. In the fabrication of built-up assemblies all butt welds in the component parts shall be complete before the final assembly.

iv. A record of butt welds shall be kept to enable it to be identified with the welders responsible for the work but material shall not be marked by hard stamping for this purpose.

The welding techniques and sequence, quality, size of electrodes, voltage and current required shall be as prescribed by manufacturers of the material and welding equipment. The Contractor shall submit full details of welding procedure in proforma given at Appendix V of IRS: B1-2001 for approval of the Engineer.

v. Welding of Stud Shear Connectors:

i. The welding of stud shear connectors shall be done by "DRAWN ARC STUD WELDING WITH CERAMIC FERRULE" technique. The shear stud and ceramic ferrules shall conform to type SD1/UF as per BS EN ISO 13918-2008.

ii. The stud and the surface to which studs are welded shall be free from scale, moisture, rust and other foreign material. The stud base shall not be painted, galvanized or cadmium plated prior to welding. Welding shall not be carried out when temperature is below 10 degrees Celsius or surface is wet or during periods of strong winds unless the work and the welder are adequately protected. The welds shall be visually free from cracks and shall be capable of developing at least the nominal ultimate strength of studs. The procedural trial for welding the stud shall be carried out when specified by the Engineer.

iii. Testing of Stud Shear Connectors:

(A) Appearance Test

1) The weld to a shear stud connector should form a complete collar around the shank and free from cracks, excessive splashes of weld material, free from injurious laps, fins, seams, twist, bends or other injurious defects.

2) Weld material should have a 'steel blue' appearance.

(B) Test to check the fixing of shear studs

1) Ring Test: Involves striking the side of the head of stud with a 2 kg hammer. A ringing tone achieved after striking indicates good fusion whereas dull tone indicates a lack of fusion (BS 5400-6) All studs shall be checked by Ring test.

2) Bend Test: Test requires the head of a stud to be displaced laterally by approximate 25% of its height using 6kg hammer.

* The weld should then be checked for sign of cracking or lack of fusion.

* Stud should not be bent as back as this is likely to damage the weld.

* The testing rate should be 1 in 50 (BS 5400-6).

vi. Making of Joints

i. Joints shall normally be made by filling not less than 50 per cent of holes with service bolts and barrel drifts in the ratio 4:1. Only barrel drifts shall be used in erection. Drifts may be used for drawing light members in position; but their use on heavy members shall be restricted to securing them in their correct position. Any error in the shop fabrication or deformation resulting from handling and transportation which prevents proper assembling and fitting up of parts shall be reported immediately to the Engineer. No reaming shall be undertaken without the written authority of the Engineer.

ii. The erection of OWG shall be done in accordance with Appendix III of IRS: B1-2001. However, if the Contractor desires to adopt any other method of erection, they shall submit the scheme and obtain the approval of the Engineer. It shall be ensured that when in position, the girder has the camber as per drawing.

vii. High Strength Friction Grip (HSFG) bolting assembly

The HSFG bolting assembly shall conform to EN 14399 Series (High strength structural bolting assemblies for preloading):

- EN 14399-1:2015- General requirements.
- EN 14399-2:2015- Suitability for preloading.
- EN 14399-3:2015- System HR- Hexagonal bolt and nut assemblies.
- EN 14399-5:2015- Plain washers.
- EN 14399-6:2015- Plain chamfered washers.
- EN 14399-9:2009- Direct Tension Indicator for bolt and nut assembly.

HSFG bolting assemblies are very sensitive to differences in manufacture and lubrication. Therefore, complete HSFG bolting assembly (i.e. bolt, nut, washers & DTI) including galvanizing shall be procured from single manufacturer. Use of Direct Tension Indicator (DTI) washers shall be mandatory in the HSFG bolting assemblies.

Grade and size of bolts shall be as per the Drawings. The surface preparation, tightening procedures and other details for HSFG bolts shall be as per RDSO standard Drawing No. RDSO/B-11760/R1.

Table: Composition of high strength structural bolting assembly and its component marking

Type of bolting assembly		System HR	
General requirements		EN 14399-1	
Suitability for preloading		EN 14399--2 and, if any, additional testing specified in the product standard	
Bolt & Nut		EN 14399-3	
Marking	Bolt	HR8.8	HR10.9
	Nut	HR8 or HR10	HR10
Washers		EN 14399-5[a] or EN 14399-6	
Marking		H or HR[b]	
Direct tension indicator and nut face washer or bolt face washer		EN 14399-9	
Marking	Direct Tension Indicator	H8	H10
	Nut Face Washer	HN	
	Bolt Face Washer	HB	

[a] EN 14399–5 can only be used under the nut.
[b] At the choice of the manufacturer.

The bolt length shall be chosen such that after tightening the following requirements are met for bolt end protrusion beyond the nut face and the thread length:

a) the length of protrusion shall be at least the length of one thread pitch measured from the outer face of the nut to the end of bolt

b) at least four full threads (in addition to the thread run out) shall remain clear between the bearing surface of the nut and unthreaded part of the shank.

Holes for HSFG bolts- The holes shall be made by drilling only. The actual diameter of hole shall be 1.5 mm more than the bolt diameter for less than 25mm diameter bolts and 2mm more than nominal diameters of HSFG bolts for diameters 25mm and above.

Surface preparation of steel interface before providing HSFG bolts–Wherever property class 8.8 bolts are used these should be hot dip galvanized as per ISO: 10684(latest version). Property class 10.9 bolts should not be hot dip galvanized since this may cause hydrogen embrittlement. So these bolts should be coated with zinc flakes as per ISO: 10683 (latest version). However, depending on the site conditions, locations of these bolts in the

structure and corrosion proneness, use of zinc flake spray coating as per ISO: 10683(latest version) can be adopted even for property class 8.8 bolts as well.

Installation of HSFG bolting assembly- Installation /tightening of preloaded bolting assemblies shall be carried out as per clause 8.3 & 8.5 of EN 1090-2 and clause 5.2 of EN 14399-9. The following steps shall be followed for tightening of bolts:

i. The holes shall be brought in alignment by using drifts etc. such that bolt threads are not damaged/enlarged during insertion of bolts.

ii. The members being joined shall be held in position by insertion of few HSFG bolts (tightened to first stage only i.e. snug tight condition).

iii. After the alignment/geometry of members is verified to be correct as per drawings, balance bolts shall be inserted and tightened upto first stage of tightening. The drifts inserted as above shall also be replaced by HSFG bolts one by one.

iv. After first stage of tightening, the joint shall be checked to see if the plies are in close contact and clearances are not exceeded.

v. Second stage tightening shall be done with torque wrench. Bolts shall be tightened until indentation on the DTI indicate full tightening. In order to minimize loosening of already tight bolts, tightening in both the stages shall be done starting from the stiffest part to free edges.

vi. 100% bolts shall be checked for proper tightening using feeler gauge of 0.4/0.25 mm.

vii. Fully tensioned bolt, opened for any reason whatsoever, shall be rejected and removed from the site of work along with washers, nut and DTI.

4. Bearing and Expansion Gear

All bearings and expansion gears shall be procured from a reputed and experienced manufacturer qualified to undertake precision fabrication of this type and shall be approved by the Engineer.

5. Trial Shop erection

Trial shop erection shall be done in accordance with Cl.614 of IRBM.

6. Field erection

Field erection shall be done in accordance with Cl.616 of IRBM.

7. Erection in contractor's Works

The whole of the work shall be completely interchangeable. First span (of each type) shall be temporarily erected complete at the Contractor's Works for inspection by the Inspecting Officer to test the accuracy of the templates. Further spans or part span assemblies built from

parts selected at random by the Inspecting Officer shall be erected from time to time to check the accuracy of the work as the Inspecting Officer may require.

8. Launching

Before taking up launching, the Contractor shall prepare and submit launching scheme along with design and methodology of launching including details of equipment proposed to be used for the approval of the Engineer.

a) Rail Flyovers (RFO)

After approval of the Engineer, launching scheme shall be got approved from Chief Bridge Engineer/Northern Railway. CRS application shall be prepared by the Contractor and submitted to the Commissioner of Railway Safety (CRS) through the Engineer, HRIDC and CBE/NR. Work of launching shall be started only after receipt of sanction of CRS.

b) Road Under Bridges

After approval of the Engineer, launching scheme shall be got approved from concerned road authorities. Work of launching shall be started only after receipt of approval of concerned road authority.

During erection of plate/composite steel girder by crane special care shall be taken to support the girder by wooden blocks & temporary bracing to ensure stability against toppling till permanent bracings are provided."

9. Track work for OWG:

Track work for open web girder bridge on H-beam sleepers shall be done as per IRPWM, relevant RDSO drawings and codal provisions.

10. Camber

In order to eliminate secondary stresses in a span under loaded condition, the nominal length (i.e. the lengths which will give no camber) of member shall be increased or decreased by the amount shown on the camber diagram supplied by the Employer. Frequent checks shall be made of the camber of girders during erection and care taken to see that the camber as per drawing is obtained when the girder is completely assembled. When span is supported on ends and intermediate supports are removed the dead load camber shall be recorded and entered in bridge register. This will provide the reference to compare the camber checked during technical inspection to ascertain the loss of camber.

11. Test certificates & testing

All materials for the work shall pass Mechanical test, Charpy test, Chemical Analysis, etc. prescribed by the relevant IS specifications or such other equivalent specifications.

For all materials including HSFG bolts, the contractor shall furnish copies of test certificates from the manufacturers including proof sheets, mill test certificates, etc. showing that the materials have been tested in accordance with the requirements of various specifications and codal provisions.

If any further testing of materials is required by Engineer in respect of these and other items, it shall be arranged for by the contractor at a reputed laboratory/National test house as approved by Engineer. For this, nothing extra shall be payable.

Even satisfactory outcome of such tests or analysis shall in no way limit, dilute or interfere with the absolute right of the Engineer to reject the whole or part of such materials supplied, which in the judgement of the inspecting authority does not comply with the conditions of the contract. The decision of the Engineer in this regard shall be final, binding and conclusive for all purposes.

The Engineer shall be empowered, at his/her discretion to make or have made under the supervision, any of the tests specified in the specifications mentioned herein in addition to such other tests as he/she may consider necessary, at any time up to the completion of the contract and to such an extent as he/she may think necessary to determine the quality of all materials used therein. In doing so, he/she shall be at liberty under any reasonable procedure, he/she may think fit to select, identify, have cut-off and take possession of test pieces from the material either before, during or after its being worked up into the finished product.

The Engineer shall also be empowered to call for a duly authenticated series of mechanical tests to be obtained from the maker for this materials used in the work and to accept the same in lieu of other tests to the extent he/she deems fit. The Contractor shall supply the material for the test pieces and shall also prepare the test pieces necessary.

The test shall be carried out by the Contractor, for which Contractor shall provide all facilities including supply of labour and plant. Engineer may at his/her discretion direct the Contractor to despatch such tests pieces as he/she may require to the National Test House or elsewhere as he/she may think fit for such testing purposes. The Engineer may at his/her discretion, check test results obtained at Contractor's work by independent tests at National Test House.

The Engineer shall at all times be empowered to examine and check the working of the Contractor's plant before and after using it. Should the Contractor's plant be found, in the Engineer's opinion, unreliable, he/she is empowered to cancel any tests already carried out in this contract and have these tests carried out at any National Test House or elsewhere, as he/she may think fit.

12. Fabrication drawings

The contractor shall prepare detailed shop drawings including drawing office dispatch lists (DODL's) on the basis of design drawings supplied by Engineer in such size and in such details as may be specified by Engineer. The shop drawings shall be submitted to Engineer in triplicate.

No work of fabrication will be started without such approval being obtained. Contractor has to arrange the proof checking of the working fabrication drawings from the nominated Institution / Consultant. The cost will be borne by the contractor.

13. Painting

a. Fabricated steel work shall not be painted over except to the extent specified in para (b) until it has been inspected and passed by the Engineer or his representative and any defect, pointed out by him has been rectified.

b. All surfaces which shall be in permanent contact and any others which will not be accessible for painting later on shall be cleaned thoroughly and given one coat of Zinc Chrome Red Oxide Priming to IS 2074 or other approved composition in the prescribed number of coats immediately prior to assembly.

c. Steel girders (including all components) shall be provided with protective coating by metalizing with sprayed aluminum as given in the Appendix-VII of IRS: B1-2001, followed by painting as per painting schedule given below-

i. One coat of etch primer to IS:5666

ii. One coat of zinc chrome primer to IS: 104 with the additional proviso that zinc chrome to be used in the manufacture of primer shall conform to type 2 of IS:51.

iii. Two coats of aluminum paint to IS: 2339 brushing or spraying as required. One coat shall be applied before the fabricated steel work leaves the shop. After the steel work is erected at site, the second finishing coat shall be applied after touching up the primer and the finishing coat if damaged in transit.

14. All third Party (RDSO/RITES/Any other nominated agency) Inspections charges for Open Web Girders and Composite Girders etc. shall be paid by the Employer.

Annexure OCS-4

PRESTRESSING

1 GENERAL

The work shall be carried out in accordance with the drawing and these specifications or as approved by the Engineer.

Concrete and un-tensioned steel for the construction of prestressed concrete members shall conform to the requirements of respective sections so far as the requirements of these Sections apply and are not specifically modified by requirements set forth herein.

Contractor shall ensure that different components of prestressing such as jacks, bearing plates, wedges, anchorages, strands, and HDPE ducts etc. are compatible to each other and the same shall be exchanged in between all the suppliers to ensure the same.

2 MATERIALS

a. Sheathing

i. The sheathing ducts shall be of the spiral corrugated type. Unless otherwise specified, the material shall be Cold Rolled Cold Annealed (CRCA) Mild Steel conforming to IS: 513 intended for mechanical treatment and surface refining but not for quench hardening or tempering.

ii. The material shall normally be bright finished. However, where specified, as in case of use in aggressive environment, galvanized or lead-coated mild steel strips shall be used. The thickness of sheathing shall be as shown on the drawing, but shall nevertheless not be less than 0.3mm, 0.4mm and 0.5mm for sheathing ducts having internal diameter of 50mm, 75mm and 90 mm respectively. For larger diameter of ducts, thickness of sheathing shall be based on recommendations of prestressing system supplier or as directed by the Engineer.

iii. For major projects, the sheathing ducts should preferably be manufactured at the project site utilising appropriate machines. With such an arrangement, long lengths of sheathing ducts may be used with consequent reduction in the number of joints and couplers. Where sheathing duct joints are unavoidable, such joints shall be made slurry tight by the use of corrugated threaded sleeve couplers which may be tightly screwed onto the outer side of the sheathing ducts.

iv. The length of the coupler should not be less than 150mm but should be increased upto 200mm wherever practicable. The joints between the ends of the coupler and the duct shall be sealed with adhesive sealing tape to prevent penetration of cement slurry during concreting. The couplers of adjacent ducts should be staggered wherever practicable. As far as possible, couplers should not be located in curved zones. The corrugated sleeve couplers are being conveniently manufactured using the sheath making machine with the next higher size of die set.

v. The internal diameter of the sheathing duct shall be in accordance with the recommendations of the system manufacturer and shall be about three times the area of the tendons. In case of 6T13, 12T13 and 19T13 sizes of tendons comprising 12/13mm dia strands, the inner diameter of the sheathing shall not be less than 50mm, 75mm and 90mm respectively or those shown in the drawing, whichever is greater.

b. Anchorages

i. Anchorages shall be procured from authorized manufacturers only. Anchorages shall conform to BS 4447. Test certificates from a laboratory fully equipped to carry out the tests shall be furnished to the Engineer. Such test certificates shall not be more than 12 months old at the time of making the proposal for adoption of a particular system for the project.

ii. No damaged anchorages shall be used. Steel parts shall be protected from corrosion at all times. Threaded parts shall be protected by greased wrappings and tapped holes shall be protected by suitable plugs until used. The anchorage components shall be kept free from mortar and loose rust and any other deleterious coating.

iii. Swages of prestressing strand and button heads of prestressing wire, where provided shall develop a strength of at least 95 per cent of the specified breaking load of the strand or wire as the case may be. Where swaging / button-heading is envisaged, the Contractor shall furnish details of his methodology and obtain approval of the Engineer, prior to his taking up the work.

c. Prestressing Steel

i. 12.7mm nominal dia stress relieved low relaxation high tensile steel strand (CLASS-II) conforming to IS: 14268 with ultimate tensile strength 1861 N/mm2 shall be used. Various test as recommended in IS: 14268 shall be conducted before transporting the lot to site. Apart from 1000 hrs relaxation test conducted by manufacturer, at least two such tests are required to be conducted by independent agency in the beginning of project.

d. Prestressing strands/Wires storage

i. All high tensile steel for prestressing work shall be stored about 30cm above the ground in a suitably covered and closed space to protect it from dampness. It shall also be invariably wrapped in gunny cloth or tar paper or any other suitable materials, as per approval of Engineer. Even if it is to be stored in an area at the site for short time during transit it shall be suitably covered. Protection during storage and repacking or application of washable protective coating to the H.T. steel shall be given by the contractor at no extra cost if the packing of H. T. Strand/wire during unloading and storage / handling in the stores gets damaged.

ii. Stock piling of H. T. Steel on the work site shall not be allowed any time, especially before and during the monsoon.

iii. The Engineer or his authorized representative shall always have an easy access to the store-yard for inspecting the H. T. Wire/strands/Bars and satisfying themselves regarding the condition thereof. Any modifications regarding storage suggested by the Engineer shall scrupulously be followed by the contractor. During monsoon days, H.T wires/strands shall be kept in reasonable airtight store, if required by the Engineer, at no extra cost.

e. Testing of Prestressing steel and Anchorages

i. All materials specified for testing shall be furnished free of cost and shall be delivered in time for tests to be made well in advance of anticipated time of use.

ii. All wire, strand or bars to be shipped to the site shall be assigned a lot number and tagged for identification purposes. Anchorage assemblies to be shipped shall be like-wise identified.

iii. All samples submitted shall be representative of the lot to be furnished and in the case of wire or strand, shall be taken from the same master roll. The Contractor shall furnish samples of at least 5.0m length selected from each lot for testing. Also, two anchorage assemblies, complete with distribution plates of each size or types to be used, shall be furnished along with short lengths of strands as required.

3 WORKMANSHIP

a. **Cleaning**

i. Tendons shall be free from loose rust, oil, grease, tar, paint, mud or any other deleterious substance.

ii. Cleaning of the steel may be carried out by immersion in suitable solvent solutions, wire brushing or passing through a pressure box containing carborandum powder. However, the tendons shall not be brought to a polished condition.

b. **Straightening**

i. High tensile steel wire and strand shall be supplied in coils of sufficiently large diameter such that tendons shall retain their physical properties and shall be straight as it unwinds from the coil. Tendons of any type that are damaged, kinked or bent shall not be used.

ii. The packing of prestressing wire / strand shall be removed only just prior to making of cable for placement. Suitable stands shall be provided to facilitate uncoiling of wires / strands without damage to steel. Care shall be taken to avoid the possibility of steel coming into contact with the ground.

c. **Positioning**

i. Post-Tensioning

Prestressing tendons shall be accurately located and maintained in position, both vertically and horizontally, as per drawings.

Tendons shall be so arranged that they have a smooth profile without sudden bends or kinks.

The location of prestressed cables shall be such as to facilitate easy placement and vibration of concrete in between the tendons.

Sheathing shall be placed in correct position and profile by providing suitable ladders and spacers. Such ladders may be provided at intervals of approximately 1.0 m. Sheathing shall be tied rigidly with such ladders/spacer bars so that they do not get disturbed during concreting.

The method of supporting and fixing shall be such that profile of cables is not disturbed during vibrations, by pressure of wet concrete, by workmen or by construction traffic.

- Each anchorage device shall be set square to the line of action of the corresponding prestressing tendon and shall be positioned securely to prevent movement during concreting.
- The anchorage devices shall be cleaned to the satisfaction of the Engineer prior to the placing of concrete. After concreting, any mortar or concrete which adheres to bearing or wedging surfaces shall be removed immediately.

d. **Cutting**

i. Cutting and trimming of wires or strands shall be done by suitable mechanical or flame cutters. When a flame cutter is used, care shall be taken to ensure that the flame does not come in contract with other stressed steel. The location of flame cutting of wire or strand shall be kept beyond 75mm of where the tendon will be gripped by the anchorage or jacks.

ii. In post-tensioning the ends of prestressing steel projecting beyond the anchorages, shall be cut after the grout has set.

e. **Protection of Prestressing steel**

i. Prestressing steel shall be continuously protected against corrosion, until grouted. The corrosion protector shall have no deleterious effect on the steel or concrete or on the bond strength of steel to concrete. Grouting shall conform to these specifications or as directed by the Engineer or specified in Contract Specifications.

f. **Sheathing Joints and Couplings**

i. Joints in sheathing shall, if so, instructed be sealed with a heat shrink tape.

ii. Special attention should be paid to its junction at the anchorage. It should tightly fit on the trumpet end of anchorage and the junction should be sealed, preferably, with heat shrink tape.

iii. The heat shrink tape is supplied in the form of bandage rolls which can be used for all diameters of sheathing ducts. The bandage is coated on the underside with a heat sensitive adhesive so that after heating the bandage material shrinks on the sheathing duct and ensures formation of a leak-proof joint. The heating is affected by means of a soft gas flame.

iv. The sheathing and all joints shall be watertight. Any temporary opening in the sheathing shall be satisfactorily plugged and all joints between sheathing and any other part of the prestressing system shall be effectively sealed to prevent entry of mortar, dust, water or other deleterious matter. Sheathing shall be neatly fitted at joints without internal projection or reduction of diameter.

v. Enlarged portions of the sheathing at couplings or anchorages shall be of sufficient length to provide for the extension of the tendons.

g. **Grout Vents**

i. Grout vents of atleast 20mm diameter shall be provided at both ends of the sheathing and at all valleys and crests along its length. Additional vents with plugs shall also be provided along the length of sheathing such that the spacings of consecutive vents do not exceed 20m. Each of the grout vents shall be provided with a plug or similar device capable of withstanding a pressure of 1.0MPa without the loss of water, air pressure or grout.

h. **Anchorages**

i. All bearing surfaces of the anchorages shall be cleaned prior to concreting and tensioning. Anchor cones, blocks and plates shall be securely positioned and maintained during concreting such that the centre line of the duct passes axially through the anchorage assembly.

ii. The anchorages shall be recessed from the concrete surface as per drawings.

iii. After the prestressing operations are completed and prestressing strands are cut, the surface shall be painted with two coats of epoxy of suitable formulation having a dry film thickness of 80 microns per coat and entire recess shall be filled with concrete or non-shrink/pre-packaged mortar or epoxy concrete.

i. **Handling and Storage**

i. Care shall be taken to avoid mechanically damaging, work-hardening or heating prestressing tendons while handling. All prestressing tendons shall be stored clear of the ground and protected from the weather, from splashes from any other materials, and from splashes from the cutting operation of an oxy-acetylene torch, or arc-welding processes in the vicinity.

ii. In no circumstances shall prestressing tendons after manufacture be subjected to any welding operation, or 'on-site' heat treatment or metallic coating such as galvanizing. This does not preclude cutting as specified.

iii. All wires, strands or bars stressed in one operation shall be taken, where possible, from the same parcel. Each cable shall be tagged with its number from which the coil numbers of the steel used can be identified. Cables shall not be kinked or twisted. Individual wires and strands for which extensions are to be measured shall be readily identifiable at each end of the member. No strand that has become unraveled shall be used.

j. **Supervision**

i. All prestressing and grouting operations shall be undertaken by trained personnel only. A representative of supplier of the prestressing system shall be present during all tensioning and grouting operations and shall ensure, monitor and certify their correctness.

4 Tensioning Equipment

All tensioning equipment shall be procured from authorized manufacturers only and be approved by the Engineer prior to use. Where hydraulic jacks are used, they shall be power driven unless otherwise approved by the Engineer. The tensioning equipment shall satisfy the following requirements:

a. The means of attachments of the prestressing steel to the jack or any other tensioning apparatus shall be safe and secure.

b. Where two or more wires / strands constitute a tendon, a single multiple stressing jack shall be used which is capable of tensioning simultaneously all the wires / strands of the tendon. Suitable facilities for handling and attaching the multi-pull jack to the tendons shall be provided.

c. The tensioning equipment shall be such that it can apply controlled total force gradually on the concrete without inducing dangerous secondary stresses in steel, anchorage or concrete; and

d. Means shall be provided for direct measurement of the force by use of dynamometres or pressure gauges fitted in the hydraulic system itself to determine the pressure in the jacks. Facilities shall also be provided for the linear measurement of the extension

of prestressing steel to the nearest mm and of any slip of the gripping devices at transfer.

e. Any indication in the loss of strength in tendons during the tensioning operation shall be brought to the attention of the Engineer. Any corrective measures which may be required in procedures and/or material shall be approved by the Engineer.

f. When friction must be reduced, water soluble oil may be used subject to the approval of the Engineer. This oil may be flushed from the duct as soon as possible after stressing is completed by use of water pressure. These ducts shall be flushed again just prior to the grouting operations. Each time the ducts are flushed, they shall be immediately blown dry with oil-free air.

5 Testing by the Contractor

For the purpose of accurately determining the tendon elongations while stressing, the Contractor shall bench test two samples of each size and type of strand tendon to determine the modulus of elasticity prior to stressing the initial tendon. The bench should be at least 6metres long, with concrete anchorage blocks having a constant area end section of at least four times that of the anchorage assembly area. The tendon shall be straight and centered on the cross-sectional area of the bench. The test procedure shall consist of stressing the tendon at an anchor assembly with the dead end consisting of a load cell. The test specimen shall be tensioned to 80 percent of ultimate in 10 increments. For each increment, the gauge pressure, elongation and load cell force shall be recorded. The data shall be furnished to the Engineer. The theoretical elongations shown on the post-tensioning working drawings shall be re-evaluated by the Contractor using the results of the tests and corrected as necessary. Revisions to the theoretical elongations shall be submitted to the Engineer for approval.

Apparatus and methods used to perform the tests shall be proposed by the Contractor and be subject to the approval of the Engineer. After the initial testing, five more tests shall be performed. These tests shall be spaced evenly throughout the duration of the Contract.

a. Post Tensioning Procedure

i. Tensioning force shall be applied in gradual and steady steps and carried out in such a manner that the applied tensions and elongations can be measured at all times. The sequence of stressing applied tensions and elongations shall be in accordance with the approved drawing or as directed by the Engineer.

ii. It shall be ensured that in no case, the load is applied to the concrete before it attains the strength specified on the drawing or as stipulated by the prestressing system supplier, whichever is more.

iii. After prestressing steel has been anchored, the force exerted by the tensioning equipment shall be decreased gradually and steadily so as to avoid shock to the prestressing steel or anchorage.

iv. The tensioning force applied to any tendon shall be determined by direct reading of the pressure gauges or dynamo metres and by comparison of the measured elongation with the calculated elongation. The calculated elongation shall be invariably adjusted with respect to the modulus of elasticity of steel for the particular lot as given by the manufacturer.

v. The difference between calculated and observed tension and elongation during prestressing operations shall be regulated.

vi. **Grouting of Prestressed Tendons:** Grouting shall conform to provisions in **Annexure D** of "IRS Concrete Bridge Code: 1997". A record of grouting operations shall be maintained in a format given by Engineer.

6 Safety Precautions during Tensioning

These are applicable for both pre-tensioning and post tensioning operations.

a. Care shall be taken during tensioning to ensure the safety of all persons in the vicinity.

b. Jacks shall be secured in such a manner that they will be held in position, should they lose their grip on the tendons.

c. No person shall be allowed to stand behind the jacks or close to the line of the tendons while tensioning is in progress.

d. The operations of the jacks and the measurement of the elongation and associated operations shall be carried out in such a manner and from such a position that the safety of all concerned is ensured.

e. A safety barrier shall be provided at both ends to prevent any tendon, which might become loose from recoiling unchecked.

f. During actual tensioning operation, warning sign shall be displayed at both ends of the tendon. No person will stand behind in line with jacks while tendon / wire are being stressed.

g. After prestressing, concrete shall neither be drilled nor any portion cut nor chipped away nor disturbed, without express approval of the Engineer.

h. No welding shall be permitted on or near tendons nor shall any heat be applied to tendons. Any tendon which has been affected by welding, weld spatter or heat shall be rejected.

7 Transportation and Storage of Units

a. Precast girders or elements shall be transported in an upright position. Points of support and the direction of reactions with respect to the girder shall approximately be the same during transportation, and storage as when the girder is placed in final position.

b. When members are to be stacked, they shall be firmly supported at such bearing positions as will ensure that the stresses induced in them are always less than the permissible design stresses. Further, inclined side supports shall be provided at the ends and along the length of a precast girder to prevent lateral movements or instability.

c. Care shall be taken during storage, hoisting and handling of the precast units to prevent their cracking or being otherwise damaged. Units worked or damaged by improper storing or handling or transport shall be replaced by the Contractor at his expense.

8 Tolerances

a. Permissible tolerances for positional deviation of prestressing tendons shall be limited to the following:

i. Variation from the specified horizontal profile: 5 mm
ii. Variation from the specified vertical profile: 5 mm
iii. Variation from the specified position in member: 5 mm

Section VII: Employer's Requirements

Section VII-7A: General Electrical Services

C O N T E N T S

CHAPTER-1 – INTRODUCTION AND OBJECTIVE

1.1 INTRODUCTION

(1) Haryana Rail Infrastructure Development Corporation Limited (HRIDC) was Incorporated on 22nd August,2017 as a Joint Venture between Government of Haryana and Ministry of Railways with equity Participation of 51% and 49% respectively. The Haryana Orbital Rail Corridor (HORC) is the project of HRIDC, from Prithla (near Palwal station of Indian Railways) to New Harsana Kalan (near Sonipat station of Indian Railways).

(2) Haryana Orbital Rail Corridor (HORC)route will be Broad Gauge, Double Line, with High Rise Electrification at 2x25 kV, AC, approximately 145 RKM and 315 TKM from Prithla to New Harsana Kalan including connectivity to Indian Railway (IR) and Dedicated Freight Corridor Corporation of India Limited (DFCCIL) stations. There are twin Tunnels from 24.850 km to 29.580 km and both tunnels interconnected at 27.215 km with one vertical shaft. The viaduct is from 20.942 km to 24.843 km.

(3) There are 17 New Stations namely Prithla, Silani, Sohna IMT, Dhulawat, Chandla Dungerwas, Panchgaon, Manesar, New Patli, Badsa, Deverkhana, Badli, Mandothi, New Asaudah, Jasaur Kheri, Kharkhoda, Tarakpur and New Harsana Kalan and details are as under:

SN	Station	Chainage (km)
1	Prithla (crossing)	0.00
2	Silani (halt)	10.40
3	Sohna IMT (crossing)	19.01
4	Dhulawat (crossing)	32.77
5	Chandla Dungerwas (halt)	42.60
6	Panchgaon (halt)	46.29
7	Manesar (junction)	51.89
8	New Patli (junction)	58.00
9	Badsa (junction)	64.75
10	Deverkhana (halt)	71.14
11	Badli (crossing)	76.83
12	Mandothi (junction)	90.45
13	New Asaudah (halt)	94.03
14	Jasaur Kheri (halt)	100.22
15	Kharkhoda (crossing)	108.72
16	Tarakpur (crossing)	114.20
17	New Harsana Kalan (crossing)	125.13

In addition to above 17 stations, There are 3 stations i.e Sultanpur and Asaudah and Patli of Indian Railway where HORC connectivity shall be made.

(4) The present works are from Prithla to IMT Sohna and there are 3 stations in the section namely Prithla, Silani and IMT Sohna. But works can be executed anywhere in the section from Prithla to New Harsana Kalan, as per directions of

the Engineer.

(5) The objective of the Specifications is to minimize maintenance cost by design and selection of Maintenance friendly System which have high Availability, low Life Cycle Cost (LCC), higher Meantime between Failure (MTBF) and minimum Maintenance Time to Restore(MTTR).

(6) The objective of the specifications is to minimize energy usage. The requirement is to reduce energy consumption by employing the energy efficient system design and product specification.

(7) The Works shall be designed and executed to achieve an aesthetic character and provide a feeling of design commonality throughout the project.

1.2 SCOPE OF WORK

The broad scope of work, relating to works are given below and shall be for the purpose of general guidance only and is not exhaustive. For complete appreciation of the scope, the specification, drawings and other relevant document, mentioned in the Tender documents shall be referred to. The indicative items of work are as under:

(1) Electrification of Prithla, Silani and IMT Sohna Station, Yard areas and S&T buildings with allied facilities and complete power supply arrangement as per Standard Railway Practice and guidelines issued by Railway Board/ RDSO/ CPWD specification etc.

(2) Supply, Installation, testing and commissioning of 11 kV/0.44 kV, 1x250 kVA Compact Substation (CSS) with Dry type transformer (250 kVA) with earthing and all safety equipment with complete power supply arrangement at Prithla and IMT Sohna stations.

(3) Supply, Installation, testing and commissioning of silent type DG Set of 1x125 kVA capacity (emission CPCB 4-plus norm) including AMF Panel & LT Panel including earthing system and all safety equipment with complete power supply arrangement at IMT Sohna station.

(4) Supply, Installation, testing and commissioning of Automatic Power Factor Correction (APFC) Panel of 150kVAR including earthing system and all safety equipment with complete power supply arrangement at Prithla and IMT Sohna station. APFC panel shall be connected to main LT Panel.

(5) Supply, Installation, Testing and Commissioning of High Mast Towers (20 meter) with luminaires, with complete cabling arrangement to meet standard lux level at Prithla, Silani and IMT Sohna stations as per specifications and guidelines issued be RDSO/ Railway Board. At Prithla and IMT Sohna, 2 nos. high mast towers shall be provided and one no. at Silani station.

(6) Supply, Installation, Testing and Commissioning of 11 meter high decorative poles with luminaires, with complete cabling arrangement Prithla, Silani and IMT Sohna stations to meet standard lux level as per specifications and guideline issued by RDSO/ Railway Board.

(7) Supply, Installation, Testing and Commissioning of Colour Light Signalling (CLS) Panel with cabling arrangement of suitable size and rating at all 3 stations (if required) as per RDSO specifications.

(8) Supply, installation, Testing and Commissioning of Single sided and Double-sided LED signage board with pictogram/ symbol at all 3 stations as per specification.

(9) The space for (13 Passenger, 1000 Kg) lift and Escalators at IMT Sohna station shall be kept. If needed, the lifts and escalators can be provided in future.

(10) Provision of LT panel for distribution of LT supply for lighting (indoor and outdoor), fans, air conditioners, yard lighting, FOB/ Sub Way Lighting, Signalling and Telecom Load, SCADA RTU load, submersible pump load, Power supply for operation of OHE motorised isolator/ Interrupter etc. Twenty percent (20%) spare capacity shall be kept in LT panel for future loads.

(11) Supply and laying of Conduits Fire Resistant PVC or GI and all conduits shall be concealed. No surface conduit shall be allowed and if surface conduit is essential then it shall be with GI pipe only and with the approval of Engineer.

(12) Provision of conduits, wiring, lights (indoor and outdoor) , fans and power sockets etc. in all stations, S&T installations at station, pump houses and other service buildings. The wiring shall be with copper wires and cables.

(13) Provision of conduits, wiring, lights, fans, air-conditioners and power sockets etc. at S&T huts at both ends of IMT Sohna station. Air-conditioners shall also be provided in S&T rooms of the Prithla and IMT Sohna stations.

(14) Provision of conduits, wiring, lights, fans, air-conditioners and power sockets etc. in S&T Auto Signalling System buildings (Auto Location Hut: ALH) - 6 nos. enroute from Prithla upto Tunnel (Palwal end).

(15) Provision of lights, fans, exhaust fans in all buildings and provision of lights in subways, platforms, passenger shelters etc.

(16) Earthing of all equipment's and systems.

(17) Lightning protection of all buildings.

(18) Supply, installation, testing and commissioning of LT copper cables. The cable shall be laid under ground, under platform, under floor, below tracks etc and cable route markers shall be provided as per specifications and drawings. These cables shall feed 20 m high mast flood light towers, 11 m high decorative poles, platform lighting, street lighting, pump sets, S&T loads at both ends of platform etc. The maximum voltage drop in cables from source to load point shall not exceed 5%.

(19) Supply, installation, testing and commissioning of HT cables with all safety norms.

(20) Supply, installation, testing and commissioning of submersible and mono-block pumpsets.

(21) Supply, installation, testing and commissioning of UPS.

(22) All Nuts, bolts, Studs, washers, Pins etc. shall be of GI or stainless steel. All earthing strips shall be of GI except Copper strips for copper earthing.

(23) Provision of water cooler, Geyser, RO system etc. at stations.

(24) Both sides of the viaduct shall be provided illumination and lux level shall be 10 (minimum). The 240 V AC, power supply for LED lights shall be taken from substation at IMT Sohna and substation at shaft of the tunnel. The feeding zone of each substation shall be approximately equal.

(25) Miscellaneous items e.g. shock treatment charts, schematic layouts, safety rubber mats, equipment number plates, first aid boxes, indication boards and danger notice plates, fire buckets, etc.

(26) All equipment testing (type test, routine tests and factory acceptance tests etc), system acceptance tests, integrated testing and commissioning of all equipments.

(27) Interface with other Contractors to ensure timely completion of the Works.

(28) Training to staff.

(29) Supply of spares.

(30) Provision of all the construction drawings, documents, and as-built drawings required to supply, install, testing and commissioning of the above works and all other installations, as required. Operation & Maintenance Manuals, training manual and other related Documentation.

(31) Provide maintenance supervision support during Defect Notification Period.

(32) The above works can be executed anywhere in the section from Prithla to New Harsana Kalan, as per directions of the Engineer.

(33) The arrangement of 11kV, 3-phase or 440 volt, 3-phase AC supply, from Power Supply Authority (PSA) substation to HORC point at H-Pole in HORC premises shall be arranged by HRIDC and all coordination with PSA including necessary payments to PSA shall be made by HRIDC.

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CHAPTER 2 - DESIGN AND PERFORMANCE REQUIREMENTS

2.1 General

1 The design, supply, installation, testing and commissioning of General Services work including Power supply system etc. shall meet the design and performance requirements within the design environments specified in this Particular Specifications.

2 Design Environment

Adequate Margin shall be built in Design, particularly to take care of Climate Conditions/Operating Environment. Wherever, the equipment installed in open at the surface level or inside service buildings at surface level, the same shall be designed for working in the existing tropical conditions and the ambient temperature and humidity levels pertaining to HORC Project area. All ferrous components and fittings shall be hot-dip galvanized. All Nuts, bolts, Studs, washers, Pins etc. shall be of GI or stainless steel. All earthing strips shall be of GI except Copper strips for copper earthing.

2.2 Basic Design Philosophy and Requirements

2.2.1 Proven Design

(a) The Contractor shall develop the design based on specification and on proven and reliable Engineering Practices. The design details shall be submitted with technical data and calculations to the Engineer for review.The Design shall include complete Single Line Diagram (SLD) indicating Local, DG set and Auxiliary Transformer LT supply.

(b) The Contractor shall submit drawings in such a form as the Engineer will require them for approval, copies as required of all drawings, diagrams, and details of all equipment in part or in whole. Any review shall be done by the Engineer on receipt of drawings in hard copy. The drawings shall be submitted in soft copy also along with submissions. The Contractor shall make drawings available to the Engineer at all reasonable times. Wiring diagrams and other drawings as the Engineer deems shall not be finally settled until satisfactory installation and testing has been made, this shall be approved in principle.

(c) The Contractor shall submit a schematic block diagram of the equipment showing the functional requirements of this specification. The Contractor shall submit a schedule including details of numbering, categories and drawing registers / indexes for the production, submission, and approval during the period of the contract of drawings and of any information, required for the Engineer in connection with the design of the contract works.

(d) This schedule shall be suited to the requirements of manufacture, delivery and installation of the contract works to meet the requirements of the contract and shall allow reasonable time (approx. 8 weeks) for study and approval by the Engineer of all drawings, calculations and graphics submitted (and as necessary, resubmitted) by the Contractor.

(e) No approval by the Engineer of any drawing shall relieve the Contractor of any of his obligations of liabilities under the contract or of his responsibility for ensuring that the work is satisfactory done and that all operational requirements shall be met.

(f) The Contractor shall provide final drawings without undue delay, and in any case within twelve weeks of the award of the contract, these drawings shall include dimensions, capacity of equipments and complete power supply arrangement with all associated items of each station.Incomplete submission of documents and Drawings shall not be considered as submission by contactor.

2.2.2 The design philosophy shall meet the following criteria:

a) Application of state-of-the-art Technology
b) Service proven design
c) Design life 30 years (However, the individual equipment shall have different design life).
d) Minimum life cycle cost
e) Low maintenance cost
f) Use of interchangeable, modular components
g) Extensive and prominent labelling of parts, cables, and wires
h) High reliability
i) Low energy loss
j) System safety
k) Adequate redundancy in system
l) Fire and smoke protection
m) Use of fire-retardant materials and fire survivals cables
n) Environment friendly
o) Adherence to operational performance requirements
p) Maximum utilization of indigenous materials and skills, subject to quality conformity.

Adequate margin shall be built into the design particularly to take care of the higher ambient temperatures, dusty conditions, and high seasonal humidity, etc. prevailing in HORC Project area.

2.2.3 SERVICE LIFE

All equipment, cables and wiring shall be designed, manufactured and installed so as to secure a service life as shown below:

Main switchboards	30 Years
Transformers	30 Years
Sub-main switchboards	30 Years
Cables	30 Years
Fire alarm main panel	30 Years
Luminaires	20 Years
Tray, trunking and supports	30 Years
Lightning protection	30 Years
Sub-assemblies and components	30 Years
Earth Mat	30 years
All other equipment	minimum 20 Years

2.2.4 Name Plates and Identification

All parts of the installation, which are of relevance for its operation and maintenance, shall be provided with nameplates, tags or other markers/ arrows, especially in enclosed areas, such as ceiling, shafts, and other places accessible for maintenance service.

2.2.5 Corrosion Protection

All ferrous components and fittings shall be hot-dip galvanized. The minimum coating of zinc shall be 1000 gm/m^2 as per RDSO's specifications no. ETI/OHE/13 (4/84 or latest), until and unless specifically mentioned in the specifications.

2.2.6 Acoustic Criteria

Noise emanating from the equipment / service installations shall be within the permissible limit prescribed in the relevant international standards for each of the equipment. In addition, Central Pollution Control Board of India laid down guidelines shall prevail.

2.2.7 Colour Coding

Colour for power cables, bus bars shall be as follows:

Phase R	:	Red
Phase Y	:	Yellow
Phase B	:	Blue
Neutral	:	Black
Ground	:	Green or Green-Yellow Strip

Large wires and cables shall be colour coded with tapes as specific colour. Colour coding for Junction boxes shall be as follow:

Normal power	:	Orange
Essential power	:	Yellow
Telephone system	:	Green
Fire Alarm System	:	Red
Control System	:	Blue

2.3 EARTHING

(1) The Contractor shall prepare an Earthing and Bonding Plan which shall include service buildings, sub-station, LT/HT Panels, High mast towers, light poles, feeder pillars, DG set pumpsets etc. This shall be submitted to the Engineer for approval. The Contractor shall take all measures as the system will be in the proximity of 2x25 kV OHE system. Earthing system shall be designed to ensure personnel safety and protection of persons and installations against damage.

(2) The earthing of sub-station, LT/HT panels, DG set and high mast towers (with 2 independent earth electrodes) shall be done with Copper cladded Steel Earth Electrode of 4-meter length, 19 mm with Exothermically welded busbar with 50 kg Earth Enhancement Compound in each pit. The pit and covers shall be made up of M-25 grade RCC concrete. The connection between equipment and earth electrode shall be made with 40x6 mm GI flat. The earth resistance of sub- station shall be less than 1 ohm.

(3) The earthing of light poles, ACO panel, Distribution Board in S&T Relay Hut at both ends of station and ALH etc., shall be done with single Copper cladded Steel Earth Rod of 4-meter length, 19 mm with Exothermically welded busbar buried 500 mm below the ground. Necessary protection shall be provided to avoid damage and rusting of the earthing system. The connection between equipment and earth electrode shall be

made with 40x6 mm GI flat. The earthing of light poles at platform shall be done on alternate poles. The metallic armour of the cable (incoming and outgoing) shall be connected to each light pole of platform.

(4) The earthing of H-pole of discom (with 2 earth electrodes) shall be done with Copper cladded Steel Earth Rod of 4-meter length, 19 mm with Exothermically welded busbar for connection with 40x6 mm GI flat. The connection between equipment and earth electrode shall be made with 40x6 mm GI flat. RCC chamber with cover (with M-25 grade concrete) shall be provided.

(5) Building Lightning Protection earthing: Protection of building against lightning shall be done in accordance with IS: 2309-2005 as applicable and shall include the provision of a parallel path lighting system complete with air terminal conductors, ground terminals, interconnecting conductors & other fittings required for the complete system. Lightning protection system shall meet the requirements of the National Building Code of India-2005. All two storey buildings shall be provided with lightning protection earthing. GI flat 40x6 mm size shall be laid on all parapet wall top and flat shall be welded to make it one piece and properly secured with GI or non-corrosive fasteners on parapet. The parapet top GI flat shall be connected to two independent copper cladded Steel Earth Electrode of 4-meter length, 19 mm with Exothermically welded busbar for connection through 40x6 mm GI flat. RCC chamber with cover (with M-25 grade concrete) shall be provided.

(6) The 4 m, 19 mm dia steel earth electrode shall have minimum 250 micron copper cladding. The earth clamp exothermically welded on the top of earth electrode shall be 50x6 mm GI flat 300 mm long with 2 holes of 10 mm dia on either side of the earth electrode centre as per the indicative drawing. All nuts, locknuts, bolts, washers etc shall be of stainless steel or GI. All bolts shall be with washers and locknuts.

(7) The earth resistance of compact sub-station body and neutral earthing shall be less than 1 ohm and of LT/HT panel, DG set and high mast towers shall be less than 2 ohms. The resistance of all other earth systems shall be less than 5 ohms. Value of each earth (in black paint) shall be measured and marked on G.I plate size 150x100x3mm painted with yellow enamel paint shall be fixed near the earth, and following information shall be indicated (i) Earth No. (ii) Individual value of earth (iii) Date of testing. Earth resistance at each electrode shall be measured jointly by the Contractor and the Engineer. Complete work shall be as per IS-3043. Normally an earth electrode shall not be located closer than 1.5m from any building. The separation between two earth electrode shall not be less than 2m.

2.4 Climate Conditions:

The traction power system shall be fully operable and maintainable in the following climatic and atmospheric conditions:

Ambient air temperature	(-)5℃ degrees to +50℃
Average ambient temperature for one year	35℃
Maximum solar gain of metallic object under the sun	1kW/sqm.
Maximum relative humidity	100%

Annual Rainfall	Dry Arid regions and also heavy monsoon Affecting regions with rainfall ranging from 1750mm to 6250mm.
Maximum number of thunderstorms days per annum	85
Maximum number of dust storm Days per annum	35
Number of rainy days per annum	120
Basic wind pressure	50m/sec as per wind map based on IS–875.
Creepage distance for (i) Extreme pollution condition (ii) Polluted conditions	As per IEC60815–2008 (31 mm/kV minimum)
Horizontal Seismic Zone	Refer IS 1893 Part1 for earthquake mapping
Creepage distance of Insulators	Minimum nominal creepage distance of insulators shall be 31mm/kV

2.5 CODES & STANDARDS

(1) Equipment, material, and systems/sub-systems shall be designed, manufactured and tested in accordance with the latest issue of approved and recognized codes and standards defined and proposed by the Contractor and approved for the Work. All standards, codes and manuals with correction slips issued up to 28 days prior to last date of Bid submission shall be applicable for this bid. Any other applicable code, circular, instruction of UIC shall be referred with the approval of the Engineer.

(2) References to standards or to material and equipment of a particular manufacturer in these contract documents shall be regarded as followed by the words or equivalent.

(3) The Contractor shall supply to the Engineer, two original full editions of the publications/ technical standards including codes, standards, manuals and other documents that Contractor proposes to use or used for the work. These publications shall be for the sole use of the Engineer and Employer and shall become the property of the Employer.

(4) The Contractor shall ensure that items of equipment and their components are standardized wherever possible throughout the Works where similar requirements and functions exist.

(5) The Contractor shall submit design to the Engineer for review and no objection. The proposed standards used shall also be referred with the design listed in the Employer's Requirements. The Contractor may propose an alternative equivalent international standard during the design stage but the acceptance of the alternative standard shall be subject to review by the Engineer.

(6) In case of any conflict or inconsistency between the provision of the codes/ standards as mentioned above and provisions contained in these specifications, the provisions mentioned in these specifications shall prevail. However, the approval of the Engineer shall be obtained to follow the relevant codes/ specifications. The decision of the Engineer shall be final.

2.6 AS-BUILT DRAWINGS

(1) Preparation of the As-built drawings shall be part of these specifications. As-built drawings shall be Final Design Drawings of the project showing the actual work done. The Contractor shall provide the as-built drawings in one original and one reproducible negative produced from the original, with the names of the signature authorities of the Engineer and the Contractor. After they are signed for approval, prints shall be taken from the signed original of each drawing. Also, two nos. Hard Disk Drive (1 TB) of all as-built drawings shall be supplied to the Engineer. Together with the as-built drawings, the Contractor shall provide reduced size (e.g., A3 size) booklets of the as-built drawings as per the Employer's Requirements.

(2) All details, dimensions, texts, etc., on the reduced size drawings shall be clearly recognizable and readable. The Contractor shall complete and obtain the Engineer's approval on the as-built drawings and make the final submission of the as-built drawings together with the A3 size booklets latest within three months following the date of the Certificate of Completion. All costs associated with the provisions mentioned above shall be deemed to be included in the contract price.

(3) As-built drawings shall cover in general (but not limited to):

a) For mechanical equipment:

i. Construction drawings,
ii. Instruction drawings,
iii. Functional block diagrams with set-point range of process parameters depicted thereon.

b) For electrical installation:

i. Installation drawings with circuit numbers and exact type-assignation of all installed equipment,
ii. Distribution diagrams with circuit numbers,
iii. Fault analysis and protection co-ordination settings the of protection system,
iv. Power consumption,
v. Precise type numbering
vi. Earthing systems

c) For distribution panels:

i. Construction drawings,
ii. Circuit drawings as operating diagrams,
iii. Additional current flow-charts where required,
iv. Accurate lists of any installed equipment with precise description of this equipment,
v. Adjustment tolerances of circuit-breakers, switches, etc.

d) For equipment:

i. Construction drawings,
ii. Circuit diagrams,
iii. Functional block diagrams with set-point range of process

iv. parameters depicted thereon,

v. List of quantities with detailed break-down of the bill of materials comprising the equipment.

e) For cabling:

i. Diagrams with dimensions, type of cables and power requirements with regular cross- section area and measured cable values shall be used for these diagrams. Cable route plan.

2.7 SYSTEM REQUIREMENTS:

1 Conformity with Governing Specifications and other Statutory Requirements: -

The work shall be carried out in accordance with the following governing specifications and other statutory rules:

i. Indian Electricity Act 2003 with latest amendment

ii. CEA Regulations, 2010

iii. Regulations laid down by Chief Electrical Inspector to the Government.

iv. Regulations laid down by EIG Indian Railways.

v. National Building Code

vi. Rules and Regulations prescribed by local authorities as applicable.

vii. Relevant, Indian Standards, IEC Standards, CENELEC, British Standards and other National/ International standards as applicable.

viii. The Contractor shall furnish information asked for by a statutory body (e.g., Government of India, Ministry of Railways, Commissioner of Railway Safety, Government of Haryana etc.) in particular format as directed by Engineer. Any documents, studies, test reports, compliances required for getting safety clearances from any authority shall be submitted by the Contractor.

2.8 ABBREVIATIONS AND ACRONYMS

Abbreviation	Description
AC	Alternating Current
ACTM	AC Traction Manual
AHRI	Airconditioning, Heating and Refrigeration Institute
AMF	Automatic Main Failure
ANSI	American National Standards Institute
APFC	Automatic Power Factor Correction
ARI	Airconditioning and Refrigeration Institute
ASM	Assistant Station Master
AuxXer	Auxiliary Transformers
AT	Auto Transformer
ALARP	As Low as Reasonably Practicable

BS	British Standards
BIS	Bureau of Indian Standards
BTS	Base Transceiver Station
CAD	Computer Aided Design
CENELEC	European Committee for ElectroTechnical Standards
CEA	Central Electricity Authority
CFM	Cubic Feet per Minute
CHC	Chief Controller
CIP	Co-ordinated Installation Plan
CLS	Colour Light Signaling
COP	Coefficient Of Performance
CP	Contract Package
CPCB	Central Pollution Control Board
CPWD	Centre Public Works Department
CPM	Critical Path Method
CRCA	Cold Rolled Close Annealed Steel
CRS	Commissioner for Railway Safety
CSD	Combined Service Drawings
CSS	Compact Sub Station
CST	Civil, Structure and Track
CV	Curriculum-Vitae
DC	Direct Current
DG	Diesel Generator
DDF	Digital Distribution Frame
DB	Dry Bulb
dB	Decibel
DCN	Design Change Notice
DFC	Dedicated Freight Corridor
DFCC	Dedicated Freight Corridor Corporation
DFCCIL	Dedicated Freight Corridor Corporation of India Limited
DIN	Deutsche Industrie Normen
DL	Double Line
DNP	Defect Notification Period
DPR	Detailed Project Report
DT	Down Time
DTN	Data Transmission Network
DVT	Design Verification Table
DVV	Design Verification and Validation
E&M	Electrical and Mechanical
EDFC	Eastern Dedicated Freight Corridor

EIG	Electrical Inspector to the Government of India
EI	Electronic Interlocking
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
EMP	Environmental Management Plan
EN	Euro Norm
ERP	Enterprise Resource Planning
Excl.	Excluding
FAT	Factory Acceptance Test
FCN	Field Change Notice
FDT	Firetrace Detection Tubing
FIU	Field Interface Unit
FM Steel	Ferritic Martensitic steel
FMEA	Fault Mode and Effects Analysis
FMECA	Failure Modes Effect and Criticality Analysis
FRCAS	Failure Recording and Corrective Action System
FRLS	Flame Retardant, Low Smoke Low Halogen
FTA	Fault Tree Analysis
GE	Geotechnical Engineering
GI	Galvanized Iron
GSM-R	Global System for Mobile Communication–Railway
GWR	Gate Working Rules
G&SR	General and Subsidiary Rules
GAD	General Arrangement Drawing
GCC	General Conditions of Contract
GS	General Specification
HRIDC	Haryana Rail Infrastructure Development Corporation Limited
HORC	Haryana Orbital Rail Corridor
HT	High Tension
HTML	Hyper Text Markup Language
HAZOP	Hazard and Operability Studies
HF	High Frequency
HDD	Hard Disc Drive
HDPE	High Density Poly Ethylene
Hz	Hertz
ID	Identification
ICD	Interface Co-ordination Document
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electro–technical Commission
IHA	Interface Hazard Analysis

IMT	Industrial Model Township
IMD	Integrated Maintenance Depot
IMSD	Integrated Maintenance Sub-Depot
IMP	Interface Management Plan
INR	Indian Rupees
IPS	Integrated Power Supply
IR	Indian Railway
IRS	Indian Railway Standards
IRSEM	Indian Railway Signal Engineering Manual
IS	Indian Standard
ISO	International Standards Organization
IT	Information Technology
Km/KM	KiloMeter
KMPH	Kilo Meter Per Hour
KV	Kilo Volt
KVAR	Kilo-Volt-Amperes Reactive power
KVA	Kilo Volt Ampere
LED	Light Emitting Diode
LILO	Loop In Loop Out
LT	Low Tension
LC	Level Crossing
LCC	Life Cycle cost
LRU	Line Replaceable Unit
LIU	Line Interface Unit
LPM	Litre per minute
M&P	Machines and Plants
MACLS	Multiple Aspect Colour Light signaling
MCB	Miniature Circuit Breaker
MCIL	Maintainability Critical Items List
MDF	Main Distribution Frame
MDO	Manually operated Draw Out
MDT	Mean Down Time
MTBSAF	Mean Time Between Service Affecting Failure
MMD	Maximum Moving Dimensions
MMI	Man Machine Interface
MOR	Ministry of Railway
MPR	Monthly Progress Report
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
MTTR	Mean Time To Restore

NABL	National Accreditation Board for Laboratories
NDT	Non Destructive Test
NMCP	Noise Monitoring and Control Plan
NOC	No Objection Certificate
NOO	Notice of Objection
NONO	Notice of No Objection
O&M	Operation and Maintenance
O&SHA	Operating and Support Hazard Analysis
OCC	Operations Control Centre
OD	Outer Diameter
ODBC	Open Data Base Connectivity
ODF	Optional Distribution Frame
OEM	Original Equipment Manufacturer
OFC	Optic Fiber Cable
OHE	Over Head Equipment
OHTL	Over Head Transmission Lines
OPM	Other Preventive Measures
NEMA	National Electrical Manufacturers Association
PBX	Private Branch Exchange
PC	Personal Computer
PHA	Preliminary Hazard Analysis
PMIS	Project Management Information System
PS	Particular Specifications
PVC	Poly Vinyl Chloride
QA	Quality Assurance
RAM	Reliability, Availability & Maintainability
RAMS	Reliability, Availability, Maintainability and Safety
RAP	Resettlement Action Plan
RBD	Reliability Block Diagram
RCIL	Reliability Critical Item List
RDSO	Research, Design and Standards Organization
RDT	Reliability Demonstration Testing
RE	Railway Electrification
RKM	Running Kilo meter
ROB	Road Over Bridge
RO	Reverse Osmosis
ROW	Right of Way
RTU	Remote Terminal Unit
RUB	Rail Under Bridge
SAT	System Acceptance Test

SCIL	Safety Critical Items List
SCADA	Supervisory Control and Data Acquisition
SDFU	Switch Disconnector Fuse Unit
SER	Signaling Equipment Room
SHE	Safety, Health and Environment
SIL	Safety Integrity Level
SLD	Single Line Diagram
SM	Station Master
SMACNA	Sheet Metal and Air-Conditioniong Contractor's National Association
SOD	Schedule of Dimensions
SOGP	Schedule of Guaranteed Parameters
SP	Sectioning & Paralleling Post
SSP	Sub-Sectioning Post
SPM	Suspended Particulate Matter
SRS	System Requirement Specification
SRR	Submission Response Request
SSHA	Sub-system Hazard Analysis
S&T	Signaling &Telecommunication
SWR	Station Working Rules
TB	Tera Byte
TDC	Transverse Duct Connection
TEFC	Totally Enclosed, Fan-Cooled
TER	Telecommunication Equipment Room
TKM	Track Kilo meter
T&P	Tools & Plants
TMS	Train Management System
TOT	Transfer of Technology
TPC	Traction Power Controller
TPN	Triple Pole and Neutral
TR	Ton of Refrigeration
TSS	Traction Sub-Station
UIC	International Union of Railways
UPS	Uninterruptible Power Supply
VAT	Value Added Tax
VDU	Video Display Unit
VRLA	Valve Regulated Lead Acid
VHF	Very High Frequency
WB	Wet Bulb
WGS	World Geodetic System
XLPE	Cross Linked Polyethylene

2.9 DOCUMENT SUBMISSION PROCEDURE

i. For each stage of submittal, the Contractor shall prepare a Submission Response Request (SRR) carrying the date of submission, the submission reference number as defined above, the submission title, the stage of submission (e.g. Inception Report, Simulation Report (if any), Detailed Design, etc.), and the signature of the Contractor's Representative:

ii. The Documents and Drawings shall be submitted under the signatures of Designer and Project Manager of The Contractors to establish proper issue & Control of the documents. The authority will not be delegated below the rank of Project Manager.

iii. The submission shall be accompanied with a checklist duly signed (with name) by the Preparer and Checker of the Drawing/ document.

iv. The submission shall be accompanied with Exception Statement on Deviations, if any to the Specifications.

v. Each Document / drawings shall be signed by the Preparer (who has prepared the Document/drawing), the Designer (who has checked the document/ drawing) for conformance to specifications, and the issuers (who has verified the document for the purpose, and issued after Careful examination) to demonstrate that document have gone through the process of quality assurance.

vi. The Contractor shall refer the indicative tender drawings while making submissions.

vii. All the documents, drawings and Designs shall be submitted with the endorsement thereon the Documents as under:

a) Certificate of the Contractor to the effect that "the submission is prepared, checked and issued by the qualified engineers of the Contractor and has been properly reviewed by the Contractor, according to the Contractor's Project Quality Assurance Plan", thereby confirming its completeness, accuracy, adequacy and validity and conformance to the satisfactory, safe and reliable performance,

b) Compliance with all relevant clauses of the Employer's Requirements;

c) Conformance to all interface requirements;

d) Certifying that it is based on auditable and proven or verified calculations or design criteria;

e) Has taken account of all requirements for approval by statutory bodies or similar organizations, and that where required, such approvals have been granted.

viii. The Contractor shall submit hard copies of all drawings, data of the documents and copy of transmittal along with a soft copy transfer electronically in the agreed format. Contractor will share the softcopies as advance information. However, the reviews will only be made on hard copies and shall be preserved in hard copies with endorsed signed copy. The work shall be executed based on the latest hardcopies of the drawings and documents.

ix. Errors, omissions, ambiguities, inconsistencies, inadequacies and other defects shall be rectified by the Contractor at his own cost and the acceptance by the Engineer of the Manufacture and Construction Documents shall not amount

to any waiver and shall not relieve the Contractor of his obligations under the Contract.

x. After receipt of "Notice of No Objection" from the Engineer, the Contractor shall submit six (6) hard copies (and softcopy) of the Design and / or Drawings for the use of the Engineer*.*

2.10 ENGINEERING REVIEW COORDINATION

2.10.1 Throughout the Design Stage, the Contractor (along with Designer) shall attend monthly design review meetings with the Engineer. At these Engineer's review meetings, the Contractor shall present information, drawings and other documents to the Engineer in respect of all submissions Program to occur during the following four week period. The Contractor's presentations shall be in sufficient depth to enable the Engineer to obtain a clear understanding of the Contractor's proposals and to discuss the methodology and process used in reaching the proposed design solutions. Unless otherwise directed by the Engineer, all meetings shall be convened in Engineer's Office or Contractor's Main Office or at the Site Office or at any other location as decided by the Engineer.

2.10.2 The Contractor shall comply all of the Engineer's observations and any agreed actions resulting from the Engineer's review meeting and shall address each of these fully before submission of the respective documents for formal review.

2.11. ENGINEER'S REVIEW

i. The Engineer will complete his review of the submission within 28-days, and communicate review comments in writing or on marked up drawings/documents.

ii. Within two weeks of the receipt of the Engineer's comments the Contractor shall resubmit the submittals/ documents needing resubmission.

iii. Where the comments are minor, the same may be clarified by calculations, part prints, etc. as acceptable to the Engineer and included in the Contractor's next submission.

iv. Should the Engineer considers the submission to be unacceptable, the Contractor shall revise and re-submit the entire submission within two weeks, unless otherwise agreed with the Engineer.

2.12 ENGINEER'S RESPONSE

1) The Engineer will respond in one of the following three ways:

   a. Notice of No Objection

   b. Notice of Objection

   c. Notice of No Objection with Comments

2) Definition of Engineer's response:

   a. "Notice of No Objection": if following his review of the submission, the Engineer has not discovered any non-compliance with the Contract, the Engineer will issue to the Contractor a formal "Notice of No Objection" (NONO). A NONO from the Engineer, irrespective of with or

without comments does not in any way imply the Engineer's consent of the submission nor does it remove any responsibility from the Contractor for complying with the Contract. Issue of a NONO from the Engineer entitles the Contractor to proceed to the next stage of the Programed work.

b. "Notice of Objection: if following his review of the submission, the Engineer discovers major non-compliance, discrepancies or omissions etc. that in his opinion are of a critical nature, the Engineer will issue a "Notice of Objection"(NOO). The Contractor shall revise and reissue the submission addressing the Engineer's comments. Following the issue of a NOO by the Engineer, the Contractor is not entitled to proceed to the next Programed stage on the path in the relevant network as previously approved by the Engineer until all of the Engineer's comments have been fully addressed and a NONO is issued.

c. "Notice of No Objection" (With Comments)": if following his review of the submission, the Engineer discovers discrepancies or omissions etc. that in his opinion are not of a critical nature, the Engineer may issue a "Notice of No Objection with Comments" (NONOC). The Contractor shall respond to the comments, agreed and incorporated prior to inclusion in the "Construction Package" Following the issue of a NONOC by the Engineer, the Contractor is entitled to proceed to the next stage of the Programed work subject to the inclusion of amendments necessary to address the comments.

3 (a) Should it be found at any time after notification of consent / "Notice of No Objection" / "Notice of No objection with Comments" (as the case may be) that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Engineer has previously notified his consent / "Notice of No Objection" / "Notice of No objection with Comments" (as the case may be), the Contractor shall, at his own expense, make such alterations or additions as, in the opinion of the Engineer, are necessary to remedy such non-compliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Engineer.

(b) No examination by the Engineer of the drawings and / or documents submitted by the Contractor, nor any consent / "Notice of No Objection" / "Notice of No objection with Comments" (as the case may be) of the Engineer in relation to the same, with or without amendment, shall absolve the Contractor from any of his obligations under the Contract or any liability for or arising from such drawings or documents.

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CHAPTER 3–EXPLANATARY NOTES FOR INDICATIVE BOOK OF QUANTITIES (BOQ) ITEMS

3.1 EXPLANATORY NOTES FOR BOQ ITEMS:

The explanatory notes to the BOQ are as under and shall be read in conjunction with tender drawings, specifications and Employer's Requirements.

S.No.	Description for BOQ Items
1 CONDUITS, WIRING, PLUGS, FAN AND DISTRIBUTION BOARDS	
1.1	**Point Wiring By 3x2.5 sqmm Copper Cable (With Modular Switches & Socket) in Conduits:** Supply of material and wiring of Light point/ Fan point/ Exhaust-Fan point. Wiring shall be done by 3x2.5 sqmm multi stranded copper flexible FRLS PVC insulated ISI marked 1100 volts grade cable, confirming to IS: 694-1990. Concealed conduit shall be laid with FRLS PVC pipe or GI pipe minimum 25 mm dia (as required). Surface conduits shall not be laid and if required, shall be done with GI pipe only with the help of GI clamps/ rawal plugs etc. as required as per site requirement. Wherever required, the flexible metallic conduits shall be provided to complete the circuit. The zinc coating on GI conduits shall be as per IS-4736. One-way piano type modular switch 6A shall be provided on phase cable. Plugs and Sockets shall conform to IS-1293 and switches to IS-3854. The entire GI box shall have modular plate for switches and 6A modular plugs with required modular design groove cutting for installation of switches/ sockets etc. The wiring shall be done in such a way that minimum conduit pipes run inside the room as far as possible. The size of copper cable used for earthing purpose shall not be less than the size of cable used for wiring and cable shall be ISI marked confirming to relevant IS code, specifications. The Contractor shall be responsible for proper plastering and distempering/ fixing of tiles to restore the original finish of wall such that it matches with original surface and colour of wall on which conduit pipe has been laid. There should be no loose connections in the wiring circuit. Joints in cables are not allowed. Any discrepancy occurred in engineering work during the wiring should be restored in the original condition by the Contractor, at his own cost. All metallic parts, fittings etc. shall be connected to the earth cable. Contractor shall make necessary interface with Civil Contractor during laying of conduits and shall handover conduiting drawing to Civil Contractor in advance.
1.2	**Supply of Material and erection of 3x2.5 Sqmm Copper Cable in Conduits**: Supply of material and wiring of single core insulated, multi-stranded 2x2.5 sqmm FRLS PVC copper cable in FRLS PVC/ GI conduit ISI mark & 2.5 sqmm FRLS PVC insulated copper cable multi-stranded for

	earthing. Concealed conduit shall be laid with FRLS PVC pipe or GI pipe minimum 25 mm dia (as required). Surface conduits shall not be laid and if required, shall be done with GI pipe only with the help of GI clamps/ rawal plugs etc. as required as per site requirement. Wherever required, the flexible metallic conduits shall be provided to complete the circuit. Cable shall be ISI marked confirming to IS: 694-1990 specifications and make of reference list. The sub wiring shall be done in such a way that minimum conduit pipes run inside the room as far as possible. The size of copper cable used for earthing purpose shall not be less than the size of cable used for phase wiring. The Contractor shall be responsible for proper plastering and distempering/ fixing of tiles to restore the original finish of wall such that it matches with original surface and colour of wall on which conduit pipe has been laid. There should be no loose connections in the wiring circuit. Joints in cables are not allowed. Any discrepancy occurred in engineering work during the wiring should be restored in the original condition by the Contractor, at his own cost. All metallic parts, fittings etc. shall be connected to the earth cable.
1.3	**Supply of Material and erection of 3x6 Sqmm Copper Cable in Conduits**: Supply of material and wiring of single core insulated, multi-stranded 2x6 sqmm FRLS PVC copper cable in FRLS PVC/ GI conduit ISI mark & 6 sqmm FRLS PVC insulated copper cable multi-stranded for earthing. Concealed conduit shall be laid with FRLS PVC pipe or GI pipe minimum 25 mm dia (as required). Surface conduits shall not be laid and if required, shall be done with GI pipe only with the help of GI clamps, plugs etc. as required as per site requirement. Wherever required, the flexible metallic conduits shall be provided to complete the circuit. Cable shall be ISI marked confirming to IS: 694-1990 specifications and make of reference list. The sub wiring shall be done in such a way that minimum conduit pipes run inside the room as far as possible. The size of copper cable used for earthing purpose shall not be less than the size of cable used for phase wiring. The Contractor shall be responsible for proper plastering and distempering/ fixing of tiles to restore the original finish of wall such that it matches with original surface and colour of wall on which conduit pipe has been laid. There should be no loose connections in the wiring circuit. Joints in cables are not allowed. Any discrepancy occurred in engineering work during the wiring should be restored in the original condition by the Contractor, at his own cost. All metallic parts, fittings etc. shall be connected to the earth cable.
1.4	**Supply and Installation of 6A Modular Switch Socket:** Supply and installation of 6A plug, 5-pin 240V modular type switch

	socket of standard size on existing board and connection with 2.5 sqmm FRLS PVC copper cable. A switch for controlling power supply of plug shall be connected in phase cable and earth cable size shall be same size of wiring to flow maximum fault current.
1.5	**Supply and Installation of 16A Modular Power Switch Socket**: Supply and installation of modular type 16A plug, 6-pin power socket 240V and switch modular type with GI or powder coated metal box concealed in wall and connection with 6sqmm FRLS PVC copper cable. A switch for controlling power supply of plug shall be connect in phase cable and earth cable size shall be same size of wiring to flow maximum fault current.
1.6	**Supply and Installation of 02 Module Plate GI Box**: Supply and installation of 2 module modular plates powder coated for installation of switches and sheet metal box of thickness 2 mm (minimum), good quality concealed fixing of GI box confirming to IS 14772 (2000). GI box should be of standard size.
1.7	**Supply and Installation of 04 Module Plate GI Box**: Supply and installation of 4 module modular plates powder coated for installation of switches and sheet metal box of thickness 2 mm (minimum), good quality concealed fixing of GI box confirming to IS 14772 (2000). GI box should be of standard size.
1.8	**Supply and Installation of 08 Module Plate GI Box**: Supply and installation of 8 module modular plates powder coated for installation of switches and sheet metal box of thickness 2 mm (minimum), good quality concealed fixing of GI box confirming to IS 14772 (2000). GI box should be of standard size.
1.9	**Supply and Installation of 12 Module Plate GI Box**: Supply and installation of 12 module modular plates powder coated for installation of switches and sheet metal box of thickness 2 mm (minimum), good quality concealed fixing of GI box confirming to IS 14772 (2000). GI box should be of standard size.
1.10	**Supply, Installation, Testing and Commissioning (SITC) of 1200 mm Sweep Ceiling Fan with Fan Regulator:** Supply, installation, testing and commissioning of all materials of 240V A.C. 1200 mm sweep ceiling fan having 3 blades, double ball bearing, copper wound motor, suitably sized down rod, canopies and capacitor etc. complete with all accessories including fixing phenolic laminated sheet cover on the fan box, FR PVC insulated multi-stranded three core copper conductor cabling and connecting with earthing system etc. Fan should have ISI mark and as per IS-374 and 5-star energy rating issued by BEE. The modular type electronic fan regulator shall be 5 step type on existing board and connection as per requirement.
1.11	**Supply, Installation, Testing and Commissioning (SITC) Of**

	300 mm Sweep Exhaust Fan: Supply, installation, testing and commissioning of exhaust fan 300 mm sweep (having reinforced insulation and metal blade) with louver shutter heavy duty (ISI marked, as per IS-2312), 5-star energy rating issued by BEE and making hole in wall including repairing the same properly with cement-sand (1:4) or M-25 grade concrete and connection complete in all respect, installation of suitable fire-resistant framing etc. The price also covers supply and installation of suitable clamps/ brackets & cost of all materials including cost of FR PVC insulated multi stranded single core copper conductor wiring, earthing connection etc. for fixing above.
1.12	**Supply, Installation, Testing and Commissioning of Double Door, MCB TPN 440V, 8 Module Distribution Boards (DB)**: Supply, installation, testing and commissioning of minimum 1.6 mm thick CRCA power coated (7 tank process) Double Door with MCB TPN 440V, 8 modules 4 row Distribution Board, with neutral and earth link and minimum IP42 ingress protection. The DB shall be with one no. four pole MCB 40A, one no. four pole RCCB 40A 30 mA and twenty four nos. SP MCB 40/32/25/16/10/6 A 'C' series conforming to IS-2675. All MCB should be of 'C 'series with breaking capacity not less than 10 kA. MCB, RCCB and DB should be of same make. The distribution board shall be fixed in such a fashion that its door flushed with the wall on which it is fixed. Circuit breakers shall be conforming to IS/IEC-60898-1.
1.13	**Supply, Installation, Testing and Commissioning of Double Door, MCB SP, 12 Way Distribution Board (DB):** Supply, installation, testing and commissioning of minimum 1.6 mm thick CRCA power coated (7 tank process) Double Door MCB SP 12 way DB, neutral and earth link and minimum IP42 ingress protection, with one no. DP MCB 40A, one no. DP RCCB 40A, 30 mA and eight nos. SP MCB 32/25/16/10/6 A 'C' series. All MCB should be of 'C' series with breaking capacity not less than 10 kA. MCB, RCCB and DB shall be of same make. The distribution board shall be fixed in such a fashion that its door flushed with the wall on which it is fixed.
1.14	**Supply, Installation, Testing and Commissioning of 440V, 3-phase Change Over Distribution Board:** Supply, installation, testing and commissioning of minimum1.6 mm thick CRCA power coated (7 tank process) box of size 610 x 450 x 190 mm approximate change over distribution board with minimum IP42 ingress protection. The distribution board shall be indoor type dust vermin proof knock out/ glands plates as applicable shall be provided in the box for incoming and outgoing cables. Earth terminals shall be provided. Danger notice shall be provided at appropriate place. The complete internal wiring for each phase selector is to be done with copper cable of size 10 sqmm. It shall comprise of following items: - • 01 no. 440V, 3-phase, 100 A TPN MCCB as incomer • 01 no. 63 A SPN MCCB as outgoing. • 04 nos. integrated LED pilot lamp (3 incoming+1 outgoing)

	01 no. 63A selector switch (phase selector switch) without OFF Three pole three ways (Three phase incoming & only one phase outgoing).
1.15	**Supply, Installation, Testing and Commissioning of MCCB 200A, 440V, 3-phase, (4 Pole, 36 kA):** Supply, installation, testing and commissioning of four Pole Moulded case circuit breaker (MCCB) of 200A, 440V, 3-phase, 36 kA with adjustable thermal, fix magnetic release complete. MCCB is to be provided in minimum 1.6 mm thick CRCA power coated enclosure at location as per the site requirement.
1.16	**Supply, Installation, Testing and Commissioning of Double Door, 63A, 240V, MCB SP 8 Way Distribution Board:** Supply, installation, testing and commissioning of minimum 1.6 mm thick CRCA power coated Double Door MCB SP 8 way DB, neutral and earth link and minimum IP42 ingress protection, with one no. DP MCB 63A, 240V, one no. DP RCCB 63A, 30 mA and eight nos. SP MCB 32 A 'C' series (for feed from ACO Panel). All MCB should be of 'C' series with breaking capacity not less than 10 kA. MCB, RCCB and DB shall be of same make. The distribution board shall be fixed in such a fashion that its door flushed with the wall on which it is fixed.
1.17	**Supply and Installation of Junction Box Size 390(H)x305(B)x170(D) mm:** Supply and installation of junction box size 390(H)x305(B)x170(D) mm comprising stainless steel material with 1.6 mm thick sheet having power coating with 7 tank processes with rubber gasket, padlock arrangement, zinc passivated earth bolt, etc. with terminals suitable for 440V/240V supply requirement. All busbars and terminals in the junction box shall be of copper material with 4 nos. copper bus bar capacity 200A, 250mm long suitable for 440V supply requirement. The box shall be fixed robustly with clamps at pole/ wall as per requirement. All the material should be of good quality.
1.18	**Supply, Installation, Testing and Commissioning of Control and Distribution Panel for Colour Light Signalling (CLS) for 10/ 25/ 50 kVA AT supply:** Supply, installation, testing and commissioning of automatic changeover panel (if required) complete for 25kV/240V, AC auxiliary transformer supply, as per RDSO specification No. TI/SPC/PSI/CLS/0020 (12/02) with A&C slips No. 1 to 4 or latest, connections as required. The Make of panel shall be on the approved list of manufacturers issued by RDSO/ Lucknow.
1.19	**Supply and Installation of Metal Clad Plug Socket 20A, 240V, Single Phase with 32A MCB:** Supply and installation of metal clad plug socket 20A, 240V, single phase with 32A MCB SP 10kA, C series including installation and sheet metal enclosure box with one 20A plug top (Ray roll type) to be supplied with board.
1.20	**Supply and Installation of Metal Clad Plug Socket 16A, 240V, Single Phase with 20A MCB:** Supply and installation of metal clad plug socket 16A, 240V, single

	phase with 20A MCB SP 10kA, C series including installation and sheet metal enclosure box with one 16A plug top (Ray roll type) to be supplied with board.
1.21	**Supply, installation, testing and commissioning of 32 mm dia GI Conduit:** Supply, installation, testing and commissioning of 32 mm dia GI Conduit concealed/surface including all junction boxes (2 way, 3 way, 4 way as required), bends etc. conforming to IS-9537.
1.22	**Supply, installation, testing and commissioning of 25 mm dia GI Conduit:** Supply, installation, testing and commissioning of 25 mm dia GI Conduit concealed/ surface including all junction boxes (2 way, 3 way, 4 way as required), bends etc. conforming to IS-9537.
1.23	Design and Drawing of conduits, wiring, panels, distribution board, as built drawings, survey, calculation etc. for item no. 1.1 to 1.22.
2 LT & HT CABLES AND LAYING	
2.1	**Supply of 2 Core x 10 sqmm Copper Cable:** Supply of 1.1 KV grade 2 Core x 10 Sqmm LT XLPE insulated, FRLS, armoured copper conductor cable, end terminations with suitable crimping sockets/ lugs, gland, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.
2.2	**Supply of 2 Core x 16 sqmm Copper Cable:** Supply of 1.1 KV grade 2 Core x 16 Sqmm LT XLPE insulated, FRLS, armoured copper conductor cable, end terminations with suitable crimping sockets/ lugs, gland, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.
2.3	**Supply of 2 Core x 35 sqmm Copper Cable:** Supply of 1.1 KV grade 2 Core x 35 Sqmm LT XLPE insulated, FRLS, armoured copper conductor cable, end terminations with suitable crimping sockets/ lugs, glands, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.
2.4	**Supply of 2 Core x 70 sqmm Copper Cable:** Supply of 1.1 KV grade, 2 Core x 70 Sqmm LT XLPE insulated, FRLS, armored copper conductor cable, end terminations with suitable crimping sockets/ lugs, glands, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.
2.5	**Supply of 2 Core x 95 sqmm Copper Cable:** Supply of 1.1 KV grade, 2 Core x 95 Sqmm LT XLPE insulated, FRLS, armored copper conductor cable, end terminations with suitable crimping sockets/ lugs, glands, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.

2.6	**Supply of 4 Core x 120 sqmm Copper Cable:** Supply of 1.1 KV grade 4 Core x 120 Sqmm LT XLPE insulated, FRLS, armoured copper conductor cable, end terminations with suitable crimping sockets/ lugs, glands, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.
2.7	**Supply of 4 Core x 240 sqmm Copper Cable:** Supply of 1.1 KV grade 4 Core x 240 Sqmm LT XLPE insulated, FRLS, armoured copper conductor cable, end terminations with suitable crimping sockets/ lugs, glands, testing and meggering etc. as per required technical specifications & confirming to IS: 7098, IS: 8130 and IEC-60502-1 standards with latest amendment.
2.8	**Supply, Installation, Testing and Commissioning of LT Heat Shrinkable Straight Through Joint:** Supply, installation, testing and commissioning of LT heat shrinkable straight through joint (conforming to IS-1255) with required accessories complete in all respect suitable for XLPE 1.1 kV and above rating cables as per site requirement.
2.9	**Supply of 3 Core x 120 sqmm 11 kV Copper Cable:** Supply of 3 Core x 120 Sqmm 11 kV XLPE insulated, armoured, Copper conductor Cable conforming to IS: 7098 (Part 2)/ 2011 or latest.
2.10	**Supply and Installation of End Termination Kit for 3 core, 70 sqmm to 185 Sqmm, 11 kV Copper Cable:** Supply and installation of outdoor type, heat shrinkable, end termination kit suitable for 3 core 11 kV 70 to 185 Sqmm XLPE insulated, armoured Copper conductor cable and making termination connections with overhead conductor, testing and commissioning etc. The material shall conform to IS-1255.
2.11	**Laying of LT/ HT Cables (All Sizes) In Air/ Pipe/ Cable Tray/ Trench etc.:** Laying and commissioning of LT/ HT XLPE insulated armoured sheathed copper cable underground/ under the road/ under the track along with pole/ wall/ trench/ air in already laid pipe. Before and after laying cable, the IR value should be checked. While laying the cable, care should be taken that no tree roots/ water logging area come on the way of cable, as it may damage the outside insulation of cable. Armoring at both ends of the cable should be earthed. At termination point of cable suitable lugs and brass glands of suitable size and good quality shall be provided. The Contractor shall restore the original condition of the Roads/ platform/ concrete flooring after laying of cable. Bending radius of the cable shall not be less than 16 times of dia. of the cable. Wherever the cable emerges out of the ground at least two loops of sufficient radius should be laid. Installation of cable along with wall/ pole/ roof top/ underneath sheds wherever required shall be done with support of G.I. Saddles/ clamp of proper size and GI Pipe as required. Breaking of floor/ wall/ road and other civil structures and repairing up to original condition, shall be done by the

	Contractor, and no extra cost shall be paid for it. Permission for crossing any road/ track if required shall be arranged by the Contractor in coordination with Engineer, and all the expenditures shall be borne by the Contractor. All the instruments required for insulation testing, high voltage testing shall be arranged by the Contractor at his own cost. The cable shall be transported by the Contractor through his own means from major electrical depot to required site of work. Before transportation of the cable it shall be tested at site to ascertain the serviceability of the cable by the Contractor. The work shall conform to IS-1255.
2.12	**Excavation and Refilling of Trench of Size 500 mm Wide and depth up to 1200 mm (as per design) for cables:** Excavation and refilling of Trench of size 500 mm wide and depth up to 1200 mm (as per design with the approval of the Engineer) in all kinds of soil for laying of HDPE/ GI pipe for underground cables crossing. Contractor shall clear all metallic parts & stones etc. in trench. After laying of pipe, the trench should be refilled with same soil, ramming (compaction not less than 95%) and restore to original position. After cable/ pipe laying Contractor shall clear all site debris. The excess earth and debris etc. shall be disposed off upto a distance of 2km at suitable place by the Contractor.
2.13	**Excavation and Refilling of Trench of Size 500 mm Wide and depth up to 1200 mm with brick protection (as per design) for cables.** Excavation and refilling of Trench of size 500 mm wide and depth up to 1200 mm with brick protection (as per design with the approval of the Engineer) for laying of LT/HT cables in all kinds of soils. The trench shall have sand cushioning, protective covering with bricks of compressive strength class designation 10 (minimum). Two rows of bricks shall be laid breadthwise (i.e brick length shall be 90 degree to the laid cable). Contractor shall clear all metallic parts & stones etc. in trench. After laying of cables and bricks, the trench should be refilled with same soil, ramming (compaction not less than 95%) and restore to original position. After cable laying Contractor shall clear all site debris. The excess earth and debris etc. shall be disposed off upto a distance of 2km at suitable place by the Contractor.
2.14	**Supply and Laying of HDPE Pipe (90 mm outside dia)**: Supply and laying of HDPE pipe in already excavated trench under floor, platform, road, ground, air etc. as per site requirement size 90 mm outside dia wall thickness 4.3 mm to 5.0 mm, PN-4 conforming to IS 4984:1995 or latest as per site requirement (including laying of 63 mm outside dia HDPE pipe for making connection to 90 mm outside dia HDPE pipe and reducer wherever required). Pipe should be laid in trench such that it shall be possible to withdraw the cables for repair or replacement without disturbing the work. The pipes shall be laid with a gradient to facilitate drainage of water. Accessories related with laying of HDPE pipe like fitting, bends joints/ coupler junction, flange

	end cap etc. as per site requirement shall be provided by Contractor and the payment of 90 mm outside dia HDPE pipe shall include all these items as required.
2.15	**Supply and Laying of HDPE Pipe (90 mm outside dia) at platform along with pit and cover**: Supply and laying of HDPE Pipe (90 mm outside dia) at platform along with pit and cover at every 40m-50m as per design in already excavated trench at platform as per site requirement. The HDPE pipe size shall be 90 mm outside dia, wall thickness 4.3 mm to 5.0 mm, PN-4 conforming to IS 4984:1995 or latest. Pipe should be laid in trench such that it shall be possible to withdraw the cables for repair or replacement without disturbing the work. The pipes shall be laid with a gradient to facilitate drainage of water. Accessories related with laying of HDPE pipe like fitting, bends joints/ coupler junction, flange end cap etc. as per site requirement shall be provided by Contractor and the payment of 90 mm outside dia HDPE pipe shall include all these items as required. The pit shall be with bricks having inside dimensions 400x400 mm with 400 mm depth and M-25 RCC cover thickness shall be 75mm and pit cover shall cover the entire brick work. The top layer of cover shall flush with platform level as per design.
2.16	**Supply and Laying of HDPE Pipe (125 mm outside dia)**: Supply and laying of HDPE pipe in already excavated trench underfloor, platform, road, ground, air etc. as per site requirement, size 125 mm outside dia wall thickness 6 mm to 6.8 mm, PN-4 conforming to IS 4984:1995 or latest. Pipe shall be laid in trench such that It shall be possible to withdraw the cables for repair or replacement without disturbing the work. The pipes shall be laid with a gradient to facilitate drainage of water. Accessories related with laying of HDPE pipe like fitting, bends joints/ coupler junction, flange end cap etc. as per site requirement shall be provided by Contractor and payment of HDPE pipe shall include all these items as required.
2.17	**Supply and Laying of HDPE Pipe (160 mm outside dia):** Supply and laying of HDPE pipe in already excavated trench under floor, platform, road, ground, air etc. with technical specification of 160 mm dia (OD), wall thickness between 7.7 mm to 8.6 mm, PN-4 with confirming to IS: 4984/1995 of latest. Pipe shall be laid in trench such that possible to withdraw the cable for repair or replacement. The pipes shall be laid with a gradient to facilitate drainage of water. Accessories related with laying of HDPE pipe like fitting, bends joints/ coupler junction, reducer, flange end cap etc. as per site requirement shall be provided by Contractor and payment of HDPE pipe shall include all these items as required.
2.18	**Supply and Laying of GI Pipe (nominal bore 125 mm):** Supply and laying of 125 mm dia GI Pipe medium class as per IS 1239 under road/ Railway track. The GI pipe shall be fixed with pole/ wall/ structure etc. by GI flat/clamps of suitable size & GI nut-bolt-washer etc. In the case of GI pipe is laid in road/ permanent floor/ other civil structures etc, and require any dismantling then repairing up to

	original condition shall be done by the Contractor. The pipes shall be laid with a gradient to facilitate drainage of water and shall be laid right angle to the track. Accessories related with laying of HDPE pipe like fitting, bends joints/ coupler junction, reducer, flange end cap etc. as per site requirement shall be provided by Contractor and payment of GI pipe shall include all these items as required.
2.19	**Supply and Installation of Cable Route Marker:** Supply and installation of Cable Route marker along straight runs of the cables at locations approved by the Engineer and generally at intervals not exceeding 100 meters. Wherever, the cable route is changing or it is entering a fixed installation, route marker shall be provided. Route marker shall also be provided at joints of cable. The item price includes labour & cost of all materials including cost of cable route markers. The route marker shall be 150mm dia, 6mm thick GI plate welded with GI angle of size 40x25x5mm and lower part of angle shall be embedded (end slightly bent) in 150x150x150mm M-15 cube which shall be buried 200 mm below the ground as per drawing. The plate shall be painted in yellow paint and on one face of plate HRIDC shall be painted in black paint and on other side voltage level (240V/440V/11000V) as applicable shall be marked. Drawing of cable route marker shall get approved from Engineer before installation.
2.20	**Drilling of horizontal bore below Railway track or road by pushing method for laying of HDPE/GI pipe:** Drilling of horizontal bore by pushing method (trenchless technology) in all types of soil/ rock for laying of HDPE/GI pipe dia up to 250mm by pushing method. Horizontal boring shall be done at minimum 1.5 metre below or as per site requirement from ground level at Road/ canal/ bridges/ Railway track portion but in case, where bank is high then boring should be such that outer side and under track HDPE/ GI pipes are in same alignment. All work shall be done without disturbing the Road/ canal/ bridges/ Railway track taking all necessary safety precautions related to Road/ canal/ bridges/ track and movement of Road transport and trains.
2.21	Design and Drawing of cable layout, trench layout, route markers, cable and pipe schedule, as built drawings, survey, calculation etc. for item no. 2.1 to 2.20.
3 LIGHTING, STREET LIGHT POLE AND HIGH MAST	
3.1	**Provision of 22 Watt LED Tube Light with fitting:** Supply, installation, testing & commissioning of surface mounted Energy efficient LED tubular lamp with fitting and its driver and Luminaries (22 watt), of CRCA steel sheet enclosure, IP-20 for indoor application, operating voltage (140-270) V, minimum 2000 lumens, complete with all accessories of approved make etc. The item price also includes labour & cost of all materials including cost of FRLS PVC insulated multi stranded single core copper conductor cable, earthing connection etc. The price also covers supply and installation of suitable clamps/ brackets etc. to fix light fittings under FOB/ Poles/ roofs/ walls/ sheds etc. The material shall conform to IS-2418, IS-3528, IS-5077, IS-10322, IS-16101, IS-16102, IS-16103, IS-16106, IS-

	16107 and other specifications as applicable.
3.2	**Provision of 40 Watt LED Street Light with Fitting:** Supply, installation, testing & commissioning of Energy efficient 40 Watt LED with street light fitting with pressure die cast aluminium housing with driver & suitable fixing arrangement, IP-65 for outdoor application, operating voltage (140-270) V, System efficacy more than 100 lumen/W, complete with all accessories of approved make etc. The item price also includes labour & cost of all materials including cost of FRLS PVC insulated multi-stranded single core copper conductor cable, earthing connection etc.
3.3	**Provision of 120 Watt LED Street Light with Fitting:** Supply, installation, testing & commissioning of Energy efficient 120 Watt LED with street light fitting with pressure die cast aluminium housing with driver & suitable fixing arrangement, IP-65 for outdoor application, operating voltage (140-270) V, System efficacy more than 100 lumen/W, complete with all accessories of approved make etc. The item price also includes labour & cost of all materials including cost of FRLS PVC insulated multi-stranded single core copper conductor cable, earthing connection etc.
3.4	**Provision of Rechargeable Batten Type 240 Watt Emergency Light:** Supply, installation, testing & commissioning of rechargeable batten type Emergency light, 240 watt (60 LEDs 4 watts) with Two-hour minimum backup. The battery life shall be minimum 4 years. The luminaire shall provided rated lumen within 5 second after switching on. The material shall conform to IS-9583.
3.5	**Provision of Outdoor LED Type Flood Light Luminaries (200 Watt):** Supply, installation, testing & commissioning of 200 watt pre wired LED Flood light fitting with 200 watt LED Type Flood Light Luminaries complete conforming to BAJAJ Cat. No. BARFEG-200W LED or equivalent with IP- 65 protection with LEDs and driver and all accessories. The Contractor shall make necessary fixing/ suspension arrangement for LED fitting. **Specification of LED fitting:** The LED lamps, driver & luminaries shall be suitable for outdoor lighting/ facade lighting and other installations. **Technical requirements of LED Flood light fitting:** (i) LED efficacy shall be 120 lumen/ watt for luminaire system wattage. (ii) LED used should be of Surface Mounted Diode (SMD) type only. (iii) L70 Reported Life span of LEDs used in the luminaries shall be greater than 50,000 hrs. at the soldering point temperature of 85°C. (iv) Color temperature of the proposed white color LED shall be 5700 K (minimum).

	(v) Color Rendering Index (CRI): Greater than 65. **Technical requirements of Driver:** (i) Efficiency of driver: power output rating > 100 W = 90% (ii) Power factor of complete fitting: 0.90. (iii) Input Operating Voltage: 140V to 270 V. (iv) Short circuit protection: Compliant (v) Open load protection: Compliant (vi) Driver Surge Protection standard: (a) 3 kV Min (b) 10 kV for lighting prone location (External to driver circuit). (vii) Total Harmonic Distortion (THD): Less than 20% at full load. (viii) Tc (Maximum Driver case temperature) must be declared on the data sheet. (ix) Isolated driver should be used. **Technical requirements of Luminaire:** (i) Shall submit the LM-79 and/or IS: 16106 test report. The manufacturer shall submit accreditation that the luminaire submitted for LM-79 testing was equipped with the LED Driver now being offered by the Contractor. (ii) Cover type: Toughened glass or UV stabilized polycarbonate cover. The material shall conform to IS-3528, IS-10322, IS-16101, IS-16106, IS-16107 and other specifications as applicable.
3.6	**Supply, installation, testing and commissioning of 11 meter high cast iron decorative street light pole**: Supply, installation, testing and commissioning of 11 meter high cast iron decorative platform/street light pole with single/double arm model (straight arm or curved hanging type arm) with all accessories i.e. GI pipe, clamps, nuts, bolts etc. along with outdoor type junction box with 5A MCB complete as required with anti corrosive treatment and suitable for 50m/s wind speed. Galvanized base plate of 220 x 220x 12 mm (as per IS 2062) and GI bolt size M20 X 600mm X 4 nos. (as minimum) in position including excavation of pit and filling the same with M-25 grade concrete with two curved 63mm dia HDPE pipe embedded in foundation for cable loop-in-loop-out including supply of material as required or recommended by pole manufacturer. The allied accessories such as cross arms bakelite sheet with SP MCB (6A, C series) and stud terminals, clamping, etc. are included. Single arm (and double arm as per requirement) of 500 to 1500 mm length are to be provided as per the site requirement with the approval of Engineer. The bakelite sheet with MCB & stud terminals shall be provided in the base compartment of the poles. All the connecting terminals shall be properly tightened and crimped in order to avoid any loose connection. Earthing of pole shall be done in proper manner under the designated item of earthing. Prior approval of foundation and pole/arm drawing shall be obtained from Engineer. The item shall also include LED light fitting accessories i.e. GI pipe, clamps, nuts, bolts etc. The outdoor type junction box (IP65

	protection) shall have loop-in loop-out arrangement for feeding cable and with 5A MCB to control pole light fittings. The cable connections shall be with proper thimbling arrangement. GI pipe shall be medium class conforming to IS 1239 and size of GI pipe shall be as per LED fitting. The Contractor shall design the spacing between two poles based on lux level calculations. The platform lights shall be controlled by Assistant Station Master (ASM) and suitable control shall be provided by the Contractor. This is in addition to the Modular Digital Timers for control of platform lights (the cost of Timer shall be paid under relevant Timer material item). Contractor shall prepare complete drawing of decorative street/platform light pole, single/double arm, its foundation, accessories, control from ASM chamber etc. as required and obtain approval of the Engineer.
3.7	**Supply, Installation, Testing and Commissioning of (OFF Delay) Modular Digital Timers:** Supply, installation, testing and commissioning of modular digital timer for automatic operation of platform, circulating area, street light etc. complete with required power contactor, digital timer, wiring, MCB etc. suitable for outdoor as required in minimum 1.6 mm CRCA powder coated enclosure of suitable size. The timer shall be programmable to any time (ON/OFF) in 24 hours. The timer shall switch ON lights at preset time and shall switch OFF also at preset time. The life of timer shall not be less than 10 years. The manufacturer's certificate regarding life shall be submitted. Contractor shall submit drawing and obtain approval of Engineer.
3.8	**Supply, Installation, Testing and Commissioning of 20 Meter High Mast:** **Structure:** The 20 meter high mast, shall be of continuously tapered, polygonal cross section minimum 20 sided, presenting a good and pleasing appearance (as per manufacture design) and shall be based on proven in-tension design conforming to relevant standards to give an assured performance and reliable service. The mast shall be designed as per IS-875 (Part 3) and Technical Report 7 (TR 7) of the Institution of Lighting Engineers. **Construction:** The Mast shall be fabricated from special steel plates, to BSEN-10025 cut and folded to form polygonal section and shall be telescopically jointed and fillet welded. The welding shall be in accordance with BS: 5135. The mast section shall have one longitudinal seam weld and no circumferential weld as per section. The Mast shall be delivered in minimum sections as per design without any circumferential welding at site, which shall be joined together by slip-stressed-fit method. The jointing shall be with stressing equipment, thus forming the sleeve joint. No site welding or bolted joint shall be accepted. The overlap

	distance shall have full penetration of longitudinal welds. The overlap distance shall be 1.5 times the diameter at penetration. The base plate of the mast shall be at least 25mm thick. A door opening of minimum 950mm x 225mm shall be provided at the base of each Mast. For metal protection of the Mast, the entire fabricated Mast shall be hot dip galvanized internally and externally, having minimum average thickness of 75 microns suitable for wind velocity of 50m/s as per IS 875 Part-3. The mast sections shall be galvanized by single dipping method. Sections galvanized by double/ multiple dipping methods shall not be accepted. The Contractor may propose heavier sections also. **Foundation: -** The Contractor shall see the site closely and minutely with regard to the nature of the soil, average depth of decomposed garbage and debris at proposed site, mast location and the other site conditions before working out the type of foundation and specification for the proposed High Mast. The Contractor shall be responsible for the design of the foundation and safe installation of the High Mast in mechanically and structurally safe working condition for the design life of the Mast. The load bearing (safe) capacity of the soil shall be carried out by the Contractor to decide the type of foundation. The holding down GI bolts shall be 16 Nos. of high tensile strength (EN – 19 grades) and shall be supplied complete with GI anchor plate of 6 mm thick for casting into the foundation. The precision made steel template with tube holes shall be provided to ensure correct vertically and horizontally of bolt alignment. The casting shall be with M-25 grade RCC concrete with safe soil bearing cap at site as 10 T/m^2 at 3 meter depth. Foundation shall bear the wind pressure minimum 200 kg/m^2 and earthquake of Haryana region. Prior approval of foundation drawing shall be obtained from the Engineer. **Door Opening: -** An adequate door opening shall be provided at the base of the mast and the opening shall be such that it permits clear access to equipment's like winches, cables, plugs and sockets etc. and also facilitate easy removal of the winch. The door opening shall be complete with a close fitting, vandal resistant, weatherproof door, provided with a heavy-duty double internal lock with special paddle key. The door opening shall be carefully designed and reinforced with welded steel section; so that the mast section at the base shall be unaffected and undue buckling of the cut portion is prevented. Size of door opening shall be minimum 950 x 225 mm to avoid buckling of the mast section under heavy wind condition. **Dynamic Loading For Mast: -** The Mast structure shall be designed for an assumed maximum reaction arising from the maximum wind speed (50m/s) likely to be exceeded only once in 50 years (180 km per hour) and is measured at height of 10M above ground level. The design life of the Mast shall be 30 years. Wind excited oscillations shall be damped by the method of construction and adequate allowance is made for the related stresses.

	The offered High Mast shall be a tested design. **Fabrication: -** A fabricated lantern carriage shall be provided for installation and holding the flood light fittings and control gearboxes. The lantern carriage shall be of special design and shall be of steel tube construction, the tubes acting as conduits for wires, with holes fully protected by grommets. The lantern carriage shall be so designed and fabricated to hold the required number of flood light fittings and the control gearboxes also have a perfect self-balance. The lantern carriage shall be fabricated in two halves and joined by bolted flanges with stainless steel bolts and nylon type stainless steel nuts to enable easy installation or removal from the erected mast. The inner lining of the carriage shall be provided with protective PVC arrangement, so that no damage is caused to the surface of the mast during the raising and lowering operation of the carriage. The entire lantern carriage shall be hot dip galvanized after fabrication. **Raising And Lowering Mechanism: -** For the installation and maintenance of the luminaries and lamps, it shall be necessary to lower and raise the lantern carriage assembly. To enable this, a suitable winch arrangement shall be provided, with the winch fixed at the base of the mast and the specially designed head frame assembly at the top. **Winch: -** The winch shall be of completely self-sustaining type, without the need for brake shoe, springs or clutches. Each driving spindle of the winch shall be positively locked when not in use, by gravity activated pawls. Individual drum also should be operated for fine adjustment of lantern carriage. The capacity, operating speed, safe working load, recommended lubrication and serial number of the winch shall be clearly marked on each winch. The gear ratio of the winch shall be 53:1. However, the minimum working load shall be not less than 750 kg. The winch shall be self-lubricating type by means of an oil bath and the oil shall be readily available grades of reputed producers. The winch drums shall be grooved to ensure perfect seat for stable and tidy rope lay, with no chances of rope slippage. The rope termination in the winch shall be such that distortion or twisting is eliminated and at least 5 to 6 turns of rope remains on the drum even when the lantern carriage is fully lowered and rested on the rest pads. It should be possible to operate the winch manually by a suitable handle and/or by an integral power tool. Operation of the winch with manual handle shall be independent of the power tool. Winches with manually operation through the power tools shaft shall not be accepted. Individual drum operation of the winch shall be possible. A Double drum winch shall have 2 drums and two worm gears independent in operation for increased safety. It shall be possible to remove the double drum after dismantling, through the door opening provided at the base of the mast. Also, a winch gearbox for

	simultaneous and reversible operation of the double drum winch shall be provided as part of the Contract. The winch shall be type tested in presence of a reputed institution and the test certificates shall be furnished before supply of materials. A test certificates shall be furnished by the Contractor from the original equipment manufacturer, for each winch in support of the maximum load operated by the winch. **Head Frame: -** The head frame which is to be designed as a capping unit of the mast, shall be of welded steel construction, galvanized both internally and externally after assembly. The top pulley shall be of appropriate diameter, large enough to accommodate the stainless steel wire ropes and the multi-core electrical cable. The pulley block shall be made of non-corrodible material, and shall be of die-cast Aluminium Alloy (LM-6). Pulley made of synthetic materials such as plastic or PVC is not acceptable. Self-lubricating bearings and stainless steel shaft shall be provided to facilitate smooth and maintenance free operation for a long period. The pulley assembly shall be fully protected by a canopy galvanized internally and externally. Close fitting guides and sleeves shall be provided to ensure that the ropes and cables do not dislodged from their respective positions in the grooves. The head frame shall be provided with guides and stops with PVC buffer for docking the lantern carriage. **Stainless Steel Wire Ropes: -** The suspension system shall essentially be without any intermediate joint and shall consist of only non-corrodible stainless steel of minimum AISI 316 grade. The stainless steel wire ropes shall be of 7/19 (7 strands including 19 wires each), the central core of stainless steel material. The overall diameter of the rope shall not be less than 8mm. The breaking load of each rope shall not be less than 2350 kg giving a factor of safety of not less than 5 for the system at full load as per the TR-7. The end constructions of rope to the winch drum shall be fitted with talurit. The thimbles shall be secured on ropes by compression splices. Three continuous lengths of stainless steel wire ropes shall be used in the system and no intermediate joints are acceptable in view of the required safety. No intermediate joints/ terminations, either bolted or else, shall be provided on the wire ropes between winch and lantern carriage. **Power Tool For The Winch: -** A suitable high powered, electrically driven, internally mounted power tool, with manual override shall be supplied for the raising and lowering of the lantern carriage for maintenance purposes. The speed for the power tool shall be to suit the system. The power tool shall be single speed. Provided with motor of the required rating. The power tool shall be supplied complete with a suitable control switch so that the operation of the mast can be done at a safe distance. The capacity and speed of the electric motor used in the power tool shall

	be suitable for the lifting of the design load installed on the lantern carriage. The power tool mounting shall be so designed that it shall be not only self-supporting but also aligns the power tool perfectly with respect to the winch spindle during the operations. Also, a handle for the manual operation of the winches in case of problems with the electrically operated tool, shall be provided and shall incorporate a torque limiting device. There shall be a separate torque-limiting device to protect the wire ropes from over stretching. It shall be mechanical with suitable load adjusting device. The torque limiter shall trip the load when it exceeds the adjusted limits. There shall be suitable provision for warning the operator once the load is tripped off. The torque limiter is a requirement as per the relevant standards in view of the overall safety of the system. Each mast shall have its own power tool motor. **Electrical System, Cable and Cable Connections: -** A suitable terminal box shall be provided as part of the contract at the base compartment of the high mast for terminating the incoming cable. The electrical connections from the bottom to the top shall be made by special trailing cable. The cable shall be EPR (Ethylene Propylene Rubber) insulated and PCP (Polychloroprene) sheathed to get flexibility and endurance. Size of the copper cable shall be minimum 5 core 2.5 Sqmm of reputed make. At the top there shall be weatherproof (GI or 7 tank powder coated) junction box to terminate the trailing cable. Connections from the top junction box to the individual luminaries shall be made by using 3 core 1.5 Sqmm flexible PVC copper cables of reputed make. The system shall have in-built facilities for testing the luminaries while in lowered position. Also, suitable provision shall be made at the base compartment of the mast to facilitate the operation of internally mounted, electrically operated power tool for raising and lowering of the lantern carriage assembly. The trailing cables of the lantern carriage rings shall be terminated by means of specially designed, metal clad, multi-pin plug and socket provided in the base compartment to enable easy disconnection when required. **Incoming Power Cable:** 4x2.5 Sqmm copper conductor armored cable for motor supply shall be provided from High mast control panel to the base compartment of the high mast. Cable shall be taken to the base compartment of the high mast through the provision made with 63mm dia HDPE pipe embedded in foundation. Power cable of suitable size up to the feeder pillar from supply point shall be laid by the Contractor. All copper cables required are included in the cost of the tender. **Lightning Arrestor:** One number heavy duty hot dip galvanized lighting spike rod shall be provided for each mast. The lightning spike rod shall be minimum 1.2 meter in length and shall be provided at the centre of the head frame. It shall be bolted solidly to the head frame to get a direct conducting path to the earth through the mast. **Aviation Obstruction Lights:**

Aviation lighting arrangement shall be made on the top of high mast system and two nos. light fittings shall be fitted on each high mast complete with wiring. The fittings shall be of Bajaj reference BJAOL-I or similar Philips/ Crompton make.

Earthing Terminals:

Suitable earth terminal using 12 mm diameter stainless steel bolts shall be provided at a convenient location on the base of the mast for lightening and electrical earthing of the mast.

High Mast Control Panel:

Each mast shall be provided with a control panel fabricated out of 14 SWG CRCA sheet (GI or 7 tank powder coated). It is to be mounted on a raised plate from above ground level. Construction endures suitability for outdoor use.

Basic components inside the control panel shall consist of the following: -

- 1X63 A TPN MCB for incoming supply
- 3X32 A SPN MCB for outgoing (50% lighting, 100% lighting, motor)
- Automatic Astronomical Timer with contactor of suitable capacity for control of lighting.
- 1 no. multi plug socket 16A for Auxiliary power supply.
- 2 nos. of contactors for forward and reverse operation of winch motor.

Control Panel shall be connected with the help of a cable to the remote control switch for raising and lowering of the lantern carriage. The power feed cable should be flexible, sheathed copper type and shall be connected between the control panel and the junction box on the lantern carriage. The control panel shall be suitable for outside use weatherproof.

Technical Data for High Mast and Components:

A. High Mast Structures:

i) Height of Mast : 20 Meter

ii) Material of construction: High tensile steel as per BSEN 10025

iii) Thickness (in mm)

Section	Thickness (20 Meter)
Top	3 mm
Middle	4 mm
Bottom	5 mm

iv) Cross section of mast : In polygon minimum 20 sides or as per design

v) No. of section of Masts : 3

	vi) Base and top diameters : 150mm (minimum) at Top 560mm (minimum) as per design of manufacture for 20m vii) Type of joints : Telescopic stress fit (slip over joint system) with no circumferential weld viii) Thickness of galvanization : Minimum 75 Microns as per BSEN ISO 1461 ix) Size of opening of door at base : Not less than 950mm x 225mm x) Length of overlap minimum : 1.5 times the diameter at penetration **B. Dynamic Loading:** i) Max. Wind speed : 50m/s ii) Height forms the ground level : 10 Meter for measurement of wind Velocity iii) Factor of safety for wind loads : More than 1.25 iv) Factor of safety for material : More than 1.15 (as per TR No.7) v) Factor of safety of Tower : More than 1.5 **C. Lantern Carriage:** i) Material of construction : G.I (Hot dip galvanized) ii) Buffer arrangement between Carriage & mast. : PVC sleeves **D. Winch:** i) No. of winch per mast : One (Double drum) **E. Method Of Operation:** : MANUAL/ ELECTRICAL i) Lubrication : Self-lubricating permanent oil bath ii) Safe Working Load (SWL) of the winch : 750 Kg iii) Breaking system : In built iv) Gear ratio : 53:1 **F. Power Tool:** i) Power supply : 240 Volts, 50 C/S, AC supply ii) Speed of power tool : 1.2 meter/ min iii) Number of speeds : Single speed iv) Reversible/ non-reversible : Reversible v) Remote control switch a) Type : Push Button. b) Length of control cable : 5 Meter copper. **G. Foundation:** i) Type of foundation : Open raft shallow M-25 grade RCC type ii) Size of foundation : As per site conditions considered and as per design

	iii) Considered wind speed/ pressure : 200 Kg/ SqM iv) Design safety factor considered : 2.5 (minimum) **H. Stainless Steel Wire Rope:** i) Grade : AISI 316 or better Grade ii) Nos. of ropes : Not less than 2 continuous ropes iii) Construction : 7/19 iv) Center core material : Stainless steel wire. v) Breaking load capacity : 2350 Kg vi) Factor of safety : not less than 5 per rope as per TR-7 **I. Torque Limitor:** a) Lifting capacity : Up to 700 Kg b) Adjustable/ Non- Adjustable : Adjustable **J. High Mast Enclosure:** Each mast shall be completely enclosed from all sides with GI panels of dimensions 1200mmx1200mm (with GI Wire Mesh 25mmx25mmx5mm) with 50x6 mm GI stiffners and wire mesh shall be enclosed in GI angles 50x50x6mm. The enclosure shall have proper entrance supported with 75x75x8 mm GI angles and 50x6 mm GI flats as required with locking arrangement etc. This enclosure shall be embedded in M-25 grade concrete work as per site requirement and approved by the Engineer.
3.9	Design and Drawing of high masts, platform/street poles, digital timer, foundation, lighting lux calculations, earthing, calculation, survey, as built drawings etc. for item no. 3.1 to 3.8.
4 ELECTRICAL EQUIPMENTS (PUMPS, AIR-CONDITIONERS, UPS, WATER COOLER ETC.)	
4.1	**Supply of Submersible Pump Set of 7.5 kW:** Supply of submersible energy efficient pump set of 7.5 kW (3 star & above rated), 20 Stages, Head Range: 15 Metre or above, 15000 LPH or above, 440 V, 3-phase, AC complete with all accessories as per site requirement. The material shall conform to IS-8034, IS-9283 or as applicable.
4.2	**Supply, Installation, Testing and Commissioning of Automatic Control Panel For 7.5 kW, 440V, 3-Phase Submersible Pump:** Supply, installation, testing and commissioning of automatic control panel with star-delta starter for 7.5 kW three-phase submersible pump voltage 380 – 440 volt, 3-phase, AC, 50Hz, IP protection IP-52. The panel box shall be stainless steel or CRCA powder coated. The cables shall be copper including connections and providing cable from main board to control panel and connection for Water Level Controller (WLC) in bore well. Necessary switchgear including protection, meters, selector switch, pushbuttons etc. as required for successful operation of submersible pump shall be provided. The approval of Engineer shall be obtained.
4.3	**Installation, Testing and Commissioning of Submersible Pump Set of 7.5 kW:** Installation, testing and commissioning of submersible pump set of 7.5 kW with G.I. pipe, nuts, bolts, washer & rubber packing and copper flat cable. Interface shall be made with Civil agencies who shall be making the bore hole.

4.4	**Supply, installation, testing and commissioning of Mono-Block Pump 1.5 kW, 240V, Complete with All Accessories:** Supply, installation, testing and commissioning of single stage Mono-block open well submersible pump set with control panel rating 1.5 kW, Head range-26 meter and above, suction and delivery size shall be 50X40mm, Discharge (LPM):180 or above at 26-meter head, IP-55 protection, suitable for 240V, single phase, 50Hz, AC supply.
4.5	**Supply and Installation of G.I. Pipe 50 mm nominal dia Medium Class With Flanges and Sockets**: Supply and installation of delivery GI pipe B class 50mm dia as per IS-1239: Part-1 or latest for bore well/ open well with flanges/ sockets/ bends etc. as per IS-1239:Part-2 as required as per site conditions in 6 meter lengths or as per requirement.
4.6	**Supply and Installation of G.I. Pipe Fitting Bends, Sockets, Flanges, Delivery Valve, Non-Return Valve:** Supply and installation G.I. pipe fittings, bends, sockets, flanges, delivery valve and non-return valve and supporting clamps in set; all complete**.** The material shall conform to IS-1239:Part-2, IS-5312, IS-6392, IS-5290, IS-13095, IS-14846 etc. as applicable
4.7	**Supply, Installation, Testing, Commissioning Of 3 Core, 10 Sqmm Copper Flat Cable:** Supply, Installation, Testing, Commissioning of flat submersible cable copper, 3C x 10 sqmm for pump set ISI mark as per IS 694 Part-I latest**.**
4.8	**Supply of Mono Block Pump 3.75 kW:** Supply, installation and connecting of monoblock Horizontal/ sump pump, 3.75 kW, 20-25 meters Head, discharge 15000 LPH complete with all accessories. IP-55 protection, suitable for 440V, 3-phase, 50Hz, AC supply.
4.9	**Supply, Installation, Testing and Commissioning of Automatic Control Panel with DOL Starter for 3.75 kW Pump:** Supply, installation, testing and commissioning of automatic control panel with with DOL starter for 3.75 kW pump, voltage 440V, 3-phase, AC, 50Hz, IP protection IP-52. The panel box shall be stainless steel or CRCA powder coated. The cables shall be copper including connections and providing cable from main board to control panel. Necessary switchgear including protection, meters, selector switch, pushbuttons etc. as required for successful operation of pump shall be provided. The approval of Engineer shall be obtained.
4.10	**Installation, Testing and Commissioning of 3.75 kW Mono Block Pump Set:** Installation, testing and commissioning of horizontal type 3.75 kW, 440V, 3-phase, mono block pump complete with DOL starter and provide with all required accessories i.e. nut-bolts, clamps, valve etc. All supports shall be correctly aligned before connecting and masonry work if required shall be done by the Contractor. Piping work from sump to overhead tank with all required accessories like GI pipe,

	bend, copper cable, coupling etc. shall be done by Contractor. Interface shall be made with Civil agencies who shall be making the tank. The drawing of the system with piping etc shall be approved by the Engineer.
4.11	**Supply, Installation, Testing and Commissioning of 32A, 240V, DP MCB:** Supply, installation, testing and commissioning of Double Pole MCB of 32A, 240V, 10 kA C series shall be provided in the metal enclosure powder coated as per the site requirement and at locations as per the instruction of the site Engineer. The material shall conform to IS-2147, IS-8623, IS/IEC-60898 Part-1 etc as applicable.
4.12	**Supply, Installation, Testing and Commissioning of Heavy Duty 5 Star, 1.5 Ton Split Inverter Type Air Conditioner:** Supply, installation, testing and commissioning of 1.5 Ton heavy duty, 5-star inverter type Split air conditioner, with remote controlled, suitable for 240V, single-phase, 50Hz, AC supply along with 4kVA voltage stabilizer (range 190V to 280V) IC controlled with initial time delay. Suitable size GI nuts, bolts, fasteners, copper pipe with insulation, drain pipe & petty hardware shall be provided to complete the work in all respect along with the required refrigerant & maintain the pressure with Eco-friendly refrigerant. Necessary hole in wall, concrete etc as required shall be made for pipe laying and the surface shall be restored to original finish. All fixtures etc for installation of indoor unit and outdoor unit shall be provided. The outdoor unit shall rest on floor or wall or roof as per site requirement and heavy duty support fixtures shall be provided as required. The 3 core copper cable of suitable size from power point to indoor and outdoor unit shall be provided by the Contractor. The material shall conform to IS-694, IS-996, IS-10617, IS-10773, IS-11338 etc as applicable.
4.13	**Supply, Installation, Testing and Commissioning of Heavy Duty 5 Star, 2 Ton Split Inverter Type Air Conditioner:** Supply, installation, testing and commissioning of 2 Ton heavy duty, 5-star inverter type Split air conditioner, with remote control, suitable for 240V, single-phase, 50Hz, AC supply along with 5kVA voltage stabilizer (range 190V to 280V) IC controlled with initial time delay. Suitable size GI nuts, bolts, fasteners, copper pipe with insulation, drain pipe & petty hardware shall be provided to complete the work in all respect along with the required refrigerant & maintain the pressure with Eco-friendly refrigerant. Necessary hole in wall, concrete etc as required shall be made for pipe laying and the surface shall be restored to original finish. All fixtures etc for installation of indoor unit and outdoor unit shall be provided. The outdoor unit shall rest on floor or wall or roof as per site requirement and heavy duty support fixtures shall be provided as required. The 3 core copper cable of suitable size from power point to indoor and outdoor unit shall be provided by the Contractor. The material shall conform to IS-694, IS-996, IS-10617, IS-10773, IS-11338 etc as applicable. In the ALH, 4 nos. air-conditioners shall be provided, 2 nos. each in signal equipment room and telecom equipment room. The air-conditioners of signal equipment room and telecom equipment room shall be provided with automatic switchover switches/contactor/timers etc so that each air-conditioner in the room work for 12 hours each or as

	programmed by the Engineer. In case of failure on one Air-conditioner of the room, the healthy air-conditioner shall work for 24 hours of the day.
4.14	**Supply, Installation, Testing and Commissioning of 2 KVA, 240 Volt, AC, Pure Sine Wave Online UPS cum Inverter:** Supply, installation, testing and commissioning of 2 kVA pure sine wave, online UPS cum inverter. The input supply shall be 240 Volt (range 170 volt to 265 volt), AC, and inverter full load output voltage shall be 230(+/-10%) volt. The unit shall consist of intelligent battery charging mechanism with adaptive battery charging with 150 AH tubular battery of voltage 12 volt (2 Nos.) suitable for heavy duty application with minimum two hours capacity. All features i.e meters, switches, overload and underload indications, input/output indications, charging current, battery voltage etc. shall be provided. The material shall conform to relevant IS specifications.
4.15	**Supply, Installation, Testing and Commissioning of Water Cooler (150 Litre):** Supply, installation, testing and commissioning of self-contained drinking water cooler 150 litre capacity (cooling capacity 150 litres per hour) [conforming to IS-1475 (part-1)], ISI marked, minimum 3-star rated, suitable for operation on 240 volt (+/- 10%), 50Hz, AC supply system. The unit shall be complete with all connected standard fittings, accessories etc. and 5 KVA, wall mounted, I.C. controlled electronic auto-voltage corrector conforming to relevant IS (latest version), suitable for operation on single phase 190 to 280 volts, 50Hz incoming AC supply and output 200 to 240 volts A.C. supply. All the indicating instruments, switches etc complete with time delay relay, voltmeter, instant start provision with push button switch etc. shall be provided. Necessary arrangement for provision of earthing of the unit shall be provided. Necessary platform of M-25 grade concrete or GI angle frame of 75x75x6mm size shall be provided as decided by the Engineer.
4.16	**Supply, Installation, Testing and Commissioning of 5 star rated storage geyser 25 litre capacity:** Supply, installation, testing and commissioning of 5-star rated storage geyser 25 litre capacity suitable for 240V, single-phase AC supply. All the required GI nuts, bolts, fasteners, petty hardware, connecting pipe assemblies, supply ON, Supply OFF indications etc shall be provided. Geyser shall be ISI/ BIS marked with 5-star rating. All safety provisions against bursting, overload trip etc shall be provided. Necessary hole in wall, concrete etc as required shall be made for installation of geyser and its accessories and the surface shall be restored to original finish after installation.
4.17	Design and Drawing of pumps, control panels, AC, water coolers, geyser, UPS, survey, calculation, as built drawings etc. for item no. 4.1 to 4.16.
5. SUBSTATION 11kV/ 0.44 KV, HT PANEL, LT PANEL, APFC PANEL, DG SET AND EARTHING	
5.1	**Supply, Installation, Testing and Commissioning Of 11kV/0.44kV, 1x250**

	kVA, Compact Substation (CSS): Supply, installation, testing and commissioning of Compact Sub-Station (CSS) (11/0.440 kV) consisting of 11 kV, 630A Load break switch, 11kV Compact VCB panel (1 isolator + 1 outgoing ACB with air insulated BUS PT metering module) with DRY type Transformer (250 kVA) Capacity and LT Switchgear with all HT & LT inter- connections, accessories, fittings & auxiliary equipment inside GI enclosure. CSS shall include (1) 11 kV, 630 Amp load break switch; (2) 11 KV Compact VCB , 11 kV, 630 Amp; (3) 11 kV, 630 Amp off load break switch; (4) LT panel; (5) CT/ PT for Metering system; (6) all HT and LT cable with proper termination arrangement of suitable size and length; (7) suitable connection to H-pole arrangement with GO/DO (gang operated/drop out) switch (as required). Provision of earthing as per requirement and supply & installation of all safety items required for 11/0.44 kV substation as per rules. Payment of earthing shall be made under the designated item of earthing. Schematic Diagram of substation and Transformer Data, computer printed and suitably laminated, shall be provided. The material shall conform to detailed specification and drawings mentioned in the tender document. Necessary cable trench wherever required for the CSS, HT/LT Panels, APFC Panel, DG set, HT/LT metering system etc. for HT/LT cables shall be provided. Chequered plates of GI 8mm thick, with hook arrangement for lifting, with installation support arrangement of channel, angles etc. as required shall be provided.
5.2	**Supply, Installation, Testing and Commissioning of Automatic Power Factor Correction Panel (APFC panel) with 150 kVAR shunt capacitors complete in all respects:** Supply, Installation, Testing and Commissioning of Automatic Power Factor Correction Panel (APFC panel) with 150 kVAR, 440 V (+/- 10%), 3-phase, 50 Hz shunt capacitors complete in all respects. The APFC panel shall be fabricated out of 2 mm thick CRCA sheets modular 7 tank process powder coated, compartmentalized, free standing, floor mounting, front hinged doors for indoor use, removable bottom gland plates for incoming cables, dust and vermin proof (IP:42 protection) with 3-phase copper busbars, complete with busbar connection, internal wiring, name plates, painting (shade grey RAL 7032) etc. The APFC panel shall consist of 4x25 kVAR + 1x50 kVAR configuration of capacitors with 5 stage microprocessor based APFC relay. Capacitor shall be rated for 500 V, AC, incoming supply controlled by MCCB with fuses for backup protection. APFC shall have over voltage and over current protection. Automatic power factor control shall be intelligent microprocessor based of L&T/ ABB/ Schneider/ Siemens make. Capacitors shall be heavy duty type suitable for continuous operation of make L&T/ Neptune/ ABB/ Schneider. APFC panel shall have ventilation exhaust fan of suitable size. All nuts, bolts, washers and mounting channel shall be stainless steel or GI. Necessary arrangement of earthing shall be made (earthing payment shall be made under the designated item of earthing). APFC panel shall be connected with main LT panel and shall become operative when power factor goes below 0.98 lagging and shall not operate on leading power factor. The capacitors shall conform to IS:13340, IS-13341, IS-13925(part-1 & part-2) and other applicable standards.
5.3	**Supply, Installation, Testing and Commissioning of Indoor Type**

	400A LT Panel: Supply, installation, testing and commissioning of minimum 1.6 mm CRCA sheet steel fabricated, cubicle, powder coated as per standard 7 tank process having outdoor type LT panel distribution board, having suitable IP54 protection, floor mounted front operated, mounted on GI base channel of suitable size, with top/ bottom removable cable gland plate as required, earth bus, hinged and lockable doors, dust and vermin proof, complete with all inter connections, small wiring by minimum 2.5 sq. mm copper FRLS cables. The panel shall consist of (1) 2 nos. incoming 400A, 4 pole, MCCBs with microprocessor release having integral overload, short circuit, earth fault and neutral protection and breaking capacity 60 KA (Ices=100%Icu). (2) outgoing 2x250A, 4x125A, 4x100A and 6x63A, 4 poles, MCCBs with adjustable overload and adjustable short trip unit and breaking capacity 36KA (Ics=100%Icu). The panel shall be provided with over voltage protection with suitable relay. The copper bus bars shall be insulated by heat shrinkable sleeves. The copper earth bus shall also be provided for suitable length and capacity for earthing purpose. The instrument shall be of flush type ammeter, voltmeter, and selector switches with CTs, feeder name and danger board. APFC panel shall be connected to this LT panel. General arrangement and wiring diagram along with panel dimensions shall be supplied by the Contractor for approval of Engineer before fabrication of panel. Special tools shall be supplied with the panel. Danger notice plate shall be placed on the front. All metal structures shall be 7 tank process powder coated. The final finishing shall be smooth and attractive. Caution boards of anodised aluminium or stainless steel plate in English/ Hindi shall be provided. Schematic Diagram of LT Panel, computer printed and suitably laminated shall be provided. The foundation of panel and trenching (with M-25 concrete) with GI/ CC/ Stone cover work shall be provided. Circuit identification by means of engraved on poly propylene sheet as per design approved by Engineer shall be provided. The panel shall be fixed on GI Channel of 100x50x6mm size with lifting hooks also. The earthing arrangement terminals (2 nos.) shall be made in the panel. The material shall conform to IS/IEC-60947 part-2 ; IS/IEC-60898 Part-1 and other relevant specifications.
5.4	**Supply, Installation, Testing and Commissioning of Indoor Type 160A LT Panel:** Supply, installation, testing and commissioning of minimum 1.6 mm CRCA sheet steel fabricated, cubicle, powder coated as per standard 7 tank process having outdoor type LT panel distribution board, having suitable IP54 protection, floor mounted front operated, mounted on GI base channel of suitable size, with top/ bottom removable cable gland plate as required, earth bus, hinged and lockable doors, dust and vermin proof, complete with all inter connections, small wiring by minimum 2.5 sq. mm copper FRLS cables. The panel shall consist of (1) 2 nos. incoming 160A, 4 pole, MCCBs

	with microprocessor release having integral overload, short circuit, earth fault and neutral protection and breaking capacity 60 KA (Ices=100%Icu). (2) outgoing 2x125A, 2x100A and 3x63A with 4 poles, MCCBs with adjustable overload and adjustable short trip unit and breaking capacity 36KA (Ics=100%Icu). The panel shall be provided with over voltage protection with suitable relay. The copper bus bar shall be insulated by heat shrinkable sleeves. The copper earth bus shall also be provided for suitable length and capacity for earthing purpose. The instrument shall be of flush type ammeter, voltmeter, and selector switches with CTs, feeder name and danger board. Schematic Diagram of LT Panel, computer printed and suitably laminated shall be provided. General arrangement and wiring diagram along with panel dimensions shall be supplied by the Contractor for approval of Engineer before fabrication of panel. Special tools shall be supplied with the panel. Danger notice plate shall be placed on the front. All metal structures shall be 7 tank process powder coated. The final finishing shall be smooth and attractive. Caution board of anodised aluminium or stainless steel plate in English/ Hindi shall be provided. The foundation of panel and trenching (with M-25 concrete) with GI/ CC/ Stone cover work shall be provided. Circuit identification by means of engraved on poly propylene sheet as per design approved by Engineer shall be provided. The panel shall be fixed on GI Channel of 100x50x6mm size with lifting hooks also. The earthing arrangement terminals (2 nos.) shall be made in the panel. The material shall conform to IS/IEC-60947 part-2 ; IS/IEC-60898 Part-1 and other relevant specifications.
5.5	**Supply, Installation, Testing and Commissioning of Indoor Type 160A Essential LT Panel:** Supply, installation, testing and commissioning of minimum 1.6 mm CRCA sheet steel fabricated, cubicle, powder coated as per standard 7 tank process having outdoor type essential LT panel distribution board, having suitable IP54 protection, floor mounted front operated, mounted on GI base channel of suitable size, with top/ bottom removable cable gland plate as required, earth bus, hinged and lockable doors, dust and vermin proof, complete with all inter connections, small wiring by minimum 2.5 sq. mm copper FRLS cables. This panel shall receive LT supply from AMF panel (of DG set) and shall feed to (a) ACO panel for CLS load and (b) emergency station loads. The panel shall consist of (1) 2nos. incoming 160A with 4 pole, MCCBs with changeover provision (if required) with microprocessor release having integral overload, short circuit, earth fault and neutral protection and breaking capacity 60 KA (Ices=100%Icu). (2) outgoing 2x125A, 3x100A and 4x63A with 4 poles, MCCBs with adjustable overload and adjustable short trip unit and breaking capacity 36KA (Ics=100%Icu). The panel shall be provided with over voltage protection with suitable relay. The copper bus bars shall be insulated

	by heat shrinkable sleeves. The copper earth bus shall also be provided for suitable length and capacity for earthing purpose. The instrument shall be of flush type ammeter, voltmeter, and selector switches with CTs, feeder name and danger board. Schematic Diagram of LT Panel, computer printed and suitably laminated shall be provided. General arrangement and wiring diagram along with panel dimensions shall be supplied by the Contractor for approval of Engineer before fabrication of panel. Special tools shall be supplied with the panel. Danger notice plate shall be placed on the front. All metal structures shall be 7 tank process powder coated. The final finishing shall be smooth and attractive. Caution board of anodised aluminium or stainless steel plate in English/ Hindi shall be provided. The foundation of panel and trenching (with M-25 concrete) with GI/ CC/ Stone cover work shall be provided. Circuit identification by means of engraved on poly propylene sheet as per design approved by Engineer shall be provided. The panel shall be fixed on GI Channel of 100x50x6mm size with lifting hooks also. The earthing arrangement terminals (2 nos.) shall be made in the panel. The material shall conform to IS/IEC-60947 part-2 ; IS/IEC-60898 Part-1 and other relevant specifications.
5.6	**Supply and Installation of 3 mm Thick Rubber Mat:** Supply and Installation of (ISI marked) Rubber mat with thickness 3 mm as per IS: 15652 (2006).
5.7	**Supply, Installation, Testing and Commissioning of 125 kVA Capacity, Radiator Cooled Silent DG Set:** Supply, installation, testing and commissioning of 1x125 kVA DG set (440 volt, 3-phase, AC, 50 Hz, at unity power factor) suitable emergency operation at full load with acoustic enclosure, AMF panel and all other accessories, construction of plinth with materials as per OEM recommendations and approved drawing, first filling of lubricating oil, supply of High Speed Diesel oil required for testing, commissioning at site etc. The Diesel Engine at 75% rating shall produce alternator output of 125kVA at unity power factor. DG set shall be complete with radiator cooled heat exchanger, turbo charged, battery starting, 1500 rpm, diesel engine, 110% engine over speed set etc. conforming to BS-5514, ISO-3046, SAE J1349, IS-10000 and as applicable. Copper wound alternator (insulation H class) with suitable rating as per manufacturer, salient pole, synchronous, 440V, 3-phase, 50 Hz, short circuit ratio not less than 0.5, brushless exciter, air cooled, star connection with isolated neutral terminals, fast acting solid state voltage regulator, anti-condensation heater etc. conforming to IS-1271, IS-2253, IS-4722, IS-4728, IS-4889, IS-6362, IS-7132, IS-7306, IS-7816, IS-12065, IS-12075, IS-12802, IS-13364, IS-13118, IEC-60034 and as applicable. DG set shall include battery set, anti-vibration pads, fuel tank (400 litre capacity) and all other accessories/ equipment's/ protective devices, copper fuel pipe etc. The battery of 12V DC with 180AH capacity along with suitable battery charger and 2 core, 70 sqmm copper XLPE insulated cable between battery and starter shall be provided. AMF control panel fabricated with CRCA, 1.6

	mm sheet, 7 tank process powder coated and comprising of incoming 4 pole, 400 Amps ACB (MDO) for DG Set, copper bus-bars, 4 pole, heavy duty contactors, multifunction panel meter for display of current and voltage on phases and lines, power factor, frequency, KWH, MD etc., LED indications lights including connections with single core 1.1 kV grade LT XLPE insulated copper conductor control cable between LT panel, AMF panel and alternator for auto and manual operation etc. DG set shall be provided with minimum protection of over-current relay, under voltage protection, under frequency protection, reverse power protection, field failure relay, single element over voltage relay with timer, PT fuse failure relay, over speed protection and any other protection required for proper functioning of DG set. Noise level shall be less than 75-dBA averages or as per latest CPCB norms whichever is less. The emission pollution level shall be as CPCB 4-Plus norm. Suitable exhaust with insulation and supports shall be provided. Foundation shall be with RCC M-25 grade (minimum). The material shall conform to CPWD specification Part-VII: DG sets (2013) and all the relevant and applicable IS/ IEC standards. All documents and design shall be submitted to Engineer for approval.
5.8	**Supply, Installation, Testing and Commissioning of Feeder Pillar:** Supply, installation, testing and commissioning of feeder pillar minimum size 900x600x300 mm fabricated from 1.6 mm thick CRCA sheet powder coated with 7 tank process suitable for outdoor installation with IP-54 protection , powder coated complete enclosed type dust and vermin proof, with gland plate in bottom as required. The connecting incoming & outgoing cables with copper lugs and brass glands, with (i) incoming 440V, 3-phase 63 amp, 4 pole MCCB, 35 kA and (ii) outgoing 4 nos. (three phase), 440V, 40A, 4 pole, 25 kA MCCB, (iii) outgoing 6 nos, 240V, 40A, 10 kA double pole MCB (iv) copper bus-bar 200 A in bus bar Chamber (v) indication lights, complete with locking arrangement with GI angle stand 600 mm height angle size 50x50x6 mm Grouted in M-25 grade concrete. Schematic Diagram of feeder pillar supplies and cabling shall be submitted to Engineer for approval.
5.9	**Supply, Installation, Testing and Commissioning of Earth Electrode Complete with RCC chamber etc.:** Supply, installation, testing and commissioning of the earthing system and earthing shall be done with 4 meter long, 19 mm dia, copper cladded steel electrode with minimum 250 micron copper cladding. RCC chamber with cover (M-25 grade concrete) along with 50 kg earth enhancing compound as per drawing shall be provided as per Employer's Requirements. Each earth electrode shall be connected with 40x6 mm GI flat with GI nuts, bolts, spring washer etc. The earth resistance shall be mentioned as per specification. The cost of 40x6mm GI flat shall be paid under the designated item.
5.10	**Supply, Installation, Testing and Commissioning of Earth Electrode buried in ground complete:** Supply, installation, testing and commissioning of earth system with 4 metre long, 19 mm dia copper cladded earth electrode with minimum 250 micron copper cladding, buried 500 mm below the earth with connections complete as required. The connections shall be made with 40x6 mm GI flat with GI nuts, bolts, spring washer etc. The

	earth resistance shall be mentioned as per specification or as approved by the Engineer. The earth system buried in earth shall be provided anti corrosion treatment. The cost of 40x6mm GI flat shall be paid under the designated item.
5.11	**Supply and Installation of 40x5 mm Copper Strip on Surface or in Recess or in GI Pipe**: Supply and installation of all materials including cost of copper strip of size 40x5 mm on surface or recess or digging in ground/ making chase in wall/ floor or in GI pipe and making good the damages, connections including soldering/ riveting etc. as required.
5.12	**Supply and laying of 40x6mm GI Flat:** Supply and laying 40mm x 6mm G.I strip for earth connection on the ground, below the ground, on wall or recess etc as applicable as per site including bending, cutting, welding, drilling holes, nuts, bolts, washers etc. The GI strip shall be in compliance to IS-1730 for mild steel strips /flats and IS 4826 for hot-dip galvanization coating on steel strip/flat. The price also include air terminal conductor provision for building lightning protection.
5.13	**Supply and Installation of 5 mm Dia GI Wire:** Supply and installation 5 mm dia GI Wire on surface or in recess for earthing as required. The GI wire shall be in compliance to IS 280 for mild steel wire and IS 4826 for hot-dip galvanization coating on round steel wire.
5.14	**Supply, installation, testing and commissioning of CO2 Panel Flooding System for length above 6000mm** - Fire Trace Tube system for Panel with size: Panel length above 6000 mm.
5.15	**Supply, installation, testing and commissioning of CO2 Panel Flooding System for length upto 6000mm** - Fire Trace Tube system for Panel with size: Panel length up to 6000 mm.
5.16	Design and Drawing of Sub-station, LT panels, APFC Panel, DG set, earthing, feeder pillar, fire trace system, as-built drawings, calculations, survey etc. for item no. 5.1 to 5.15.
6 FIRE FIGHTING EQUIPMENTS	
6.1	**Supply and Installation of Safety Items in the Substation:** Supply and installation of First Aid Box with medicine (ISI mark) and associated materials, Shock Treatment Chart on Aluminium frame, (a) First Aid Box (ISI mark) complete with medicines – 2 set (b) Electric Shock Treatment Chart (large size) with Aluminium frame and laminated as approved – 5 nos.
6.2	**Supply and installation of Set of 04 fire buckets (10 litre) capacity with one GI stand and GI cover:** Supply and installation of set of 04 stainless steel fire buckets (10 litre) capacity; with one GI stand and GI cover of thickness minimum 2mm supported with suitable GI angles at suitable location as approved by Engineer.
6.3	**Supply and installation of Portable fire extinguisher Dry Chemical Powder** as per IS 2171, ISI marked (5 kg). Necessary installation shall be done and fixing arrangement drawing shall be approved by the Engineer.
6.4	**Supply and installation Carbon dioxide fire extinguishers, capacity 4.5 kg:**

	complete as required (CCOE Nagpur approved cylinders) capacity 4.5 kg ISI marked IS: 2878. Necessary installation shall be done and fixing arrangement drawing shall be approved by the Engineer.
7 VIADUCT LIGHTING	
7.1	**Provision of 22 Watt LED with bulkhead Light Fitting on viaduct:** Supply, installation, testing & commissioning of Energy efficient 22 Watt LED with bulkhead light fitting on viaduct with pressure die cast aluminium housing with driver & suitable fixing arrangement, IP-67 for outdoor application, operating voltage (140-270) V AC, system efficacy more than 100 lumen/W, wattage of each LED shall be greater than 1 W and less than 3 W, complete with all accessories of approved make etc. The life of LED lamp shall be minimum 50000 hours. The light fitting shall be provided on side railings of both sides of viaduct. The item price includes labour and cost of all materials including cost of FRLS PVC insulated multi-stranded single core copper conductor cable used for connection to light fitting from the terminal or junction box etc, earthing connection etc. The bulkhead light fittings shall be provided every 15 m to 20m distance. The illumination between the mid point area of two lights shall not be less than 10 lux. The uniform lux ratio (minimum to maximum lumens) shall not be less than $1/10^{th}$ across the installations on the viaduct. The Contractor shall submit dialux calculations and design for approval of the Engineer. The luminaire shall conform to IEC 60598. Provision of modular digital timer for automatic operation of viaduct LED light shall be made as per details given in Section C-3 (Item No. 6) and payment will be made in that section.
7.2	**Laying of 2 Core x 70 sqmm LT Cable In Viaduct/ Tunnel/ Air etc.:** Laying and commissioning of 2 Core x 70 Sqmm LT, XLPE insulated armoured sheathed copper cable between (a) IMT Sohna station to a point on viaduct and (b) viaduct point to substation on tunnel shaft. The point on viaduct shall be such that cable length on both sides i.e. to IMT Sohna station and tunnel shaft substation shall be equal. The cable shall be laid in viaduct/ tunnel/ air/tunnel shaft, as required. Clamping with G.I. Saddles/ clamp of proper size suitable for 2 Core x 70 Sqmm LT cable with all accessories shall be provided for the laying of cable. The fixing arrangement shall not become loose due to train vibrations. Before and after laying of cable, the IR value shall be checked. While laying the cable, care shall be taken to avoid any damage to outside insulation of cable. Armouring at both ends of the cables shall be earthed. At termination point of cable suitable lugs and brass glands of suitable size and good quality shall be provided. The Contractor shall restore the original condition of the concrete flooring/ viaduct/ tunnel after laying of cable. Bending radius of the cable shall not be less than 16 times of dia. of the cable. Wherever, the cable emerges out of the ground at least two loops of sufficient radius should be laid. Installation of cable along with wall/ pole/ viaduct/ tunnel, wherever required, shall be done with support of G.I. saddles/ clamp of proper size and GI Pipe as required. Breaking of floor/ wall/ viaduct/ tunnel and other civil structures and repairing up to original condition, shall

	be done by the Contractor, and no extra cost shall be paid for it. Track crossing, if required, shall be arranged by the Contractor in coordination with Engineer. All the instruments required for insulation testing, high voltage testing shall be arranged by the Contractor at his own cost. The cable shall be transported by the Contractor through his own means from major electrical depot to required site of work. Before transportation of the cable, it shall be tested at site to ascertain the serviceability of the cable by the Contractor. The work shall conform to IS-1255. All stainless steel/ GI Saddle Clamp of proper size shall be provided at every one metre, for support of 2 core x 70 sqmm copper cable including stainless steel screw, washer-nut-bolt, drilling etc. all complete. The clamps shall not come out or become loose due to vibrations. GI earth wire of 10 mm dia shall run from IMT Sohna station to Tunnel shaft substation along with each cable properly clamped. The earthing of cable armour shall be done at each end of the cable with proper clamps. Each junction box shall be earthed with this earth wire by suitable T-clamps as required. The viaduct railing (if railing length is more than 20m) shall be earthed with 10mm dia GI wire with suitable connectors. Necessary interface by the Contractor shall be made with the concerned civil Contractor. The price include 10 mm dia GI wire supply, laying and connection wherever required. The GI wire shall be in compliance to IS 280 for mild steel wire and IS 4826 for hot-dip galvanization coating on round steel wire. The approval of Engineer of method statement of cable laying, earthing and drawing shall be obtained before start of work.
7.3	**Laying of 2 Core x 10 Sqmm LT Cable In Viaduct/ Tunnel/ Air etc.:** Laying and commissioning of 2 Core x 10 Sqmm LT, XLPE insulated armoured sheathed copper cable between junction boxes having double pole (DP) MCB to the light fittings. The cabling arrangement shall be such that each DP MCB shall cater to supply power to 10-15 nos. of LED lights on the viaduct. The 2 Core x 10 Sqmm copper cable shall be laid in viaduct as required. Clamping with G.I. Saddles/ clamp of proper size suitable for 2 Core x 10 Sqmm LT cable with all accessories shall be provided for the laying of cable. The cable shall have loop-in loop-out in suitable size junction box (stainless steel or 7 tank process powder coating) with necessary termination at every LED light fitting. Before and after laying cable, the IR value shall be checked. While laying the cable, care shall be taken to avoid any damage to outside insulation of cable. Armouring at both ends of the cable should be earthed. At termination point of cable suitable lugs and brass glands of suitable size and good quality shall be provided. The Contractor shall restore the original condition of the concrete flooring/ viaduct after laying of cable. Bending radius of the cable shall not be less than 16 times of dia. of the cable. Installation of cable along with wall/ viaduct wherever required shall be done with support of G.I. Saddles/ clamp of proper size and GI Pipe as required. Breaking of floor/ wall/ viaduct and other civil structures and repairing up to original condition, shall be done by the Contractor, and no extra cost shall be

	paid for it. All the instruments required for insulation testing, high voltage testing shall be arranged by the Contractor at his own cost. The cable shall be transported by the Contractor through his own means from major electrical depot to required site of work. Before transportation of the cable, it shall be tested at site to ascertain the serviceability of the cable by the Contractor. The work shall conform to IS-1255. For earthing of LED light fittings, single core PVC insulated multi-stranded copper cable 6 sqmm size shall run from each junction box to all LED fitting with each 2Cx10 sqmm cable properly clamped. The earthing of each LED bulkhead light fitting shall be done and this earth cable shall terminate at junction box and shall be properly earthed with junction box. The price include PVC insulated multi-stranded 6 sqmm copper cable supply, laying and connection wherever required. The approval of Engineer of method statement of cable laying and drawing shall be obtained before start of work.
7.4	**Supply and Installation of Junction Box Size 250(H)x200(B)x105(D) mm:** Supply and installation of junction box size 250(H)x200(B)x105(D) mm comprising stainless steel material with 1.6 mm thick sheet having power coating with 7 tank processes with rubber gasket, padlock arrangement, zinc passivated earth bolt, etc. with terminals suitable for 240V supply requirement. All busbars and terminals in the junction box shall be of copper material. The junction box shall be IP 65 outdoor type for cable entry with terminals for connection of viaduct lighting. The box shall be fixed robustly with clamps at pole/ wall/ handrail as per requirement. The junction box shall be installed at every 400m on viaduct. The junction box shall enable loop-in loop-out of 2 core x 70 sqmm copper cable and shall have 2 nos. 6A, double pole MCB for supply of power to LED lights on both sides of junction box.
7.5	Design and Drawing of Viaduct lighting, cabling, earthing, calculation, survey, as-built drawings etc for item no. 7.1 to 7.4.
8 MISCELLANEOUS	
8.1	**Supply, Installation, Testing and Commissioning of 25 Litre Fully Automatic with Auto Cut-Off RO water purification system:** Wall mounted potable water purification system (Reverse Osmosis), 240V, AC with inbuilt storage tank (stainless steel type), minimum inlet pressure 1 kg/cm^2, Maximum inlet pressure 3.5 kg/cm^2, High pressure pump, Micron filter and also confirming to ISO 9001:2015, ISO 14001:2004, IS 10500 or latest. All the accessories required for installation of this system on wall/ structure shall be provided and after installation the wall shall be restored to the original finish by the Contractor.
8.2 & 8.3	**Supply, Installation, Testing and Commissioning of Single Sided and Double Sided LED Signage Board:** Supply, installation, testing and commissioning of LED back lit single & double sided signage boards with IP-65 CRCA housing, vinyl print on acrylic sheet which is back lit with high grade, high brightness LED

modules inbuilt Switch Mode Power Supply (SMPS) driver, without battery backup. Operating voltage 80-270V AC. LED with L70 life of minimum 50,000 hours, LPM technology, including fabrication and supply of clamping arrangements. The Engineer Authorities shall decide the size, colour & content to be printed on the signage Board. Signage Board shall be prewired with flexible copper cable and terminated in a connector from where 3-core flexible cable shall be brought out for connecting the board to ceiling rose, as per site requirement. The body of Glow sign board to be connected with earth. The pictogram and letter of desired colour and size made by translucent vinyl sheet cut through computerized machine shall be pasted on acrylic sheet. Acrylic sheet with pictogram shall be fixed on CRCA/ GI sheet powder coated box with suitable arrangement. Subject matter and pictogram can be seen in the standard book of signage available in office. The installation shall be done with GI or stainless steel nuts/ bolts/ washers etc.

LED Signage Board:- Depth of box shall be approximately 100 mm (for single sided) 140mm (for double sided) and made by 0.8 mm thick CRCA/ GI sheet with powder coated having louvers for ventilation on two sides having suitable gaskets for protection against water and vermin ingress. Louvers should be covered with wire mesh to avoid entry of insects/ lizards of suitable size as per requirement. LED light shall be provided inside the box in such way that intensity of light on both side of box (no dark spot) remains same. Individual Switch Mode Power Supply (SMPS) operated from AC source ranging from 80V to 270 Volts, 50 Hz AC, single phase shall be supplied in each board and fitted in such way that no impression is appeared outside the board. The box is to be fitted in shed with approx. size 40x40x5 mm slotted angle nut bolt etc. at a minimum clear height.

Script slogan shall be advised to the Contractor by the Site Engineer.

LED:- Clear cool white colour 5 mm LEDs of uniform intensity and luminosity shall be used for excellent Visibility. The intensity of the illumination is such that it shall be possible to read the information clearly from a distance of minimum 20 meters. NICHIA/ PHILIPS/ LUMILIDE/ AVAGO/ Seol semiconductor/ OSRAM make LED with L70 life of minimum 50,000 hours and with specified parameters as per latest data sheet of Original Equipment Manufacturer shall be used.

SMPS:- All power supply units supplied are Switch Mode Power Supply type (SMPS) operated from AC source ranging from 80V to 270 Volts, 50 Hz AC, and single phase. All the power units are tested at 50% load of maximum working capacity. Protection against transient coming in the power supply source or generated by some other source is provided. Protection against voltage fluctuations of short durations is also provided.

Signage board has following specifications:

Acrylic sheet thickness	3 mm
Dimension of LED module	295 mm x 295 mm or 600 mm x 295 m

		approx.
	Protection	IP-65
	LED System Wattage	6 W max per square feet
	LED Wattage	0.06 W per LED
	Luminosity	700 mcd
	LED Color	Cool White
	Viewing Angle	70 Degree
	Solid Angle	70 Degree
	Distance between LEDs	1.5" Diagonally
	No. of LEDs in each module	72 (for 295 mm x 295 mm)
	Lux level inside the surface	≥3400 Lux @ 2" +/- 10%
	Color Temperature	5500K/ 6500K
8.4	**Dismantling of Rail Pole, Cable Pole, Overhead Line, Cable Tray Complete:** The Contractor shall cut the rail/ pole 300 mm below the ground and released material shall be handed over to store of owner (IR/ DFC etc.) or any other site as per instruction of the Engineer with own cost and transport. The site shall be properly finished. The dismantling of overhead line /cable tray of length upto 100 m each shall be considered as one number and material shall be handed over to IR/DFC. Material deposit certificate in this regard shall be handed over to the Engineer.	
8.5	**Supply and Installation of GI Cable Duct 40x60 mm (wxh) Minimum 2 mm Thick:** Supply and installation of GI cable duct 40 x 60 mm (w x h) minimum 2 mm thick and fixing as per site requirement. All drilling work, hole in wall, suspenders, anchors bolts, angle supports, nuts, bolts etc shall be provided. The wall/floor may involve dismantling and the same shall be restored to the original finish.	
8.6	**Supply and Installation of Stainless Steel Wire Mesh 25mm X 25mm (of 5 mm dia wire) Welded on GI Angle:** Supply and installation of Stainless Steel Wire Mesh 25mm x 25mm (of 5 mm dia steel wire) welded on GI angle frame 30x30x3 mm which is fixed on base GI angle frame of 50x50x6 mm and 40x6 mm GI flat in center to support the mesh. Necessary GI nuts, bolts, washers etc shall be provided. The grouting of GI angle 50x50x6 mm or as required shall be done in M-25 grade concrete.	
8.7	**Supply, Installation, Testing and Commissioning of GI Perforated Cable Tray of Size 150x50 mm with Thickness 1.6 mm:** Supply, installation, testing and commissioning of the hot dip galvanized perforated cable trays of Size 150x50 mm with thickness 1.6 mm and their fittings shall conform to the Indian Standards or their latest amended editions or equivalent International Standard. All drilling work, holes in wall, suspenders, anchors bolts, angle supports, nuts, bolts etc shall be provided. The wall/floor may involve dismantling and the same shall be restored to the original finish.	

8.8	**Spares:** Supply and Testing of maintenance spares. (1) Digital earth testers: Mains operation & rechargeable battery operation, 0-20-200-2000 Ohms, Short circuit current 6 mA, noise rejection 8 mA, Guard out parallel leakage resistance with a max error of 2%, IP65 rated & CAT IV rating, Safety - IEC1010-1, EMC-IEC61326-1. (2) Earth Leakage Detector 1000 V: Range: 0-30 mA/300 mA/30 A/300 A, 0.01 mA resolution for measuring earth leakage currents, Jaw Opening 40 mm, Analogue Bar graph Display for trending, 300 V phase to earth and 500 V phase to phase CAT III or 600 V CAT II double insulated, Safety - IEC1010-1, EMC-IEC61326-1. (3) Digital Insulation Tester 2.5 kV: 2.5 kV Insulation Tester measurement consisting of selectable measurement voltage in the 100…2500 V range with 100 V step, continuous indication of 2.5 kV insulation resistance or leakage current, automatic discharge of capacitance of tested object after the insulation resistance measurement, acoustic signalling of five-second periods to facilitate obtaining time characteristics, indication of actual test voltage during the measurement, protection against measuring live objects, two and three-lead measurement method, Continuity measurement of protective and equipotential conductors according to EN 61557-4 with the >200 mA current, Leakage current measurement, Measurement of alternating and direct voltages, Built-in rechargeable battery pack. The instruments meet the requirements of the EN 61557 standard. (4) Digital Insulation Tester 0 – 1000 V: Measures Insulation Resistance, Continuity and AC Voltage, Three rated test voltages of 250V, 500V and 1000V, IR measurement upto 2000MΩ, Robust Design: Protection class IP54, 200mA current for continuity measurement, Auto discharge of test voltage, Meets international safety standards EN 61010-1 CAT III 600V. (5) Digital Vernier Caliper: Top quality material, 150mm measuring range, Precision reading, laser reticle, Measuring Range: 0-150 millimeter, Resolution: 0.01 millimeter, Repeatability: 0.01 millimeter, Maximum measurement speed: 1m/s, Power: 1 x 1.5V LR44 cell (included), Size: 237 x 76 x 11 millimeter for caliper 40 x 15 millimeter for LCD screen. (6) Portable Diesel Generating set 3 kVA 240 V A.C.: Portable Diesel Air Cooled Generator Set, 3KVA Application, 3KVA Generator generally used for generating electricity purpose (exp: lighting, power supply-purpose and for heavy power services) in offices, Institutes etc. because of their constant voltage property. Max AC Output: 3KVA, Rated AC Output: 3kW, Rated Voltage: 240 V, AC Frequency: 50Hz, Engine Output: 3.8kW, Fuel Type: Diesel, Fuel Consumption: 750ml/hr, Starting System: Recoil and Self Start Both, Engine Type: 4-Stroke, Air Cooled, Cylinder: Single. (7) Digital Micro Meter: Range: 325-350 mm, Digital step: 0.001 mm, maximum permissible error: +/- 6 µm, accuracy: +/- 6 µm, flatness: 0.6 µm, display: LCD, character height 7.5mm, power supply: 2 batteries SR-44, measuring spindle: with spindle lock, 8mm dia, spindle pitch 0.5mm etc. (8) Digital Multi-meter: 1000V AC/DC; 10A AC/DC (with test leads and current jacks); resistance to 50 MΩ; capacitance to 10,000 µF, frequency to 100 kHz; temperature from -10 ℃ to 60 ℃, Robust, fast and accurate with manual and automatic ranging, Display Hold, Auto Hold, and Min/Max-Average recording, Backlit digital display. (9) Safety Helmet: Straps should be fitted such that minimum clearance be at least 30 mm and maximum clearance more than 80 mm. Chin strap should

	have minimum width of 19 mm and directly attached to shell. Nape strip should have minimum depth of 115 mm. The mass of helmet without attachments should be 400 g. (10) Tool Kit box having impact drill, 1-piece case, masonry drill bits, wood drill bits, allen keys, 10-pieces hex bits, sockets, screws, wall plugs, 7-pieces wrenches (size 8/9,10/11,12/13,14/15,16/17,18/19,21/22), 1-piece magnetic bit holder, 1-piece cutter, 1-piece hammer, 1-piece plier, 1-piece long nose plier, 1-piece 1/4-inch adapter and 1-piece socket etc. (11) Portable grinder Electrically operated: An electric angle grinder is a hand-operated tool that is powered by electricity and is used with several attachments for grinding, cutting and polishing. Power consumption: 660W, disc diameter: 100mm, no load speed: 12000 rpm, voltage: 220 V, weight: 1.5 kg, with power supply cord etc. (12) Portable Electric drill: Max. Drilling Diameter: 16mm, Size: 6.5-16.0mm, No-Load Speed : 330-2700 RPM, Rated Voltage : 220V, Frequency : 50 Hz, Rated Input Power : 305-1600W.
8.9	**Operation and Maintenance Manuals:** Preparation of Operations and Maintenance Manuals and supply of requisite hard bound copies and in soft copies (pdf and word format) as per Employer's requirement.
8.10	**Training to Staff:** Imparting Training to Employers/ Engineer Staff in Classroom and at Site. Preparation of Training manuals for supply to each Trainee in hard bound copy. Supply of requisite hard bound copies and in soft copies (pdf and word format) as per Employer's requirement.

Notes:

1. The make of material shall be as per Reference list.
2. The plastering shall be done with 1:4 (cement : sand ratio) and concrete grade shall be minimum M-25. The brick class designation shall be minimum 10. The painting and distempering etc shall match the original finish.
3. The specifications, wherever mentioned, shall be latest or with latest amendment. Contractor to provide specifications, if not included in the tender document, as applicable. The indicative list of Standards is given in the tender document for reference purpose for all items of BOQ.
4. Prices of all items mentioned in each price schedule are included in the respective price schedule of BOQ.
5. Danger notice boards, danger signs and warning boards, indication boards etc. shall be provided at all 440V and above voltage rated equipments and prices of these shall be considered inbuilt in the respective prices.

3.2 PAYMENT

3.2.1 Payment shall be made after carrying out the work to the satisfaction of the Engineer. Item-wise payment shall be made as under:

A: Composite Items – where cost of supply and installation is combined:

(1) The cost of material and erection shall be taken in the ratio of 80%:20% of the item cost.

(2) Material cost payment (80%):
   (a) 60% payment of material shall be made after supply and acceptance of material
   (b) 15% payment of material shall be made after erection of material.
   (c) 5% payment of material shall be made after commissioning of items of work.

(3) Erection Payment (20%):
   (a) 10% payment shall be made after erection of material.
   (b) 10% payment shall be made after commissioning of item of work.

B: Supply items:

(a) 80% payment of material cost shall be made after supply and acceptance of the material.
(b) 20% payment of material cost shall be made after commissioning of the work.

C: Laying/installation items:

(a) 80% payment of Laying/installation cost shall be made after completion of Laying/installation of the item.
(b) 20% payment of Laying /installation cost of shall be made after commissioning of the work.

3.2.2 Payment shall be made for the executed quantity. All wastages etc. shall be on the Contractor's account.

3.2.3 The quantities given in BOQ are indicative only and final quantities shall be as per approved drawings and quantities executed at site.

3.3 LIST OF STANDARDS

SN	IS/ IEC Code	Title
1	IS - 5	Ready mixed paints and Enamels
2	IS - 325	Three phase induction motors.
3	IS - 374	Specification for electric ceiling type fans and regulators
4	IS - 636	Non percolating flexible fire fighting delivery hose.
5	IS - 694	Polyvinyl chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750 V
6	IS -732	Code of practice for electrical wiring and fitting of building.
7	IS -778	Gunmetal gate, globe and check valves for general purpose.
8	IS -780	Sluice valve for water works purpose (50 to 300 mm size).
9	IS - 875	Code of practice for design loads (other than earthquake) for buildings and structures
10	IS - 884	Specification for first aid hose reel for fire fighting.
11	IS - 900	Code of practice for installation and maintenance of induction motor.
12	IS - 901	Specification for coupling, double male and double female instantaneous pattern for fire fighting.
13	IS - 902	Specification for suction hose couplings for fire fighting purposes.
14	IS - 903	Specification for fire hose delivery coupling branch pipe, nozzles and nozzle spanner.
15	IS - 904	Specification for two-way and three-way suction collecting heads for fire fighting purposes.
16	IS - 907	Specification for suction strainers, cylindrical type for fire fighting purposes.
17	IS - 908	Specifications for hydrant, sand post type.
18	IS - 909	Specification for ground fire hydrant.
19	IS - 937	Specification for washers for water fittings for fire fighting purposes.
20	IS - 1239 Pt.1	steel tubes, tubulars and other wrought steel fittings — specification

SN	IS/ IEC Code	Title
21	IS – 1248 Pt.1	Direct acting indicating analogue electrical measuring instruments and their accessories
22	IS – 1255	Code of practice for installation and maintenance of power cables up to and including 33 kV rating
23	IS - 1293	Plugs and Sockets
24	IS - 1475	Self-contained drinking water coolers – specification
25	IS - 1514	Specification for PVC insulated (heavy duty) electric cables
26	IS - 1520	Horizontal centrifugal pumps for clear, cold, fresh water.
27	IS - 1536	Centrifugally Cast Iron Pipe.
28	IS - 1537	Vertically cast Iron Pipe.
29	IS - 1538	Cast Iron Pipe Fitting.
30	IS -1554 Pt. I	PVC insulated (heavy duty) electric cables for working voltage up to and including 1100 volts.
31	IS -1554 Pt. II	PVC insulated (heavy duty) electric cables for working voltage up to and including 11000 volts.
32	IS - 1641	Code of practices for fire safety of building (general) : General principles for fire grading and classifications.
33	IS - 1642	Code of practice for fire safety of building (general): Details of construction.
34	IS - 1643	Code of practice for fire safety of building (general) : Exposure hazard.
35	IS - 1644	Code of practice for fire safety of building (general): Exit requirements and personal hazard.
36	IS - 1646	Code of practice for fire safety of building (general) : Electrical Installation.
36A	IS-1730	Steel plates, sheets, strips and flats for structural and general engineering purposes – dimensions.
37	IS - 1822	Motor starter for voltage not exceeding 1000 volts.
38	IS – 2062	Hot rolled medium and high tensile structural steel - specification
39	IS - 2082	Stationary storage type electric water heaters - specification
40	IS - 2147	Degrees of protection provided by enclosures for low voltage switchgear and controlgear
41	IS - 2208	HRC cartridge fuse links upto 650 volts.
42	IS - 2268	electric call bells and buzzers for indoor use-specification
43	IS - 2312	Specification for propeller type ac ventilating fans
44	IS – 2418	Tubular fluorescent lamps for general lighting services
45	IS - 2516	A.C. circuit breaker for voltages not exceeding 1000 volts.

SN	IS/ IEC Code	Title
46	IS - 2592	Recommendation for methods for measurement or fluid flow be means of orifice plates and nozzles.
47	IS - 2629	Recommended practice for hot-dip galvanizing of iron and steel
48	IS - 2675	Specification for enclosed distribution fuseboards and cutouts for voltages not exceeding 1000 V ac and 1200 V dc
49	IS - 2705	Current transformers-specification
50	IS - 2871	Specification for branch pipe, universal for fire fighting.
51	IS -2930	Functional requirements for hose laying tender for fire brigade use.
52	IS - 3231	Specification for electrical relays for power system protection
53	IS - 3427	AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
54	IS – 3528	Waterproof electric lighting fitting
55	IS - 3589	Electrically welded steel pipes for water, gas and sewage.
56	IS - 3624	Burden tube pressure and vacuum gauges.
57	IS – 3646	Code of practice for interior illumination Part 1 – General requirements and recommendations for working interiors Part 2 – Schedule of illumination and glare index Part 3 – Calculations of coefficients of utilization
58	IS - 3844	Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises.
59	IS - 3854	Switches for domestic and similar purposes
60	IS - 4047	Heavy duty air break switches and composite units of air break switches and fuses for voltage not exceeding 1000 volts.
61	IS - 4722	Rotating electrical machines — specification
62	IS - 4728	Terminal markings and direction of rotation for rotating electrical machinery
63	IS-4736	Specification for hot-dip zinc coatings on mild steel tubes
64	IS - 4984	High density polyethylene pipes for water supply - specification
65	IS - 5077	Specification for decorative lighting outfits
66	IS – 5135	Arc welding of carbon and carbon manganese steels
67	IS - 5290	Specification for landing valves.
68	IS - 6392	Steel pipe flanges.
69	IS – 6665	Code of practice of industrial lighting
70	IS - 7098 Pt.1	Specification for crosslinked polyethylene insulated pvc sheathed cables

SN	IS/ IEC Code	Title
71	IS – 7098 Pt.2	Crosslinked polyethylene insulated thermoplastic sheathed cables — specification
72	IS - 7637	Glossary of terms for fire fighting equipment.
73	IS - 8034	submersible pump sets — specification
74	IS - 8090	Specification for coupling, branch pipe, node, used in hose reel tubing for fire fighting.
75	IS - 8216	Inspection of lifts wire and ropes
76	IS - 8442	Specification for stand post type water monitor for fire fighting.
77	IS - 8757	Glossary of terms associated with Fire safety.
78	IS - 8828	Electrical accessories - circuit-breakers for overcurrent protection for household and similar installations
79	IS - 9283	Motors for submersible pump sets — specification
80	IS - 9537	Specification for conduits for electrical installations
81	IS – 9583	Specification for emergency lighting units
82	IS - 9668	Code of practice for provision and maintenance of water supplies and fire fighting.
83	IS - 9972	Specification for Automatic sprinkler heads.
84	IS - 9974	Specification for high pressure sodium vapour lamps
85	IS - 10001	Performance requirements for constant speed compression ignition (diesel) engines for general purposes (up to 20 kw)
86	IS - 10221	Code of practice for-coating and wrapping of under ground mild steel pipe lines.
87	IS – 10322	Luminaires Part 1 – General requirements Part 2 – Constructional requirements Part 3 – Screw and screwless terminals Part 4 – Methods of tests Part 5 (All Sections) – Particular requirements
88	IS - 11037	Specification for electronic type fan regulators
89	IS - 11101	Specification for extended branch pipe for fire brigade use.
90	IS - 11171	Dry type Power transformer
91	IS - 11260	Stabilized power supplies ac output, Part 1: Ratings and performance
92	IS - 12615	Energy efficient induction motors — three phase squirrel cage
93	IS - 12349	Fire Protection sign.
94	IS - 12585	Specification for thermoplastic hoses Textile Reinforcement for water Genset purposes.
95	IS - 12407	Graphic symbols for protection plan.
96	IS - 12640	Residual Current Operated Circuit - Breakers for Household and Similar Uses, Part 1: Circuit-Breakers Without Integral Overcurrent Protection (RCCBs) [ETD 7: Low Voltage Switchgear and Control gear]

SN	IS/ IEC Code	Title
97	IS - 13095	Butterfly valves.
98	IS - 13118	High-Voltage Alternating-Current Circuit-Breakers
99	IS - 13314	Solid state invertors run from storage batteries
100	IS - 13340	Power Capacitors of Self-healing Type for AC Power Systems having Rated Voltage up to 650 V
101	IS - 13341	Requirements for ageing test, self-healing test and destruction test on shunt capacitors of the self-healing type for ac power systems having a rated voltage up to and including 650 V
102	IS - 13364	AC generators driven by reciprocating internal combustion engines- specification
103	IS – 13573 Pt.1, Pt.2, Pt.3	Joints and terminations of polymeric cables for working voltages from 66kv up to and including 33 kv - performance requirements and type test
104	IS - 13703	Specification for low-voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC
105	IS - 13779	AC static watthour meters, class 1and 2 - specification
106	IS – 13875 Pt.2	Digital measuring instruments for measurement, control, Part 2: Terms, tests, data sheet details of instruments for measuring analog quantities
107	IS – 13947 Pt.1, Pt.2, Pt.3, Pt.4, Pt.5	Specification for low-voltage switchgear and control gear
108	IS - 14220	Open well submersible pump sets — specification
109	IS -14665 Pt.2/Sec.1	Code of practice for installation, operation & maintenance of passenger lifts.
110	IS:14665 Pt.3/sec.1	Safety rules
111	IS:14665-part-5	Inspection manual
112	IS – 14772	General requirements for accessories for household and similar fixed Electrical installations - specification
113	IS - 15105	Design and installation of fixed automatic sprinkler fire extinguisher system - Code of practices
114	IS - 15111	Self-ballasted lamps for general lighting services
115	IS - 15652	Insulating mats for electrical purposes — specification
116	IS – 16101	General lighting — LEDs and LED modules — terms and definitions
117	IS - 16102 Pt.1, Pt.2	Self-ballasted led lamps for general lighting services
118	IS - 16103	LED modules for general lighting
119	IS – 16106	Methods of electrical and photometric measurements of solid state lighting (LED) products
120	IS – 16107	Luminaires performance

SN	IS/ IEC Code	Title
121	IEC 60502-1	Power cables with extruded insulation and their accessories for rated voltages from 1 kV up to 30 kV. Part 1: Cables for rated voltages of 1 kV and 3 kV.
122	IS/IEC-60898-1	Electrical accessories – circuit breakers for over current protection for house and similar installations.
123	BSEN 10025	Hot rolled products of structural steels
124	Technical Report 7	Technical Report 7 of Institution of Lighting Engineers - High masts

3.4 MATERIAL REFERENCE LIST

S. No.	Items	Reference Makes
1	11 kV Vacuum Circuit Breaker	GEC, Siemens, Crompton Greave, Alsthom (Areva), ABB, BHEL, L&T, Schneider or similar
2	Air Circuit Breaker (ACB)	ABB / Schneider/ L&T/ Siemens or similar
3	Compact Substation (CSS) with HT/ LT switch gear, transformer and connected accessories	ABB, Siemens, L&T, Crompton Greave, BHEL, GEC, Alsthom (Areva), Schneider, Voltamp or similar
4	MCCBs, MCBs, ELCBS/ RCCBs, RCBO, DB, TP, HRC fuse, Changing over switch, Switch Fuse Unit	ABB / Legrand/ / Schneider/ L&T/ Havells or similar
5	XLPE HT Cable 11 kV grade	Havells/ CCI/ KEC /RPG / Universal Cable / Sterlite/ Polycab or similar
6	PVC/ XLPE Power Cables up to 1.1kV grade	Havells/ CCI / KEI / Finolex / RPG / Universal/ Polycab / Batra Henlay or similar
7	Instrument Voltmeter, Ammeter, PF meter	AE / Precise / IMP / Secure or similar
8	11kV Cable End Termination & Jointing kits	Raychem RPG / 3M or similar
9	Relays	ABB / Schneider/L&T or similar
10	Luminaries, LED & related Accessories	Phillips/ Crompton/ Bajaj/ GE/ Osram/ Wipro/ Surya/Syska or similar

S. No.	Items	Reference Makes
11	PVC insulated Elect. Cables Sheathed/ unsheathed, PVC flexible LT cable, multicore, single core, Flat cable for submersible pumps	Finolex / Polycab / KEI/ Havells / Lapp/ Universal or similar
12	Current Transformer	AE / Kappa / Pragati / Precise / Hitachi / Plastofab or similar
13	On line UPS, Servo Stabilizer, Inverter, CVT	Luminous/ Microtek/ APC Schneider / Emerson Network Power / Exide/ Amaron or similar
14	Rotary Switches, Selector Switches	ABB / Kay Cee / L&T / Schneider or similar
15	Exhaust fan/ Air Circulator/ Bracket & Pedestal fans/ Ceiling fan	Crompton Greaves/ Usha/ Bajaj/ Havells/ Schneider/ Orient/ Khaitan or similar
16	High Mast Tower / Street Light pole for general purpose lighting	Bajaj/ Philips/ Crompton/ Wipro or similar
17	Electronic Energy Meter	L&T, IMP, HPL, Secure, ABB, Enercon or Similar.
18	Capacitors - PF correction for Electrical General Services	Elspec / Schneider / ABB/ Siemens or similar
19	DG Sets - Portable	Birla Yamaha/ CGL/ Shriram, Mahindra/ Honda or Similar.
20	DG set	Sudhir/ Sterling / Powerica/ Jackson/ Cummins/ Caterpiller/ Greaves Cotton or similar
21	Alternator for DG set	Stamford/ Landert motoren AG / Crompton Greaves/ Kirloskar/ Bharat Bijlee or similar
22	Induction Motor	ABB/ BBL/ Crompton Greaves / Kirloskar or similar
23	LT Switchgear & control gears- Contactors & motor starters, Energy Efficient Soft Starter panel/ Earthing Switch, Single phase Preventer	GE/ Schneider/ ABB, L&T or similar
24	Pumps- Submersible	ABB/ BBL/ Crompton Greaves / KSB/ Kirloskar or similar
25	Timers- electronic solid State	ABB/ Schneider Electric / Omron or similar

S. No.	Items	Reference Makes
26	Water Coolers	Blue Star, Kelvinator, Shriram, Voltas or Similar.
27	Electrical accessories (Piano switch, Plugs & sockets, ceiling rose, Angle holder, holders, Modular switch and socket)	Anchor / Roma/ North-West/ Schneider/ Legrand/ Havells Crabtree or similar
28	Bell Buzzer	CONA/ MAX/ Anchor/ SSK or similar
29	Electronic fan regulator/ modular Fan Regulator	Anchor/ Roma/ North-West/ Schneider/ Legrand/ Havells Crabtree or similar
30	GI/ MS Pipe	TATA/ Jindal/ Prakash/ Surya SAIL or similar
31	Lifts	OTIS/ Schindler, KONE/ Johnson or Similar
32	LEDs	NICHIA/ OSRAM/ SEOUL SEMICONDUCTOR/ PHILIPS/ LUMILEDS/ Syska or Similar
33	HDPE PIPE	Duraline/ Godavari/ Rex Polyextrusion/ Eflex or similar
34	Battery Charger for battery room	Amar Raja/ Exide/ RS Power or Similar.
35	Conduits GI/ PVC include accessories	BEC / AKG / Polypack/ Precision or similar
36	LT Panels	Rittal/ ABB/ Schneider/ Neptune/ Adlec or similar
37	Glands	Comet/ Dowells/ Lapp Kabel/ Hummel or similar
38	Insulating Mats	Vardhman/ ERDI certified/ as per IS or similar
39	Lugs	Dowells/ Jainsons or similar
40	High Mast Lights	Philips/ Bajaj/ Crompton/ Wipro or similar
41	Lights and Luminaire	Philips/ Bajaj/ Crompton/ Wipro/ Surya or similar
42	Light aviation	Philips/ Bajaj/ Avaids or similar
43	MCB Distribution Boards	ABB/ Havells/ Legrand/ Schneider or similar

S. No.	Items	Reference Makes
44	Cable Trays & Covers	Adarsh/ Indiana / Maheshwari/ BEC or similar
45	Split Air Conditioner	Voltas/ Hitachi/ Carrier/ Daikin/ Toshiba/ Blue Star/ O-General/ LG/ Samsung or similar
46	Geyser	Bajaj, Usha, Havells, Crompton or similar
47	Fire Alarm System	Honeywell/ Notifier/ Edwards/ Tyco/ Siemens/ Apollo/ Rockwell or similar
48	Portable Fire Extinguisher	Minimax/ Newage/ Safeguard/ Kanex/ Cease Fire or similar
49	Tool kit box	Bosch, Taparia, Hitachi, Stanley.

3.5 TYPICAL ILLUMINATION LEVEL AT VARIOUS LOCATIONS

SN	Location	Recommended Normal Lux Level at floor level	Type of Fitting	Indoor/Outdoor
1	Circulating Area and platform	100	LED	Outdoor
2	Entrance	200	LED	Outdoor
3	Covered Passageway Corridor Stair	150	LED	Indoor
4	Stores	200	LED	Indoor
5	Other Service Building	200	LED	Indoor
6	Public Utility Services (Toilet/Bathroom)	150	LED	Indoor
7	Equipment Room	300	LED	Indoor
8	Control Room	300	LED	Indoor
9	Staff Quarters	200	LED	Indoor
10	Streetlight	15	LED	Outdoor
11	Rest Room	150	LED	Indoor
12	Rooms	200	LED	Indoor
13	Washbasin	150	LED	Indoor
14	Substation building/ battery room/ Cable distribution Area	150	LED	Indoor
15	Sign Boards	-	LED	Outdoor
16	Level Crossing	50	LED	Outdoor
17	Switch Yard	50	LED	Outdoor
18	Depot (Technical Rooms)	300	LED	Outdoor
19	Sign, Maps, Displays	200	LED	Indoor/ Outdoor

Note: Above Lux levels may be ascertained from relevant standards as per applicability.

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CHAPTER – 4 INSTALLATION AND CONSTRUCTION

4.1 REQUIREMENTS

4.1.1 General Requirements

i. The Contractor shall comply with all Enactments in executing the Works, including but not limited to all statutory provisions on occupational health and safety.

ii. The Contractor shall co-ordinate with Other Contractors in the execution of the Works.

iii. The Contractor shall co-operate with all Relevant Authorities in the execution of the Works.

iv. The installation of all equipment shall be undertaken at all times by suitably trained and competent employees of the Contractor, to the satisfaction of the Engineer.

v. Only appropriate tools, plant, equipment, and vehicles shall be used.

vi. Installation of all equipment shall be in accordance with the Construction and Installation Plan described in the drawing/plans as approved by Engineer.

vii. Installation of all equipment shall conform to the best industry practices.

viii. Precautions shall be undertaken to ensure the safety of personnel and equipment for all installation works.

ix. The Contractor shall, prior to starting any installation and construction work, identify any possible hazards, and implement measures of eliminating and/or controlling such potential hazards, in line with safe working practices.

x. The Contractor shall ensure that all areas of work are sufficiently illuminated for the works to be undertaken and that a safe system of work is employed for all activities.

xi. The Contractor shall operate a robust system for the control of persons entering or working upon the site.

xii. The Contractor shall co-operate, always, with the Engineer and Other Contractors to ensure that the Site is protected from unauthorised admission, either wilfully or otherwise.

xiii. The Contractor shall make due provision for the safe access and egress to the Site of Works for its staff and subcontractors.

xiv. This access shall be maintained such that it is free of all hazards and is in a safe condition throughout the duration of the Works.

xv. Contractor shall submit method statement for (a) Erection of equipment, (b) Equipment testing and commissioning and (c) Performa and checklist for recording during equipment testing for review by the Engineer.

xvi. The Contractor shall set up at least one main store/ depot for receiving and storing materials & other equipment at his own cost. The Contractor shall keep the stores in safe and secure manner to avoid any damage or rust.

xvii. Contractor shall always keep at least one set of drawing approved by Engineer in hard copy at site.

4.1.2 Specific Requirements

The installation and construction work pertaining to this Contract shall include, but not be limited to the following: -

i. Finalisation of the Construction and Installation Programme provided by Contractor and duly approved by Engineer.

ii. Survey on Site and review the technical requirements shown in this Specification and the Engineer's Drawings(if any).
iii. Production of the calculation sheets and installation drawings for Site installation.
iv. Production of specific site designs and drawings based on typical designs and drawings supplied.
v. Installation in accordance with the finalised installation drawings.
vi. Co-ordination with Other Contractors.
vii. Submission of the installation reports and records.
viii. Testing and commissioning, as per finalised protocol and programme.

4.2 CONSTRUCTION AND INSTALLATION PLAN

4.2.1 The Contractor shall undertake installation work in stages as shown in the detailed installation programme. Installation, testing and commissioning of later stages shall not impact revenue operation of earlier stages. As a minimum, the detailed Construction and Installation Plan shall include but not be limited to all the activities, installation details and methods of all activities, equipment, and tools to be used for installation, safety issues, supervision, temporary land occupation needed and the vehicles to be used for installation.

4.2.2 Material Handling

To facilitate handling of equipment during installation and maintenance thereafter, the Contractor shall closely co-ordinate and interface with other Contractors. The entire material handling plan for movement of bulky items such as Transformers, Panels, DG sets, and cables etc. shall be carefully planned. Crane of adequate capacity with a jib of requisite length will be arranged by the Contractor at his own cost. A road crane for handling heavy materials at the contractor's depot for loading and unloading of material will be arranged by the Contractor and shall arrange his own crew for its operation and maintenance. All charges including pay and allowances of the crew and all running expenditure shall be borne by the Contractor.

4.3 SITE SUPERVISION/ DEPLOYMENT OF TECHNICAL STAFF: -

4.3.1 The Contractor shall set up a Site supervision system, which shall be part of the overall safety, system assurance and quality management system.

(i) The Contractor shall provide Sufficient number of experienced Engineers, Supervisors, and skilled workers to ensure progress and quality of the work at Site and in the Contractor's workshops (if any), are maintained to the satisfaction of the Engineer. The minimum number of Engineers required to be deployed is shown in table below:-

No.	Post	Minimum Eligibility	Minimum Requirements in nos.
1	Senior Engineer (Electrical) (Overall, in charge)	Graduate in Electrical Engineering with minimum 7 years experience in Electrical General Services work or HT & LT works, air-conditioning and	1

No.	Post	Minimum Eligibility	Minimum Requirements in nos.
		fire detection/suppression work.	
2	Senior Designer (Electrical)	Graduate in Electrical Engineering or Electronics and Communications Engineering with minimum 7 years experience in Electrical General Services work or HT & LT works, Airconditioning and Fire Detection and Suppression work.	1
3	Field Engineer (Electrical)	Graduate in Electrical Engineering or Electronics and Communications Engineering with minimum 5 years experience in General Services work or HT & LT works, Airconditioning works. **Or** Diploma in Electrical Engineering with minimum 8 years experience in General Services work or HT & LT works.	2

(ii) The Contractor shall submit to the Engineer, not later than 60 days from the date of award of Contract, the organization chart showing following key positions, and CVs of the incumbents and the brief job descriptions. The Engineer shall issue Notice of "No-objection" or otherwise for the appointment of "key positions" within stipulated working days of such submission. The incomplete submission of CV shall not be considered as submission.

(iii) The performance of personnel shall be under observation by Engineer. In case the performance of any personnel is not up to the mark, as decided by Engineer, Contractor shall provide replacement of such personnel, with similar experience within one month.

(iv) In case the Contractor fails to employ the technical staff as aforesaid to the satisfaction of the Engineer, the recovery shall be as mentioned below per month or part thereof of default.

SN	Post	Amount to be recovered per person month or part thereof of default (Rs)
1	Senior Engineer (Electrical) (Overall Incharge)	Rs.80,000/-

2	Senior Designer (Electrical)	Rs.80,000/-
3	Field Engineer (Electrical)	Rs.50,000 /-

(v) Contractor shall abide by the provisions of Payment of Wages act & Minimum wage act.

(vi) The Contractor shall be responsible for the supervision of the concerned system installation, primary fixing system, earth mats etc.

(vii) The Contractor shall maintain a set of drawings at each system which accurately reflect the current status of field changes. The Contractor shall obtain letter of No Objection from the Engineer for any such changes. The Contractor shall prepare final drawings showing the as built configuration. These drawings shall be developed in a logical format to facilitate routine system maintenance and troubleshooting.

(viii) The Engineer reserves the right to undertake, at any time, checks on the proficiency of the Contractors staff, licensing and all associated documentation. If any of the Contractor's staff be found incompetent or unlicensed he shall be removed from the site until their Competency has been established.

4.4 WORKMANSHIP

4.4.1 All the installation shall be carried out according to the instructions shown in these specifications and Drawings (as approved). All assemblies of equipment and their components and parts shall be completely interchangeable if they are of similar type. The style and procedure of the workmanship shall be consistent throughout the Works. Unless otherwise specified, the Engineer shall decide the final colours for all paint work and other finishes to be applied to any part of the Works. All parts, which are subject to, wear or damage by dust, shall be completely enclosed in dust proof housings.

4.4.2 Installation of Cables

(1) The Contractor shall co-ordinate with the Civil Contractors wherever necessary, for the installation of cables in cable galleries, trenches, ducts, trays, risers and other locations.

(2) The cable system shall, during installation, be fully protected from mechanical damage and be generally accessible at all points for inspection along its entire route. Suitable cable markers shall be provided for covered cables upon completion of installation Should it prove necessary to cut any cable during installation, all cut ends shall be properly sealed.

(3) The maximum pulling force of any cable during installation shall not exceed the design force of cables.

(4) All cables shall be installed in the formed cable trenches, shafts, hangers, trays and brackets. The minimum recommended bending radius of the cables shall be adhered to during installation.

(5) All materials used for termination, jointing and installation of cables in confined spaces shall have flame retardant, low smoke, halogen free characteristics.

4.5 Interface Between C-5 (Elect.)/ Civil Contractor and Other Contractors

The Contractor shall carry out necessary interface with other Contractors working in the area for successful completion of works. The indicative list of interfaces as under:

S. No	Item Description	C-5 (General Electrical)/Civil Contractor	Other Contractor
1.	Auxiliary Transformer LT Supply	Shall connect Local/DG LT supply to ACO Panel.	SYS-1 Contractor shall install ACO panels and distribute LT supply to SYS -2 S&T Contractor and to SCADA and OHE motorised Isolator.
2.	Track Crossing of LT cables.	Shall lay GI pipes under the tracks for crossing the LT cable	Track Contractor shall facilitate laying of GI pipe below the track
3.	Power supply from State Electricity Authority	Shall connect 11 kV cable from H-pole of State Electricity Authorities to 11 kV Metering room and CSS.	State Electricity Authorities to facilitate connection of 11 kV cable by C-5 Contractor at H-pole.
4.	HTP, MDP, DG and SCADA connectivity	Shall facilitate to SYS-1 Contractor to connect SCADA to General Power Supply	SYS-1 Contractor shall to provide SCADA connectivity for General Power Supply.
5	Viaduct illumination	Shall interface with civil Contractor for laying of power cables and erection of junction box and light fittings.	Shall interface with SYS-1 (OHE) and SYS-2 (S&T) contractors during cable laying.

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CHAPTER – 5 TESTING AND COMMISSIONING

5.1 TESTING

(1) The testing & commissioning related to the Various General Services works shall be done in conformity with the requirements of RDSO/Railway Board Standards and standard Railway practices. Testing constitutes an essential obligation to satisfy the Railway System.

(2) These Employer's Requirements establish the overall procedure for the Contractor to follow for the Works that is related to the components manufactured off-site and supplied for installation in the Permanent Works. These requirements relate to their manufacturing, procurement, delivery, testing and installation in the system and associated activities.

(3) The Contractor shall establish procedures and controls that govern the procurement and manufacturing off-site of material/equipment/ components required for the works and supply them for construction/installation, assembling and wiring in the Permanent Works.

(4) The Contractor shall submit a comprehensive Testing Plan & Program for the project to the Engineer for his consent.

(5) Type Test shall be performed by the Contractor and shall be witnessed by Employer's Personnel and / or the Engineer.

(6) Factory Acceptance Test (FAT) including stage inspection shall be performed by the Contractor and shall be witnessed by Employer's Personnel and/ or the Engineer.

(7) Approval for witnessing Type Test shall be communicated by the Engineer to the Contractor after obtaining consent from the Employer.

(8) The material delivered to the Site and offered for Inspection shall be manufactured normally not earlier than one (1) year and their guarantee period shall cover the Defect Notification Period (DNP). However, the specified period of Manufacturer's Warranty shall commence from the date of commissioning of the Work and all the manufacturer's Warranties shall be in the name of the Employer.

(9) Manufacturing and testing of various equipment, components and fittings shall be as per approved technical requirement, Schedule of Guaranteed Parameters (SOGP) etc.

5.2 TESTING AND EQUIPMENT ACCEPTANCE

(1) The Contractor shall carry out all the tests and checks for good construction and the satisfactory operation of all power supply installations. Also, the Contractor shall co-ordinate and arrange testing equipment etc. required for testing purposes.

(2) The various high, medium, and low voltage equipment will be subjected to all the tests required under equipment test sheets, (lists are not exhaustive) as per the relevant RDSO or IEC or other standards mentioned in the technical specification of each equipment or otherwise.

(3) The Contractor shall be responsible for assembly and installation of all pieces of equipment mentioned in this specification. The maintenance equipment and the special tooling shall be delivered as soon as equipment installation shall be

completed. The Contractor shall arrange and witness all the tests at commissioning and supervision after energising. These tests will enable checking the quality of the equipment and its compliance with the specifications.

5.3 FACTORY ACCEPTANCE TEST PLAN

(1) The Contractor shall prepare and submit for review by the Engineer the Factory Acceptance Test Plan detailing the Contractor's plan, documents, inspections and tests that shall be conducted to verify and validate the Works prior to delivery to the Site. The plan shall consist of a narrative description supported by graphics, diagrams and tabulations as required.

(2) (a) The Contractor's strategy for inspection and Factory Acceptance Tests of all constituent parts of the Works and Procurement Management & Manufacturing Plan.

(c) These quenching and interrelations of the inspections and tests including all Quality Hold Points and Quality Control Points.

(d) The type and extent of inspection and Factory Acceptance Tests to be undertaken and the parts of the Works to be proven by that testing.

(e) The objective of each inspection or test, what particular design and operating criteria the test or inspection will prove and how the success of the test or inspection will be demonstrated or measured.

(f) The plan for the production and submission of the inspection and test procedures to the Engineer for review including the submission of the inspection and test reports and records; and Type Tests, Routine Tests, First Article Inspections and any other tests constituting the Factory Acceptance Tests.

(3) This plan shall clearly demonstrate the logic of all related processes the logical dependencies between the individual tests of the Works, and shall also show the interfaces and dependencies with the Contractor's delivery program. The Factory acceptance Tests shall be carried out in OEM's Premises/ factory/ Manufacturing place.

(4) Factory acceptance Tests (FAT) shall include Type, Routine, Acceptance, Special Tests, as approved by the Engineer at Original Equipment Manufacturer's (OEM) factory or the Accredited Test lab / test house. The accredited Test lab or test house. Shall be approved by the Engineer. .Routine tests shall include tests such as visual inspection, dimension check, electrical conductivity check, insulation check, calibration, mechanical and hydraulic tests and any other compliance tests etc. as per specification. Type tests shall be performed on a sample of the complete equipment of each type and rating etc. based on SOGP and agreed standards or specification. The FAT stage may also include some integration tests at the manufacturer's factory, which are performed to test the integration of the components that make equipment. Each software system shall be tested to simulate inputs and outputs including integration testing as possible, thereby reducing the overall integration risks to equipment at later stages. Each software FAT should take place in an environment as close as possible to the operational environment or suitably de-rated for application duty requirement.

(5) The FAT Plan shall include a comprehensive list of the tests, Tests to be witnessed by representatives of various parties i.e. the Contractors' representatives, the Employer and /or Engineer or their representatives, the duration of the test, Tentative dates. The Contractor shall give minimum 28 days prior notice period to all representatives to witness the test.

(6) The FAT Plan shall include details of inspection, testing and witnessing of the Contractor's and subcontractor's procurement and manufacturing activities at OEM's Factory, as a minimum, it shall include:

a. First Article Inspection;

b. Stage inspections;

c. Quality Hold Points;

d. Type Tests; and

e. Routine tests.

(7) The Contractor shall arrange for all equipment and systems manufactured for incorporation into the Permanent Works to undergo a Factory Acceptance Test (FAT) before shipment from the place of manufacture..

(8) The Contractor shall be responsible for re-inspecting and re-testing any failed inspection and Factory Acceptance Test including regression testing on previously passed items.

(9) Inspections and tests that are to be witnessed by the Employer's and /or Engineer's Personnel shall be grouped and scheduled so that as many inspections and tests as possible may be witnessed during a single visit.

(10) The Contractor shall prepare two copies of the inspection or test report immediately after the completion of each inspection or test whether or not witnessed by the Employer and/or the Engineer's Personnel. f the Employer's Personnel /the Engineer has witnessed the inspection or test, he may countersign the inspection or test **(**i.e. whether or not the equipment being inspected or tested has passed satisfactorily) contained therein. If the Employer's Personnel /the Engineer has not witnessed the inspection or test (i.e. if a waiver has been granted, or for some other reason in accordance with the Contract), the Contractor shall forward two copies of the inspection or test report without delay to the Engineer. In case the results of the inspection or test do not meet the requirements of the Specification, the Employer/ the Employer's Personnel/ the Engineer may call for a re-inspection or re-test.

(11) For standard equipment which is serial or bulk manufactured, manufacturer's type test certificates (or equivalent) may be acceptable, subject to review by the Engineer.

(12) Test equipment and instrumentation shall be subject to approved calibration tests within a properly controlled calibration scheme, and signed calibration certificates shall be supplied to the Engineer in duplicate. Such calibration checks shall be undertaken prior to testing and, if required by the Employer's Personnel/ the Engineer, shall be repeated afterwards.

(13) Materials and equipment shall not be released for shipment until all applicable inspections and tests including Factory Acceptance Tests have been satisfactorily completed.

(14) The Contractor shall maintain records to demonstrate evidence of quality and accountability. These records shall include results of inspections, tests, process controls, certification of processes and personnel, discrepant material and other quality control requirements.

(15) Inspecting and testing records shall be in ISO format and as a minimum, indicate the nature of the observations made, the number & types of deficiencies found and action proposed to correct deficiencies. Also, records for monitoring work performance and for inspecting and testing shall indicate action taken for the correction of deficiencies.

(16) The Contractor shall submit to the Engineer a request for a "Notice of No Objection to Supply" the manufactured items along with all the relevant manufacturer's test certificates and inspection certificates prior to shipping / transporting. However, the material which have been inspected and the testing of which has already been witnessed by the Employer's representative, the "Notice of No Objection to Supply" may be issued directly by the Employer's representative.

5.4 INSPECTION AND TESTING COST

(1) The testing and inspection of the material shall be done by Employer's and/or Engineer's representative and all costs associated with the testing/inspection shall be borne by the Contractor including travel/lodging/boarding charges. of Employer's and/or Engineer's representative. Employer may nominate any third party for testing and inspection of material also. Any testing/inspection charges to be paid to the Test Laboratories etc. shall also be borne by the Contractor.

(2) The Contractor shall bear all expenses of Employer's and/or Engineer's representative including hotel/travel/cost of witnessing the retesting/re-inspection(if any) caused by defects or failure of equipment to meet the requirements of the Contract in the first instance.

5.5 PACKAGING AND SHIPPING

(1) The packaging and shipping shall be done ensuring that the equipment and cables do not get damaged during transit. The Contractor's quality control personnel shall verify the inspection and preparation for shipment.

(2) Each case, crate or package shall be of robust construction and suitable for the intended purpose. Packaging material that are likely to suffer deterioration in quality as a result of exposure to environmental conditions likely to be met during transit from the factory of origin to the Site shall not be used.

(3) Each case, crate or package shall be legibly and indelibly marked in large capital letters with the address, Contract number, 'right way up', opening points and other markings like "fragile", "keep dry", "handle with care" etc. along with visual display of internationally accepted symbols as necessary to permit material to be readily identified and handled during transit and when received at Site.

(4) Each case, crate or package shall contain a comprehensive packing list showing the number, mark, size, weight and contents together with any relevant drawings. .The second copy of the packing list shall be enclosed in a watertight enclosure on the outside of each case, crate or package. Distribution of additional copies of each packing list shall be in accordance with the requirements of the Engineer.

(5) Care shall be taken to prevent movement of equipment within containers by the provision of bracing, straps and securing bolts as necessary.

(6) Bags of loose items shall be packed in cases and shall be clearly identified b ywell-secured metal labels on which the quantity and name of the part and its index or catalogue number have been stamped.

(7) Spare parts shall be suitably packed for storage over an indefinite period without deterioration and shall be clearly identified showing full name and part number without any need to unwrap packaging. Electrical and other delicate items or equipment shall be cocooned.

(8) Cable ends, cable entry points into equipment and other similar terminations and openings

shall be sealed or blanked off to prevent the ingress of dirt, vermin or moisture.

(9) Tube ends and other similar openings shall be thoroughly cleaned and then blanked-off to prevent ingress of dirt or moisture.

(10) Particular care shall be taken to prevent damage to or corrosion of shafts and journals, where they rest on timber or other supports that may contain moisture.

(11) At such points wrappings impregnated with anti-rusting compositions shall be used, of sufficient strength to resist chafing under the pressures and movements likely to occur in transit.

(12) Care shall be taken to minimize risk of damage to ball and roller bearings and any fragile material in transit.

5.6 CABLE DRUMS

(1) Immediately after the tests at the place of manufacturing, both ends of every length of cables shall be sealed by enclosing them with approved caps, tight fitting and adequately secured to prevent ingress of moisture.

(2) The ends of the factory lengths of cable shall be marked "A" and "Z", "A" being the end at which the sequence of core numbers is clockwise and "Z" the end at which the sequence is anti-clockwise.

(3) The end which is left projecting from the drum shall be consistently "A" or "Z", and shall be protected against damage in such a manner that the enclosure cannot be easily removed during handling while in transit.

(4) Cables shall be supplied on drums in the longest possible lengths and within practical limits.

(5) The maximum allowable diameter of cable drum shall be 2000 mm. The use of cable drums with diameter in excess of 2000 mm shall be subjected to the review of the Engineer.

(6) The drums shall also be designed for use in conjunction with any special cable- laying equipment and accessories complete with spindles and cable drum braking gear, which shall be used to install the cables on Site.

(7) Each drum shall bear a distinguishing number and label "HRIDCL", either printed or neatly chiseled on the outside of a flange.

(8) Particulars of the cable, i.e. voltage, length, conductor size, number of cores, section and length, gross and net weights, shall be clearly shown on one flange of the drum.

(9) An arrow showing direction of rolling shall be shown. Both ends of the cables shall have heat shrinkable caps. The caps shall incorporate sealants which melt on heating at temperatures well above outdoor ambient expected in HORC area.

5.7 HANDLING, STORAGE AND DELIVERY

(1) The Contractor shall ensure Comprehensive Test and inspection instructions for handling, shipping, storage, preserving, packaging, packing, marking, and shipping to protect the quality of the equipment and to prevent damage, loss, deterioration, degradation or substitution thereof.

(2) Handling procedures shall include the use of special crates, boxes, containers, transportation vehicles, equipment and facilities for material handling.

(3) The Contractor shall provide adequate and storage (covered) facilities, at its own cost,

for storing in a safe and secure manner all the plant & equipment and manufactured items to be supplied and erected as part of the Contract.

(4) The Contractor shall make its own arrangement of covered space for storage facility and security of material in the store. However, if the spare land is available with the Employer, the same shall be handed over to the Contractor free of cost, for the purpose of establishing temporary construction depot(s) with the condition that whenever the Employer requires this portion of land back, the same shall be handed over by the Contractor at one month notice at no extra cost/compensation to the Contractor.

(5) Contractor shall take suitable measures for protection against deterioration or damage to equipment in storage. Where shelf-life of the equipment / material is limited, this shall be clearly stated on the shipment. Secure compound and covered storage for the high value items shall be integral part of the safe storage. Spares to be supplied shall also be kept safe and secure until handed over to the Employer at the time of Commissioning.

(6) The Contractor shall include the delivery activities in his Monthly Schedule Updates for submission to the Engineer.

(7) The Contractor shall ensure the Site is ready and in good conditions for delivery.

(8) The Contractor shall remove temporary fittings, if necessary, for delivery of items to site and shall restore the fittings to the original state and to the satisfaction of the Engineer.

(9) No dangerous goods shall be delivered to the Site.

5.8 GENERAL PRECAUTIONS

(1) Spare parts shall be suitably packed for storage over an indefinite period without deterioration and shall be clearly identified showing full name and part number without any need to unwrap packaging. Electrical and other delicate items or equipment shall be cocooned.

(2) Cable ends, cable entry points into equipment and other similar terminations and openings shall be sealed or blanked off to prevent the ingress of dirt, vermin or moisture.

(3) Tube ends and other similar openings shall be thoroughly cleaned and then blanked-off to prevent ingress of dirt or moisture.

5.9 WARRANTY CERTIFICATES FROM OEM:

(1) All Original Warranty Certificates of OEMs of all Electrical system and equipment including contract spare, Commissioning spare, DNP spares and Special tools & Test and Measuring equipment shall be valid for three years or as specified in RDSO Specification of the equipment whichever is more and registered in the name of Employer. These warranty certificates received from the OEMs should be passed on to Engineer before final Taking over.

(2) Validity of period of Warranty Certificates shall start from date of Commissioning.

(3) Warranty period and defect liability support shall start from the date of Commissioning.

5.10 INSTALLATION METHOD STATEMENT

(1) Installation Method Statements shall be submitted to the Engineer for review at least 28 days prior to the installation activity commencing on site.

(2) The installation method statement shall include the details on the methods and procedures of installation, site arrangement, manpower resources, equipment and tools required. Drawings shall be included to illustrate the proposed installation details. Necessary safety items, first aid provision, emergency vehicles and means for evacuation of injured person to hospitals etc. in case of accident shall be incorporated.

(3) Prior to proceeding with installation, the Contractor shall submit, for the Engineer's consent, six copies of drawings showing all installations including dimensions, supports, hardware, installation methods and documents confirming the availability and location of special installation tools and equipment and all other pertinent data.

(4) The Contractor shall make certain that the installation of all supports, gaskets, hardware, etc., are accomplished so as to assure safe, accurate and trouble-free installation. The installation for major items such as important components and vital equipment such as transformers, DG set, HT panel, high masts, etc. shall be undertaken preferably in the presence of the manufacturer's field service representative.

(5) Upon noticing or being advised of any inconsistencies between the installation drawings and documentation and the installed equipment, the Contractor shall notify his acknowledgement to the Engineer and correct such errors within two weeks.

(6) Equipment that is improperly installed shall be removed, checked, tested and reinstalled. Any damage caused due to improper installation and removal shall be rectified before reinstallation at no extra cost to the Employer.

5.11 SITE ACCEPTANCE TESTS, COMMISSIONING AND TRIALS:

5.11.1 Site commissioning tests: The Contractor shall ensure that:

(a) All equipment, cabling, distribution etc. is electrically and mechanically safe.
(b) All interlocks, isolators and door and cover securing mechanisms shall be properly fitted and adjusted.
(c) All exposed metal work is properly bonded and grounded and all connections and points required to be grounded for a safe and satisfactory operation shall be properly grounded in accordance with the manufacturer's requirements.
(d) All cables, cores and terminations shall be secure, properly fitted and correctly identified and colored.
(e) All phases, polarities, neutral and common connections shall be correctly switched / connected as required, so that the power is correctly available at all points and that the voltage and frequency at all equipment is correct and in accordance with the requirements for correct work.
(f) All supplies shall be properly fused or otherwise protected, to give successfully discrimination and safe disconnection under fault conditions.
(g) All contacts shall be properly aligned / adjusted and not subject to excessive wear or corrosion.
(h) Batteries shall be correctly installed, connected, and fitted and checked that the battery chargers are working correctly.
(i) The insulation-resistance of all cabling and equipment shall not be less than specified.

(j) During the commissioning of major item like HT panel, Transformer, DG sets etc. the Contractor shall arrange expert Engineer of OEM of such item at respective sites. The expenditure for charges for the same including transport, lodging, shall be borne by the Contractor at no extra cost.

(k) All instruments and meters shall be energized with correct polarity and working properly.

(l) All fault indications and alarms shall be working correctly.

(m) In addition to all operational tests required for a successful hand-over, the operation of all interlocks, sequences and protections which are not utilized in normal operations shall be subject of acceptance by the Engineer.

(n) The on-site commissioning tests shall be conducted under the supervision of the Engineer.

(o) The Contractor shall prepare the check lists, proforma etc. of each equipment for recording the test results, with the consent of the Engineer.

(p) On completion of the site acceptance tests, the Contractor shall forward the test results certified by him to the Engineer. When the Engineer has received the results and deems that the plant has successfully passed the tests, he will write to the contractor to that effect.

5.11.2 Commissioning

(a) At least six weeks in advance of any particular site testing, the Contractor shall submit details of tests and details for the tests equipment proposes to use for that testing, to the Engineer for approval.

(b) All tests for statutory requirements and insurances including arrangements for such tests, inspections by Authorized bodies, persons or insurers, as necessary and the provision of certificates in the prescribed and approved forms necessary to enable plant and equipment to be put in to service, shall be made by the Contractor.

(c) The commissioning tests for each part of the plant shall be carried out on site.

(d) As installation proceeds, the insulation resistance of cables shall be checked and recorded. The identification of the cores shall be confirmed from end to end of each cable end. In the case of communication, alarm and control-cabling, identification of the cores from end to end of each circuit shall be done. Tests on cables shall be completed and accepted by the Engineer before the testing of the associated equipment starts.

(e) All tests for statutory requirements and insurances including arrangements for such tests, inspections by authorized bodies, persons or insurers, as necessary and the provision of certificates in the prescribed and approved forms necessary to enable plant and equipment to be put into service, shall be made by the Contractor.

(f) The final acceptance tests shall be done after all on-site commissioning tests have been successfully completed and all defects detected during those tests have been rectified, which are accepted by the Engineer. The tests shall include full operation tests on the works as a whole and selected technical tests on some or all of the equipment.

5.11.3 Energization :

1. The Contractor shall prepare operation safety rules and procedures for the review of the Engineer before Energization. The Contractor shall carry out all necessary

checks to ensure safe Energization.

2. All power equipments shall be subject to inspection by inspectors from the Electrical Inspectorate of Engineer before Energization. The Contractor shall ensure that all Employer's Requirements are met. Contractor shall be responsible for reliable operation of all Electrical equipments.

5.11.4 TRIAL OPERATION

(a) The trial operation shall be done with full responsibility of the Contractor. The trial operation shall take place after tests on completion.

(b) The trial operation shall show the evidence of a fully functional operation of the electrical system and that security is given during operation. Therefore, the trial operation shall occur without significant malfunctions. The Contractor shall test different operation cases during the trial operation (e.g., loss of different equipment etc.).

(c) The Contractor shall make all organizational measures during the trial operation, so that malfunctions can be rectified as soon as possible (within max. 2 days).

(d) The Contractor shall commence extended period of trial run to prove that all technical systems work properly to the satisfaction of the Engineer/Employer and Commissioner for Railway Safety or any other Authorized Official and to allow all technical systems to settle and also to train staff to become conversant with the working procedures. The Contractor's personnel shall be available throughout the scope of work over the whole of this period. After successful Trial Run and obtaining statutory clearances / approvals from CRS / EIG and / or other relevant authorities, the Works shall be commissioned with the consent of the Engineer. The results of the different tests during trial operation shall be signed by the Contractor and the Engineer.

5.12 INTEGRATED TESTING

(1) Integrated Testing shall include the Work of other Contractor(s) also to ascertain that all systems work properly. The details of integrated tests to be performed shall be prepared by the Contractor and shall be submitted to Engineer for approval. The Contractor shall, follow satisfactory completion of tests on his works, equipment, sub- systems or system, perform, as approved by the Engineer. Program of tests to verify and confirm the compatibility and complete performance of his works, equipment, sub- systems or system with the works, equipment, sub-systems or system provided by others.

(2) The Contractor shall submit to the Engineer the requirements and procedures in respect of the Contractor's scope of work for Integrated System Tests in conjunction with the other Contractors to demonstrate that the complete system provided under the Contract is fully operational and meets the specified performance criteria.

(3) Integrated Testing & Commissioning include all the tests undertaken in order to demonstrate that the various components of the railway systems operate satisfactorily between one another and meet all specified requirements for design, operability, safety, and integration with other systems.

(5) These tests shall be entirely within the requirements of one or more of the Project Contracts or they shall involve a multiplicity of Contract procedure. The final Integrated Testing and Commissioning shall be carried out after the SCADA system and OCC have become operational.

(6) Those systems that can be tested without depending on the running of trains, such as SCADA and Telecom system etc., will have their integration tests scheduled to commence as early as possible. It is preferable that any interface problem associated with these "trainless" system tests be identified and resolved prior to the commencement of test running.

(**7)** The Integrated Tests by the Contractor and other Contractors shall include a period of Trial Run.

(8) The results of the Integrated Testing and Commissioning shall be compiled and evaluated by the Contractor and shall be submitted to the Engineer

(9) If the Works, or a part thereof, or a Section, or a plant & equipment and manufactured item fail to pass Integrated Testing and Commissioning and the Contractor in consequence proposes to make any adjustment or modification to the Works or a part thereof, or a section, or the plant & equipment and manufactured item, the Engineer may, with the approval of the Employer, instruct the Contractor to carry out such adjustment or modification at his own cost to satisfy the requirements of Integrated Testing and Commissioning within such time as the Employer / Engineer may deem to be reasonable.

(10) If the Works, or a part thereof, or a Section, or a plant & equipment and manufactured item fail to pass the Integrated Testing and Commissioning, the Engineer shall require such failed Test(s) to be repeated under the same terms and conditions. If such failure and retesting results due to the fault of the Contractor and cause the Employer to incur additional cost, the same shall be recoverable from the Contractor by the Employer and shall be deducted by the Employer from any money due or to become due, to the Contractor.

5.13 TEST RECORDS

5.13.1 Tests Reports

(1) The Contractor shall submit manufacturer's type test and routine test certificates and reports for each equipment and device. Complete test results are to be submitted in clearly identified and organized booklet, indicating item of equipment, make, model, type, date of tests, and type of tests, descriptions and procedures. Test reports shall also include the Quality Assurance Certification, the standards to which the equipment comply, and the standards to which the equipment was tested.

(2) The Contractor shall submit to the Engineer for review, not less than three (3) months before testing and commissioning activities commence his proposed format for testing and the commissioning records. The records shall be appropriately sub-divided to make provision for the various parts of the Permanent Works covered by the Contract.

(3) The format of the records shall cover all tests, provide positive identification by serial number for assemblies and sub-assemblies of the Works and show modifications to Employer's drawings and diagrams or "As Built" data to be certified by the Engineer in the course of installation, testing and commissioning.

(4) The Contractor shall, during the execution of the Works, prepare such reports and record of design, manufacture, installation and testing, as may be required, in order that a license may be issued or statutory requirements may be met or approval given. Such reports or records shall be adequate to enable each part of the Permanent Works to be commissioned and to meet the requirements of the licensing authority or any standing statutory regulations and shall be reviewed by the Engineer.

(**5**) The Contractor shall obtain report of each inspection and/or test. Such report shall show the result of all the inspections and/or tests carried out and shall certify that the work has

been inspected and/or tested in accordance with the requirements of the Contract and that the work complies with the requirements of the Contract.

(6) The Contractor shall prepare an inspection or test report immediately after the completion of each inspection or test whether or not witnessed by the Employer or the Engineer. If the Employer or the Engineer or Employer's Representative has witnessed the inspection or test, he may countersign the inspection or test report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily contained therein).If the Employer or the Engineer has not witnessed the inspection or test (i.e. if a waiver has been granted, or the Employer or the Engineer has not witnessed the inspection or test for some other reason in accordance with the Contract), the Contractor shall forward two copies of the inspection or test report without delay to the Engineer. The Engineer will countersign the report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) and return one copy to the Contractor. Where the results of the inspection or test do not meet the requirements of the Specification, the Employer/ the Engineer may call for a re-inspection or re-test.

(7) The Contractor shall carry out an analysis of the results and certify that the work has been inspected/tested in accordance with the requirements of the contract and the work complies with the requirements of the Contract.

(8) Authorized representative of the Contractor, who has been assigned the required authority under the relevant quality plan, shall sign each report of inspection and/or test.

(**9)** In addition to any other requirements, the report shall contain but not limited to:

(a) Material or part of the Works tested.

(b) Location of the batch from which the samples were taken or location of the part of the Works.

(c) Place of testing.

(d) Date and time of tests.

(e) Weather conditions in the case of in-situ tests.

(f) Technical personnel supervising or carrying out the tests or inspection.

(g) Size and description of samples and specimens.

(h)Method of sampling.

(i)Properties tested or inspected.

(j) Method of testing or inspection.

(k) All relevant checklists and worksheets used during the inspection and /or test, including readings and measurements taken during the tests.

(l) Test results, including any calculations and graphs.

(m) Specified acceptance criteria; and

(n) Other details stated in the Contract.

5.13.2 After Commissioning of a part of the Works, the Contractor shall complete each commissioning record in the agreed format and shall forward copies of the record to the Engineer for review.

5.14 SPARES, TOOLS AND TEST EQUIPMENT

(1) The Contractor shall supply at least six weeks before the start of Defect Notification Period, the Spares, Tools and Test Equipment for various Systems/Sub- Systems, which are essential for day to day use in both corrective and preventive maintenance and for workshop use in repairing of modules/units.

(2) The list of Tools and Test Equipment is as under:

S. No	Description	Quantity in No's
1	Digital earth testers	2 nos.
2	Earth Leakage Detector 1000 V	2 nos.
3	Digital Insulation Tester 2.5 kV	2 nos.
4	Digital Insulation Tester 0 – 1000 V	2 nos.
5	Digital Vernier Caliper	5 nos.
6	Portable diesel Generating set 3 kVA 230 V.A.C.	1 nos.
7	Digital Micro Meter	5 nos.
8	Digital Multi-meter	5 Nos
9	Safety Helmet	10 Nos
10	Box spanner set	5 Nos
11	Portable grinder Electrically operated	2 Nos
12	Portable Electric drill	2 nos.

(3) The following spares shall be provided and rates of BOQ shall be applicable:

S. No	Description	Quantity in No's
1	Cable 2 core, 10 sqmm copper cable	1000 m
2	Cable 2 core, 16 sqmm copper cable	500 m
3	Cable 2 core, 35 sqmm copper cable	500 m
4	Cable 2 core, 70 sqmm copper cable	500 m
5	22 w LED tubular lamp	100 nos
6	40 W LED light	50 nos.
7	Emergency light 240 Watt	10 nos.
8	200 watt LED flood light for high mast	10 nos.
9	Metal clad plug socket 20A single phase with 32A MCB	5 nos.
10	Metal clad plug socket 16A single phase with 20A MCB	5 nos.
11	MCCB 200A, 4 pole, 440 volt, 36kA	1 no.
12	2 kVA, 240 V AC online UPS cum Inverter	1 no.
13	1200 mm sweep ceiling fans, 5-star rated with regulator	10 nos.
14	300 mm sweep 5-star rated exhaust fan	3 nos.

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CHAPTER – 6 MAINTENANCE AND TRAINING

6.1 INTRODUCTION

6.1.1 (a) The Contractor shall provide comprehensive training and documentation to the Employer's staff in accordance with the Employer's Requirements and the chapter of General Specifications. The training of maintenance staff for Electrical system shall be organised considering RDSO, Railway standards, Railway practices and guidelines of equipment manufacturers.

(b) This training shall enable the staff, to operate and maintain all the installations in the most efficient and safe manner, to achieve the maximum reliability and economy required by such System. All type of Routine, Preventative, Schedule Maintenance and breakdown maintenance work will be carried out at regular intervals, based on latest SMI's/ Instructions/Guidelines issued by RDSO; Railway Board and equipment manufacturers' recommendations.

6.1.2 Maintenance Management

(**a**) The management of the maintenance process entails defining various levels of responsibility and enabling them to implement the strategic orientations.

(**b**) The management process helps to improve the performance of the maintenance work of different components with quality, on time and at low cost. It shall be implemented at three levels:

i. At the level of human resources and management in the context of the scheduling of work, the allocation of human resources and the training of personnel.

ii. At the skills level to ensure quality, safety and suitable working conditions.

iii. At an economic and financial level to ensure responsible management of production, spare parts, purchasing and miscellaneous costs.

(**C**) The quality of this management depends on the capability of those entrusted with operation and maintenance responsibilities:

i. To exploit the results of management within their field of responsibility.

ii. To react in the event of any deviation from the action plans defined with a view to achieving the set objectives.

(d) The management control function ensures timely advice to be given to those with operational and maintenance responsibility:

i. By placing at their disposal, the tools and information required for piloting and diagnosis.

ii. By participating in carrying out this diagnosis.

iii. By participating in the task of defining the objectives to be achieved.

6.1.3 Requirements of Facilities and Tools

(a) The achievement of the objectives assigned to the maintenance division about quality, safety and regularity for the lowest possible overall cost requires mobilisation of various resources.

The facilities and tools are essential part of the resources placed at the disposal of the maintenance division to achieve the set objectives.

(b) When determining these requirements, in-depth knowledge in the dedicated maintenance plan is needed while taking due account of the experience acquired in similar fixed installation which has been in service for several years.

6.2 SUPERVISION AND PLANNING OF MAINTENANCE

1 General

The Contractor shall make use of all relevant information to provide supervision of maintenance. According to the maintenance strategy, all equipment and infrastructure supplied for the 'Project' must be such as to ensure for minimum or no maintenance. Maintenance activities required must be capable of being performed with little or no impact on the train service. In addition, the maintenance work systems shall ensure safety of personnel and equipment.

The Contractor shall ensure that to supervise maintenance during the DNP (Defect Notification Period) personnel are always available with the relevant skills and level of competence.

The Contractor, upon noticing any defects, deficiency in quality and quantity of spares and materials shall without delay, arranges for alternative source of supply and submit his proposal to the Engineer for review.

2 Planned Maintenance

Routine preventative maintenance will be carried out at regular intervals based on condition, reliability, usage, and service history, SMI's issued by RDSO, instructions of Railway Board and equipment manufacturers' recommendations. The Operating and Maintenance Manual shall describe the different levels of planned maintenance.

3 Supervisory Staff

The Contractor shall provide supervisory Maintenance staffs who are expert in all the different levels of fault finding, maintenance and repair of the various relevant systems supplied under the Contract:

i. Electrical system

ii. Switchgear/power supply arrangement

iii. Other works

4 Maintenance Requirements

(1) Testing and Commissioning of System and Equipment

In the event of a failure requiring modifications to the System, the Contractor shall undertake any testing and re-commissioning required. Any such modification shall be submitted for Engineer review.

(2) Temporary Alterations to Restore Service

The Contractor shall undertake any temporary modifications necessary to maintain service.

Any such modification shall be submitted for Engineer review.

(3) Discrepancies between Installation and Design Records

Should the Contractor discover inconsistencies between the maintenance drawings and documentation and the installed equipment, the Contractor shall correct all such errors within two weeks.

(4) Communications

The Contractor shall ensure that adequate communication facilities are provided to its staff during the DNP and maintenance period as per approval of Engineer.

(5) Location of Staff

The Contractor shall be responsible for locating staff such that the Contractor meets its contractual obligations and as per approval of Engineer.

(6) Maintenance System

(a) The Contractor shall provide document, and maintenance manuals to the Engineer upon for various schedule and preventive maintenance. The maintenance manuals shall be approved by the engineer. These manuals shall be followed by the Contractors during DNP.

(b) Corrective maintenance shall be available 24 hours per day, able to respond to all foreseeable circumstances**.**

(c) The maintenance system shall cover all parts and equipment of the system designed, installed and commissioned by the Contractor. The Contractor shall take into account the requirements of the operations and maintenance when determining and proposing its maintenance regime.

(7) Scope and Hours of Coverage

The schedule and corrective maintenance shall be robust in design. The Contractor shall provide full 24 hour On-Call coverage and shall be such that initial response and rectification of failure are in accordance with the following:

i. Assistance to first level and corrective maintenance within 30 minutes, upon request of first line maintainer.

ii. All elements of preventative maintenance shall be carried out and completed during non-traffic hours without interrupting train services.

(8) Routine and Corrective Maintenance Procedures

Routine and corrective maintenance procedures shall be supplied for all equipment. The format shall be as follows:

i. Uniform format and layout irrespective of equipment supplier.

ii. Colour coding for each activity.

iii. Cross referenced to the Operation and Maintenance Manuals.

iv. Document control information.

(9) Maintenance Manuals

The Contractor shall provide particulars of operating parameters, tools for dismantling and testing, methods of assembly and disassembly, tolerances, repair techniques and all other information necessary to set up a repair and servicing programme as per satisfaction of Engineer.

The Contractor shall provide documentation for all hardware and software for computer systems and other associated electronic equipment to meet the following requirements.

Such documents shall include but not be limited to:

i. manufacturers' documentation supplied as standard with the equipment.

ii. hardware configuration with details of expansion capabilities and options.

iii. programme loading instructions, including runtime environment configuration.

iv. programme listing including comprehensive 'comment statements' in hard copy and soft format for source code, compilers, and development tools necessary to modify and recompile software.

v. flow charts, data flow diagrams and state diagrams as appropriate.

vi. description of software modules including purpose, linkage with other modules, error routines and any special considerations.

vii. memory maps for both internal and peripheral memory showing description of all programmes, data files, overlay areas, memory available for expansion and the like.

viii. loading and operating instructions for diagnostic programmes and specifically developed debugging tools; and

ix. Programming manuals relevant to operating systems, languages, development tools, etc.

The manual shall also include inspection/overhaul procedure and periodicity of various inspection/overhaul schedules in detail including the tools, special tools/plants, and facilities required. The Operations and Maintenance (O & M) Manuals shall be prepared by the Contractor and shall be submitted to Engineer for review who shall obtain consent of Employer. The O&M manuals shall be submitted supplied at least 3 months prior to taking over of works by the Employer. The O&M Manuals shall supplied 10 copies in hard bound copies, two nos in pdf & editable (word) format in two nos. Hard Disc Drive (1 TB minimum capacity).

6.3 TRAINING:

6.3.1 General

(a) During the contract period, the Contractor shall provide training manuals, as well as onsite training and classroom training courses to ensure that the Employer/ Engineer's staff associated with this project acquire full knowledge and understanding of all aspects of the design, day to day operations, breakdown and routine maintenance and fault diagnosis of the power supply, the surveillance and control equipment as well as the hardware and software.

(b) The Contractor shall provide comprehensive training to the Employer/ Engineer's personnel about all equipment in theoretical and practical way. The Engineer shall nominate members of staff, who shall be attending the training courses.

(c) The Contractor shall nominate qualified instructors for imparting training. The Contractor shall obtain prior approval of the Engineer for the instructor giving full details of instructor's qualifications and experience in each case. The Instructors shall have minimum 10 years experience in operation and maintenance of Electrical general services work and degree/diploma in Electrical Engineering.

(d) The Contractor shall provide all relevant and necessary facilities which are needed for complete and effective staff training (such as video, TV, slide and film-projectors and others tools) and venue. Within three months after the signing of the contract, the Contractor shall submit detailed syllabus for the training courses for approval by the Engineer. Training shall be completed at least 3 months prior to the start of DNP.

(e) The training courses and/or sessions shall include system performance requirements and all major equipment and works designed, by the Contractor.

(f) The training instructors shall be qualified and experienced to impart training. The assessment criteria for adjudging the knowledge of Employer/ Engineer's staff shall be

developed by the Contractor and submitted to the Engineer for review at least three months before any course is conducted.

(g) The Contractor shall provide full-time on-Site management and co-ordination of the entire training programme to ensure the continuity of classes, and proper distribution of training materials, and be responsible for interfacing with the instructors. The training courses in hard bound copies shall be delivered to all Employer/ Engineer's staff, including instructors, operation and maintenance Engineering staff. The Contractor shall supply training material to Engineer in four nos. hard bound copies, two nos. softcopies in pdf & word format in two nos. pendrives (1 TB minimum capacity).

6.3.2 Mock-Up for Training

The Contractor shall install mock-up equipment for system and any other facility(s) considered necessary for the training of Engineer's staff. The training mock-up shall include but not limited to the following: -

i. Clear Cut Section drawings/ photographs of various power supply equipment's such as Circuit Breakers, HT/LT panel, Power supply arraignment, Current Transformers and Potential Transformers, Submersible pumps.

ii. Cut Section drawings/ photographs of HT/LT cables.

iii. Cut Section drawings/ photographs of Gas Insulated Switchgear and other types of panels.

iv. Clear photographs of transformers, their windings, bushings etc.

v. Samples of various item used in substations.

vi. Clear drawings and photographs of Control panel, protection schemes, earthing and complete power supply arrangement system.

The Contractor shall submit full details of the training span and other mock up equipment, photographs etc. including proposed training activities and objectives.

6.3.3 Training of Employer/ Engineer's Training Instructors (ETI)

The objective of the training is to enable the Employer/ Engineer's Training Instructors to be competent to deliver future training courses for other employees of the Employer.

The Contractor shall provide training to the Employer/ Engineer's Training Instructors on the various Systems. Aspects covered shall include, but not be limited to, the following:

i. Configuration of the entire System, including interface with the Haryana Bijlee Vitran Nigam Limited (HBVNL) supply system at the feeding points.

ii. Feature and functional principles of the entire System.

iii. System design aspects including but not limited to design standards, design criteria and parameters, short-circuit and other calculations, insulation and protection co-ordination.

iv. Details of major equipment and material including but not limited to voltage and current transformers, Electrical fittings, assemblies and protection relays, and cables of different types and their joints used in the system.

v. System operation and maintenance management and procedures.

vi. Earthing arrangement, covering safety aspects of touch and step potential, safety to personnel, passengers and outsiders.

6.3.4 Operations Staff Training

The objective of the training is to enable the Engineer's operations staff to be familiar with the Systems, with focus on the operational aspects under normal and emergency conditions.

The training shall also enable the trainee to acquire full capability for identification, trouble shooting and rectification of faults in the specified duration. After classroom training which includes mock ups of equipment, the staff shall be trained in actual operation.

6.3.5 Training Requirements

Manweeks of Contractor's Training Instructors for training the Employer's maintenance personnel shall be as under.

S.No.	Training	Man-Weeks
1	HT/LT Panels, Transformer, Circuit Breakers, DG set, AMF Panel, Switchgear and Cables, Capacitor bank.	2
2	Electrical Wiring, Pumps, Submersible pumps, UPS, Battery, Conduits, fencing.	2
3	Electrical Safety & Earthing system	1

6.4 DEFECTS NOTIFICATION PERIOD (DNP)

6.4.1 The Contractor shall be responsible for rectification of all the Defects and deficiencies, till the expiry of period of 01 (one) year from the date of taking over of works by the Employer. The Contractor shall repair or rectify all Defects and deficiencies observed by the Employer/ Engineer during the Defects Notification Period within time period as may be determined by the Engineer in accordance with Good Industry Practice. In any case, the defect shall be removed within 4 hours.

6.4.2 Contractor's Office During Defect Notification Period

Contractor shall establish and maintain the 'Maintenance office' manned with the supervisory and maintenance staff with a Dedicated Desk Officer to attend the calls of the Employer's Personnel and inform their Head of Maintenance who would promptly act to attend the emergencies/ maintenance calls including organizing of all the resources i.e. artisans and Material. The Contractor Shall Maintain a computer based Failure Reporting, Analysis, and Corrective Action System (FRACAS) system to log all the events of Failure.

6.4.3 Man and Material Required During Defect Notification Period

The contractor shall resource the required staff and Material during the Defect Notification period at their own cost for 24 hours all 7 days of every week to attend the Defects. The deployment of staff shall be approved by the Engineer. The Material, if any, used from the spares shall be made good. The contractor shall arrange all the Tools & Plants needed to attend the defects during the Defect Notification period. The Contractor shall replace, the defective systems/sub-systems/ equipment /modules/items/parts during the Defect

Notification Period (DNP). For this purpose, the Contractor shall store adequate number of equipment/modules/items/parts so that the defect is rectified in the least possible time without adversely affecting the train operation. Contractor shall submit the list of DNP spares with types and quantity which contractor intends to hold during DNP, at least six months before start of DNP, to Engineer for review.

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CHAPTER – 7 TECHNICAL SPECIFICATIONS AND DRAWINGS

Appendix-1: Intelligent Addressable Fire Detection and Alarm System

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CHAPTER – 7 TECHNICAL SPECIFICATIONS AND DRAWINGS

Appendix- 2: PORTABLE FIRE EXTINGUISHERS

1 SCOPE

The scope of work covers the supply and installation of portable fire extinguishers. The following types are envisaged in these specifications and provided as shown in the schedule of portable fire extinguishers:

a) Dry powder extinguisher.
b) Carbon-dioxide extinguisher.
c) Mono ammonia phosphate extinguisher.
d) Water expelling type.

2 Standards

The following standards and rules and regulations shall be applicable:

(a)	Fire protection manual of the Tariff Advisory Committee, Fire Insurance Association of India	
(b)	IS:4308 – 2003	Portable fire extinguisher dry power type
(C)	IS:2878 – 2004	Portable fire extinguisher carbon-dioxide type
(d)	Local Fire Brigade/Authority	

3 Extinguishers

3.1 **Dry powder type :**

The extinguishers shall be of 2, 5 and 10 kg capacity, cartridge type unless otherwise specified. The body shall be of cold rolled carbon steel grade D, 1.5mm thick up to 5 kg and 2mm for 10 kg. The construction shall be similar to 'Soda Acid type' but of the following dimensions:

Capacity (kg)	Outside diameter (mm)	Filler opening (mm)
2	100	45
5	150	45
10	175	45

(a) The discharge fitting shall be with 500mm, 10mm diameter hose up to 5 kg and 750 mm, 12.5 mm diameter for 10 kg with a trigger controlled nozzle capable of discharging 85% of the contents as follows:

Capacity	Time (sec)	Throw (m)
2	8 – 10	2
5	15 – 20	4
10	23 – 30	6

(b) A carbon dioxide cartridge conforming to IS: 4947 - 1985 shall be fitted in a cartridge holder with an inner shell. A spring loaded piercing device shall be provided in the cap for piercing the seal of the gas cartridge. A siphon tube of copper or PVC shall be provided for upright operation. The cap and neck ring shall be similar to Soda Acid type extinguisher.

(c) All internal and external components and surfaces shall have anti-corrosive coating of not less than 12 microns applied uniformly as indicated below:

(a)	Body	Mild Steel	Tin alloy
(b)	Cage for acid bottle and spring	Brass sheets	Lead or Tin alloy
(c)	Discharge fittings	Leaded-tin bronze	Tin alloy
(d)	Stainer	Brass sheets	Lead or Tin alloy

3.2 **Carbon dioxide type.**

(a) The extinguishers shall be rated for 2.0 and 4.5 kg by weight of carbon dioxide, unless otherwise stated. The contents shall be with a filling ratio not exceeding 0.667.

(b) The discharge head shall be simple and to operate conforming to IS: 3224 - 2002 with a safety release as per IS: 5903 - 1970 set to 18.0 to 20.0 N/mm^2. A siphon tube of copper or PVC shall be fitted. A non -conducting discharge horn and a high-pressure hose (27.5 N/ mm^2 pressure) shall be fitted with each extinguisher.

(c) The discharge system shall be to designed to expel 95% of the contents in continuous discharge as follows:

Capacity (kg)	Time (sec)
2	8 – 18
3	10 – 20
4	9 – 24

4 GENERAL REQUIREMENTS

(1) All extinguishers shall be standard products, approved by the Tariff Advisory Committee and Local Fire Authority, manufactured and tested strictly in accordance with the relevant Indian Standard. All markings and test results shall be stamped in the appropriate colour markings according to the Indian Standards.

(2) All Extinguishers shall have a structurally designed galvanized steel handle and a suitable wall-mounting bracket.

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CHAPTER – 7 TECHNICAL SPECIFICATIONS AND DRAWINGS

Appendix- 3: FIRETRACE TUBE SYSTEM

1 GENERAL

(a) The Fire Trace Tube System shall be simple self-activating system and shall offer the widest Versatility. The system shall not have any complex electronics or any moving parts.

(b) Fire trace tube system shall have a flexible detection and delivery system called Fire Trace Tubing. The tubing shall be manufactured from specially processed polymer materials to achieve the desired heat detection and delivery characteristics.

(c) The Fire Trace Tubing, which is pressurized, shall be placed within an enclosed aera above potential fire hazards and secured in place with brackets provided.

(d) The Fire trace system shall discharge the extinguishant directly from the burst hole in the tube, this will be the closest point to the fire, and will allow the fastest extinguishing time and minimum spread of the fire.

(e) The Fire trace automatic fire extinguishing systems shall not need any external energy / power supply. The fire trace system shall always operative even during energy break down.

(f) The Fire trace automatic detection shall be considered as a lineal heat/flame detector. When the temperature is increased to above 120 deg. C or the Fire trace automatic detection tube is touched by a flame, the tube bursts and initiates the diffusion of the extinguishing medium.

(g) The design of the Fire trace automatic fire extinguishing system shall be simple and allow for a minimum of maintenance work. The system shall have reduced risk of malfunction because there are virtually no moving parts and shall reduces the risk of false alarms. The Fire trace automatic detection tube shall be capable of working even when contaminated with oil, dust and debris as long as the contamination will allow heat to pass through to the tube.

(h) The System shall not require specialist equipment or highly trained installers.

(i) The Fire trace automatic fire extinguishing system shall be minimally affected by vibrations or similar disturbances since there are no mechanical function mechanisms or electric contacts.

(j) Fire traces systems shall be suitable for Clean Agent Gas and all other high pressure applications. Fire trace shall have the ability to provide automatic protection.

2 INSTALLATION:

(1) The red Firetrace Detection Tubing (FDT) shall run into and throughout the cabinet, ensuring that detection is close at hand should a fire start.

(2) Should a fire break out, the point on the pressurized FDT nearest the heat source will burst, allowing the fire suppression agent to flow from the Fire trace cylinder through the tubing and out of the rupture hole directly at the source of the fire. The result is a long discharge of agent in the immediate vicinity of the fire, suppressing the fire where it starts.

(3) The following items shall be provided for each panel:

i. 9.0 kg capacity $C0_2$, IHP Valve Assembly with automatic valve, push in connector for tube, 9.0 Kg $C0_2$ & mounting bracket — 2 nos.
ii. Filling Adopter — 2 nos.
iii. Outlet Adopter — 2 nos.
iv. Pressure Switches for monitoring system activation — 2 nos.
v. End of Line Adopter - 2 nos.
vi. Fire trace make linear pneumatic heat Detection Tube with all necessary fittings & supports 170 meter

vii. Master Control Unit for controlling each system complete with pressure switches buzzers and electronic hooters including all necessary accessories + electrical wiring to make each entire system functional — 2 nos.

viii. Auto weight measuring Unit for Cylinders with automatic audio/visual Alam — 2 nos.

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CHAPTER – 7 TECHNICAL SPECIFICATIONS AND DRAWINGS

Appendix- 4: Technical Specification for Compact Substation (CSS)

1. GENERAL:

Supply, installation, testing and commissioning of Compact Sub-Station (CSS) (11/0.44 kV) consisting of 11 kV Compact VCB panel (1 incoming isolator + 1 outgoing ACB with air insulated BUS PT metering module) with DRY type Transformer (250 kVA) Capacity and LT Switchgear with all HT & LT inter- connections, accessories, fittings & auxiliary equipment inside GI enclosure etc.

2. DESIGN CRITERIA

(a) Package substation consisting of 4 way, 11kV SF6 insulated switchgear with 630A at 11 kV vacuum circuit breaker, 11kV/440V, 250 kVA dry type transformer, 440V, 630A VCB incoming with all connection, accessories, fitting and auxiliary equipments in an enclosure to supply low voltage energy from high voltage system as detailed in this specification. The complete unit shall be installed on a substation plinth (base).

(b) The prefabricated package substation shall be designed for (a) compactness, (b) fast installation, (c) maintenance free operation, (d) safety for worker/ operator.

(c) The switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials.

(d) The continuous operation at specified ratings temperature rise of the various switchgear components shall be limited to permissible value stipulated in the relevant standard and/ or of this specification.

(e) The enclosure of high voltage switchgear-control gear, low voltage switchgear-control gear and transformer of package substation shall be designed to take minimum space for the installation including the space required for approaching various doors and equipment inside.

3. SYSTEM DETAILS

3.3 (a) The main components of prefabricated substation are transformer, high voltage switchgear-control gear, low voltage switchgear-control gear and corresponding interconnections (cable, flexible busbars) and auxiliary equipments. The components shall be enclosed by either common enclosure or by an assembly of enclosure. All the components shall comply with their relevant IEC standards.

(b) The enclosure shall be made of CRCA sheet powder coated 7 tank process for all weather conditions. The metal base shall ensure rigidity for easy transport & installation. The protection degree of the enclosure shall be IP23 for LT & HT switchgear compartment and transformer compartment. Proper/ adequate ventilation aperture shall be provided for natural ventilation by way of Louvers etc. The doors shall be provided with proper interlocking arrangement for safety of operator.

(c) The LV outgoing of the transformer shall be connected to incomer of the Low Voltage Switchgear by means of Copper Cables / Flexible Copper Busbars.

3.4 **Internal Fault:**

Failure within the package substation due either to a defect, an exceptional service condition or mal-operation may initiate an internal arc. Such an event may lead to the risk of injury, if persons are present. It is desirable that the highest practicable degree of protection to persons shall be provided. The design for internal arc fault shall be tested for 20KA as per IEC 61330/ 62271-202.

3.5 **Covers and Doors:** Covers and doors are part of the enclosure. When they are closed, they shall provide the degree of protection specified for the enclosure. Ventilation openings shall be so arranged or shielded that same degree of protection as specified for enclosure is obtained. Additional GI/stainless steel wire mesh shall be used with proper danger board for safety of the operator. All covers, doors or roof shall be provided with locking facility.

3.6 **Earthing:** All metallic components shall be earthed to a common earthing point. It shall be terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/ strips and lug arrangement. The continuity of the earth system shall be ensured taking into account the thermal & mechanical stresses caused by the current it may have to carry. The components to be connected to the earth system shall include:

(a) The enclosure of the package substation,
(b) The enclosure of high voltage switchgear and control gear from the terminal.
(c) The transformer tank
(e) Frame of substation.

3.7 There shall be an arrangement for internal lighting activated by associated switch for HV, transformer and LV compartments separately.

3.8 **Labels:** Labels for warning, manufacturer's operating instructions etc. shall be durable & clearly legible.

3.9 The Circuit Breaker shall control 11kV/ 415V transformer of rating 250 KVA and relay settings shall be selected accordingly.

3.10 **General Finish:** Totally enclosed, metal clad, vermin and dust proof suitable for tropical climate use as detailed in the specification.

3.11 **Ratings:** The busbars shall have continuous rating of 800A. Circuit Breaker shall have a continuous rating of 630A in accordance with relevant IEC standard. Switchgear shall be complete with all connections, busbars etc.

3.12 **Breaking and Making Capacity:** Circuit Breaker shall be capable of having rupturing capacity of 20 kA symmetrical at 11 kV.

3.13 **Isolator (Load Break Switch):** The Isolators shall conform to IS: 4710/9920 (latest version). The isolator shall be ON load type, triple pole, spring assisted, hand operated, non-automatic type with quick break contacts and fault indication. The operating handle shall have three positions 'ON', 'OFF' and 'EARTH' which shall be clearly marked with suitable arrangement to padlock in any position. A safety arrangement for locking shall be provided by which the isolator operation shall be prevented from 'ON' position to 'EARTH' position or vice versa.

3.14 (a) (i) Vacuum Circuit Breaker (VCB): The Unit shall consist of 630A, 11kV, 3-phase spring assisted three position, three pole vacuum circuit breaker, with integral fault making/ dead breaking earth switch. The function shall be naturally interlocked to prevent the main and earth switch from being switched 'ON' at the same time and the VCB shall not be allowed to trip in 'Earth On' position. The selection of the main/ earth switch lever on the panel, which is allowed to move only if the main or earth switches in the off position. The lever shall be able to pad locked in either the main or earth position.

(ii) The manual operation of the vacuum circuit breaker shall not have an effect on the trip spring. This should only be discharged under a fault (electrical) trip condition. The manual

reset operation should recharge the trip spring and reset the VCB mechanism in 'main off' position.

(iii) **Protection Relay:** The CB shall be fitted with self-powered relay inside the front cover to avoid any tampering. The relay should be 3 Over Current and 1 Earth Fault, fed by protection CT mounted in the cable box.

3.15 (b) **(i) Air Circuit Breaker (ACB):** The Unit shall consist of 630A, 440V, 3-phase, tee-off spring assisted three position, three pole air circuit breaker, with integral fault making/ dead breaking earth switch. The function shall be naturally interlocked to prevent the main and earth switch from being switched 'ON' at the same time and the ACB shall not be allowed to trip in 'Earth On' position. The selection of the main/ earth switch lever on the panel, which is allowed to move only if the main or earth switches in the off position. The lever shall be able to pad locked in either the main or earth position.

(ii) The manual operation of the air circuit breaker shall not have an effect on the trip spring. This should only be discharged under a fault (electrical) trip condition. The manual reset operation should recharge the trip spring and reset the ACB mechanism in 'main off' position.

3.16 Cable Box:

The VCB shall be provided with suitable and identical cable boxes in front for connecting 2 runs of 3 core X 120 sqmm, 11 kV cable from vertically below. The cable boxes shall be so located at convenient height to facilitate easy cable jointing work. The height available for cable termination should be minimum 500 mm. The Cable termination shall be done by heat shrinkable termination method so adequate clearances shall be maintained between phases for termination. It shall be possible to terminate 2 runs of 3 Core X 120 sqmm cable.

3.17 Locking Arrangement: Suitable padlocking arrangements shall be provided as stated below.

(a) CB manual operating handle in the "OFF" position.
(b) Each feeder Panel operating handle in 'Closed', 'Open" or 'Earth' position.

3.18 Ratings:

	Vacuum Circuit Breaker (VCB)	
1)	**Circuit Breaker**	
a)	Type	Vacuum Circuit Breaker
b)	Rated voltage	11 kV, 3-phase
c)	Load Breaking current	20 kA
d)	Making current	50 kA
e)	Rated current	630 amp
f)	No. of poles	3
g)	Operating mechanism.	Trip free & free handle type with mechanically operated and pad locking
2)	**Busbars:**	
a)	Material	Copper
b)	Rated Current	630 Amp
c)	Short time rating for 3 Sec.	20 A

3)	**Isolator**	
a)	Type	Load break switch
b)	Rated current	630 Amps
c)	Rated breaking capacity	630 Amps
d)	Fault making capacity	50 kA peak
e)	No. of poles	3
f)	Operating mechanism	Operating handle with ON, OFF, Earth position with arrangement for padlocking in each position.
4)	**Isolator**	
a)	Type	Off Load break switch
b)	Rated current	630 Amps
c)	Rated breaking capacity	630 Amps
d)	No. of poles	3
e)	Operating mechanism	Operating handle with ON, OFF, Earth position with arrangement for padlocking in each position.

4 11kV/440V, 250 kVA, CAST RESIN DRY TYPE TRANSFORMER SPECIFICATION

SN	Descriptions	Unit	Specification
1	Service		Continuous
2	Type		Cast Resin Dry Type
3	Rating	kVA	250
4	Rated frequency	Hz	50
5	Number of Phase		
	HV Side		3
	LV Side		3
6	Rated Voltage		
	HV side	kV	11
	LV side	kV	0.440
7	Vector Group		Dyn 11
8	Type of Cooling		AN (Air Natural)
9	Class of insulations		Class F
10	Method of earthing- LV		Solidly Earthed
11	Duty		Continuous
12	Taps		
	a) Range	**%**	+5% to -5%
	b) No. of Steps		Five
	c) In steps of		2.5
	d) Tapping Provided on HV Side		Taps Provided on HV side
13	Tap Changer Type		Off Circuit Tap Links
14	Reference Standards		IS 2026/IS 11171
15	Fittings and Accessories		
	a) Off circuit tap links		Yes
	b) 02 nos. Earthing Terminal		Yes
	c) Rating and Diagram Plate		Yes
	d) Lifting Lugs for Complete Transformer		Yes

	e) Cover Lifting lugs		Yes
	f) Rollers		Yes

5 Low Tension (LT) Panel:

(a) **Nominal voltage**: 3 Phase, 440V, 50 Hz
(b) **Neutral:** Solidly earthed at substation**.**
(c) **Busbar:** 800A copper
(d) **Circuit Ways:** 630A, 3-pole, Air Circuit Breaker(ACB), fixed type with Over Current, short circuit and Earth Fault Releases (Microprocessor based).

(e) **Earthing:**

(1) Earthing arrangement shall be provided for earthing of each armoured cable, neutral busbar, chassis and framework of the cubicle with separate earthing terminals at two ends. The main earthing terminals shall be suitably marked. The earthing terminals shall be of adequate size, protected against corrosion, and readily accessible. These shall be identified by means of sign marked in a legible manner on or adjacent to terminals.
(2) Neutral bus bar strip shall be connected to Earthing terminal with help of GI strip of suitable capacity & GI nut, bolt, washer arrangement.

6 **ROUTINE TESTS FOR THE PACKAGE SUBSTATION COMPLETELY ASSEMBLED**:

(a) **Routine Tests:** The routine tests shall be made on each complete prefabricated substation. These tests shall include but not limited to the following:

(1) Voltage tests on auxiliary circuit.
(2) Functional test.
(3) Verification of complete wiring.
(4) VCB, ACB, busbars etc

(b) **Test Certificates**:

The test reports of all the tests carried out at the works shall be furnished in three (3) copies to the Engineer.

7 CODES AND STANDARDS

7.2.2.1.1 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standards. The 11 kV package substation design must be as per IEC- 61330.

7.2.2.1.2 The package substation offered shall in general comply with the latest issues including amendments of the following standards:

Description	Standard
High voltage low voltage prefabricated substation	IEC-61330/ 62271-202
High voltage switches	IEC-60265
Metal enclosed high voltage switchgear	IEC-60298/ 62271-200
High voltage switchgear	IEC-60694/ 62271-100
Low voltage switchgear and control gear	IEC-60439/ 60947
Power transformers	IEC-60076

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CHAPTER – 7 TECHNICAL SPECIFICATIONS AND DRAWINGS

APPENDIX-5: LIST OF DRAWINGS

LIST OF DRAWINGS

Electrical Drawings

SN	Description	Drawing No.
1	Indicative LT Supply System with Local, DG and Auxiliary Transformer Supply	GC-HRIDC-C5-DRW-ELE-001-A1
2	Indicative LT Supply Distribution Diagram	GC-HRIDC-C5-DRW-ELE-002-A0
3	Indicative Arrangement of decorative street light pole at station and platform	GC-HRIDC-C5-DRW-ELE-003-A1
4	Indicative cable route plan for track crossing of power cable and route marker	GC-HRIDC-C5-DRW-ELE-004-A0
5	Indicative earthing arrangement of electrical system by copper cladded electrode	GC-HRIDC-C5-DRW-ELE-005-A0
6	Indicative schematic drawing of 11kV power supply arrangement	GC-HRIDC-C5-DRW-ELE-006-A0
7	Indicative LT Supply System with Local and Auxiliary Transformer Supply	GC-HRIDC-C5-DRW-ELE-007-A1
8	Indicative Compact Substation (CSS) single line diagram	GC-HRIDC-C5-DRW-ELE-008-A0
9	Indicative viaduct lighting drawing	GC-HRIDC-C5-DRW-ELE-009-A0

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Section VII: Employer's Requirements
Section VII-7B: Signalling & Telecom (S&T) Works

Table of Contents

Chapter 1

Relocation of S&T Cables in Connection with Civil Works under Package C-5 of HORC Project

1. Introduction

1.1 Signaling & Telecom cables and location boxes in Prithla Station area and beyond are infringing into earth work of formation in connection with laying of New BG Double Railway line from Ch: (-) 2.296 Km to 10.00 Km including Prithla Station of HORC project. These cables and location boxes need to be shifted/ replaced with new cables and location boxes on alternate route, as decided by the Engineer.

2. Scope of the Works:

Scope of the Works broadly includes supply of material and execution of work as given below:

2.1 Supply of major materials-

2.1.1 Supply of Signaling cable 6, 12 & 24 core dia. 1.5 mm as per RDSO Specification IRS-S-63/2014 {Rev. 4.0}/(latest).

2.1.2 Supply of Location Box as per RDSO drg. no- RDSO/S-11500 & RDSO/S-11507 /(latest) and termination material etc.

2.1.3 Supply of relays Q-series as per specification BRS 930/ BRS 931/(latest).

2.1.4 Supply of 24F OFC as per RDSO specification IRS-TC-*110/2020*/ (latest).

2.1.5 Supply of 6 Quad Cable as per RDSO specification no. IRS TC: 30/2005 /(latest).

2.1.6 Supply of HDPE duct as per RDSO specification- no. RDSO/SPN/TC/45/*2013* Rev 2.0/ (latest)

2.1.7 Supply of DWC pipe as per RDSO specification no. RDSO/SPN/204/2011 ver 0.1/ (latest).

2.1.8 Supply of material for OFC & quad cable jointing and Splicing termination etc as per RDSO/TEC specifications/ (latest).

2.2 Execution of work

2.2.1 Trenching, protection work and laying of cables and backfilling.

2.2.2 Installation of Location boxes with proper foundation as per drawings, providing fittings for installing equipment- & terminating cables etc.

2.2.3 Termination /Splicing of Cables and testing etc.

2.2.4 Transfer of S&T circuits in new cables laid.

2.2.5 Releasing of old material from site.

2.2.6 Documentation of completed work and handing over to DFC.

3. The Signalling and Telecom work shall be carried out as per technical requirements, approved guidelines, practices and drawings as enclosed in **Chapters 2** and **3 below**. For items where the specifications are not specifically indicated above, the material shall be as per RDSO/ TEC specifications or from approved sources as per BIS. The drawings for the execution of works are given in Section VII-8: Tender Drawings and Documents, Part 2-Employer's Requirements.

[End of Chapter 1]

Chapter 2

Technical Requirements- Signalling Cable Laying, Termination and Testing

1. Signalling Cables

1.1 The cables for carrying **outdoor Signalling circuits** shall be PVC insulated, PVC sheathed and armoured unscreened cable conforming to IRS specification, described in scope of work above. The cable shall be of **6/12/19/**24 core with annealed copper conductor having minimum cross-sectional area of **1.5 sq.mm.**

1.2 The cables for carrying **Signalling power supplies** outdoor shall be copper conductor, minimum conductor size **25 sq. mm,** Multi strand PVC insulated armoured, unscreened, underground power cable as per IRS specification described in scope of work above or equivalent BIS specifications.

1.3 The **Quad cable used for Axle Counter circuit** shall be 0.9mm 6 Quad Telecom underground polyethylene insulated jelly filled (PIJF) cable as per RDSO specification described in scope of work above.

1.4 The **Optic Fiber Cable** for the Signalling system shall be provided as per RDSO Specification described in scope of work above. The OFC shall be laid in 40/33mm HDPE duct and spliced/ terminated.

1.5 Indoor Cable/ Wire used shall be single/multi core, plain annealed high conductivity copper conductor, PVC insulated unarmored as per IRS specification described in scope of work above. All equipment shall, be wired as per the requirement of the relevant RDSO specification of the equipment and/or as specified by the OEM. The Q style relays shall be wired with 16/0.2 mm multi strand wire.

1.6 All cables shall be adequately rated for their current carrying capacity. All power cables shall be able to withstand full load current for peak operation.

1.7 A **labelling** scheme shall be applied for all cables installed. Each cable shall be uniquely identified. Labels shall be tied at both ends, at entry and exit points of cable trays, ducts and trenches and at other appropriate locations where necessary. The type of labels to be used shall be approved by the Engineer.

1.8 The **DWC-HDPE pipe/duct** used for protection of Signalling cables **below the track/ road, on the slope of embankment for crossing bridges, on the top of PCC/RCC bridges, Cable duct in tunnels** or any other place shall be supplied as per RDSO specifications described in scope of work above.

1.9 Medium type "B" Grade **GI Pipe** (blue colour strip) perforated shall be provided on the top level of all OWG bridges.

1.10 On top of PCC/RCC bridges, if concrete cable duct is not available then GI pipe with suitable support shall be provided with concrete cover.

1.11 Signalling cables shall be laid in RCC ducts in station areas, and protected with RCC covers. Since HORC has most of the railway alignment at 6-8 meters elevated from ground, the ducts shall be laid inside the edge of formation with approval of the Engineer. Outside the station area i.e., beyond Home Signals, the signalling cable shall be protected with 'B' class bricks laid perpendicular to trench.

1.12 Signalling and Telecom cables shall be laid in separate trenches to the extent possible. If that is not possible a brick separation shall be provided.

2. Cable Core Allocation

2.1 A cable core distribution plan shall be prepared for each installation. Separate cables may be considered for line wise and function wise cabling.

2.2 Preferably 6/12/24 core outdoor signalling cables shall only be used.

2.3 Adequate spare conductors, a minimum of **20% of the total conductors (min 2 core)** used shall be provided for each main cable up to home signal and **10% (2Crores min) up to distant signal**. All branch/tail cables shall have at least **10% spare cores** (min. 2 cores). The spare conductors shall be provided in the outermost layer. All spare cores shall be made through up to the end points and terminated. For signals far from relay room (viz. distant signal), **double cores in cable** may be provided.

2.4 Where a number of cables have been used, the circuits shall be so distributed that the cables can be disconnected for maintenance purposes with the least possible dislocation to traffic. Line-wise and if necessary, function-wise cables shall be provided.

2.5 A separate cable shall be used for operation of each point/crossover. **Operation and detection circuit** shall work on different cables.

2.6 **UP and DN track vacancy detection systems** shall be in different cables.

2.7 The quad cable used for signalling functions shall also **have 20% (2 core min) spare** conductors.

3. Cable Route Plan

3.1 After deciding the size and the number of conductors in the different types of cables to be used on a route, a foot survey along the track shall be done to determine the best route for the cable.

3.2 While planning the cable route, any future yard modification etc. shall also be kept in view.

3.3 As far as possible low-lying areas, platform copings, drainages, hutments, rocky terrains, points and crossings, shall be avoided.

3.4 The cable route plan shall **show the actual alignment of track, giving offsets from permanent way** or permanent structures at regular intervals. The diagram shall indicate the various **road and track crossings, crossings with electric power cables, oil & gas, water and sewage lines** and other items of importance.

3.5 All cable routes shall be carefully coordinated with all the interfacing parties. The cable trenching work shall be taken in hand only when the cable route plan has been approved by the Engineer.

3.6 The cable shall be laid in the HORC/IR land and as advised by Engineer.

4. Storing & transportation of cable

4.1 Cable drums shall not be stacked on flat side. Suitable stoppers shall be placed for stability.

4.2 Cable drums shall have easy access for lifting and moving.

4.3 When rolling the cable drum either for unloading or transportation, the drum shall always be rotated in the direction of the 'arrow' which is marked on the drum.

4.4 The drums shall not be rolled over objects that could cause damage to the protective battens of the cable.

4.5 When unloading is carried out from the vehicle the drum shall not be dropped on the ground directly to avoid damage due to impact. A fork lifter or ramp shall be used.

4.6 During all stages of storage, it is essential that the ends of the cable are effectively sealed by end cap or in any other approved manner to avoid water entry into the cable.

4.7 It is desirable that cable drums are stored in covered shed to protect against direct exposure to sun/rains.

5. Paying-out the Cable

5.1 For paying out cables, the cable drums shall be mounted on cable wheels. It shall be ensured that no kink is formed while paying out the cable.

5.2 Cable drum shall never be kept on its side and cable uncoiled since this can result in twisting of cable conductors resulting in damage to them.

5.3 The drum on the wheel shall be brought to one end of the trench and the end of the cable freed and the cable shall be laid along the trench.

5.4 The cable drum shall be brought as close to the cable trench if possible. The cable drum shall clear the ground by 5 to 10 cm.

5.5 The wooden battens on the drums shall be carefully removed shortly prior to laying and before the drum is mounted on the jack.

5.6 A party of labourers shall move along the trench carrying cable at suitable intervals so that cable is not damaged due to dragging along the ground or bent unduly.

5.7 The in-charge of cable laying shall ensure proper synchronization of all labourers for smooth laying.

5.8 In cases where the wheels are not available, the drum shall be mounted on an axle at one end of the trench and cable paid out and carried by labourers.

5.9 In no case, shall the drum be rolled off onto the road for laying the cable and the cable dragged on the ground for laying purposes.

5.10 Whenever mechanized equipment is used, the work shall be carried out by a trained operator under the supervision of the Engineer or its authorized representative.

5.11 Where the cable drum is in damaged condition the cable may be placed on a horizontal revolving platform and the cable paid out in the same manner as given in paras above.

5.12 Paying out of cable shall be done by rotating the cable drum and not by pulling the cable with excessive force.

5.13 Wherever flaking of cable is required, it shall be done by making a succession of loops in the form of Figure of '8', these loops being disposed on top of each other to avoid tangling of cable. Figure of '8' flaking shall only be carried out under the direct supervision of an experienced official.

6. Excavation and Backfilling of the Trenches

6.1 Manual trenching is recommended for laying of Signalling cables in the station yards from Home-to-Home signal and mechanized trenching is recommended beyond the Home signal.

6.2 Digging of trench between IR track and HORC track shall be manual or mechanized as proposed by the contractor as per site survey/feasibility and approved by the Engineer for every Station & Automatic section separately.

6.3 Excavation of Cable Trench shall be made in all kinds of soils including clearing roots of trees, rocks, etc. During excavation, the earth of the trenches shall not be thrown on the ballast. The earth shall be thrown by the side of the trenches away from track.

6.4 Trenches shall be straight as far as possible and steep angles shall be avoided.

6.5 The width of manually made cable trenches shall be commensurate with the number of cables. The approx. width shall be kept as **0.3 metres o**r as required to accommodate cables.

6.6 It is desirable that the excavation of the trenches is not done in long lengths and does not remain uncovered for long period. It shall be preferable that cables are laid and refilling done within- short time.

6.7 Before commencement of the laying, inspection of the trench and inspection of protection works shall be carried out by the Engineer so as to ensure their conformity with the specification.

6.8 After cable has been laid and until the whole of the cables to be laid in the trench have been covered with their protective covers, no sharp metal tool such as spades, crowbar or fencing pins shall be used in the trench or placed in such a position that they may fall into the trench.

6.9 For **road/platforms/railway track crossing**, trenchless horizontal directional drilling (HDD) technique shall be adopted under the supervision of competent staff for laying of RCC/GI/DWC-HDPE pipe. Both ends of RCC/GI/DWC-HDPE pipes shall be closed properly using accessories and the pits shall be properly backfilled. There shall be no damage to the road/platform/tracks or any such structures etc. enrooted during or after the HDD operations.

6.10 The backfilling of the trenches shall be done properly. The earth excavated shall be put back on the trench rammed and consolidated.

7. Cable Laying Underground

7.1 The cables may be laid underground, either in the trench, in ducts, in cement troughs, in pipes or in any other approved manner.

7.2 Cable laying in ducts-RCC ducts/ Half split DWC pipe be used for laying the cable from Home-to-Home Signal in Station yard. The ducts shall have suitable covers and shall rest on walls of duct as per Tender drawings (Guidelines of cable laying).

7.3 The cables shall generally be laid keeping in view all the relevant provisions of Signal Engineering Manual of IR and Tender drawings (Guidelines of cable laying)

7.4 Before commencing work on any part of the site, the Contractor shall ascertain that the Engineer and also, where applicable, the local and statutory authorities or other bodies/persons concerned have reviewed the cable route. The Contractor shall further ensure that all necessary permits in such cases have been obtained and notices served.

7.5 Every precaution shall be taken to ensure that cables and equipment are not installed in a manner or under conditions likely to cause electrolytic or other corrosive action or damage to, or be detrimental to, the performance of the cables and equipment during operation.

7.6 Signalling cables shall not run parallel with cables carrying high voltages or heavy currents and shall conform to the requirements specified in BS 7671. Signalling tail cables shall be mechanically protected by DWC pipe of outer diameter 120mm to avoid being damaged from track side maintenance activities and shall be immune to any malfunction from electromagnetic interference.

7.7 All cables shall be laid along the track preferably **one meter** inside the HORC/IR boundary. If it is necessary to lay the cable outside the HORC boundary it shall be laid on the berm with interface with Civil contractor and approval of the Engineer. After back filling, compaction of the formation shall be done properly.

7.8 The cable laid parallel to the track shall be buried at a depth of minimum 1.0 meter (topmost cable) from ground level. However, in case of rocky soil, the depth may be reduced suitably with precast cement concrete slab of minimum 10 cm. thickness provided for protection of cables. When it concerns the laying of tail cables which serve the track apparatus etc., the depth shall not be less than 0.50 meters.

7.9 No sharp object like stone chips, iron pieces etc. shall ever come in contact with laid cables irrespective of the method of laying the same. The bottom of the cable trench shall be levelled and got rid of any sharp materials/ edges. In the soft ground, the cable shall be laid at the bottom of the trench previously levelled. In both the above cases, the cable shall be covered with a layer of sand or soft soil/ earth of 0.10 meter thickness and thereafter a protective cover of trough or a layer of bricks shall be placed in Automatic section and half split DWC pipe in station area shall be placed.

7.10 At each end of the main cable an extra loop length of **4 to 5 meter shall** be kept.

7.11 Before starting cabling work, location boxes shall first be erected so that cable after laying is directly taken inside location box and its multiple handling/damage by re-digging and taking inside Location box/Signal equipment Room is eliminated.

7.12 Signalling and Telecommunication cable shall be laid in separate trenches to the extent possible, however if laid in same trench a Brick separation shall be provided. Telecom cable shall be laid on both side of the Railway track.

8. Cable Laying in Electrified Area

8.1 The cable shall be laid at not less than one meter from the nearest edge of the mast foundations supporting the catenary or any other live conductor, provided the depth of the cable does not exceed 0.5 meters with suitable cable protection measures provided. When the cable is laid at a depth greater than 0.5 meters, a minimum distance of 3 meters between the cable and the nearest edge of the O.H.E. structure shall be maintained. If it is difficult to maintain these distances, the cable shall be laid in concrete/heavy duty HDPE/Ducts or any other approved means for a distance of 3metres on either side of the mast and the distance between the cable and mast may be reduced to 0.5 meters. Protection of signalling cables from power surges is necessary.

8.2 In the vicinity of the SP/SSP, the cable shall be laid at least one meter away from any metallic body of the station, which is fixed in the ground, and at least 5 meters away from the station earthing. The distance of 5 meters can be reduced to one meter provided the cables are laid in RCC/GI/DWC/HDPE pipes or any other approved means.

8.3 Where an independent Earth is provided for an OHE structure, i.e. where the mast is connected to a separate Earth instead of being connected to the rail, the cables shall be laid at least one meter away from such Earth.

8.4 Where there are OHE structures along the cable route, the cable trenches shall be as far as possible, and not less than 5.5 meters away from the centre of the Track.

9. Laying of Different Type of Cable in Same Trench

9.1 The OFC cable shall be laid/blown in lubricated HDPE pipe as per Telecom manual.

9.2 Where several cables of different categories have to be laid in the same trench, they shall be placed as far as possible in the following order starting from the main track side, so that in the event of failures, the maintenance staff may easily recognize the damaged cables:

(i) Telecommunication cable

(ii) Signalling cable

(iii) Power cable of S&T

9.3 A distance of approximately **10 cm must be** maintained between Telecommunication cable and Signalling cables. The Signalling cables must be separated from power cables/Telecom cables by a row of bricks placed between them as per sketch shown in Tender drawings (Guidelines for cable laying) of this document.

10. Cable Laying in Ducts

10.1 In the station area it is desirable to protect the cables in RCC ducts/Concrete cover of suitable design. The ducts shall also be considered where it is not desirable to lay cables directly in the trench like in close to habitation, marshy, rock mixed soil areas.

10.2 Cables for longer distances shall be laid on the bottom layer. Duct shall be filled with sand after cable is laid to avoid entry of rodents.

10.3 The ducts shall be of such design as to prevent collecting water in the duct.

10.4 Cables in any conduits, Pipes or ducts shall not occupy cross-sectional space of more than 50%.

10.5 When cables are laid in Pipes /RCC duct, care shall be taken to see that no ballast or stones have been dropped inside the Pipes /RCC duct. The Pipes/ RCC duct shall be cleared of all ballast and stones before the cover is secured. When the ends of covers are joined together with cement plaster, a piece of paper or wood shall be placed under the joint to prevent the cement plaster from falling on the cable.

10.6 After placing the Pipes /RCC duct in the trench the ducts must be aligned using an 8 mm rod. For this purpose, a hole is left in the Pipes /RCC duct for insertion of rods. Wherever there is a diversion proper care shall be taken to cover the cables, either by smoothly forming a curve with duct or a masonry structure can be constructed to protect the cables. After laying the cables the ducts shall be covered with RCC slab and shall be continuously plastered at the end with trunking/RCC duct.

10.7 Where it is necessary to take the cables between the tracks, it shall be carried in trunking/RCC duct kept sufficiently below the ballast level.

10.8 In the station area the S & T cables shall be laid in RCC/ Half split DWC duct as per sketch given in Tender drawings.

11. Cable Laying in Solid & Rocky Soil Area

11.1 In case of rocky soil, the depth may be reduced suitably.

11.2 Sharp edges on the sides must be smoothened out and bottom of the chase shall be levelled. In the rocky ground the cable shall be laid normally on layer of sifted earth of 50 mm thickness previously deposited at the bottom of the trench. Cable shall be covered with a layer of sand or sifted earth of 100 mm thickness.

11.3 In case sharp edge of rocky ground cannot be protected with sifted earth, concrete/ RCC/GI/DWC-HDPE pipe shall be used if numbers of cables are small. If the number of cables is large, RCC duct shall be used. In isolated cases, it can be given smooth surface by using either masonry bricks or cement concrete.

11.4 A row of bricks shall then be placed lengthwise on the top and joined with cement mortar and a layer of concrete with cement plaster shall be provided on the top of the same.

11.5 A sketch showing the laying of cables in rocky area is placed at Tender drawings of this document.

11.6 Laying in special soil condition: Cable shall not be run through abnormally high acidic or alkaline soil or through sewage. If this is unavoidable special measures shall be taken to prevent corrosion. Cable may be laid in the concrete/ RCC/GI/DWC-HDPE pipes properly jointed to prevent ingress of moisture.

Cable laying in residential area: When laying the cable in residential area, the cable shall be specially protected on both sides up to a distance of about 50-100 meters beyond the building line subjected to approval of Engineer. In such cases, the cable shall be protected by means of concreting of 50 mm as proposed for rocky soil/ in concrete/ RCC/GI/DWC-HDPE pipes. This is better than using bricks as in residential area bricks are usually found while digging and its special significance of cable protection may be overlooked.

12. Track Crossing

12.1 As far as possible, the cable shall be crossed from one side of the yard to the other, a minimum number of locations.

12.2 Track crossing shall be **through trenchless** method. The following precaution shall be taken:

(i) The cable crosses the track at right angles.

(ii) The cable does not cross the track under points and crossings.

(iii) The cable is laid in concrete/RCC/GI/DWC-HDPE pipes or suitable ducts or in any other approved manner while crossing the track.

(iv) Cable laid across the track must be1.0metre(minimum)below the bottom of the rail.

(v) No digging shall be done below the sleepers.

(vi) A sketch showing track crossing is placed in Tender drawings of this document.

13. Road Crossing

13.1 Road crossing shall be done through **trenchless** method. The cable shall be laid in concrete/ RCC pipes or in any other approved manner while crossing the road at the depth of **1 meter from the ground** level. It shall extend **1 meter (minimum)** on each side of the road keeping in view the future increase in the width of the road.

13.2 When crossing roads, it is necessary to lay the cables in such a manner as to avoid the necessity of bending the cable sharply and minimize the excavation of road surface as far as possible.

13.3 The crossing of main roads often involves difficulties, especially if traffic is heavy. Precautions to avoid accidents to workmen, pedestrians and vehicles shall be taken. On minor roads, which can be temporarily closed to traffic it is possible to open up across the entire width of the road, pipes shall be installed quickly in the cutting, which is then filled in there by reducing to a minimum the time for which the road is closed.

13.4 Some roads, which are broad, may be opened for half their width allowing the other half for use of traffic, pipes are laid, trench filled in the first half and the other half opened up after the first half is opened half is linked with those laid in the first half.

13.5 Whenever a cable is laid across an important road, particularly one with a special surface, space for future expansion may be provided. Either of the following methods may be adopted: -

(i) The size of the pipe shall be so chosen that provision for laying of additional cables in future is kept. Pipes having diameters ranging from 100 to 200 mm are suggested, or

(ii) A spare pipe may be laid, through which a cable can be drawn when required. It will be advantageous to leave a lead wire of G.I wire in the pipe for drawing the cable in future.

(iii) A separate pipe of suitable diameter shall be used for telecommunication cable.

(iv) A sketch showing the track crossing is placed at Tender drawings of the document.

14. Cable Laying on Bridges/Culverts

14.1 Wherever practicable, the cable may be taken underground across the drain bed at a suitable depth for crossing small culverts with low flood level. A sketch showing cable laying on culverts with low flood level is placed at Tender drawings of this document. Wherever cable may not be taken underground across the drain bed, cable shall be taken on the approach slopes of culvert through **GI pipe** of suitable sizes **with concrete cover** and blocks. A sketch showing cable laying on culverts with high flood level is placed at Tender drawings of this document. **The Civil contractor shall provide ducts on the concrete bridges, culverts, Viaduct and Tunnels on both sides.** The same may be used by the S&T contractor for laying of S&T cables. The cables in these ducts shall be laid in **HDPE/DWC** pipes.

14.2 When cables have to cross a **metallic bridge**, they shall be placed inside a GI pipe/ metallic through (filled with an anti-theft measure as sealing compound). The cable shall be supported across the bridge in a manner which would involve minimum vibrations to the cable and which will facilitate maintenance work. Adequate cable length to the extent 5 to 6 meters shall be made available at the approaches of bridge. A sketch showing cable laying on metallic bridges is placed at Tender drawings **(Guidelines for cable laying)** of this document.

14.3 In case of arch bridges, cable shall be taken through **GI pipes on top of** the arch adjoining the parapet wall. The pipe shall be covered with ballast. Cement Concreting of 50 mm shall be done throughout from entry/exit end of cable up to diversion point including slope on either side. The entry and exit ends of the cable from the pipe to the diversion point of the cable shall be concreted for 1 metre (minimum). A sketches showing cable laying on arch bridges are placed at Tender drawings of this document.

14.4 On PCC/ RCC box Bridges, concrete duct (300mmx300mm minimum) on the side of HORC tracks shall be provided by the **Civil Contractor** for laying of cables. All Outdoor Signalling cables and Telecommunication Cables (OFC cable, Telecom Quad Cable & PIJF Telephone Cables etc.) on these Concrete Bridges & Culverts shall be laid inside DWC Pipes. OFC cable shall be laid inside the HDPE duct. Entry/Exit of the Cables to/from Bridges & Culverts shall be suitably protected by concrete cover. The Contractor shall carry out necessary co-ordination with Civil, Structure & Track Contractor in this matter. Cable shall be laid in Double Wall Corrugated (DWC) Pipes in the slope to climb from ground to top level of bridges. It shall be so laid to maintain a continuous depth of 1 meter (top of DWC Pipe) from the nearest ground level. The slope of track formation shall be restored to its original condition after laying of cables.

14.5 On steel girder bridges, GI pipe shall be laid with suitable clamps/channels etc.

14.6 As the laying involves movement of a large number of staff over the bridge the line shall be blocked, and flagman posted on other side. On a double line only the line near which the cable is being laid shall be blocked but care shall be taken to see that staff is aware of this and measures taken to prevent staff from straying on to the unblocked line.

14.7 Damage to cable is likely to occur if care is not taken in laying cable where the bed changes from solid support such as a foundation, pier of bridge to soft support such as soft soil. The cable must

not press against the edge of the solid support. The soft soil near the edge must be tamped and the cable raised slightly.

14.8 To prevent theft and miscreant activities on the approach of cable to bridge/culvert where it is not possible to ensure adequate depth, **concrete protection** is proposed.

14.9 To cross the bridges full DWC pipe shall be provided on the slope at the distance of about 500mm from the edge of retaining wall.

15. Cable Laying in Monsoon Season

15.1 Cable laying in monsoon when the precipitation is heavy shall be avoided. The trenches will be inundated and visual inspection of the bedding of the trench will be rendered difficult. Threading the cable in pipes will also be more difficult.

15.2 When cable laying is necessary during the rainy season, the cable ends shall be inserted in a pipe sealed at one end and the pipe buried. Termination work shall be started only when there is a likelihood of a clear weather for three to four days.

16. Laying of Cable Above Ground

16.1 Signalling cables for outdoor circuits shall not normally be laid above ground. In exceptional cases where it becomes unavoidable, the following precautions shall be taken:

(i) The cable shall be suspended in wooden cleats, from cable hangers or in any other approved manner so that no mechanical damage occurs to the cable even under exposed condition.

(ii) The cable supports shall be so spaced as to avoid sag.

16.2 **Cable Markers:** Underground Cable Route shall be identified by **concrete markers** directly buried inside the trench at **100 m interval** and at diversion and track crossing points within the Station section from home to home with the approval of Engineer. Outside station section **concrete type cable route route marker** be provided **at every 100 m interval and at diversions, track road/crossing points bridge approach** with the approval of Engineer

17. Entry of Cable at Cabin, Relay-room, Location-boxes etc.

17.1 All cable entry points in the Signal/Telecom equipment room, battery room, SM's room, IPS room, MSDAC room at Station or S&T Huts, location boxes, junction boxes etc. shall be **properly sealed** using modular based cable and pipe sealing system/other approved means. All cable entries from/to adjacent rooms through overhead duct/ladder shall also be sealed.

17.2 All cable entrance ducts must **be closed with suitable masonry works, sand covered and plastering** to prevent entry of rats etc. RCC slab shall be provided on the cable pit of the Signalling/Telecom equipment rooms at the Stations and S&T Huts.

17.3 Cable shall be protected on both sides up to a distance of **10 meter beyond the building line** of Signalling/Telecom equipment rooms, Battery room, Power supply room, SM's room of Station and S&T Huts.

17.4 Damage to cable is likely to occur if care is not taken in laying cable where the bed changes from solid support such as a foundation/masonry to soft support such as soft soil. The cable must not press against the edge of the solid support. The soft soil near the edge must be tamped and the cable raised slightly.

18. Termination of cables

18.1 No jointing of Signalling cables is permitted. All cables shall be terminated. The number of termination locations shall be minimized, preferably by laying full length cable.

18.2 The cable termination of Signalling cables shall be undertaken on approved type of terminations with ease of maintenance and disconnection facility on CT racks/ location boxes/junction boxes.

18.3 All wire and cable conductors shall be clearly identified and numbered at each end using durable shrink on or tag type labels. A description of the terminating function shall be included. Each core so terminated shall be provided with identification marking on cable and on conductors/terminals and ferrules with letters or/numbers embossed on them as per requirement of circuitry. This will enable easy identification of conductors in case of any failures or cable disconnections or cable cut by outsider/miscreants. Proper marking and termination practice ensures quick and easy restoration during failures.

18.4 Unused cable cores/pairs of multi-core/pair cables shall also be terminated and marked so.

18.5 Crimping or other standard industry practice shall be used for terminating all conductors. Solder terminations shall only be used with the approval of the Engineer.

18.6 Wherever practical, multiple pin plugs and sockets shall be used to connect multi- core cables and wiring loops to all items of equipment. These shall have some form of keying to prevent incorrect equipment modules from being installed.

18.7 The cable terminations shall be secured enough to withstand vibration level that is likely to be experienced in the HORC environment.

19. Cable Termination Rack (CTR) and Location Box

19.1 Cable Termination Rack (CTR) with **20% extra** capacity for future expansion shall be provided.

19.2 **Only screw less terminals with isolation facility** shall be used for cable terminations. The terminals and fuses used shall meet the requirements of RDSO specification described in scope of work above. If any alternative terminal type is proposed for use, it should be got approved by the Engineer.

19.3 All external power/ signalling / data lines susceptible to lightning or high induced voltage shall be provided with **Stage-3 surge protection devices** as per available Para of this specification.

19.4 The Cable Termination Rack (CTR) shall be equipped with copper earth bar to which all cable shields shall be connected and soldered. The copper earth bar shall be connected to the earth.

19.5 The Outdoor cables shall be terminated in Location Boxes.

19.6 Location boxes shall be rugged and free from ingress of rodents, insects, dust, moisture, and water.

19.7 Location boxes shall be able to withstand vibration level, likely to be experienced alongside the track.

19.8 Location boxes shall be theft and vandal proof as far as possible and shall be able to withstand the climate of the region.

19.9 Cable entry points in the location boxes shall be filled with sand and plastered with cement.

19.10 Separate Location boxes shall be used for UP and DN line cables.

19.11 All location boxes shall be provided with 110 V AC LED lighting arrangement with ON/OFF switch to assist maintenance/repair work undertaken during the night.

19.12 The installation of Location boxes shall not be done on loose earth/ water logger area. It should be installed on proper concrete foundation. The foundation drawing shall be proposed by the Contractor and approved by the Engineer.

20. Testing of cable

20.1 Before the cable is laid in the trench, a visual inspection of the cable shall be made to see that there is no damage to the cable. It shall be tested for insulation and continuity of the cores. Thereafter, the cable shall be laid into the trench. Record of insulation and loop resistance must be maintained.

20.2 Testing of all main and tail cables after laying of the cable in trenches and also after termination in apparatus cases, in boxes and in relay room shall be done.

20.3 If any defect is noticed during the testing after laying the cable the same shall be replaced.

20.4 The insulation resistance tests shall be made when conductors, cables and insulated parts are clean and dry. An insulation tester shall be used for insulation testing. Any metallic sheath or metal work of any rack or apparatus case shall be bonded to earth during the test.

20.5 Insulation resistance so measured shall not be less than 5 mega ohms per km at buried temperature. If the insulation resistance is found to be lower than 5 mega ohms, the cause shall be investigated, and immediate steps taken to repair or replace the cable to prevent any malfunctioning of the equipment and circuits.

20.6 Supervision of cable laying: The work shall be supervised personally by an **official authorized by the Engineer. The cable trench shall be inspected by the authorized** person and jointly signed by him/her and the Contractor's authorized person before cable laying is undertaken on the request for inspection (RFI). The record of joint inspection of the trench shall be maintained.

21. Earthing and Bonding

General: Earthing shall be provided for all Indoor & Outdoor Signalling installations to achieve the following objectives:

21.1 Efficiently dissipate heavy fault currents and electrical surges, both in magnitude and duration, to protect equipment from being damaged to minimize down time, service interruption and replacement cost.

21.2 Provide a stable reference for electrical and RF circuits at the installation to minimize noise during normal operation.

21.3 Protection of personnel who work within the area from dangerous electric shock caused due to "step potential" or "touch potential".

21.4 To achieve the primary goal of assuring personnel safety and damage control, a low impedance path shall be made available to the current generated due to lightning or power system fault. The potential differences between any two points should be as low as possible. Safety considerations also require the equipment chassis or enclosure to be earthed to minimize shock hazards to system staff.

21.5 To achieve the secondary goal of providing protection for sensitive and interconnected electronic and electrical systems, earthing shall be designed to minimize the noise voltage generated by currents from two or more circuits flowing through common earth impedance and to avoid creating earth loops susceptible to magnetic fields and differences in earth potential.

21.6 The Earthing and Bonding system shall meet or exceed the requirements of IEEE 1100, NFPA 780, IEC 62561-7 and IEC 62305.

21.7 To minimize the effect of circulating earth loops and to provide equipotential bonding, "star type" bonding connection shall only be provided as required.

21.8 The contractor shall submit the design for Earthing and Bonding of Signalling and Telecommunication systems for review and approval by the Engineer. OEM's original data sheets of the proposed devices shall also be submitted along with the protection methods adopted in their design.

22. Indoor Signalling installation

22.1 The equipment rooms housing Indoor Signalling equipment and their power supply shall be provided with suitable earthing and bonding system.

22.2 There shall be one earth busbar in each equipment rooms viz. Signalling, power, telecom room etc. called sub equipotential earth busbar (SEEB). The earth bus bar located in the power supply equipment room shall be directly connected to Class 'B' SPD and the main earth pit, termed as main equipotential earth busbar (MEEB).

22.3 The SEEB shall have pre-drilled holes of suitable size for termination of bonding conductors. The SEEB shall be insulated from the building walls using low voltage fire resistant insulators. All terminations on the SEEBs shall be using copper lugs with spring washers.

22.4 All the equipment/racks in the equipment room shall be directly connected to its SEEB. Each of sub-equipotential earth busbar (SEEB) installed in the rooms shall be directly connected to main equipotential earth busbar (MEEB) using bonding conductors.

22.5 The routing of bonding conductors from equipment/racks to SEEB and from SEEB to MEEB shall be as short as possible and direct with minimum bends and separated from other wiring. The connection from SPD to MEEB shall be as short as possible and preferably without any bend.

22.6 The connection between any two moving parts like doors with Bonding Ring Conductor, etc. shall be connected by 316L Stainless Steel Flexible braids, which are UL listed, RoHS compliant and meeting IEC 60439.1 & IEC 61439.1.

22.7 All bonding connections, whether it is from equipment or SPD to respective lugs on bus bars or of the Main earth bond with the Main Earth electrode, shall be with stainless steel nuts and bolts and exothermic welding while keeping in mind the conditions of UL listing, IEEE 837 & tamper proof weld metals.

22.8 The Earthing system shall use maintenance free loop earth as per RDSO specification with latest amendment and shall be designed to give an earth resistance of less than 1 ohm. The design should be based on calculation methods as per IEEE 80 which require the parameters like target ohmic resistance value, soil resistivity, electrode length, electrode diameter etc. SM room equipment, Signalling equipment rooms/Object controller equipment room, IPS room, MSDAC room etc. shall be connected with this earth.

22.9 The earth electrode shall be made of high tensile low carbon steel circular rods, molecular bonded with copper on outer surface to meet the requirements of UL 467. The Ground Enhancement material should meet the requirement of IEEE 80's Clause 14.5 (d) and should be tested as per IEC 62561-7 standard. All the earth electrodes shall be bonded together using Galvanized Steel tapes or Copper Bonded Steel Conductors of suitable size in continuous length of max. up to 100 meter to achieve equipotential bonding. For Power supply equipment, MSDAC equipment etc. separate maintenance free earthing arrangement shall be provided.

22.10 Despite the provision of earthing, as specified above, if failures of solid state electronic equipment occur on account of finite earth resistance, particularly due to high voltage transients and lightning, further protection as necessary shall be provided.

23. Outdoor Signalling installation

23.1 All the Outdoor Signalling equipment viz. Signals, Location boxes etc. shall be provided with suitable Earthing arrangement with earth value **<5Ω.**

23.2 The target earth resistance value for outdoor Signalling equipment shall be in accordance with the requirement specified for the equipment by the OEM/RDSO specification.

23.3 The Signalling equipment having Solid State components and the enclosures housing them shall be provided with maintenance free earth using copper bonded steel electrode, earth enhancement compound and bonding connection through exothermic welding as per RDSO specification with latest amendments. Each MSDAC DP shall be provided separate one maintenance free earth electrode or more with Earth value shall be **<1Ω or OEM's design.**

23.4 In order to arrive at the required target resistance value, the number of earth electrodes should be decided based on the calculations involving soil resistivity as per the standards above, all interconnected in parametric ring form or in parallel manner.

23.5 Where the equipment to be earthed is in close vicinity they should be connected to a common earth in star configuration.

23.6 For **outdoor Signalling items installed in Location boxes**, one earth busbar of suitable size shall be provided in each location box and earth point of all equipment and cable armour etc. shall be terminated on this busbar. This busbar shall be connected to a normal earthing electrode.

23.7 **All Apparatus Cases and Signals shall be earthed with General/ Conventional earth pit.** Multi-strand single core PVC insulated copper cable as per IS:694, **10 Sq mm cable** shall be used to connect the Apparatus cases of signals with the earth pit. Cable shall be protected with the conduit.

23.8 **GI wire as earthing bond** shall not be used.

23.9 All earth pits shall have **concrete cover, painting of earth value and date of testing.**

[End of Chapter 2]

Chapter 3

Technical Requirements for laying of HDPE Duct, OFC, QUAD, PIJF Telecom and Other Cables

1. Telecom Cables

The following types of underground cables but not limited to shall be used for various telecom circuits:

1.1 PIJF cable 6 Quad 0.9 mm conductor Dia, as described in scope of work above, suitable for underground laying and are used for control circuits, block working and axle counters etc.

1.2 Multi pair (10 pairs to 200 pair), Multi Dia (0.5mm/ 0.63mm/ 0.9mm) PIJF (Polythene insulated Jelly Filled) Cable as per RDSO specifications, suitable for underground laying and are generally used for Telephone exchange subscriber lines or branch/ tail cables. A minimum of 10 pair PIJF armoured cables shall be used in this project.

1.3 OFC cable as per RDSO specification described in scope of work above.

1.4 HDPE duct as per RDSO specification described in scope of work above.

2. Cable Laying

2.1 The detailed guidelines for Signalling cable laying detailed in Chapter 2 and Tender drawings (Guidelines for Cable laying) are also applicable for telecom cable laying.

2.2 The outdoor cables (optical fibre cable inside HDPE duct, telecom PIJF Quad cable & PIJF telephone cables etc.) shall be laid within IR/HORC boundary and as far away from the track as possible. If it is necessary to lay cable outside the IR/HORC boundary, permission shall be obtained in advance from the concerned authority or cable can be laid on berm with interfacing with civil contractor and proper compaction after backfilling.

2.3 The Contractor shall prepare a Cable Route Plan in consultation with Civil structure Contractor and get it approved by the Engineer before starting the trenching work.

2.4 The Contractor shall supply all protection material like ducts/troughs/GI pipes/DWC/RCC pipes/ bricks etc. required for cable laying.

2.5 HDPE duct for OFC cable shall be laid in a trench with depth of 1.2 meter from the natural earth profile or from the rail level whichever is lower and width of 0.3 meter or as required and suitably protected.

2.6 The outdoor cables (PIJF Quad/ telephone cables etc.) shall be laid at 1 meter depth. Spare loop of min. 10 meters shall be kept before equipment room/location boxes /approach of bridges/ road & track crossings etc. Such spare cables in pits shall be adequately covered on suitable pits to protect against damage and theft.

2.7 The cable entry into equipment rooms/location boxes etc. shall be suitably sealed to prevent entry of rodents etc.

2.8 While splicing OFC cables, correctly coloured fibre splice protector shall be used to enclose each individual splice. Each fibre splice shall be tested to ensure correct fibre continuity and splice loss.

2.9 Before the cable is laid, it shall be tested for insulation and continuity of the cores. The continuity

of armour and screen of the cable also need to be checked before laying.

2.10 Bedding and armouring of the cable shall also be inspected to see that there has been no damage during transit or in storage.

2.11 Thermo-shrinkable jointing kit shall be used for jointing PIJF/Quad cables.

2.12 The screen and armour of cables shall be jointed with suitable wires. This is essential to get the specified screening factor in association with its earthing at stations. This should be done first to avoid any electric shock due to induction.

2.13 To achieve the specified screening factor and human safety, the metallic armour of the optical fiber cable, PIJF Quad and telephone cables, earthing (<10 ohm) shall be provided at stations and at required intervals in block section, user premises etc.

2.14 PIJF Quad cable and telephone cables shall be terminated on disconnection type terminal blocks complying with IEC 60947-7-1. These terminal blocks shall be made of polyamide 6.6 insulating material and shall use non-corrosive metal parts. These terminal blocks shall have provision for identification/number for each termination and shall be securely attached to mounting rails.

2.15 Wherever possible, standard multi-pin plug/socket shall be used to terminate multi-core cables for connecting to the equipment. Heat-shrinkable sleeves shall enclose all exposed and terminated contacts inside multi-pin connectors.

2.16 Splicing of OFC cable shall be done as per standard practice of Railways in RDSO/ TEC approved joint enclosures. Joint pits of approved type shall be provided to protect the OFC joint.

3. Testing of Cables Laid

3.1 During cable laying work cables section shall be tested after each joint is made to facilitate tracing of a fault during jointing. On discovery of a fault during the cable laying, the last joint must be opened out and defect rectified.

3.2 The wires in the cable must be tested just before laying and after laying and jointing and also regularly on the laid cable for the following:

i. Continuity

ii. Absence of crossed pair/quad

iii. Absence of conductor cores contacts

iv. Insulation resistance

v. Absence of contacts between wires forming a pair (short circuit)

vi. Transmission loss & crosstalk

vii. Continuity of armour and screen of the cable need to be checked before laying

3.3 To facilitate testing, every wire at the starting end shall be twisted with its mate to form a loop in each pair, each twist being insulated from other pairs by means of PVC sleeves.

3.4 In the case of multi-layer cable, the layers of the cable shall be separated with cotton thread or twine to keep the wires in their proper places, so that the position of faulty wire or pair may be easily ascertained.

3.5 The tests shall be conducted from the other end of the cable. After the test is over, the end shall be cut and sealed or terminated as per the requirements at site.

3.6 For continuity test, all conductors are to be bunched together and then earthed through the armour

and screen of the cable with a soft bare copper wire and connected to one probe of the Multimeter. Now any of the wire from the bunch may be separated and when touched to the other probe of the Multimeter, it should give continuity buzzer sound and loop resistance value. If the loop resistance value is substantially less than the calculated value as per the loop length, it indicates shorting within the pair.

3.7 Disconnect the mate of the wire under test from the bunch and this buzzer sound should disappear proving the absence of crosses and wrong contacts. If any of the wire shows the cross or contact, they should be earthed again to trace wires with which they are crossed or are in contact. Each pair of conductors should be tested in the above manner before jointing the next length. Where the test proves that wires have been cross jointed, the joints shall be opened and the fault rectified to avoid crosstalk. Re-crossing in the next jointing does not clear the fault.

3.8 The insulation test shall be taken on half of the pairs of the cable bunched together, the other half being earthed to the armour and screen. The second half shall then be tested in a similar manner to the first half earthed. The test shall be carried out with a megger before connecting it to the terminal equipment. If a contact between the wires forming a pair exists, it will be shown by the megger registering a dead earth. In this case, each pair shall be tested individually until the faulty pair is found.

3.9 Insulation test of newly laid U/G cable shall be done with a megger of 5OOV and after wards it shall be done with a megger of 100V/500V depending upon the overall condition of cable and spares available.

3.10 Underground cables shall be tested once every year for continuity, transmission loss, cross-talk, loop resistance, armour continuity, insulation resistance and tracing & updating of cable route diagram and the results of tests shall be recorded.

3.11 Underground cable installations when laid strictly in accordance with the recommended practice then it will hardly need any maintenance throughout their anticipated span of life. As far as the buried portion of the cable is concerned, no repairs are generally possible except in cases where moisture or water has entered the cable and is detected before it has damaged the insulation.

3.12 No digging operations by other departments shall be carried out close to the cable route without prior notice to the Telecommunication Engineer who shall supervise or arrange supervision to ensure necessary precautions to protect the cable from damage has been taken or being taken during the work.

4. CABLE FAULTS

4.1 TYPE:

i. Low insulation in one limb or both.

ii. Open/break in one limb or both.

iii. Short/Earth.

iv. Multiple faults.

v. Foreign potential

4.2 Localisation of faults- Various types of cable fault locators available generally work on the following principle:

i. Potential distribution method

ii. Pulse reflection (ECHO) method

4.3 Rectification of faults- After localisation of faults, the defective portion of cable may be replaced by healthy piece of cable with proper joint.

5. Identification

5.1 Descriptive labels shall be provided for all cabinets, enclosures, panels, assemblies and sub-assemblies. Labels shall be of engraved type, metallic with durable markings and shall have character size not less than 6 mm high.

5.2 The details of the labels including the material and size of the characters and sample of the labels shall be submitted to the Engineer for review.

5.3 Labels and notices on equipment shall be fixed with roundhead brass screws or self- tapping screws. Stick-on labels or fixing by adhesive shall not be accepted.\

6. Earthing of Telecom system

At Station/TSS/SP/SSP/ S&T Huts separate maintenance free earth electrode shall be provided for earthing of the telecom equipment.

6.1 The metallic sheath and armouring of all cables (RF Cables/Optical Fibre Cable/Quad cable/PIJF telephone cable/ Leaky cables etc.) shall require earthing. The earthing shall be done at the equipment room and termination points, as per the established practices in RE areas of the Indian Railways.

6.2 The earthing electrodes for the clean earth shall be located at least 20 m away from the main electrical power earth.

6.3 The route for the clean earth shall be so chosen as to minimise the effect of any inductive interference.

6.4 For the purpose of measurement of earth resistance, a small interconnecting copper strip of appropriate cross-section shall be provided in the ring earth in a small manhole chamber so that the ring earth can be broken from the loop.

6.5 The earth resistance at any point on the clean earth shall **be below 0.5 Ohm**, and that for the main earth shall not **exceed 1.0 Ohm at any** location and under any soil and/or climatic condition.

6.6 All metal work and metallic items shall be earthed to the main earth to ensure the safety of personnel.

6.7 At every kilometer armour of OFC cable shall be cut for 5cm length and this piece shall be removed and covered by heat shrink tube.

6.8 The earthing methods and details shall be submitted to the Engineer for review.

Armour of optical fibre cable and Quad cable shall be directly earthed at TER end and earthed through a surge protection device at the other end station;

6.9 Unless specified otherwise, all equipment to be housed in outdoor environment (open areas etc.) shall be with IP 65 enclosures as a minimum.

7. TESTING AND COMMISSIONING

7.1 General

7.1.1 The Contractor shall perform stage-wise testing and commissioning activities in accordance with the requirements given in this Specification.

7.1.2 The Contractor shall ensure that prior to the commencement of tests; documentation associated with tests has been reviewed No Objection by the Engineer.

7.1.3 The Contractor shall ensure that the Equipment/Subsystem/System is in a state ready for Testing and Commissioning before the commencement of the tests. The Contractor shall conduct Trial tests and satisfy himself before offering the Equipment/Subsystem/System for the tests. Test results of the Contractor's own trial tests shall be made available to the Engineer on demand. This is to indicate the readiness of the Equipment/Subsystem/System for tests.

7.1.4 The Contractor shall provide all necessary Test instruments, Special tools and Test software to carry out the tests.

7.1.5 The Contractor shall extend full support to the Engineer and provide all necessary facilities to enable convenient inspection of materials, work and testing.

7.1.6 The Contractor shall investigate and provide corrective actions for all the faults detected during the tests. The tests shall be resumed only after all the faults are properly cleared. The Contractor shall submit Fault report to the Engineer to describe the symptom and causes of the Faults and the Corrective actions taken.

7.2 TESTING STAGES

7.2.1 The Contractor shall carryout testing and commissioning activities in the following phases:

i. Factory Acceptance Tests;

ii. Installation Tests;

iii. System Acceptance Tests;

7.3 FACTORY ACCEPTANCE TESTS

7.3.1 The Contractor shall prepare and submit, at least three months before the tests, for review by the Engineer the Factory Acceptance Test Plan, detailing and explaining how the contractor shall plan, perform, and document all inspections and tests that shall be conducted to verify and validate the works prior to delivery to Site. In addition, the Factory Test Plan shall also include the following:

i. A list of equipment and cables for individual Subsystems to have Factory Acceptance Test;

ii. The program of all the activities related to factory acceptance tests;

iii. The locations where factory acceptance tests to be carried out;

iv. The estimated duration of tests activities at each location; and

v. Submission of schedule of all the factory acceptance test procedures for equipment and cable.

vi. Submission of specifications and standards, reviewed design documentation for reference for FAT of equipment and cable.

7.3.2 Factory Acceptance Test shall be carried out for equipment and cables of all the Subsystems as per RDSO guidelines. The inspection shall generally be done by RDSO or Engineers' representative.

7.3.3 Where any part of testing is carried out by an independent laboratory, a copy of Test Certificate issued by the relevant authority of that laboratory shall be submitted along with the Factory Acceptance Test Procedure.

7.3.4 The Factory Acceptance Tests are considered completed only if the Engineer without objection reviews the Factory Acceptance Test results.

7.4 INSTALLATION TESTS

7.4.1 Installation Tests shall be carried out on individual Subsystem location by location after the completion of equipment's physical installation. This shall include following tests but not limited to:

7.4.2 Pre-Installation test/inspection shall include the verification of FAT/Quality test report, Invoice, OEM manuals, Warranty certificates etc. RFI shall be submitted for this test/ inspection.

7.4.3 Post installation test shall include the installation of equipment as per approved drawing, Particular specification etc. Power supply test shall be the part of post-installation test.

7.4.4 The Objective of the installation tests shall be to ensure the following:

- The equipment is installed in accordance with the reviewed design documentation
- The equipment is installed in accordance with the requirements detailed in this Specification
- All cables are properly and accurately connected and terminated
- All installation works are of acceptable workmanship

7.4.5 The Contractor shall develop procedures for Installation Tests and shall submit to the Engineer for review. The Installation test procedures shall describe in detail all tests to be performed on the equipment and cables along with Pass/Fail criteria (i.e. the standards or limit to be achieved).

7.4.6 The Contractor shall measure the end-to-end performance of all cores of the copper cables and optical fibre cables, including all spare cores, laid between different locations.

7.4.7 All the **installation test results, physical locations of the equipment and serial numbers** shall be captured in the test record forms. The Contractor shall include completed test record forms in the Test Report and submit to the Engineer for review.

7.4.8 The Installation Tests are considered completed only if the Engineer without objection reviews the Installation Test results.

7.5 SYSTEM ACCEPTANCE TESTS

7.5.1 The Contractor shall carry out System Acceptance Tests after the completion of the Installation Test. System Acceptance test shall include the functional test of all equipment.

7.5.2 System Acceptance Tests shall be carried out on individual Subsystem as well as whole System to verify the functional, operational performance, electrical performance and services coverage at the stage:

i. After successful completion of the Installation Tests;

ii. After the Subsystems have been configured with correct settings and parameters;

iii. Properly connected to the power supply and can be switched on for System Acceptance Tests; and

iv. Before the equipment of different locations are ready for Integrated Testing& Commissioning.

7.5.3 The Contractor shall develop System Acceptance Tests procedures for each Subsystem and System as a whole and submit to the Engineer for review.

7.6 Where performance across interfaces to other System within this Contract is required to be verified during the System Acceptance Tests, the Contractor shall include **a list of other systems and the interface test procedures** in the System Acceptance Tests procedures for the relevant Subsystem.

7.7 Where performance across interfaces to Project Contractors or to other parties is required to be verified during the System Acceptance Tests, the Contractor shall include a list of Project Contractors and the interface test procedures agreed with the relevant Project Contractors in the System Acceptance Tests procedures for the relevant Subsystem.

7.8 The Contractor shall conduct end-to-end circuit test to verify the circuit integrity and electrical performance for all circuits including spare.

7.9 The System Acceptance Tests are considered completed only if the Engineer with No objection reviews the System Acceptance Test results.

7.10 Upon completion of the System Acceptance Test, the individual Subsystem shall be operational and shall be ready to be connected to other Subsystems and interfacing systems for testing.

[End of Chapter 3]

Section VII-8: Tender Drawings and Documents

A- Tender Drawings
B- Documents

Note: Tenderer shall download Section VII-8: Tender Drawings and Documents from HRIDC website. Section VII-8: Tender Drawings and Documents are available for downloading under Active Tender Section on HRIDC website (https://hridc.co.in/active-tender.php). Section VII-8: Tender Drawings and Documents uploaded on HRIDC website for Package C-5 shall be deemed to form part of Tender Documents. List of Tender Drawings and Documents are enclosed hereunder.

Section VII-8A
Tender Drawings

Tenderer shall download Section VII-8: Tender Drawings and Documents from HRIDC website. Section VII-8: Tender Drawings and Documents are available for downloading under Active Tender Section on HRIDC website (https://hridc.co.in/active-tender.php). Section VII-8: Tender Drawings and Documents uploaded on HRIDC website for Package C-5 shall be deemed to form part of Tender Documents. List of Tender Drawings are enclosed hereunder.

	- **Black colour shows Tender drawings which have not been revised**
	- **Blue colour shows Tender drawings which have been revised**
	- **Red colour shows New additional Tender drawings**

List of Tender Drawings
I. Civil Drawings

S. No	TITLE	DRAWING NO.
1. ALIGNMENT PLAN & L-SECTION		
1.	Conceptual Plan & longitudinal section (-2.296KM to -0.6KM)	GC-HRIDC-ALL-DRW-ALN-P&P-(-2.296) - (-0.6) KM_A0
2.	Conceptual Plan & longitudinal section (-0.6 KM TO 0.0 KM)	GC-HRIDC-ALL-DRW-ALN-P&P-(-0.6) - (0.0) KM_A0
3.	Conceptual Plan & longitudinal section (0.0 KM TO 5.0 KM)	GC-HRIDC-ALL-DRW-ALN-P&P-0-5KM_A1
4.	Conceptual Plan & longitudinal section (5.0 KM TO 10.0 KM)	GC-HRIDC-ALL-DRW-ALN-P&P-5-10KM_A0
5.	Conceptual Plan and longitudinal section (10.0KM to 15.0KM)	GC-HRIDC-ALL-DRW-ALN-P&P-10-15KM_A2
6.	Conceptual Plan and longitudinal section (15.0KM to 20.0KM)	GC-HRIDC-ALL-DRW-ALN-P&P-15-20KM_A2
7.	Conceptual Plan & longitudinal section (20.0 KM TO 25.0 KM)	GC-HRIDC-ALL-DRW-ALN-P&P-20-25KM_A1
2. ESP/YARD PLAN		
1.	Detailed Design Yard Layout Plan for New Prithala Junction Station.	14YLPLT4103 Rev 2 dated 22.09.2023
2.	Conceptual Engineering Scale Plan Prithla Junction Yard Ch:00m F/Prithla	GC-HRIDC-C5-DRW-STN-ESP-PRI01_A0
3.	Conceptual Engineering Scale Plan Silani Station Yard CH:10341.882m F/Prithla	GC-HRIDC-C5-DRW-STN-ESP-SIL01_A0
4.	Conceptual Engineering Scale Plan IMT Sohna	GC-HRIDC-C5-DRW-STN-ESP-SOH01_A1
3. STATION BUILDING AND SUBWAY		
1.	Conceptual Plan of Prithla Station & Subway No. 8 & 8A	GC-HRIDC-C5-DRW-STN-SAD-PRI01_A0 (Sheet 1 of 3)

S. No	TITLE	DRAWING NO.
	Conceptual Architectural Drawing Prithla Station Building	GC-HRIDC-C5-DRW-STN-SAD-PRI01_A1 (Sheet 2 of 3)
	Conceptual Architectural Drawing Prithla Building	GC-HRIDC-C5-DRW-STN-SAD-PRI01_A1 (Sheet 3 of 3)
2.	Conceptual Plan of SILANI Station and Subway No. 39 & 39A	GC-HRIDC-C5-DRW-STN-SAD-SIL01_A0 (Sheet 1 of 1)
3.	Conceptual Plan of Sohna Station and Subway No. 66 & 66A	GC-HRIDC-C5-DRW-STN-SAD-SOH01_A0 (Sheet 1 of 3)
	Conceptual Architectural Drawing IMT Sohna Station Building	GC-HRIDC-C5-DRW-STN-SAD-SOH01_A1 (Sheet 2 of 3)
		GC-HRIDC-C5-DRW-STN-SAD-SOH01_A1 (Sheet 3 of 3)
4. BRIDGES		
4.1 MINOR BRIDGES		
4.1.1 MAIN LINE		
1.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No.6 1x 2x 2m RCC Box at Ch.-574.471	GC-HRIDC-C5-DRW-BRD-GAD_01006_A0
2.	Conceptual General Arrangement Drawing For Road Under Bridge No. 07, Span 1.0x4.6x5.65 RCC Box at Ch:-252.537	GC-HRIDC-C5-DRW-BRD-GAD_01007_A0
3.	Conceptual General Arrangement Drawing For Road Under Bridge No. 09 Span 1.0x4.6x4.15 RCC Box at Ch:139.953	GC-HRIDC-C5-DRW-BRD-GAD_01009_A0
4.	Conceptual General Arrangement Drawing For Balancing Culvert + RUB Bridge No. 10 Span 1x5.2x5.0 + 1x4.7x5 RCC Box at Ch: 371.033 (CANAL CROSSING DHATIR DISTRIBUTORY RD 25000)	GC-HRIDC-C5-DRW-BRD-GAD_010010_A1
5.	Conceptual General Arrangement Drawing For Road Under Bridge No 11 Span 1x4.6x4.15 RCC Box at Ch: 958.395	GC-HRIDC-C5-DRW-BRD-GAD_01011_A0
6.	Conceptual General Arrangement Drawing For Road Under Bridge No 13 Span 1x4.60x4.15, RCC box at Ch: 2034.968	GC-HRIDC-C5-DRW-BRD-GAD-01013_A0
7.	Conceptual General Arrangement Drawing For RUB + Balancing Culvert Bridge No. 14 Span 2x5.2x4.15 RCC Box at Ch: 2493.015 (CANAL CROSSING CHANDPUR MINOR RD 6500)	GC-HRIDC-C5-DRW-BRD-GAD_01014_A1
8.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 15 Span 1x2x2 RCC Box at Ch: 3153.203	GC-HRIDC-C5-DRW-BRD-GAD_01015_A0
9.	Conceptual General Arrangement Drawing For Road Under Bridge No. 18	GC-HRIDC-C5-DRW-BRD-GAD_01018_A0

S. No	TITLE	DRAWING NO.
	1x9.75mx6.70m RCC Box at Ch.4373.615m	
10.	Conceptual General Arrangement Drawing For Road Under Bridge No 19 Span 1.0x4.6x4.15 RCC Box at Ch: 4858.791	GC-HRIDC-C5-DRW-BRD-GAD-01019_A1
11.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No 20 Span 1x2.0x2.0 RCC Box at Ch.4891.994	GC-HRIDC-C5-DRW-BRD-GAD-01020_A1
12.	Conceptual General Arrangement Drawing For Road Under Bridge No. 21 1 x 4.6 x 4.15m RCC Box at Ch.5340.10m	GC-HRIDC-C5-DRW-BRD-GAD_01021_A0
13.	Conceptual General Arrangement Drawing For Road Under Bridge No. 22 1x 4.6 x 4.15m RCC Box at Ch.5807.675m	GC-HRIDC-C5-DRW-BRD-GAD_01022_A0
14.	Conceptual General Arrangement Drawing For Balancing Culvert No. 23 1x 3 x 3m RCC Box at Ch.6409.986m	GC-HRIDC-C5-DRW-BRD-GAD_0023_A0
15.	Conceptual General Arrangement Drawing For Road Under Bridge No. 24 1x 4.6 x 4.150 m RCC Box at Ch.6881.539m	GC-HRIDC-C5-DRW-BRD-GAD_01024_A0
16.	Conceptual General Arrangement Drawing For Road Under Bridge No 25 Span 1.0x4.60x4.50 RCC Box at Ch: 7548.737	GC-HRIDC-C5-DRW-BRD-GAD-01025_A0
17.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 27 Span 1x2x2 RCC Box at Ch: 7941.374	GC-HRIDC-C5-DRW-BRD-GAD_01027_A0
18.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 29 Span 1x2x2 RCC Box at Ch: 8141.419	GC-HRIDC-C5-DRW-BRD-GAD_01029_A0
19.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 31, 1 x 4 x 3.0m RCC Box at Ch.8593.734m	GC-HRIDC-C5-DRW-BRD-GAD_01031_A1
20.	Conceptual General Arrangement Drawing For Balancing Culvert No. 32 1x4.0x3.7m RCC Box at Ch: 8891.591m	GC-HRIDC-C5-DRW-BRD-GAD_01032_A0
21.	Conceptual General Arrangement Drawing For Road Under Bridge No. 33 1 x 7.00 x 4.15m RCC Box at Ch.9293.620m	GC-HRIDC-C5-DRW-BRD-GAD_01033_A0
22.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 35 Span 1x2x2 RCC Box at Ch: 9591.677	GC-HRIDC-C5-DRW-BRD-GAD_01035_A0
23.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 36 Span 1x2x2 RCC Box at Ch: 9882.453	GC-HRIDC-C5-DRW-BRD-GAD_01036_A0
24.	Conceptual General Arrangement Drawing For Road Under Bridge No. 37 1 x 5.70 x 4.15m RCC Box at Ch.9894.460m	GC-HRIDC-C5-DRW-BRD-GAD_01037_A0

S. No	TITLE	DRAWING NO.
25.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 38 Span 1x3x3 RCC Box at Ch: 10090.792	GC-HRIDC-C5-DRW-BRD-GAD_01038_A1
26.	Conceptual General Arrangement Drawing For Road Under Bridge No. 40 Span 1x8.40x5.15 RCC Box at Ch: 10410.702	GC-HRIDC-C5-DRW-BRD-GAD_01040_A1
27.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 42 Span 1x2x2 RCC Box at Ch: 10907.894	GC-HRIDC-C5-DRW-BRD-GAD_01042_A0
28.	Conceptual General Arrangement Drawing For Road Under Bridge No. 43 Span 1.0x4.70x5.65 RCC Box at Ch: 11203.249	GC-HRIDC-C5-DRW-BRD-GAD_01043_A0
29.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 44 Span 1x2.0x2.0 RCC Box at Ch: 11403.443	GC-HRIDC-C5-DRW-BRD-GAD_01044_A1
30.	Conceptual General Arrangement Drawing For Road Under Bridge No. 64 Span 2x6.0x4.0 RCC Box at Ch: 18558.00	GC-HRIDC-C5-DRW-BRD-GAD_01064_A1
31.	Conceptual General Arrangement Drawing For Balancing Culvert Bridge No. 65 Span 1x2x2 RCC Box at Ch: 18735.000	GC-HRIDC-C5-DRW-BRD-GAD_01065_A0
32.	Conceptual General Arrangement Drawing For Road + Balancing Culvert No. 67 Span 2.0x7.5x7.5 RCC Box at Ch: 19435.000 (CANAL CROSSING REWASAN DRAIN RD 10350)	GC-HRIDC-C5-DRW-BRD-GAD-01067_A1
4.1.2 CONNECTING LINE		
A. PRITHLA TO NEW PRITHLA		
1.	Conceptual General Arrangement Drawing For Pipe Culvert Bridge No. 1 1x1.2m Dia ,at Ch:-1950.000	GC-HRIDC-C5-DRW-BRD-GAD_01001_A0
2.	Conceptual General Arrangement Drawing For Balancing Culvert + RUB Bridge No. 02 Span 1x2.5x5.05+1x3.6x5.05, RCC Box, at Ch: -1832.759	GC-HRIDC-C5-DRW-BRD-GAD_01002_A1
3.	Conceptual General Arrangement Drawing For Road Under Bridge No. 03, Span 1.0x4.60x5.65 RCC Box at Ch: -1312.056	GC-HRIDC-C5-DRW-BRD-GAD_01003_A0
4.2 MAJOR BRIDGES		
4.2.1 MAIN LINE		
1.	Conceptual General Arrangement Drawing for Prop Canal Crossing Bridge No. 4,	GC-HRIDC-C5-DRW-BRD-GAD_01004_A0

S. No	TITLE	DRAWING NO.
	1x8x7.5+1x24.4+1x8x7.5m (CG+ RCC Box) at Ch. -795.733	
2.	Conceptual General Arrangement Drawing for Road No. 5, 1x 12 x 6.10m RCC Box at Ch. -592.612m	GC-HRIDC-C5-DRW-BRD-GAD_01005_A0
3.	Conceptual General Arrangement Drawing Proposed RUB Bridge No.12 1x12.2 PSC U Slab Ch:1696.624	GC-HRIDC-C5-DRW-BRD-GAD_01012_A0
4.	Conceptual General Arrangement Drawing Proposed Major Bridge No. 16 1x12x6.10 m, RCC box Ch: 3472.548m	GC-HRIDC-C5-DRW-BRD-GAD_01016_A0
5.	Conceptual General Arrangement Drawing for Proposed Major RUB No.17 4x30.5 Open web Girder at Ch:4256.298m (NH-148A DND-2)	GC-HRIDC-C5-DRG-BRD-GAD_00017_A0 (Sheet 1 of 2) GC-HRIDC-C5-DRG-BRD-GAD_00017_A0 (Sheet 2 of 2)
6.	Conceptual General Arrangement Drawing Proposed RUB Bridge No. 26 1x12x6.10 m, RCC Box Ch: 7753.296m	GC-HRIDC-C5-DRW-BRD-GAD_01026_A0
7.	Conceptual General Arrangement Drawing For Prop. Major Bridge No. 28 18.3X30.5+18.3(OWG+CG) AT CH: 8036.354m (CANAL CROSSING GURGAON CANAL RD 79150)	GC-HRIDC-C5-DRG-BRD-GAD_01028_A0
8.	Conceptual General Arrangement Drawing For Prop. Drain Crossing Bridge No.30, 1X30.5 (Composite Girder) AT CH: 8298.110m (CANAL CROSSING NUH DRAIN RD 87645)	GC-HRIDC-C5-DRG-BRD-GAD_01030_A0
9.	Conceptual General Arrangement Drawing Proposed IOCL Crossing Bridge No. 34 1 x24.4m (CG) AT CH.9536.901m	GC-HRIDC-C5-DRW-BRD-GAD_01034_A0
10.	Conceptual General Arrangement Drawing for Road Under Bridge no. 41 Span 1x12x5.650 RCC Box at Ch: 10709.675	GC-HRIDC-C5-DRW-BRD-GAD_01041_A0
11.	Conceptual General Arrangement Drawing for Prop. Major Bridge No.045, at Ch: 11543.518m 2X76.2 (Open Web Girder) (NH 919 PALWAL SOHNA ROAD)	GC-HRIDC-C5-DRW-BRD-GAD_01045_A0
12.	Conceptual General Arrangement Drawing For Stream Bridge No.53 2x24.4 m CG at Ch:14472.112	GC-HRIDC-C4-DRW-BRD-GAD_01053_A2

S. No	TITLE	DRAWING NO.
13.	Conceptual General Arrangement Drawing for Prop. Drain Crossing bridge no.63 1x5x4.9+1x12.2m+1x5x4.9 (PSC U Slab +RCC Box) at CH: 18310 (CANAL CROSSING INDRI DISTRIBUTARY RD 11260)	GC-HRIDC-C5-DRW-BRD-GAD_01063_A0
14.	Conceptual General Arrangement Drawing for Prop. Major RUB No.68 2x61(OWG) at Ch: 20184 (CANAL CROSSING REWASAN DRAIN RD 6670) NH-248A	GC-HRIDC-C5-DRG-BRD-GAD_01068_A0
15.	Conceptual General Arrangement Drawing for Prop. Major Bridge no.69 12.2+2X18.3+12.2 (CG+PSC U Slab) at Ch: 20400m	GC-HRIDC-C5-DRG-BRD-GAD_01069_A0
16.	Conceptual General Arrangement Drawing for Viaduct Br. No.70, Span: 105X24.4+1X30.5+41x24.4 +1x30+1x11.10 (Composite Girder) from Ch: 20942.473m to 24843.543m	GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 1 of 15 to 15 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 2 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 3 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 4 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 5 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 6 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 7 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 8 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 9 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 10 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 11 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 12 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 13 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 14 of 15)
		GC-HRIDC-C5-DRG-BRD-GAD_01070_A0 (Sheet 15 of 15)

S. No	TITLE	DRAWING NO.
5. MISCELLANEOUS DRAWINGS (CONCEPTUAL PLANS)		
1.	Conceptual Plan Typical Embankment/Cutting Profile	GC-HRIDC-SK-GEN-001_A1
2.	Conceptual Plan Mini Platform Shelter	GC-HRIDC-SK-GEN-003
3.	Conceptual Plan R.C. Pre-Cast Fencing for End Platform	GC-HRIDC-SK-GEN-004
4.	Conceptual Plan Station Name Board	GC-HRIDC-SK-GEN-005
5.	Conceptual Plan Proposed Toilet Block on End Platforms	GC-HRIDC-SK-GEN-007_A1
6.	Conceptual Plan Drains for Embankment	GC-HRIDC-SK-GEN-008_A1
7.	Conceptual Plan Steel Barricade	GC-HRIDC-SK-GEN-009
8.	Conceptual Plan Water Booth with One Side Taps Arrangement (End Platform)	GC-HRIDC-SK-GEN-010_A1
9.	Conceptual Plan Water Booth with Both Side Taps Arrangement (Island Platform)	GC-HRIDC-SK-GEN-011_A1
10.	Conceptual Plan of Auto Location Hut (S&T)	GC-HRIDC-SK-GEN-012_A1
11.	Conceptual Plan Ticket Counter	GC-HRIDC-SK-GEN-013
12.	Conceptual Plan CC Toe Wall	GC-HRIDC-SK-GEN-014_A1
13.	Conceptual Plan Typical Details of Protection Work of Bridge Approaches	GC-HRIDC-SK-GEN-015_A1
14.	Conceptual Plan Barbed Wire Fencing	GC-HRIDC-SK-GEN-016_A1
15.	Conceptual Plan RCC Duct of Signalling Cable	GC-HRIDC-SK-GEN-017
16.	Conceptual Plan for Transition System of Bridge Approaches	GC-HRIDC-SK-GEN-019
17.	Conceptual Plan for Self-Supporting Roof Covering Shed	GC-HRIDC-SK-GEN-020
18.	Conceptual Plan for Formation Details Below of Subway and Lift Well	GC-HRIDC-SK-GEN-021
19.	Conceptual Plan for Trolley Refuge in Embankment	GC-HRIDC-SK-GEN-022
20.	Conceptual Plan for Trolley Refuge in Cutting	GC-HRIDC-SK-GEN-023
21.	Conceptual Sketch for RCC Platform Wall	GC-HRIDC-SK-GEN-024
22.	Conceptual Plan for Single and Double Lane Road	GC-HRIDC-SK-GEN-025
23.	Conceptual Sketch for Reinforced Earth Wall with Geogrid Reinforcement	GC-HRIDC-SK-GEN-026
24.	Conceptual Plan OHE Portal for OWG Girder	GC-HRIDC-SK-GEN-035
25.	Conceptual Plan for Mild Steel Pipe 323.9mm Outer Dia for Future Utilities	GC-HRIDC-SK-GEN-030

S. No	TITLE	DRAWING NO.
26.	Jurisdictional Sketch Of C-5 Package	GC-HRIDC-C5-SK-CIVIL-001_A0
27.	Conceptual Plan Drainage Arrangement (Prithla)	GC-HRIDC-C5-SK-CIVIL-002_A1
28.	Conceptual Plan Drainage Arrangement (Silani)	GC-HRIDC-C5-SK-CIVIL-003_A1
29.	Conceptual Plan Drainage Arrangement (IMT Sohna)	GC-HRIDC-C5-SK-CIVIL-004_A1
30.	Conceptual Plan Bank/Cutting Benching at Interface Locations	GC-HRIDC-C5-SK-CIVIL-009_A0
31.	Type Plan Powder Toilet for Divyangs	N.R.H.Q.E PLAN NO. HQ/20/11-2021
32.	Conceptual Plan OWG With Concrete Deck for BLT	GC-HRIDC-SK-GEN-036
33.	Conceptual Plan Ground Improvement for Embankment at Pond/Water Logged Area.	GC-HRIDC-SK-GEN-037
34.	Conceptual Plan for OHE Earthing & OHE Bolt Fixing Arrangement on Bridges	GC-HRIDC- C5-SK-GEN-038
35.	Conceptual Plan Location of Signal Post for Composite Girder Bridges	GC-HRIDC-SK-GEN-034
36.	Conceptual Plan Location of OHE Mast In Viaduct	GC-HRIDC-SK-GEN-032
37.	Conceptual Plan Location of OHE Mast for Composite Girder Bridges	GC-HRIDC- SK-GEN-031
38.	Indicative OHE Guy Rod Arrangement on Viaduct	GC-HRIDC-SYS1-DRW-ELE-007_A0
39.	Conceptual Plan Typical Embankment/Cutting Profile	GC-HRIDC-SK-GEN-001_A1
40.	Conceptual Cross- sectional sketch of ALH	GC-HRIDC- SK-GEN-039_A0
41.	Conceptual Plan drains between HORC embankment & DFC	GC-HRIDC- SK-GEN-041_A0
42.	Conceptual Plan S&T hut	GC-HRIDC- SK-GEN-002_A0
43.	Typical Conceptual Cross-sectional sketch of Platform	GC-HRIDC- SK-GEN-042_A0
44.	Typical Cross section of Road in RUB (Minor bridge)	GC-HRIDC- SK-GEN-043_A0

II. General Electrical Services Drawings

S. No	TITLE	DRAWING NO.
1.	Indicative LT Supply System with Local, DG and Auxiliary Transformer Supply	GC-HRIDC-C5-DRW-ELE-001-A1
2.	Indicative LT Supply Distribution Diagram	GC-HRIDC-C5-DRW-ELE-002-A0
3.	Indicative Arrangement of Decorative Street Light Pole at Station and Platform	GC-HRIDC-C5-DRW-ELE-03-A1
4.	Indicative Cable Route Plan for Track Crossing of Power Cable and Route Marker	GC-HRIDC-C5-DRW-ELE-04-A0

5.	Indicative Earthing Arrangement of Electrical System by Copper Cladded Electrode	GC-HRIDC-C5-DRW-ELE-05-A0
6.	Indicative Schematic Drawing Of 11 KV Power Supply Arrangement	GC-HRIDC-C5-DRW-ELE-06-A0
7.	Indicative LT Supply System With Local & Auxilary Transformer Supply	GC-HRIDC-C5-DRW-ELE-007-A1
8.	Indicative Compact Substation (CSS) Single Line Diagram	GC-HRIDC-C5-DRW-ELE-08-A0
9.	Indicative Viaduct Lighting and Railing Earthing Arrangement	GC-HRIDC-C5-DRW-ELE-09-A0

III. Signalling & Telecommunication Drawings

S. No	TITLE	DRAWING NO.
1.	Typical Main Cable Distribution Plan for Double Line (4 Lines) P.I. Station	SDO/CABLE LAYING/001
2.	Position of Trenches for Cable Laying	SDO/CABLE LAYING/002
3.	Cable Trench	SDO/CABLE LAYING/003
4.	Laying Of Signalling Cable & Telecom/ Power Cable in Same Trench	SDO/CABLE LAYING/004
5.	Laying Of Cables in Rocky Area	NR/SIG/CABLE/004
6.	Track Crossings	NR/SIG/CABLE/005
7.	Road Crossings	NR/SIG/CABLE/006
8.	Cable Laying on Culverts with Low Flood Level	SDO/CABLE LAYING/011
9.	Cable Laying on Culverts with High Flood Level	NR/SIG/CABLE/007
10.	Cable Laying on Metallic Bridges	SDO/CABLE LAYING/013
11.	Cable Trough for Metallic Bridges	SDO/CABLE LAYING/014
12.	Cable Laying on Arch Bridges	NR/SIG/CABLE/008
13.	Brick Masonry Channel for Arch Bridge	SDO/CABLE LAYING/016
14.	Arrangement of Jumper cable	SDO/CABLE LAYING/017
15.	CI Cable Marker & Concreting	SDO/CABLE LAYING/018
16.	CI Cable Marker	SDO/CABLE LAYING/019
17.	Concrete Cable Marker	SDO/CABLE LAYING/020
18.	Method of Unrolling Cable	SDO/CABLE LAYING/021
19.	Rule Made of Pipe for Measuring Trench Depth	SDO/CABLE LAYING/022

Section VII-8B
Documents

Tenderer shall download Section VII-8: Tender Drawings and Documents from HRIDC website. Section VII-8: Tender Drawings and Documents are available for downloading under Active Tender Section on HRIDC website (https://hridc.co.in/active-tender.php). Section VII-8: Tender Drawings and Documents uploaded on HRIDC website for Package C-5 shall be deemed to form part of Tender Documents. List of Documents are enclosed hereunder.

	Black colour shows Documents which have not been revised
	Blue colour shows Documents which have been revised
	Red colour shows New additional Documents

S.NO	LIST OF DOCUMENTS	Pg. No
1.	List of Curve and Gradients	1-5
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APPENDIX 1
DRAWING LIST

1. GENERAL

The Tender Documents contains a set of reference/Tender drawings that are applicable to the Contract Works. The Tenderer shall incorporate into the Tender only those drawings from that set which amplify aspects of the Contractor's Technical Proposals. General information drawings will not be included in the Contract. The dimensions mentioned in the tender drawings are indicative and may vary as per the design of the Contractor.

The List of Drawings issued with the Tender documents is stated in Part-2 Employer's Requirements - Tender Drawings and Documents.

APPENDIX – 2

CONTRACT KEY DATES AND COMPLETION DATE

Key Dates	Weeks from Commencement Date	Description of Stage	Delay Damage for each week of delay or part thereof for non-achieving the key dates
Key Date 1	4	Submission of Initial Works Programme with all activities for entire work Package C-5.	
Key Date 2	10	Submission of Preliminary Design & GAD of bridges including RSI except viaduct. (Submission may be in stages but to start NOT later than 6 weeks.)	
Key Date 3	12	Submission and approval of Detailed Works Programme (resources & cost loaded) incorporating all comments of Engineer including 2 weeks for review by the Engineer.	0.01% of the fixed lump sum price quoted in Schedule 'A'.
Key Date 4	14	Submission of Preliminary Design & GAD of viaduct including RSI of viaduct.	
Key Date 5	26	Submission and approval of Definitive Design & GFC drawings for 10 Nos. of Major Bridges, 32 Nos. of Minor Bridges and 1 km length of viaduct. (Submission may be in stages but to start NOT later than -12 weeks from Commencement Date and completed within 26 weeks)	0.02% of the fixed lump sum price quoted in Schedule 'A'.
Key Date 6	40	Completion of substructure of viaduct of at least 05 spans for double line track.	0.02% of the fixed lump sum price quoted in Schedule 'A'.
Key Date 7	75	Completion of all the works from Ch. 2000 m to 12000 m excluding Major Br No.17, 28 & 45, slope protection and drainage works to enable execution of works by T-2 Contractor (track), SYS – 1 Contractor & SYS – 2 Contractor.	
Key Date 8	75	Submission and approval of design of BLT including fastening system.	
Key Date 9	104	Completion of station buildings at Prithla & IMT Sohna stations and all Auto location huts to enable execution of works by SYS-2	0.02% of the fixed lump sum price quoted in Schedule 'A'.

Key Dates	Weeks from Commencement Date	Description of Stage	Delay Damage for each week of delay or part thereof for non-achieving the key dates
		Contractor (Signalling & Telecommunication).	
Key Date 10	125	Completion of all the works from Ch. (-)2296 m to 12,000 m and 18,000.0 m to 20,942 m excluding slope protection and drainage works.	
Key Date 11	130	Completion of all spans of viaduct of one line including deck slab and BLT with transition.	0.02% of the fixed lump sum price quoted in Schedule 'A'.

APPENDIX 3

WORKS AREAS AND TEMPORARY POWER SUPPLY

3. WORK AREA (WITHIN ROW) ACCESS DATES

3.1 General

"Works Areas" means the areas of the Site within the Right of Way of HORC including land in KMP ROW, *land in DFC ROW* and any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working area.

a) The dates on which Work Areas (within ROW) are available to the Contractor for the commencement of the Works are defined as Work Area Access Dates (AD).

b) The Work Area Access Dates that apply to this Contract are stated in terms of days after the Commencement Date of the Works.

c) Where Work Areas are to be made available to the Contractor, they shall be available within the specified day. Where Work Areas are to be vacated, they shall be released not later than midnight on the specified day.

3.2 Work Area Access Schedule

The access to and possession of Works Area (within ROW) shall be made available as per Part A Contract Data of Particular Conditions of the Contract (PCC).

3.3 ELECTRICAL GENERAL

Temporary electrical Site installations and distribution systems shall be in accordance with:-

(a) Indian Electricity Rules

(b) The Power Companies' Supply Rules;

(c) Electricity and its subsidiary Regulations;

(d) IEE Wiring Regulations (16^{th} Edition);

(e) BS 7375 Distribution of Electricity on Construction and Building Sites;

(f) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and

(g) BS 6164 Safety in Tunnelling in the Construction Industry.

(h) Any other applicable national standards

3.4 MATERIALS, APPLIANCES AND COMPONENTS

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

3.5 DESIGN CONSIDERATIONS

(i) Distribution equipment utilised within the temporary electrical distribution system shall incorporate the following features:-

(a) flexibility in application for repeated use;

(b) suitability for transport and storage;

(c) robust construction to resist moisture and damage; and

(d) safety in use.

(ii) All cabling shall be run at high level whenever possible and firmly secured to ensure they do not present a hazard or obstruction to people and equipment.

(iii) The installation on Site shall allow convenient access to authorised and competent operators to work on the apparatus contained within.

3.6 MAINS VOLTAGE

(i) The Site mains voltage shall be as per the Electricity Authority, 415V/ 3 phase 4 wire system.

(a) Single phase voltage shall be as per the Electricity Authority, 230V supply.

(b) Reduced voltages shall conform to BS 7375.

(ii) Types of Distribution Supply

The following voltages shall be adhered to for typical applications throughout the distribution systems:

(a) fixed plant - 415V/ 3 phase;

(b) movable plant fed by trailing cable - 415V /3 phase;

(c) installations in Site buildings - 230V /1 phase;

(d) fixed flood lighting - 230V/ 1 phase;

(e) portable and hand held tools - 115V /1 phase;

(f) Site lighting (other than flood lighting) - 115V /1 phase; and

(g) portable hand-lamps (general use) - 115V /1 phase.

(iii) When the low voltage supply is energised via the Employer's transformer, any power utilised from that source shall be either 415V 3 phase or / 230V. 1 phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.

3.7 PROTECTION OF CIRCUITS

(i) Protection shall be provided for all main and sub-circuits against excess current, under and over voltage, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.

(ii) Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with:-

(a) BS 88;

(b) BS EN 60898;

(c) BS 7375; and

(d) Any other appropriate Indian Standards.

3.8 EARTHING

(i) Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.

(ii) Earthing systems shall conform to the following standards:-

(e) IEE Wiring Regulations (16th Edition);

(b) BS 7430;

(c) BS 7375; and

(d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

3.9 PLUGS, SOCKET OUTLETS AND COUPLERS

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

3.10 CABLES

(i) Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.

(ii) For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following specifications appropriate to the duties imposed on it:

(a) BS 6708 flexible cables for use at mines and quarries;

(b) BS 6007 rubber insulated cables for electric power and lighting; and

(c) BS 6500 insulated flexible cords and cables.

(iii) Where low voltage cables are to be used, reference shall be made to BS 7375. The following specifications shall also be referred to particularly for underground cables:-

(a) BS 6346 for armoured PVC insulated cables; and

(b) BS 6708 Flexible cables for use at mines and quarries.

(iv) All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes) shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.

(v) Armoured cables having an over sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.

(vi) For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.

(vii) Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be of a type insulated and sheathed with a general purpose or heat resisting elastomer.

(viii) All cables which are likely to be frequently moved in normal use shall be flexible cables.

Flexible cables shall be in accordance with BS 6500 and BS 7375.

3.11 LIGHTING INSTALLATION

(i) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.

(ii) Voltage shall not exceed 55 V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.

(iii) Luminaries shall have a degree of protection not less than IP 54. In particularly

bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.

(iv) The Contractor shall upgrade the lighting level to a minimum of 200 lux by localised lighting in all areas where required by the Engineer,.

(v) Mechanical protection of luminaries against damage by impact shall be provided by use of wire guards or other such devices whenever risk of damage occurs.

3.12 ELECTRICAL MOTORS

(i) Totally enclosed fan cooled motors to BS 4999:Part 105 shall be used.

(ii) Motor control and protection circuits shall be as stipulated in BS 6164. Emergency stops for machinery shall be provided.

3.13 INSPECTION AND TESTING

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16^{th} Edition)

3.14 IDENTIFICATION

Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

3.15 MAINTENANCE

(i) Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.

(ii) All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.

APPENDIX 4

PROJECT CALENDAR

4. GENERAL

4.1. For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 5 days week - Monday through Friday, except for National (Govt. of India) Holidays.

4.2. The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity by a particular week, this shall mean by midnight on the Sunday of that week. Requirements for the computation of Key Date are given in Appendix 2 to the Employer's Requirements.

4.3. A 7-day week calendar shall be adopted for various (Work) programme schedules for scheduling purposes. For Project purposes, the presentation shall be in 'Week"' units.

APPENDIX – 5

INTERFACE, COORDINATION AND COOPERATION WITH OTHER PARTIES

5.1 LIST OF CONTRACT PACKAGES IN HORC

S. No.	Package	Name of Work
1.	C-1	Priority Section - Construction of Earthwork, Bridges, Station Buildings, Retaining Walls and other miscellaneous works in connection with laying of New BG Double Railway line of HORC Project from Km 49.7 to Km 55.6 and its connectivity (new BG single line) from proposed Manesar Station of HORC to existing Patli Railway Station of IR Network.
2.	T-1	T-1: Laying of Track and track related works including supply of ballast, special sleepers, switches and crossings track fittings but excluding supply of Rails and line Sleepers in connection with laying of New BG Double Railway Line of HORC project from Km 32.00 to Km 61.5 and its connectivities to IR Network from Manesar to Patli Stations and New Patli to Patli & New Patli to Sultanpur Stations.
3.	Br-1	Fabrication, assembly & launching of 1X76.2 m span Open Web Girder (OWG) each over three lines on NH-352W (Pataudi Road) between Manesar and Patli stations including supplying & fixing of H-beam sleepers in connection with laying of New BG Double Railway Line of HORC project at Km 54.498.
4.	C-23	Design and Construction of Civil Works (Earthwork, Bridges, Station Buildings, Retaining Walls and other miscellaneous Works) from km 29.68 to km 49.70 & from km 55.60 to km 61.50 and its connectivities to IR network from New Patli to Patli station & New Patli to Sultanpur station including modifications/civil works at Sultanpur Station in connection with laying of New BG Double Railway line of HORC project.
5.	C-4	Composite Contract package in connection with New BG Railway Line of HORC project for: (i) Design & Construction of Twin Tunnel using NATM and Cut & Cover method from km 24.850 to km 29.580; (ii) Design & Installation of Ballastless Track (excluding supply of rails) from km 24.843 to km 29.680; (iii) Detailed Design, Supply, Installation, Testing & Commissioning of General Electrical Services including Supply, Erection, Testing and Commissioning of 11kV HT/LT Power and Control Cable Network, GIS Substation (11/0.433) kVA, Tunnel lighting system, etc. from km 24.843 to km 29.680; (iv) Design & Construction of Embankment, Bridges and other miscellaneous works from km 12.00 to km 18.00.

S. No.	Package	Name of Work
6.	C-5	**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for: (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844
7.	C-6	Design and Construction of Civil Works (Earthwork, Bridges, Station Buildings, Retaining Walls & other miscellaneous Works) and General Electrical Services works from km 61.50 to km 125.98 and its connectivities to IR network from proposed Badsa Station of HORC to Existing Sultanpur station and proposed Mandothi station to existing Asaudha Station in connection with laying of New BG Double Railway line of HORC Project.
8.	SYS-1	**Contract Package SYS-1:** Design, Supply, Installation, Testing & Commissioning of 2x25kV, 50Hz, AC, High Rise Overhead Electrification (OHE), Power Supply System and SCADA in connection with laying of New BG Double Railway Line from Prithla to New Harsana Kalan of Haryana Orbital Rail Corridor (HORC) Project from Km (-) 2.099 to Km 125.98 Including Rigid Overhead Conductor System (ROCS) in Tunnel Portion i.e from km 24.850 to km 29.580 and its connectivity to IR/DFC networks at New Prithla, Patli, Sultanpur, Asaudah and New Harsana Kalan including modifications in New Prithla, Sultanpur, Asaudah and New Harsana Kalan Station Yards (approximately 145 RKM and 315 TKM).
9.	SYS-2	Design, Supply, Installation & Commissioning of Signalling & Telecom system in connection with laying of New BG Railway Double line of HORC Project from Prithla station (Ch: Km (-) 2.296 to New Harsana Kalan Junction (Ch: Km 125.98 Km) and single line connectivity from Manesar to Patli station of IR, from New Patli Junction to Patli station of IR, New Patli Junction Station to existing Sultanpur station of IR, Badsa Junction to Sultanpur Station, from Mandothi Junction to existing Asaudha station of IR including modifications in IR stations at Patli, Farukhnagar, Garhi Harsaru, Asaudha, Sonipat, Rathdana and DFCCIL stations New Prithla and New Tauru.

S. No.	Package	Name of Work
10.	T-2	Design, Supply and laying of Track and Track related works in connection with laying of New BG Double Railway Line of HORC project from Km -2.296 to Km 24.87, Km 29.06 to Km 32.00 and from Km 61.50 to Km 125.98 including its connectivities from proposed Badsa station of HORC to existing Sultanpur station on IR Network and proposed Mandothi station to existing Asaudha Station on IR Network.
11.	MSIL* (OHE)	Design, Supply, Erection, Testing & Commissioning of 25kV, 50 HZ, Single Phase, High Rise OHE System for Electrification Works including foundations, structures and all ancillary equipments for (i) Electrification of Maruti Suzuki Railway Yard" and "General Electrical works of proposed Station Building in Maruti Yard in connection with Railway Siding for Maruti Suzuki India Ltd. Manesar" and (ii) OHE modification of PATLI YARD area including provision of double line Sectioning Post (SP) with CB arrangement & SCADA Equipment at PATLI STATION and electrification of PATLI-MANESAR Single line connectivity in connection with HORC Project, in the State of Haryana.
12.	PSC-01	Manufacture and Supply of Pre-stressed Mono Block Concrete Line Sleepers conforming to RDSO Drg. No. T-8746 in connection with laying of New BG Double Railway Line from Prithla to New Harsana Kalan of Haryana Orbital Rail Corridor (HORC) Project

Notes:

1. The above list is only tentative and has been provided for giving overview of the Project to the Tenderers. However, it may undergo change in future at the sole discretion of HRIDC/HORC.
2. Automatic Signalling System is proposed for HORC project
3. *Patli (including)-Manesar-MSIL connectivity line OHE Works

5.2 GENERAL

5.2.1 This Appendix describes the Contractor's responsibilities with regard to interface management and coordination and includes interfacing with other contractors employed by the Employer (referred to as "Interfacing Contractors" hereinafter), and Interfacing Parties including entities such as local authorities, statutory bodies, public utility companies, private service providers, consultants or contractors whether or not specifically mentioned in the Contract. This responsibility is not limited to a particular number of Interfacing Contractors and Interfacing Parties, and all interfaces as required in the Contract are the sole responsibility of the Contractor.

5.2.2 Interfaces internal to the Contract are the sole responsibility of the Contractor and are not covered by this Appendix.

5.3 RESPONSIBILITIES OF THE CONTRACTOR

5.3.1 So as to ensure that the whole Project including Interfacing Contractors' works as well as the Contractor's Works shall be executed in the most efficient manner in the best interest of the Employer, the Contractor shall:

a) Take the lead in the management of the coordination process with Interfacing Contractors and Interfacing Parties.

b) Accord access to the Site and/or services to any related party in the Contract including members of the Interfacing Contractors, Interfacing Parties and the Engineer/Employer.

c) Not impede the work of the Interfacing Contractors and Interfacing Parties and shall accord them all reasonable opportunities and facilities.

5.3.2 The Contractor shall, in accordance with the Employer's Requirements, coordinate and integrate the:

a) Contractor's own Works under the Contract with the works of the Interfacing Contractors and Interfacing Parties.

b) Works of the Interfacing Contractors and Interfacing Parties.

5.3.3 The Contractor shall comply with any instruction which the Engineer may give. The Contractor's responsibilities shall neither be mitigated nor in any way affected by virtue of similar responsibilities being placed on the Interfacing Contractors. The Contractor shall be responsible for the detailed coordination of his manufacturing, installation, construction, testing and commissioning activities.

5.3.4 The Contractor shall carefully review any pertinent information made available by the Engineer relating to the nature and programming of all related parties' contracts and use such information in his planning of the Works.

5.3.5 The Contractor shall communicate and exchange information directly with the Interfacing Contractors and Interfacing Parties with a copy to the Engineer for information. Information as necessary to fulfil the Contractor's interface obligations shall be directly requested and obtained from the Interfacing Contractors and Interfacing Parties with a copy to the Engineer for information and receipt acknowledged.

5.3.6 The Contractor shall ensure that the Contractor's requirements, including any design inputs to other packages, are provided to all related parties of the Interfacing Contractors and Interfacing Parties before the cut-off dates as identified in the Interface Management Plan to be developed by the Contractor and consented to by the Engineer

5.3.7 Where other contracts requiring interface are yet to be awarded, the Contractor shall proceed with coordination activities with the Engineer, until such time as the Interfacing Contractors are employed by the Employer.

5.3.8 The Contractor shall take all reasonable steps to ensure that the Works are integrated with the manufacture, installation, execution and testing of such other works and shall in particular but without limitation to:

a) Comply with any instruction which the Engineer may give for the integration of the Works with the design of any other part of the Project;

b) Consult, liaise and cooperate with those responsible for carrying out such other works, including where necessary, in the preparation of the respective designs and drawings, the preparation of coordinated programmes, method statements, coordination drawings and specifications together with arrangements of service priorities and zoning to coordinate the priorities of tasks and division of the area together with the items mentionedpreviously; and

5.3.9 Participate in the Integrated Testing and Commissioning of the Works with the Interfacing Contractors and Interfacing Parties and demonstrate to the satisfaction of the Engineer that the Works have been constructed in a manner compatible with the works of the Interfacing Contractors and Interfacing Parties.

5.3.10 There shall be a continuous requirement for coordination by the Contractor between Interfacing Contractors/Interfacing Parties.

5.3.11 During the Works the Contractor shall provide within the Site the facilities including, but not limited to, staging, storage and unloading, and temporary storage areas for the temporary use of Interfacing Contractors and/or Interfacing Parties, as may reasonably be required during the construction/installation and commissioning process. Where separate locations need to be provided for each of the Interfacing Contractors and/or Interfacing Parties, prior to construction commencing, specific details shall be coordinated and agreed between the Contractor and the Interfacing Contractors and/or Interfacing Parties.

5.3.12 The Contractor shall attend meetings with Interfacing Contractor and Interfacing Parties (if necessary) and raise/provide correspondence in this regard in accordance with the Employer's Requirements and/or as instructed by the Engineer. The identity of the Interfacing Contractor(s) and/or Interfacing Parties may not be known before the execution of the Contract but this shall not be a grounds for the Contractor to object to the subsequent appointment of any Interfacing Contractor and/or Interfacing Party.

5.3.13 The Contractor shall in accordance with the requirements of the Contract and instructions of the Engineer coordinate his own Works with the works of Interfacing Contractors and/or Interfacing Parties strictly adhering to the Coordination and Interfacing Programme and shall accord the Interfacing Contractors and/or Interfacing Party's all reasonable opportunities for carrying out their works

5.3.14 If the Contractor suffers delay by reason of failure caused by any Interfacing Contractor/Interfacing Party to meet the specified installation interfacing and/or coordination completion dates resulting in delay beyond the extent which could be reasonably foreseen by an experienced contractor at the time when the Coordination and Interfacing Programme is formulated and consented by the Engineer, then the Engineer shall take such delay into consideration in determining any extension of time to which the Contractor is entitled under the Contract

5.3.15 If any act or omission of the Contractor, whether directly or indirectly, results in the delay in execution of the works of an Interfacing Contractor and/or Interfacing Party associated with the execution of the project, the matter shall be settled by the Engineer

5.3.16 All requests for information or clarification, acknowledgement of receipt of information and any official communication between the Contractor and Interfacing Contractors/Interfacing Parties shall be made in writing with a copy to the Engineer for information.

5.3.17 The Contractor shall notify the Engineer in writing of any problems encountered in obtaining necessary information and/or lack of cooperation from an Interfacing Contractor/Interfacing Party. In the event that the Engineer considers that the resolution of an interface is not proceeding satisfactorily, the Engineer shall review the matter and establish a coordinated plan directing the Contractor and the Interfacing Contractors/ Interfacing Parties regarding the required action.

5.3.18 The Contractor shall prepare minutes recording all the matters discussed and agreed at all the meetings.

5.3.19 The Contractor shall ensure that copies of all correspondence, drawings, meeting minutes, programmes, etc. relating to the Contractor's coordination and interfacing meetings with the Interfacing Contractors and Interfacing Parties or the sharing of correspondence, drawings, programmes, etc. are issued to all concerned parties and the Engineer no later than seven days from the date of such meetings and the date of issue of such correspondence, drawings, programmes, etc.

5.3.20 Should it appear to the Engineer that the Three Month Rolling Programme does not conform with the Coordination and Interfacing Programme, the Contractor shall be required to revise all such programmes so as to conform to the approved Contractual Works Programme.

5.4 INTERFACE ADMINISTRATION SYSTEM

5.4.1 The Contractor shall establish an Interface Administration System (the "IAS") and participate in the activities with the Interfacing Contractors and Interfacing Parties. The IAS shall include, but not be limited to, the following provision of:

a) An Interface Manager who shall be responsible for and the authority to resolve interfacematters to the satisfaction of the Engineer;

b) The necessary support team for the IAS;

c) Procedures and details for response to, confirmation of and making written agreements with regard to interfaces;

d) Details of the arrangement for attendance at coordination and interface meetings (including those that may be arranged by Interfacing Contractors, Interfacing Parties or the Engineer). The representatives of Contractor, Interfacing Contractors and InterfacingParties shall be empowered to make agreements on coordination and interfaces. The Contractor shall arrange regular meetings for the Engineer to monitor the status of coordination and interfaces and may arrange special coordination and interface meetingsas may be necessary to resolve specific issues. The Engineer can require the Contractor to arrange a special coordination and interface meetings if necessary. The Contractor mayrequest assistance from the Engineer to arrange coordination and interface meetings on particular subjects;

e) Details to the Engineer of regular status information and/or details of coordination and interfaces including copies of relevant correspondence and material; and

f) Details to the Engineer of access to information for the purpose of conducting audits on interface compliance and for confirming that interface coordination and interface management is proceeding consistently with the requirements of the Contract.

5.4.2 CONSTRUCTION INTERFACE

a) Construction coordination and interface shall be required throughout the duration of the Contract and shall commence from the time of the LOA until the Taking Over of the Works.

b) The Contractor shall coordinate and interface with the Interfacing Contractors and Interfacing Parties to execute the respective construction activities efficiently.

c) The Contractor shall cooperate with Interfacing Contractors and Interfacing Parties on all Site- related matters including but not limited to Site access and occupation, safety, verification of work compatibility and survey control, etc. The Contractor shall advise the Interfacing Contractors and Interfacing Parties in advance when a construction item is ready for site inspection to verify compatibility with the Interfacing Contractors' and Interfacing Parties' needs and shall facilitate access to the Site for the Interfacing Contractors and Interfacing Parties.

d) At or near the completion of the construction of any interface-related element of the Contractor's Work, the Contractor shall:

   i) Advise the Interfacing Contractors and Interfacing Parties that the as-constructed interface- related Works can be inspected and provide the necessary access to the Site and its occupation.

   ii) Agree in writing to the Interfacing Contractors and Interfacing Parties, and as consented bythe Engineer, on the adoption of any Interfacing Contractors' and/ or Interfacing Parties' applicable comments on the constructed Works.

e) On advice from the Interfacing Contractor or Interfacing Party that an as-constructed interface- related element is ready for inspection, the Contractor shall:

f) Conduct on-site inspections of the Works elements and give comments in writing to the Interfacing Contractor and/or Interfacing Party.

g) Agree in writing to the Interfacing Contractor or Interfacing Party that the as-constructed Works meet the coordination and/or interface requirements.

h) Prior to applying for a Taking-Over Certificate, the Contractor shall obtain written confirmation from each Interfacing Contractor and each Interfacing Party, that the interface elements meet the requirements of the Interfacing Contractors and Interfacing Parties. If any Interfacing Contractor or Interfacing Party withholds such confirmation, the Engineer shall decide on further action, as requested by the Contractor prior to the issue of a Taking-Over Certificate.

i) Where Contractor's Works are identified as failing to meet the requirements of the Contract and such shall impact the Interfacing Contractors' works or Interfacing Parties' works, the Contractor shall submit the proposed remedial measures to the Engineer for review and shall copy the same to the Interfacing Contractors and/or Interfacing Parties.

j) The Contractor shall coordinate and interface with the Engineer with respect to all construction/installation activities and shall follow the Engineer's instructions for requesting access for such activities.

k) The Contractor shall undertake construction/ installation in accordance with the approved (Contractual) Works Programme. The Contractor shall coordinate and interface with Interfacing Contractors and/or Interfacing Parties for the planning and execution of the testing and commissioning activities.

5.5 INTERFACE DOCUMENTS

5.5.1 Preparation of Interface Documents

The Contractor shall prepare as required the following coordination and interface documents which shall be used to completely define the Contractor's coordination and interface details:

a. Interface Table;

b. Coordination and Interfacing Programme; and

c. Interface Management Plan (IMP).

5.5.2 These coordination and interface documents shall be submitted for review by the Engineer in order to obtain the Engineer's Approval. For all subsequent updates, these documents shall be submitted to the Engineer for information, review and comment. A summary of principal issues with suitable solutions shall be included in each Monthly Progress Report.

5.6 INTERFACE TABLE FOR SUPPLY AND INSTALLATION ITEMS

5.6.1 The Interface Table shall include at least (but without limitation) the items related with the Contractor's Contract described in Appendix 5. The Interface Table, which describes the relationships between the Contractor and Interfacing Contractors and/or the Interfacing Parties and their roles and responsibilities, shall be submitted to the Engineer for consideration after further development of Interface Table.

5.6.2 The Interface Table shall indicate the demarcation of scope of responsibilities between the Contractor and the Interfacing Contractors and the Interfacing Parties.

5.6.3 Within sixty (60) days of notification from the Engineer of the identity of each Interfacing Contractor, the Contractor shall develop and submit to the Engineer an Interface Table that is mutually acceptable to both the Contractor and the Interfacing Contractors and Interfacing Parties.

5.7 COORDINATION AND INTERFACING PROGRAMME

5.7.1 The Contractor shall prepare and submit a Coordination and Interfacing Programme to the Engineer in accordance with the Employer's Requirements and/or as instructed by the Engineer as detailed below.

5.7.2 The Coordination and Interfacing Programme shall be submitted to the Engineer for consent within sixty (60) days from the Letter of Acceptance (LOA) to allow for checking and monitoring by the Engineer.

5.7.3 The Coordination and Interfacing Programme shall include detailed activities describing all aspects of the works of Interfacing Contractors and Interfacing Parties to meet all Sections or Milestones given in the Contract and be clearly linked to other programmes such as the (Contractual) Works Programme (or Work Segment Programmes) to streamline the Works and the works of the Interfacing Contractors and Interfacing Parties.

5.7.4 The Coordination and Interfacing Programme shall indicate the physical areas to which the Interfacing Contractors and Interfacing Parties require access, with access dates, durations required and the required degree of completion of the Works prior to the access dates by Interfacing Contractors and Interfacing Parties.

5.7.5 It is the Contractor's responsibility to ensure timely coordination with the Interfacing Contractors and Interfacing Parties to review, revise and finalise his Coordination and Interfacing Programmes so as not to affect the progress of the Works and/or the works of the Interfacing Contractors and Interfacing Parties.

5.7.6 The Contractor shall note that the following conditions apply to the works of the Interfacing Contractors and/or Interfacing Parties:

a) The Interfacing Contractors and/or Interfacing Parties shall not have exclusive access to any part of the Site except with the consent of the Engineer;

b) The Contractor shall take note that concurrent time allocations for certain areas may be given to more than one Interfacing Contractors and or Interfacing Parties. The Contractorshall coordinate the Works in such areas with the works of the Interfacing Contractors and/or Interfacing Parties and report to the Engineer for his review and consent;

c) The absence of a Coordination and Interfacing Programme date or construction/ installation period for the Interfacing Contractors and/or Interfacing Parties in a specific area shall not prejudice the right of the Engineer to establish a reasonable Coordination and Interfacing Programme date or construction/installation period for thatarea;

d) The Contractor and the Interfacing Contractors shall comply with the Sections or Milestones and other successive activities specified in the Coordination and Interfacing Programme.

5.8 INTERFACE MANAGEMENT PLAN (IMP)

5.8.1 The Contractor shall develop and submit to the Engineer, within sixty (60) days from the LOA, an IMP for all interface issues that may arise during the construction, testing and commissioning of the Works, in consultation with the Interfacing Contractors / Interfacing Parties and the Engineer. The IMP shall allow adequate time periods for each of the Interfacing Contractors/ Interfacing Parties and the Contractor to install their Plant, equipment and Materials in the designated areas.

5.8.2 The IMP shall:

a) Identify all the systems and sub-systems and facilities with interfacing requirements;

b) Define as far as possible the authority and responsibility of the contractor's, the Interfacing Contractor's and interfacing party's involved in interface management and development;

c) Identify the information to be exchanged, together with the management and technical skills required for the associated development of the works, at each phase of the contractor's and Interfacing Contractor's and Interfacing Parties' project life-cycles;

d) Address the Contractual Works Programme (or Work Segment Programmes) of the Contract to meet the Contractor's sections or Milestones and the Interfacing Contractors' sections or milestones and highlight any programme risks requiring the Engineer's attention;

e) Include relevant consideration of the requirements of "Environment Social Health and Safety Manual" as described in Appendix 13;

f) Address the supply, installation, testing and commissioning programmes of the Contract to meet Interfacing Contractors' Sections or Milestones, and highlight any programme risks requiring management attention; and

g) Indicate dates for commencement and completion of each principal activity by the Contractor and those of the Interfacing Contractors and Interfacing Parties, including delivery and installation of Plant, equipment and Materials.

5.8.3 After the Engineer reviews and issues approval to the IMP, the Contractor shall execute the Works accordingly.

5.8.4 The Contractor shall raise and apprise the Engineer immediately of any difficulty in developing a mutually acceptable IMP.

5.8.5 Employer's / Engineer's Input

a) The Employer or Engineer or both will coordinate the activities of the Contractor with reference to interfacing with third parties during all the phases of the Contract.

b) The Employer or Engineer, within the scope of the relevant Contract provisions, may assist the Contractor in the following fields:

(1) Coordination and interface with state and local authorities for the timely receipt of required permits, certificates and approvals related to the construction process;

(2) Coordination and interface with state and local authorities for the implementation of acquisition procedures for any additional land areas that may be required by the Contractor; and

(3) Any other fields or activities related to the Contract as may be required for the purposes of facilitating the Contractor's performance.

c) The Engineer shall conduct a coordination and interface meeting with the interfacing parties every fortnight with the Contractor which may be attended by the Employer. The primary objective of the meeting will be to review progress of the coordination and interface activities.

d) The support and assistance of the Employer and/or the Engineer shall not release the Contractor of any of his obligations under this Contract.

5.9 DETAILED INTERFACE DESCRIPTION (DID)

5.9.1 The DID is the document that provides a clear technical description of each of interface in the Interface Table.

5.9.2 Any revision to the DID shall be mutually acceptable to both the Interfacing Contractors and Interfacing Parties. Only then shall this be submitted to the Engineer for his review.

5.9.3 DID shall contain the following items:

S. No.	Detailed Interface Description
1	Item number and name of interface in Interface Table
2	Name of the Contractor and Interfacing Contractor/Interfacing Party
3	Confirmation Table of both the Contractor and Interfacing Contractor/Interfacing Party
4	Creation date and modification date
5	Correction history
6	The following items shall be described: physical interface, functional interface, protocols, software and data interface, naming conversion, design constrains, environmental conditions, and drawings
7	Reference Documents

5.10 CONTENTS OF INTERFACE MANAGEMENT PLAN

Interface Management Plan (IMP) should be prepared including necessary contents referring Table 1. The intention of each section is described by the text inside angle brackets.

Table1: Sample Contents of Interface Management Plan

1	Introduction	
	1.1	Purpose of Document <Describe the methodology to be adopted by the Contractor in managing all interface issues >
	1.2	Overview <Project overview of the Contractor and the Interfacing Contractor>
2	Resource Management	
	2.1	Organization and Roles & Responsibilities
	2.2	Resource Requirement <Detailed description of the manpower, tools, logistics shall be included in this section>
3	Interface Requirements	
	3.1	Allocation of Interfacing Requirements <This is an introduction to Section3.2>
	3.2	Interface Description between Contractors <Task Allocation Table (TAT) shall be included in this section>
	3.3	Areas of Concern <Process for managing the interface concern>
4	Process Management	
	4.1	Change of Interfacing Requirement <The process for the management of interface requirement change shall be addressed in this section.>
	4.2	Verification and Validation of Interfacing Requirements <The approach to be adopted by the Contractor to manage verification and validation of interfacing requirements shall be addressed in this section.>
	4.3	Testing and Commissioning on Interfaces <The approach to be adopted by the Contractor for the management of Interface in the Testing and Commissioning stage shall be addressed in this section.>
	4.4	Quality Procedures <All Contractor's internal quality procedures applicable for the interface management shall be listed here.>
	4.5	Systems Assurance Plans <Considered requirement of the Systems Assurance.>

5	Document Management	
	5.1	Reference Documents <All applicable reference documents shall be listed in this section.>
	5.2	Structure of Reference Documents <The Structure of reference documents shall be addressed in this section.>
	5.3	Version Control of Interface Documents <Configuration management of interface documents shall be addressed in this section.>
6	Communication	
	6.1	Terms of Reference of Interface Meetings <The terms of reference of interface meetings shall be addressed here.>
	6.2	Exchange of Information between Contractors <The process for the exchange of information between the pair-wise contractors shall be stated here.>
	6.3	Submission to Employer <The approach to be adopted by the pair-wise contractors on the Submission of the Interface Management Plan to Employer shall be described here.>
	6.4	Request for Employer Attention <The criteria and methodology on requesting for Employer attention shall be mentioned here.>
7	Interface Hazard Management	
	7.1	Strategy and Approach
8	Programme	
	8.1	Key Activities <Include schedule of meetings, schedule of exchange of information, etc.>
	8.2	Section and Milestone <Include Design Freeze Dates, Integrated Test Dates, Critical Items dates, etc. Should include reference to appropriate programmes so that any future changes in programme date need not result in resubmission of this plan for approval.>
	8.3	Critical Items/ Critical Paths <This section shall highlight all the critical items and critical paths to the Employer.>

5.11 INTERFACE TABLE

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
1.	Information exchange on alignment with following details: a) Formation Cross section b) Track alignment Drawings c) Coordinates of track centre d) Curves e) Gradient f) Rail levels, g) Yard layouts	(i) C-5 Contractor shall provide details of formation cross section, Plan & L-Section, curves and gradient to T-2 and SYS-1 contractors.	(i) T-2 contractor shall carry out detailed survey and verify plan & L-section, cross section etc and shall prepare final track alignment drawings, yard ESP, curves, gradients, rail level etc and share with SYS-1 and SYS-2 contractors.
2.	Handing/Taking over of abutment A-2 of viaduct for construction of superstructure.	(i) C-5 Contractor shall provide the design parameters for design of abutment A-2 to C-4 Contractor.	(i) C-4 Contractor shall construct abutment A-2 of viaduct and handover the site to C-5 Contractor for construction of superstructure.
3.	Handing/Taking over of site for laying of track on formation.	(i) C-5 Contractor shall share the handing over schedule with T-2 Contractor. (ii) C-5 Contractor shall complete the work of formation and bridges as per schedule and handover formation to T-2 Contractor for laying of track.	(i) T-2 Contractor shall take access to the formation and complete installation of track.

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
4.	Cross Section of bank at junction with C-4 Contractor.	C-5 Contractor shall complete formation at junctions with C-4 Contractor.	(i) C-4 contractor shall provide stepped profile of bank at junction with C-5 contractor at Ch.12000 and Ch.18000 as shown in Tender drawings
5.	Provide access to site for SYS-1 and SYS-2 contractors for OHE and S&T works	(i) C-5 contractor in coordination with T-2 Contractor shall share the handing over schedule to SYS-1 and SYS-2 Contractors as per schedule.	(i) SYS-1 Contractor shall take access to the formation /track from Civil and Track Contractors and complete OHE works SYS-2 contractor shall take telecom and signalling access and lay cabels and install S&T outdoors indoor equipment.
6.	*Bridges (Concrete / Steel) - OHE Load on the Pier cap of bridges due to OHE Masts*	*(i) C-5 Contractor shall share the relevant bridge drawings with SYS-1 Contractor.* *(ii) C-5 Contractor shall take into account the OHE mast location, loads and bending moment etc. provided by SYS-1 Contractor and ensure that the Pier Caps are designed and constructed suitable for OHE Mast.* (iii) *C-5 Contractors shall supply & provide holding down bolts as per design given by SYS-1 Contractor and also provide template for keeping bolts in position during concreting.*	*(i) SYS-1 Contractor shall provide OHE Layout Plan (LOP) of proposed locations of OHE Masts.* *(ii) SYS-1 Contractor shall also share values of max direct load, Bending Moment, etc. arising due to the OHE Masts, fittings and anchors, which have to be considered in the design of Piers.* *(iii) SYS-1 Contractor shall coordinate with C-5 contractor and confirm suitability of Holding down bolts, template etc. as per design and specification and extend all assistance in installation of Holding*

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
			Down Bolts (HDB) and template as per approved design/drawings to the C-5 Contractor. (iv) *SYS-1 Contractor shall provide staff to witness the provisions made by the C-5 contractor for adequacy and suitability.*
7.	Electrical Clearances at Bridges (ROBs),Rail Fly Overs(RFOs) and other Over Head Structures above tracks or OHE	(i) Civil Contractors shall supply list of Bridges (ROBs),Rail Fly Overs(RFOs) and other Over Head Structures indicating their specific locations, cross-sections, height above rail level and dimensional details for evaluation of infringements, if any. (ii) Civil Contractors shall accommodate the requirement of the SYS-1 Contractor as approved by the Engineer.	(i) SYS-1 Contractor shall interface with C-5 Contractor for infringements to Electrical Clearances and required modifications / improvements. (ii) SYS-1 Contractor shall update /modify traction OHE drawings based on the interface information. (iii) SYS-1 Contractor shall interface and get all drawings & schemes approved from the Engineer ascertaining adequacy of electrical clearances.

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
8.	Earthing and bonding of Steel Bridges.	(i) Civil Contractors shall facilitate SYS-1 Contractor for earthing and bonding of steel bridges.	(i) SYS-1 Contractor shall provide schematic drawings for earthing & bonding of overhead steel bridges.
9.	*Earthing & Bonding of concrete of pier of major bridges and Viaduct.*	*(i) C-5 Contractor shall install dedicated reinforcement earth bars in concrete at each pier for each track to ensure earth continuity as per approved drawings.* *(ii) C-5 Contractor shall allow SYS-1 Contractor to witness casting of each bar to ensure the continuity of the earth conductor as per the approved drawings.* *(iii) C-5 Contractor shall paint mark on the concrete surface of designated earth bar to facilitate supervision.* *(iv) C-5 Contractor shall supply and install brought out connections viz. terminal plates on every pier cap for each track to ensure earthing & bonding connection with OHE system and BEC (if required).*	*(i) SYS-1 Contractor shall provide schematic drawings for earthing & bonding connections with dedicated reinforcement bars in concrete of pier cap to piles/legs of concrete bridges.* *(ii) SYS-1 Contractor shall interface and get all drawings & schemes approved from the Engineer.* *(iii) SYS-1 Contractor shall supply and install flexible cable / jumper/GI flat and connect the terminal plates with OHE System and BEC (if required) at every consecutive spans.* *(iv) SYS-1 Contractor shall arrange adequate supervision of appropriate level at various stages of construction to ensure provisions of earth continuity in concrete structures.*

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
10.	S&T service structures at stations and auto signal huts	(i) C-5 contractor shall share the handing over schedule of S&T service structures with SYS-1 & SYS–2 contractors and hand over to SYS-2 contractor as per schedule.	(i) SYS-1 and SYS – 2 contractors shall take the access to S&T service structures. SYS-1 contractor shall install electric fitting/fixture and SYS-2 contractor shall install S&T equipment.
11.	Signals post & junction box on viaducts	(i) C -5 contractor shall take into account signal post & junction box location, loads etc. and ensure the viaduct girder is designed and constructed for signals post & junction box. (ii) C-5 contractor shall provide holding down bolts as per details provided by SYS-2 contractor and also provide template for keeping bolts in position.	(i) SYS-2 contractor shall provide location, loads and fixing details of signal posts & junction box to C-5 contractor, which have to be considered in design of viaduct girders. (ii) SYS-2 contractor shall coordinate with C-5 contractor and confirm for suitability and extend all assistance in providing holding down bolts as per approved design / drawing. (iii) SYS-2 contractor shall provide staff to witness the provisions made by C-5 contractor for adequacy and suitability.

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
12.	S&T cable duct in stations area.	(i) C-5 contractor shall construct S&T cable ducts in station yard. The C-5 contractor shall share handing over schedule to SYS-2 contractor and hand over cable ducts to SYS-2 contractor as per schedule.	(i) SYS-2 contractor shall take over the cable duct and lay S&T cables as per approved design/drawings.
13.	Safety Precautions during working in DFCCIL Track.	C-5 Contractor will take necessary precautions while working in Br No.87.	
14.	Working in Prithla Yard of DFCCIL	C-5 Contractor shall interface with DFCCIL for works of Prithla Junction (South) SSP.	
15.	*Viaduct deck slab - fixing of anchor bolts of OHE guy rod arrangement.*	*(i) C-5 Contractor shall share the relevant viaduct drawings with SYS-1 Contractor.* *(ii) C-5 Contractor shall take into account the OHE anchor location, loads and bending moment etc. provided by SYS-1 Contractor and ensure that the viaduct decks are designed and constructed suitable for OHE anchor requirement.* *(iii) C-5 Contractor shall arrange the GI anchor bolts as per details given by SYS-1 Contractor and install the GI anchor bolts on viaduct deck during concreting as per*	*(i) SYS-1 Contractor shall provide OHE Layout Plan (LOP) of proposed locations of OHE anchors.* *(ii) SYS-1 Contractor shall share values of maximum direct load, bending moment, pulling load etc. arising due to the OHE anchors, fittings and load, which have to be considered in the design of viaduct deck slab.* *(iii) SYS-1 Contractor shall provide design details, material composition etc. of anchor bolts of guy rod arrangement to C-5 Contractor.* *(iv) SYS-1 Contractor shall*

Item No.	Item Description	Civil Contractor (C-5)	Civil, Track and System Contractors (C-4, T-2, SYS-1and SYS-2)
		approved drawings.	*provide staff to witness the provisions made by the C-5 Contractor for adequacy and suitability of anchors.*
16.	*DFC New Prithla Yard SSP - Retaining wall between HORC Track and DFC Prithla SSP*	*(i) C-5 Contractor shall coordinate with SYS-1 Contractor and integrate the cross feeder gantry structure OHE foundations in the retaining wall between HORC track and DFC Prithla SSP.* *(ii) C-5 Contractor shall take into account OHE foundation data i.e direct load, bending moment, foundation design with dia and depth etc. for design of the retaining wall.*	*(i) SYS-1 Contractor shall coordinate with C-5 Contractor for integration of cross feeder gantry structures foundations with retaining wall at DFC Prithla SSP location.* *(ii) SYS-1 Contractor shall provide all cross feeder gantry OHE foundation data i.e direct load, bending moment, foundation design with dia and depth etc. for design of retaining wall to C-5 Contractor.* *(iii) SYS-1 OHE Contractor shall provide staff during concreting of retaining wall to ensure that cross feeder gantry structure foundation is cast as per approved drawings.*
17.	*Construction of railway formation by utilizing surplus earth released from C-4 Package*	*C-5 Contractor shall carry out C&G of the site where surplus earth is to be used and record levels before allowing C-4 contractor to dump surplus earth.*	*C-4 Contractor shall ensure that dumping of surplus earth in C-5 package is done only after C&G of the site and recording of the level by C-5 Contractor.*

5.12 Interface requirements specified above are by no means exhaustive and it remains the Contractors' responsibilities to develop, update and execute jointly Interface Requirements during design & throughout the execution of Works, to ensure that:

i. all interface issues between the Contracts/Systems are satisfactorily resolved;
ii. design, supply, installation and testing of equipment are fully co-ordinated; and
iii. all equipment and facilities supplied under the Contracts are fully compatible with each other, whilst meeting the requirements of the respective Specifications.

APPENDIX 6

PROGRAMME REQUIREMENTS

6. GENERAL

6.1 PURPOSE OF PROGRAMME

6.1.1 There are two primary purposes for the requirement of Programme (Scheduling) information described in this document:

a) Evaluation of tender.

b) Status Reports during Construction

To provide the Engineer with status reports for managing, monitoring and coordinating the awarded contracts during their execution within the overall multi-contract project schedule.

The requirements are organized in two stages. The first stage is a requirement for all Bidders and shall be submitted as part of Bid. The second stage is a requirement of the Employer and describes a series of reports to be submitted by the Contractor to the Engineer during the execution of contract, following the award of contract.

6.1.2 The Tenderer/Contractor shall programme his work at all times to meet the Key Date stated in Appendix 2 to the Employer's Requirements and the specified interface periods for the design and installation of the Works with those of the Interfacing Contractors and shall during the progress of the Works constantly monitor his progress against the programmes described below.

6.1.3 The Tenderer/Contractor shall include in all programmes his work obligations towards shared access, shared Site areas and other coincident or adjacent Works Areas.

6.1.4 The Works Programme, and all more detailed or revised versions, shall be submitted to the Engineer in hard copy as well as soft copy for his consent in accordance with the provisions of the GC.

6.2 METHODOLOGY

6.2.1 The computerized Critical Path Method (CPM) network using the Precedence Diagramming Method (PDM), has been selected by the Employer as the technique for contract management system and in co-coordinating the multi-contract project. This technique shall also be employed by the Tenderer in preparing their Tender submissions and by the Contractor in their Construction Stage submissions.

6.2.2 Unless otherwise agreed by the Engineer, all programmes submitted by the Contractor shall be produced using computerized Critical Path Method (CPM) Networks developed implementing the Precedence Diagramming Method (PDM) with Cost Loaded Charts and Tables.

6.2.3 The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design, pre-construction, construction, and sub-contracts in executing the CPM scheduling by PDM. The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

6.3 PROGRAMME MANAGEMENT SOFTWARE

6.3.1 CPM programming software used shall be Primavera Project Planning (P6) Program - Ver 21.12 or later. Any other compatible system capable of direct file interchange capability with software program used by the Employer - Primavera (P6), Ver 21.12 or later can be used with Engineer's consent. Scheduling software and relevant instruction manuals, licensed for use in connection with the contract, shall be provided by the Contractor according to the Employer's specifications

6.3.2 The Tenderer may use a system other than Primavera but will be required to demonstrate that full electronic data transfer to Primavera is available and that the various levels of reporting and coding capabilities are at least equivalent to Primavera. Compatibility and comparable performance between Primavera and the Tenderer's proposed system shall be demonstrated in his Tender submission. Should compatibility not be demonstrated to the Employer's satisfaction the Contractor shall utilise Primavera for development, stat using, updating and revision of all the Programmes during the duration of the Contract. Upon the Engineer's consent of a system other than Primavera, the Contractor shall supply the Engineer with an original licensed copy, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

6.4 POST CONTRACT AWARD

6.4.1 The Contractor shall develop his Tender Programme into the Initial Works Programme including an outline Narrative Statement and submit its more detailed version as per the key dates mentioned in Appendix 2 to the Engineer for approval.

6.4.2 The first Three Month Rolling Programme shall be submitted within thirty (30) days of the date of commencement and all subsequent editions shall accompany the Monthly Progress Report. The Monthly Progress Reports shall also include a Programme Update as described below. These programmes shall subsequently be updated as described below.

6.4.3 The Contractor shall take into account the programmes of Interfacing Contractors while finalizing the Works Programme It is the Contractor's responsibility to ensure timely co-ordination with the Interfacing Contractors to review, revise and finalise his Work Programme so as not to affect the progress of Works/ and or the works of the Interfacing Contractors. The Detailed Works Programme when approved by the Engineer after incorporating requirement of Interfacing Contractors shall form the Baseline Programme and shall be called "Programme" against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline programme but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.

6.4.4 For Initial & Detailed Work Programme submission, one (1) original and three (3) copies each of the following Programmes and Reports shall be submitted to the Engineer:

a) Programme: Baseline CPM Network

b) Programme: Baseline Milestone based Cost Activity Schedule

c) Baseline Schedule Report

d) Narrative Statement

e) Baseline Physical Progress 'S' curve

f) Baseline Resource Charts

6.4.5 The Engineer shall review and comment on the Contractor's programmes and information submitted under this Clause. The Engineer will confirm his consent or otherwise of the

submissions within thirty (30) calendar days.

6.4.6 The Engineer shall require the Contractor to re-submit within thirty (30) calendar days if he is of the opinion that the programmes and information submitted by the Contractor is unlikely to meet the Contract Key Date.

6.4.7 If in the opinion of the Engineer, any of the Contractor's revised programmes or Baseline Schedule Report is not acceptable, it shall be construed as a failure of the Contractor to meet the Contract Key Date.

6.4.8 Notwithstanding the above, the Engineer may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if" statements. The initial computer-generated report after receiving the Engineer's consent will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.

6.4.9 Failure to include any element of work required for performance of the Contract shall not relieve the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

6.5 WORKS PROGRAMME

6.5.1 The Works Programme shall show the Contractor's plan for organising and carrying out whole of the Works.

6.5.2 The Works Programme shall be a computerised Critical Path Method (CPM) network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly or monthly time scale.

6.5.3 Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:

a) Key Date,

b) all physical work to be undertaken in the performance of the Contract obligations, including Temporary Works,

c) the requested date for issue of any drawings or information by the Engineer,

d) incorporation of principal aspects of the Design Submission Programme,

e) procurement of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment,

f) any off-site work such as production or pre-fabrication of components,

g) installation of temporary construction facilities,

h) interface periods with Interfacing Contractors or utility undertakings,

i) design, supply and/or construction activities of sub-contractors,

j) any outside influence which will or may affect the Works.

6.5.4 The Works Programme shall show achievement of all Key Date.

6.5.5 Activity descriptions shall be unique, describing discrete elements of work. Any activity creating an imposed time or other constraint shall be fully defined by the Contractor.

6.5.6 The Works Programme shall be organised in a logical work-breakdown-structure

including work stages and phases, and shall clearly indicate the critical path(s).

Each activity in the Works Programme shall be coded to indicate:

a) Activity ID and Activity Code.

b) The Engineer may request additional activity coding to the extent available without restraint to the Contractor's utilisation of the programme software. When requested the Contractor shall add the required additional coding to the Programme. The Contractor shall use additional code fields as requested to comply with the requirements and for the use of the Contractor.

6.5.7 Activity duration shall not exceed two (2) weeks, unless otherwise consented to by the Engineer, except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The Contractor shall submit a Programme/Project Calendar cross reference clearly indicating the allowance for holidays.

6.5.8 The Works Programme, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic and hard copy format (time scale logic diagrams in A1 size, reports in A4 size).

6.5.9 Activity Report shall list all activities, and events in the Works Programme, sorted by activity identification number.

The Activity Report shall include the following for each activity and event:

a) activity identification number and description,

b) duration expressed in Days,

c) early and late start, & early and late finish dates. Planned start and finish dates,

d) calculated total float and free float,

e) predecessor(s) and successor(s), accompanying relationships and lead/lag duration,

f) imposed time or date constraints,

g) calendar.

6.5.10 Narrative Statement

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of Key Date, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences and primary item of plant, Construction Equipment, Temporary Works and the like. It shall fully explain the reasons for the main logic links in the Programme and include particulars of how activity durations are established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

6.5.11 Baseline Physical Progress 'S' Curve

The Contractor shall also submit a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the CPM Network Logic Diagram, expressed in percentage terms. This 'S' curve shall be generated from the computerized CPM Network Logic Diagram.

6.5.12 Baseline Resource Charts

The Contractor shall also submit a Resource Charts, generated from the Contractor's CPM Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project.

As an additional monitoring facility, indicator resources shall be assigned to relevant activities for the major items of work. Indicator resources shall be directly allocated for excavation (cum.), piling (no.), diaphragm walling (m.), concrete (cum.), tunnel lining (m), etc. Resource indicators may be input as a daily rate, expected required rate, or as an activity total in the relevant units. These are purely indicative quantities and do not form part of contract.

6.5.13 All submissions of proposed Works Programmes subsequently, after approval of the Initial Works Programme, shall include the actual physical progress of work and forecast of the remaining work. Actual progress shall be stated in percent complete, remaining duration, and actual start and finish dates for each activity in the Works Programme.

6.6 INITIAL WORKS PROGRAMME

6.6.1 The Initial Works Programme submitted as under Clause 6.4 above need not include the full details. It should be a condensed version with combined activities of longer. The outline Narrative Statement shall be in sufficient detail to clearly show the Contractor's intention.

6.6.2 After the Engineer's consent to the Initial Works Programme, the Contractor shall submit to the Engineer an expanded and more detailed version of the Initial Works Programme containing all of the information and detail required as per Key Date mentioned in Appendix 2.

6.6.3 Such submission shall make use of the Tender Programme submitted earlier but refined to include the best estimates of dates for the work of Interfacing Contracts which has impact on the Contractor's programme. Such programmes shall be amended subsequently to incorporate the actual dates/ schedule of the affecting contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Interfacing Contractors to finalise the Initial Programme, without affecting progress of the work.

6.7 WORKS PROGRAMME REVISIONS

6.7.1 The Contractor shall immediately notify the Engineer in writing of the need for any changes in the Works Programme, whether due to a change of intention or of circumstances or for any other reason. Where such proposed change affects timely completion of the Works or any other Key Date the Contractor shall within fourteen (14) days of the date of notifying the Engineer submit for the Engineer's consent its proposed revised Works Programme and accompanying Narrative Statement. The proposed revised Works Programme shall show the sequence of operations of any and all works related to the change and the impact of changed work or changed conditions.

6.7.2 If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Programme which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the Contractor within fourteen (14) days after the Engineer's instruction. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions.

6.7.3 All activities that have negative float must be analysed by the Contractor to identify the impact on the timely completion of the Works or on the achievement of Key Date.

6.8 THREE MONTH ROLLING PROGRAMME

6.8.1 The Three-Month Rolling Programme shall be an expansion of the current Works Programme, covering sequential periods of three months. The Three-Month Rolling Programme shall provide more detail of the Contractor's plan, organisation and execution of the work within these periods. In particular, the Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary, to a daily level of detail.

6.8.2 The Three-Month Rolling Programme shall be developed as a Critical Path Method (CPM) network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A4 and time-scaled networks diagrams on an A1 size reproducible media. Tasks in the programme shall be derivatives of and directly related to tasks in the approved Works Programme.

6.8.3 The Contractor shall describe the discrete work elements and work element inter-relationships necessary to complete all works and any separable parts thereof including work assigned to sub-contractors.

6.8.4 Activity duration shall not exceed two (2) weeks unless otherwise consented to by the Engineer.

6.8.5 Each activity in the Three-Month Rolling Programme shall be coded, or described so as clearly to indicate the corresponding activity in the Works Programme.

6.9 THREE MONTH ROLLING PROGRAMME REVISIONS AND UPDATE

6.9.1 The Three-Month Rolling Programme shall be extended forward each month as described under Clause 6. 4 above. Each submission of the Three-Month Rolling Programme shall be accompanied by a Programme Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month period.

6.9.2 If the Three Month Rolling Programme is at variance with the Works Programme, the Programme Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities to be undertaken over the three-month period, including programme assumptions and methods to be employed in achieving timely completion.

6.9.3 The Contractor shall revise the Three-Month Rolling Programme or propose revisions of the Works Programme, or both, from time to time as may be appropriate to ensure consistency between them.

6.10 THREE WEEK ROLLING BAR CHART SCHEDULE

Once a week, on a day mutually agreed to by the Engineer and the Contractor, a meeting will be held to assess progress by the Contractor during the previous work week. The Contractor shall submit a construction schedule listing activity completed and in-progress from the previous week and the activities scheduled for the succeeding two weeks based on the detailed Works Programme. Copies of the schedule shall be submitted on A3 sized paper.

6.11 PROJECT CALENDAR

For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 5 days week - Monday through Friday, except for National (Govt. of India) Holidays. For Project purposes, a week begins at 0001 hours on a Monday and ends at 2359 hours on a Sunday. The completion of an activity or the achievement of an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered week. An access date or activity start date when given as a week number shall be taken to mean 0001 hours on a Monday of the Numbered week.

6.12 PROGRAMMING PERSONNEL

The Contractor shall submit, as part of its Staff Organization Plan, the names and required information for the staff to be employed on Works Programming. The Works Programmer shall hold reputable professional qualifications and relevant experience as per Attachment C-1 to Employer's Requirements – Construction .The programmer shall be employed by the Contractor full time on the Contract until the completion or such earlier time.

6.13 PROGRAMME AND REPORT SUBMISSION FORMAT

The Contractor shall submit one (1) original and three (3) copies and a soft copy of all submissions to the Engineer. All submissions shall be in A0, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Engineer.

The format for all Programme and Report submissions shall be strictly in accordance with the format or as requested by the Engineer.

APPENDIX 7

MEETINGS

7. MEETINGS

7.1 Kick-Off Meeting

The Engineer shall hold Kick-Off Meeting within 7 calendar days from the Commencement Date. Purpose of the Meeting is formally to notify all parties concerned under the Contract thatthe project has begun, and every party has a common understanding and his role from the Commencement Date until issuance of the Taking-Over Certificate.

At the Kick-Off Meeting, followings will be, but not limited, discussed.

a) Outline of the Works

b) Communication rules (process, emails, approvals, etc.)

c) Other matters regarding proceeding and management of the Contract.

d) Profile of the Site

e) Time Schedule List of Contractual Events/Submissions, including Milestones, Time(s) for Completion and Defects Notification Period(s).

f) Introduction of key persons of the Contractor and Employer, with role, Function and authority of each person.

g) Role and responsibility of Emergency notification process.

7.2 Regular Meetings

7.2.1 The Engineer shall hold regular meetings with the Contractor as necessary for the proper management and co-ordination of the Works. The Contractor's representative and other personnel as considered necessary by the Engineer, shall attend such meetings.

7.2.2 Within twenty eight (28) days after the Commencement Date, the Engineer and the Contractor's Representative shall agree upon a programme for weekly and monthly meetings covering the first three (3) months after such twenty eight (28) days. The Contractor's Representative shall make sure that the Contractor's Personnel designated to attend meetings make themselves available for the meetings. The Engineer shall prepare the agenda for the meetings and the relevant documents to be submitted to the meeting, including as a minimum the minutes of the previous meeting. Thereafter, the programme for weekly and monthly meetings shall be updated monthly in the monthly progress meetings.

7.2.3 The Engineer may initiate ad-hoc meetings as and when the need arises, through prior consultation with the Contractor's Representative where possible, and the Contractor's Representative and other Contractor's Personnel designated by the Engineer and/or the Contractor's Representative shall attend such meetings. The Engineer shall prepare a proposed agenda of the meeting, for prior consultation with the Contractor's Representative where possible.

7.3 Monthly Progress Meeting

A Monthly Progress Meeting shall be called by the Engineer and shall be held every month within three (3) days following issuance of the Contractor's Monthly Progress Report. If the day specified, is not a working day, then the meeting shall be heldon the next working day after the specified date. The Engineer shall notify the Contractor of any change in the date or time, or both, of the meeting. The main purpose of the meeting is to discuss progress of the Works and if there is any delay in progress, being encountered by the Contractor, the Contractor shall indicate the cause of delay and present the method of recovery.The results of the discussions of the meeting shall be included in the Contractor's next MonthlyProgress Report to be provided.

7.4 Co-ordination Meeting

The Contractor shall organize co-ordination meetings as required with related parties. Before conducting such co-ordination meetings with the related parties, the Contractor shall give priornotice and agenda of the meeting to the Engineer and the Employer.

7.5 Meetings called by the Contractor

The Contractor's Representative may request the Engineer to meet him and other Contractor's Personnel whenever necessary to discuss the issues pertaining to the Works and the Contract. The Engineer shall comply with the request where physically possible. The Contractor shall prepare a proposed agenda for the meeting and submit it to the Engineer when making request for the meeting.

7.6 Other Meetings

The Contractor's Representative shall attend, and shall arrange for representatives of the Subcontractors, public departments, transportation companies, utility undertakings and other contractors employed by the Employer to attend, meetings when required by the Engineer. The Contractor shall inform the Engineer in 48 hours (or such a shorter period as agreed by the Engineer) before conducting meetings with the public departments, transportation companies, utility undertakings and/or the other contractors and shall give the Engineer an opportunity to attend such meetings.

7.7 Minutes of Meetings

The Engineer in principle shall be responsible for the preparation of the minutes of meetings, circulating it to the parties who attended the meeting before the next relevant meeting. The Engineer shall also be responsible for the minutes of ad-hoc meetings in a similar manner, unless otherwise agreed with the Employer.

7.8 MONTHLY PROGRESS REPORTS

7.8.1 GENERAL

The Contractor shall submit to the Engineer, a Monthly Progress Report. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates. It shall be submitted in a format to which the Engineer shall have given his consent and shall contain sections/sub-sections.

7.8.2 FINANCIAL STATUS

a) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.

b) A spread sheet summarising each activity, the budget, costs incurred during the period, costs to date, costs to go, cost forecast (total of costs to date and costs to go) and cost variance (difference between cost forecast and budget).

c) A spread sheet indicating the status of all payments due and made.

d) A report on of the status of any outstanding claims. The report shall in particular provide interim updated accounts of continuing claims.

7.8.3 PHYSICAL PROGRESS

a) It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.

b) It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.

7.8.4 PROGRAMME UPDATE (For Entire Project)

a) The monthly Programme Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the end of the month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the Contractor's submittal:

(1) Early Work and Baseline Submittals – explains determination of activity duration and describes the Contractor's approach for meeting required Key Date as specified in the Contract.

(2) Updated Detail Programme Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:

i. If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Date, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Date or mitigate potential delays. Identify deviation from previous month's critical path.

ii. Identify by activity number and description, activities in progress and activities scheduled to be completed.

iii. Discuss Variation Order Work Items, if any.

b) The Programme Status which shall:

(1) show Works Programme status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.

(2) be presented as a bar-chart size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings;

c) The Activity Variance Analysis which shall analyse activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works Programme.

7.8.5 KEY DETAILS STATUS

A report on the status of all Key details due to have been achieved during the month and forecasts of achievement of any missed Key details, and those due in the next month.

7.8.6 THREE MONTH ROLLING PROGRAMME

The monthly issue of the Three-Month Rolling Programme.

7.8.7 PLANNING AND CO-ORDINATION

a) A summary of all planning/co-ordination activities during the month and details of outstanding actions.

b) A schedule of all submissions and consents/approvals obtained/outstanding.

7.8.8 PROCUREMENT REPORT

a) A summary of all significant procurement activities during the month, including action taken to overcome problems.

b) A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

(1) purchase Order Date - Scheduled/Actual,

(2) manufacturer/Supplier and Origin,

(3) letter of Credit Issued date,

(4) manufacturer/Supplier Ship Date - Scheduled/Actual,

(5) method of Shipment,

(6) arrival Date in India- Scheduled/Actual.

7.8.9 SAFETY

A review of all safety aspects during the month including reports on all accidents and actions proposed to prevent further occurrence.

7.8.10 ENVIRONMENTAL AND SOCIAL

A review of all the environmental and social issues during the past month to include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

APPENDIX 8
MANAGEMENT PLANS AND SUBMISSIONS

8 MANAGEMENT PLANS

8.1 General

8.1.1 In order to ensure the Contractor understands and complies with the requirements of the Contract, a series of Management Plan shall be developed. These Management Plans will serve to structure the submittals in a manner that the Contractor can develop and prepare the submittals and the Engineer can review and comment on a prescribed programme.

8.1.2 The Management Plans shall be configured as a family of "stand-alone" plans and associated documents, each covering one of the subjects listed below.

8.1.3 The plans and documents shall be co-ordinated with each other and shall collectively define describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities etc. and shall show how these combine together to assure that the work truly meets the requirements of the specifications in respect of the subject listed.

8.1.4 All plans and documents shall be submitted as per Key Dates mentioned in Appendix 2. Further submissions shall be made:

a) when required in accordance with the Works Programme;
b) whenever the development of the Contractor's designs or planning allows the plan to be developed further;
c) in response to comments made by the Engineer:
d) whenever any change occurs that invalidates the information contained in the previously submitted and reviewed document, within 14 days of the occurrence of such change; and
e) when requested by the Engineer from time to time.

8.2 General Organisation

The plans listed below shall be developed and submitted by the Contractor for the Engineer's review:

a) Project Management Plan
   1) Contractor's Project Plan
   2) Interface Management Plan

b) Works Quality Management Plan
   1) Works Quality Management Plan
   2) RAMS Plan
   3) Electromagnetic Compatibility Management Plan
   4) Software Quality Assurance Plan

c) Design, Procurement and Manufacturing Management Plan
   1) Design Plan
   2) Factory Testing Plan
   3) Procurement, Manufacturing and Delivery Plan

d) Construction and Installation Management Plan

1) Construction and Installation Plan
2) Environment, Social Health and Safety, Management Plan

e) Completion Management Plan
1) Commissioning Plan
2) Operational and Maintenance Manuals Plan
3) Training Plan
4) Spares Management Plan
5) Defects Management Plan

8.3 Project Management Plan

The overall management of the Works shall be the Contractor's responsibility. The organisation of the resources for the design, procurement, manufacture, delivery, installation, testing and commissioning, and setting to work is to be developed into a Project Management Plan. Each section of this plan shall fully describe the Contractor's understanding of the Works and management skills and structure required to achieve the same.

8.3.1 Contractor's Project Plan

a) The Contractor's Project Plan shall provide a clear overview of the Contractor's organisation, management systems and methods to be used for execution and completion of the Works.

b) The Contractor's Project Plan shall include a summary description of each and every stage of implementation of the Works, clearly showing the principal organisational interfaces both within the Contractor's own organisation (including sub-contractors of every tier) and with Other Contractors and Relevant Authorities, defining how each of these interfaces is to be managed and controlled. An organisation chart shall be produced to illustrate the subdivision of the work into elements for effective technical and managerial control, the reporting structure and the interface relationship among all parties involved. Names, addresses, telephone and fax numbers of all principle contacts shall be listed.

c) The Contractor's Project Plan shall contain structured organisation charts showing the hierarchical relationship of the Contractor's organisation (including sub contractors of every tier). The organisation charts shall be produced as a "family" such that the basic chart shows the overall organisation structure supported by subsidiary charts detailing the internal structure of various departments or sections of the overall organisation.

d) The Contractor's Project Plan shall include full details of the qualifications, experience, authority and responsibility of the personnel assigned to all key positions of the Contractor's organisation (including sub-contractors of every tier). As a minimum, this shall include all levels down to senior managers and shall include the personnel responsible for each individual department and functional group. A clear reference shall be given as to the location of staff (e.g. site resident or factory based, etc). Names, addresses, telephone and fax numbers of all principle contacts shall be listed.

e) The Contractor's Project Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall, without limitation, identify and set out:

(1) the procedure for audit;

(2) the procedures for the control of receipt and issue of all Works related correspondence so as to ensure traceability;

(3) the procedures for filing system to be implemented to maintain the Contractor's records during the course of the work. The filing systems used by the Contractor and sub contractors of any tier shall be compatible as for as is necessary;

(4) the procedures for the identification, production, verification, internal approval, review (when required) by the Engineer, distribution, implementation and recording of changes to all drawings, reports and specifications;

(5) the procedures for the evaluation, selection, engagement and monitoring of sub-contractor/suppliers together with the means of application of quality assurance to their work including audit and acceptance;

(6) the procedure for the regular review and revision of each type of quality plan and its supplemental individual specific quality plans to ensure their continuing suitability and effectiveness, in addition to the methods to be used for revision and issue of revised documentation;

(7) the procedures for the control, calibration and maintenance of inspection, testing and measuring equipment;

(8) the procedures for the selection, indexing, disposition and maintenance of project record for storage in the archives. A list of items to be archived, including their periods of retention shall be submitted for review by the Engineer;

(9) the procedures for identifying training needs and for the provision of training of all personnel performing activities affecting quality; and

(10) the procedures for the control of non-conformity.

f) The Contractor's Project Plan shall include details of Contractor's Office.

8.3.2 Interface Management Plan

The Contractor shall prepare Interface Management Plan in accordance with Appendix 5.

8.4 **Works Quality Management Plans**

8.4.1 The Contractor shall submit for review by the Engineer Works Quality Management plan in accordance with the requirements of Appendix 11.

8.4.2 RAMS Plans

a) The Contractor shall implement a formal Reliability Plan and a formal Maintainability Plan in accordance with the PS.

b) The Contractor shall submit for review by the Engineer the Contractor's Reliability Plan and Maintainability Plan in accordance with the requirements of General Specification (S&T). The Contractors Reliability Plan and a Maintainability Plan shall include Failure Modes, Effects and Criticality Analysis and the production of a Reliability Critical Items List.

c) The contractor shall submit for review by the Engineer the Contractor's Systems Safety Plan. The Systems Safety Plan shall address all the factors referenced in this Specification and as required by the Particular Specification(S&T).

8.4.3 Software Quality Assurance Plan

Where software is a design deliverable, the Contractor shall submit a Software Quality Assurance Plan in accordance with the requirements of Appendix 11 The Software Quality Assurance Plan shall address all elements of the design and development of software

required as part of the Works.

8.5 **Design, Procurement and Manufacturing Plan**

The Design, Procurement and Manufacturing Plan shall be configured as a family of "stand- alone" plans and associated documents each covering one of the subjects listed below. The plans shall be coordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organization, sequencing of activities, etc. and shall show how these combine together to assure that the Works fully meet the requirements of the Specification in respect of the subjects listed.

8.5.1 Design Plan

a) Design shall be undertaken in various phases to ensure a smooth flow of information for review by the Engineer. Submissions shall be strictly in accordance with the Design Submissions Programme.

b) The Contractor shall perform his designs for the Works and prepare a Design Plan for his design work in accordance with the following design stages. The Contractor shall submit to the Engineer for his review, relevant design information.

8.5.2 Factory Testing Plan

a) The Contractor shall prepare and submit for review by the Engineer the Contractor's Factory Testing Plan detailing and explaining how the Contractor will plan, perform, and document all inspections and tests that will be conducted to verify and validate the Works prior to delivery to the Site. The plan shall consist of a narrative description supported by graphics, diagrams and tabulations as required.

The plan shall contain but not be limited to the following topics:

(1) the Contractor's strategy for inspection and Factory Acceptance Tests of all constituent parts of the Works and how this relates to the sequence of delivery;

(2) the sequencing and interrelationships of the inspections and tests including:

i. First Article Inspection

ii. all Quality Hold Points; and

iii. all Quality Control Points;

(3) the type and extent of inspection and Factory Acceptance Tests to be undertaken and the parts of the Works to be proven by that testing;

(4) the objective of each inspection or test, what particular design and operating criteria the test or inspection will prove and how the success of the test or inspection will be demonstrated or measured;

(5) organisation chart and CV of key personnel in inspection and test team;

(6) the plan for the production and submission of the inspection and test procedures tothe Engineer for review including the submission of the inspection and test reports and records; and

(7) Type Tests, Routine Tests, First Article Inspections and any other tests constituting

the Factory Acceptance Tests.

~~b)~~ The Contractor shall arrange for all equipment and systems manufactured for incorporation into the Permanent Works to undergo a Factory Acceptance Test (FAT) before shipment from the place of manufacture. Any particular requirements for inspection and testing at the place of manufacture are prescribed in the PS.

c) The Contactor shall be responsible for re-inspecting and re-testing any failed inspection and Factory Acceptance Test including regression testing on previously passed items.

d) Inspections and tests that are to be witnessed by the Employer or the Engineer shall be sensibly grouped and scheduled so that as many inspections and tests as possible may be witnessed during a single visit.

e) If required, Type Tests as detailed in relevant Particular Specifications shall be performed on all items of equipment to be installed as part of the Permanent Works under the Contract. The Type testing shall be based on the environmental class of the sites into which the equipment will be installed.

f) For all production items a First Article Inspection shall be undertaken. Latest drawings, inspection & test procedures, specifications and quality documentation for inspection of equipment shall be submitted for First Article Inspection to the Engineer. Routine production testing methods shall be detailed for review by the Engineer. Routine testing shall ensure that all samples of a production item are within the tolerances required for complete interchangeability.

g) The Contractor shall prepare two copies of an inspection or test report immediately after the completion of each inspection or test whether or not witnessed by the Employer or the Engineer. If the Employer or the Engineer has witnessed the inspection or test, he will countersign the inspection or test report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) contained therein. If the Employer or the Engineer has not witnessed the inspection or test (i.e. if a waiver has been granted, or the Employer or the Engineer has not witnessed the inspection or test for some other reason in accordance with the Contract), the Contractor shall forward two copies of the inspection or test report without delay to the Engineer. The Engineer will countersign the report to indicate his review of the information and conclusions (i.e. whether or not the equipment being inspected or tested has passed satisfactorily) and return one copy to the Contractor. Where the results of the inspection or test do not meet the requirements of the Specification, the Employer or the Engineer may call for a re-inspection or re-test.

h) For standard equipment which is serial or bulk manufactured, manufacturer's type test certificates (or equivalent) may, subject to review by the Engineer be accepted.

i) Test equipment and instrumentation shall be subject to approved calibration tests within a properly controlled calibration scheme, and signed calibration certificates shall be supplied to the Engineer in duplicate. Such calibration checks shall be undertaken prior to testing and if required by the Engineer shall be repeated afterwards.

j) Materials and equipment shall not be released for shipment until all applicable inspections and tests including Factory Acceptance Tests have been satisfactorily completed.

8.5.3 Procurement, Manufacturing and Delivery Plan

a) The Contractor shall prepare a procurement, manufacturing and delivery plans in respect of all items and goods. Separate parts of the plan shall be prepared for Contractor or sub-contractor off-site activities. Each plan shall identify the scope of work to be applied. In relation to such scope of work, it shall, without limitation, define:

(1) the organization of the Contractor's staff directly responsible for the day-to-day management of the manufacturing activity on or off the Site;

(2) the specific allocations of responsibility and authority given to identified personnel for the day-to-day management of the work with particular reference to the supervision, inspection and testing of the work;

(3) the interfacing or co-ordination required with the Contractor's other related plans;

(4) the specific methods of manufacture to identify any relevant method statements and develop those method statements to a degree of sufficient detail reviewed by the Engineer; and

(5) the list of procedures and work instructions to manage and control the quality of work during purchasing, manufacturing and delivery, including without limitation:

i. the purchasing of items and goods and ensuring they comply with the requirements of the Specification, including (without limit) purchasing documentation and specific Verification arrangements for Contractor/Engineer inspection of material or manufactured product prior to release for use;
ii. the manufacturing process so as to ensure compliance with the design;
iii. the manufacturing process so as to ensure clear identification and traceability of material and manufactured parts;
iv. the inspection and testing of incoming materials, in process and final product so as to ensure specified requirements for the material and/or manufactured product are met;
v. the identification of the inspection and test status of all material and manufactured products during all stages of the manufacturing process to ensure that only products that have passed the required inspections and tests are dispatched for use and/or installation;
vi. review and disposal of non-conforming material or product so as to avoid unintended use;
vii. the assessment and disposal of non-conforming material and manufactured product and approval for reworking or rejection as scrap;
viii. the identification of preventive action so as to prevent recurrence of similar non-conformance; and
ix. the handling, storage, packaging, preservation and delivery of manufactured product.

b) The Contractor shall prepare and submit the inspection and testing plans to manage and

control any test and inspection activities ;

c) The Contractor shall propose a structured set of inspection hold points. The hold points shall be structured such that a formal hold point is allowed for each significant element of the manufacturing process. At each hold point, the Engineer shall hold a formal inspection or advise that the inspection had been waived.

d) Once the inspection and any required remedial actions are completed to the satisfaction of the Engineer, the Engineer shall not withhold his notice of no objection for shipping unreasonably, provided all pre-delivery assembly and testing has been successfully completed.

e) Any unit delivered without the Engineer notice of no objection shall be rejected at the Site and all expenses thereby shall be borne by the Contractor.

8.6 Construction and Installation Management Plan

The Construction and Installation Management Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below.

The plans shall be co-ordinated with each other and shall collectively define, describe andencompass the Contractor's proposed methods, procedures, processes, organization, sequencing of activities, etc and shall show how these combine together to ensure that theworks truly meet the requirements of the Specification in respect of the subjects listed

8.6.1 Construction and Installation Plan

a) The Contractor shall prepare plans for the construction and installation activities on and off the site and shall ensure that these are properly related to the subsequent testing and commissioning activity.

b) Separate parts of the plan shall be prepared for other contractor(s) or sub-contractor(s) off-site activities.

c) Each construction plan shall identify the scope of activity to be controlled. In relation to scope of such activity, it shall, without limitation, define:

(1) the organisation of Contractor's staff directly responsible for the day to day management of the activity on or off the site;

(2) the specific allocations of responsibility and authority given to identified personnel for the day to day management of the works with particular reference to the supervision, inspection and testing of works;

(3) the interfacing or co-ordination required with the Contractor's other related plans;

(4) the specific methods of construction and installation to identify any relevant method statements to a sufficient degree of detail reviewed by the Engineer;

(5) a detailed method statement which shall include but not be limited to;

i. description of main operations and sub-operations;

ii. sequence of sub-operations;

iii. quantities of the work and production rates to be achieved;
iv. resources to be employed; and
v. quality checks to be carried out, supervision being exercised and safety precautions to be employed;

(6) the list of procedures and work instructions to manage and control the quality of construction and installation works, including without limitation:

i. the inspection and testing activities of incoming materials, in process and final product so as to ensure specified requirements for the material and/or product are met;
ii. the purchasing of materials and ensuring they comply with the requirement of the specification, including purchasing documentation and specific Verification arrangements for Contractor/Engineer inspection of material or manufactured product prior to release for use/installation;
iii. the construction processes including Temporary Works so as to ensure compliance with drawings and specification. In addition, any software to be used in construction, installation and commissioning process shall be identified and details of the Verification and validation processes for the software application shall be given;
iv. the construction and installation process so as to ensure clear identification and traceability of material and manufactured product;
v. the identification of the inspection and test status of all material and manufactured product during all stages of the construction and installation process to ensure that only products that have passed the inspections and tests are dispatched for use and/or installation;
vi. review and disposition of non-conforming material or product so as to avoid unintended use/installation;
vii. the assessment and disposition of non-conforming material and product and approval of reworking or rejection as scrap;
viii. the identification of preventive action so as to prevent recurrence of similar non- conformance; and
ix. The handling, storage, packaging, preservation and delivery of product; and

d) The Contractor shall prepare and submit inspection and test plans to manage and control any test and inspection activities.

e) The following particulars shall be submitted to the Engineer for review within 28 days of the Commencement Date of the Works;

(1) drawings showing the layout within the Site of the Contractor's accommodation, project signboards, access roads and major facilities required early in the Contract;
(2) drawings showing the details to be included on Project signboards.

f) Drawings showing the location of stores, storage areas, work areas and other major facilities shall be submitted to the Engineer for review as early as possible, but in any case, not later 28 days before construction of the facilities.

8.6.2 Environment, Social, Health and Safety (ESHS) Plan

ESHS plan shall be submitted by the Contractor in accordance with ESHS manual given in Appendix 13 for the Engineer's review within 28 days of issue of Letter of Acceptance.

8.6.3 Completion Management Plan

General

a) The Contractor shall organise the services required under the Contract to bring the Works into service under one plan. This co-ordinated approach shall allow the Engineer to review all aspects of completion in an integrated manner.

b) The Completion Management Plan shall be configured as an integrated plan with associated documents, covering the subjects described herein.

c) The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities and the like, and shall show how these combine together to assure that the Works truly meet the requirements of the Contract with respect to the matters listed herein after.

8.6.4 Commissioning Plan

a) The Contractor shall submit the first draft of the Commissioning Plan to the Engineer within 180 days of the Commencement Date of the Works.

b) The Commissioning Plan shall consist of the following for all Signalling & Telecommunication work:

(1) Installation Tests Schedule

The Contractor shall submit to the Engineer a comprehensive schedule of the installation tests as required by relevant Particular Specifications and in accordance with the Installation Programme. The schedule shall be submitted within the period of time laid down in the Particular Specifications , or, if none is given, not later than 56 days in advance of the date for the commencement of the Installation Tests. Pre-Installation Inspection shall include the verification of FAT/Quality test report, Invoice, OEM manuals etc. Post installation test shall include the installation of equipment as per approved drawing, Particular specification etc. Power supply test shall be the part of Post-installation test.

(2) System Acceptance Tests Plan

The Contractor shall submit to the Engineer, a comprehensive System Acceptance Tests Plan including all requirements detailed in the relevant Particular Specification(S&T). The plan shall be submitted within the period of time laid down in the Particular Specification(S&T) or, if none is given, not later than 112 days in advance of the date for the commencement of the System Acceptance Tests. System Acceptance test shall include the functional test of all equipment from the SM panel.

(3) Integrated Testing & Commissioning Plan

The Contractor shall submit to the Engineer a comprehensive Integrated Testing and Commissioning Plan including all requirements detailed in Particular Specifications . The plan shall be submitted within the period of time laid down in Particular Specifications , or, if none is given not later than 112 days in advance of the date for the commencement of Integrated Testing and Commissioning. This test shall include the test of equipment from the IMD/ control centre of the project.

8.6.5 Operation and Maintenance Manuals Plan

a) The Contractor shall develop an Operation and Maintenance Manuals Plan to suit staged commissioning of the system and to ensure timely preparation of the Operation and Maintenance Manuals and the "As-Built" Documents in a format and to a level of detail reviewed without objection by the Engineer.

b) The Contractor shall submit the Operation and Maintenance Manuals Plan not later than 45 days prior to the issue of the Taking Over certificate for the works and according to the staged commissioning, if applicable, of the proposed systems.

8.6.6 Training Plan

a) The Contractor shall ensure the timely preparation of the Contractor's Training Plan in a format and to a level of detail reviewed without objection by the Engineer and fulfilling the requirements.

b) The Contractor shall submit the Training Plan by the date stated in the Particular Specifications , or, if none is given, not less than 84 days prior to the start of installation activities for the works.

8.6.7 Spares Management Plan

a) The Contractor shall submit for review by the Engineer a Spares Management Plan to furnish a priced manufacturer-recommended list of spare parts, necessary to support continuous operation of all such equipment for a minimum period of 24 months after the commencement of revenue operations.

b) The Contractor shall submit the Spares Management Plan not less than 182 days prior to the issue of the Taking Over Certificate for the Works.

8.6.8 Defects Management Plan

The Contractor shall submit for review by the Engineer a Defects Management Plan to repair, replace and perform any remedial item upon the Works identified by the Engineer during Defects Notification Period (DNP). The first submission of this

plan is required not less than 365 days prior to the issue of the Taking Over Certificate for the Works. The Contractor shall;

a) endeavour to complete all necessary work in a timely responsible manner;
b) not proceed with any remedial work without the consent of the Engineer;
c) submit a plan that details the method and timing of any proposed work; and
d) update the plan monthly, showing progress of the work and time to completion.

APPENDIX 9

DOCUMENTS, DRAWING AND CAD STANDARDS

9. General

A document may consist of document cover, revision history, table of contents, text and attachment(s) in this sequence where applicable.

1) Cover format (Times New Roman)
2) Heading and name of client shall be on top, in capital, size 10.
3) Name of the project in bold letters, size 22.
4) Content of document in bold capitals, size 16.
5) Document reference number in bold capitals, size 12.
6) Company name: capitals, size 14.
7) Company logo in size 35 x 40 (W x H) mm.
8) Address of the company in regular letters, size 10.
9) Document Format (Time New Roman)
10) General Regulations
11) Letter size: 12.
12) Paper size A4 (A3 is used for table and figures).
13) Periods and semicolons shall be placed right after the preceding letter or number.
14) The space between paragraphs and headings shall be 1.15 lines.
15) Main headings shall be placed in number order, with a period placed right after the number, followed by a space, with a heading text in bold capital letters. For example.:

9.1 IN BOLD CAPITAL

Other headings are placed in number order, with a period placed right after the number, followed by a space, with a heading in regular letters. For ex.:

a) In normal letter.
b) Notes

Notes relating to tables shall be included in the table; in case they are not able to be included, it shall be clearly specified that they are notes relating to a particular table reference.

The text of notes is usually given in italics.

9.2 Language of Communication and Units

The language for communications shall be the English language. The Contractor shall utilize the SI system of measurement units.

9.3 Photographs

The Contractor shall take digital photographs of the Works at least on monthly basis and include them in the Contractor's Monthly Progress Reports. These photographs shall be taken at locations agreed with the Engineer as appropriate to record progress, quality and

other relevant aspects of the Works. The number of the photographs shall be sufficient to cover all aspects of the Works in progress.

The digital photograph shall be colour jpeg image format with standard aspect ratio 4:3 and resolution of 300 DPI for all graphics in the printing. Read Only Memory (ROM) based electronic media of digital photographs shall be included as an integral part of the submittal. The locations and directions of the photographs taken shall be marked on a key plan of the Site, to be included in the submittal.

Each photograph shall be properly numbered and dated and include a brief explanatory note of the subject matter of the photograph, for ease of understanding.

Immediately before the issue of any Taking-Over Certificates for Works or Sections, the Contractor shall commission a professional photographer (or any person with equivalent skills) and take photographs of (where applicable, the interior to be taken by wide angle lenses) of exterior and all salient sections and features of the Works, for record purposes. The Contractor shall submit to the Engineer for approval as an integral part of the As-Built Documents, four (4) separately bound sets of colour prints of such record photographs, including one (1) set of Read Only Memory (ROM)-based electronic media containing an original jpeg image file of each photograph in accordance with the directory and naming convention agreed with the Engineer. The number of colour print images in a set shall not exceed 100, and each hard copy set of photographs shall be of A4 size with a cover page indicating information such as date, titles of the project and the Contract, and name of the Employer and the Contractor. Each of the photographs shall be properly numbered, dated and include a brief explanatory note of the subject matter.

9.4 Videos

On a monthly basis, or earlier if directed by the Engineer, the Contractor shall take digital video records to record the progress of the Works on Site (minimum duration of each to be ten minutes, covering all the areas of the Site where works are ongoing) as agreed with the Engineer, and submit the videos every month along with the Monthly Progress Report. The first video shall be made before the Commencement of the Works on the Site.

Within twenty-eight (28) days of receipt of the Letter of Acceptance, but in no case later than the Commencement Date, the Contractor shall submit to the Engineer a proposal for the provision of digital video recordings along with commentary of the progress of the Works.

The videos shall be taken by a competent person from an approved professional service provider (or any person with equivalent skills). The video shooting locations are to be identified in the afore mentioned proposal. This video should be submitted in a video format acceptable to the Engineer, with or without editing.

Immediately before the issue of the Taking-Over Certificate for the whole of the Works, the Contractor shall complete video recording and start editing the videos taken, to produce a 60- minute digital video-audio presentation with a suitable title. Each section of the video shall indicate the date on which it was taken. The presentation material shall have narration in English. The Contractor shall use a professional service provider to video, edit and produce the presentation material.

9.5 DRAWING AND CAD STANDARDS

a) The purpose of this document is to define the minimum Drafting and CAD standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the works.

b) By defining a common format for the presentation of drawings and CAD files, the exchange of drawn information is improved and will maximize the use of CAD in the coordination process.

c) All submissions shall be made in accordance with the Employer's Requirements in a format reviewed without objection and in accordance with the requirements in:

   i. The Contract;

   ii. The Document submittal instructions to Consultants and Contractors.

d) Paper and drawing sizes shall be "A" series sheets as specified in BS3429.

e) The following software (latest and updated version) compatible with Intel-Windows based computers shall be used, unless otherwise stated, for the various required electronic submissions.

Document Type	**Electronic Document Format**
Text Documents	**MS Word**
Spread Sheets	**MS Excel**
Data Base Files	**MS Access**
Presentation Files	**MS PowerPoint**
Programmes	**Primavera for Windows, Suretrack**
AutoCAD Graphics	**AutoCAD**
Photographic	**Adobe Photoshop**
Desktop Publishing	**Page Make 6.5,5**
CADD Drawings	**AutoCAD**

f) Media for Electronic File Submission - Email

One copy shall be submitted unless otherwise stated in CD-ROM

g) Internet File Formats/Standards

The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Employer.

a) All the data formats or standards must be supported by Microsoft Internet Explorer (latest version) running on windows professional (latest version).

b) The following list shows the file types and the corresponding data formats to be used on Internet. The Contractor shall comply with them unless prior consent is obtained for a different Data format from the Employer's Requirements:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF to JPEG
Computer Aid Design files (CAD)	Computer Graphics Metafile (CGM)
Video	Window video (.avi)
Sound	Wave file (.wav)

h) The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless prior consent is obtained for a different standard from the Employer's Requirements

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Markup Language (HTML)

The hard copy of all documents shall be the contractual copy.

1) GENERAL REQUIREMENTS

General:

i) The Contractor shall adopt a title block similar to that used in the Drawings for all drawings prepared under the Contract.

ii) Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.

iii) The current status of each drawing shall be clearly defined by the use of a single letter code as follows:

P - Preliminary Design Drawing

D - Definitive Design Drawing

C - Construction Reference Drawing

W - Working Drawing

B - As-Built Drawing

M - As Manufactured Drawing

E - Employer's Drawing

Types of drawings:

i) 'Design drawings' mean all drawings except shop drawings and as-built drawings.

ii) 'Working drawings' are design drawings of sufficient detail to fully describe the Works and adequate to use for construction or installation.

iii) 'Site drawings and sketches' are drawings, often in sketch form, prepared on site to describe modifications of the Working drawings, where site conditions warrant changes that do not invalidate the design.

iv) 'Shop drawings' are special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.

v) 'As-built drawings' show the Works exactly as constructed or installed. They are usually prepared by amending the working drawings to take into account changes necessitated by site conditions and described in Site drawings. These drawings shall be completed on a regular basis as the works progress, and shall not be left until completion of the entire works.

2) COMPUTER AIDED DESIGN STANDARDS

a) Introduction
Scope of Use

Data input procedures between the Engineer and contractors must be co- ordinated, and the key parameters used to form CAD data files must be standardized. The production of all CAD data files shall comply with the following requirements.

b) Objectives

The main objectives of the CAD standards are as follows:

i. To ensure that the CAD data files produced for Project are co-ordinated and referenced in a consistent manner.

ii. To provide the information and procedures necessary for a CAD user from one discipline or external organization to access (and use as background reference), information from a CAD data file prepared by another discipline or external organization.

iii. To standardize the information contained within CAD data files which may be common to more than one discipline such as drawing borders, title boxes, grid lines etc.

iv. To establish procedures necessary for the management of CAD data files.

v. To ensure all contractors use 'Model space' and "Paper space' in the production of their CAD files.

c) General

i. To facilitate co-ordination between contractors, it is a requirement that all drawings issued by contractors for co-ordination or record purposes shall be produced using CAD methods. Drawings shall be issued in digital format in addition to the paper copies.

ii. The intent of the issue of digital information is to aid the related design by others. The definitive version of all drawings shall always be the paper or polyester film copies which have been issued by the contractor or organization originating the drawing.

iii. (Drawings and drawing packages issued for co-ordination, record purposes or for acceptance shall be accompanied by a complete set of the corresponding CAD data files.

iv. Any contractor or organization making use of the CAD data from others shall be responsible for satisfying himself that such data is producing an accurate representation of the information on the corresponding paper drawing which is satisfactory for the purpose for which he is using it. Provided the general principles of this section have been achieved by the originator of the CAD data, contractors making use of the CAD data from others shall not be entitled to require alterations in the manner in which such CAD data is being presented to them.

v. In particular, automatic determination of physical dimensions from the data file shall always be verified against the figured dimensions on the paper or polyester drawings. Figured dimensions shall be taken as correct where discrepancies occur.

vi. The purpose is to ensure that total co-ordination is achieved between the CAD 'Model Space" file and the "Paper Drawing" output during the revision cycle of the design and production process. Duplicated data in "Model and Paper Space" file will not be acceptable unless an automatic update link exists between the two data sets. "Paper Space" files are not typically required as part of the CAD Media Receipt from contractors, unless specifically requested.

d) CAD Quality Control Check

(i) Random CAD Quality Control Audits will be carried out by Engineer on all CAD media received and transmitted.

(ii) These checks DO NOT verify the technical content of the CAD data received or transmitted (as this is the responsibility of the originating organization), however compliance with Project CAD and Drafting Standards shall be checked.

(iii) In addition, all contractors who transmit and receive CAD data from the Project shall have CAD quality control procedures in place. A typical control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

e) CAD Data Transfer Media and Format

i. Data exchange format between the Engineer and the Contractor, shall be as follows:

Documents including design sheets, tables and figures: Word (*.docx), Excel (*.xlsx) and PDF (*.pdf).

Drawings: Autodesk's AutoCad 2016 or higher release. Electronic

Data Transfer Media: Pen Drive/Hard disk.

ii. All documents/drawings shall be labelled on the data shield with: Name of Company/ Consultant

Project Tile Document/Drawing

Filenames

iii. The Contractor shall ensure the supplied media is free from virus.

f) CAD Media Receipt & Transmittal

i. CAD Media Transmittal (from the Contractor to Engineer) – this will consist of the following:

a) CAD Digital Media (disk(s), CD's or tape(s)) shall typically contain CAD "Model Space" and "Paper Space" files.

b) CAD data sheet

c) CAD issue/revision sheet

d) CAD quality Checklist confirming compliance

e) Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).

ii. The above CAD media will be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by Employer' Representative from all contractors shall be in AutoCAD (version 14)

iii. All CAD media received from contractors will be retained by Engineer except for SCSI disk (if used) as an audit trial/archive of a specific contractor's design evolution.

iv. CAD Media Receipt (from Engineer to the Contractor)

a. CAD Media should normally be obtained from the respective interfacing contractor(s), but should Engineer issue CAD media it will consist of the following:

a) CAD Digital Media (disk(s) or tape(s) typically contain only CAD "Model Space" files.

b) CAD data sheet

c) CAD issue/revision sheet

b) The above CAD media will be collectively known as the "CAD Media Receipt Set". The CAD data file transmittal format used by Engineer to all contractors will be in AutoCAD (version 14).

c) Each CAD transmittal disk/tape will be labelled with proper disk label as approved by the Engineer. Any CAD data transmitted without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.

a) Revisions

i. All "Revisions", 'In Abeyance' and 'Deletions' shall be located on a common layer. This layer can be turned on or off for plotting purposes.

ii. The following example text indicates the current CAD file revision, i.e., "Revision [A]". This shall be allocated to a defined layer on all CAD "Model Space" files, in text of a size that will be readable when the CAD "Model Space" file is fitted to the screen, with all levels on.

iii. Libraries, Blocks, & Block Names

a. All Construction Industry symbols produced as CAD Cells shall typically conform to British Standard BS1192 – part 3.

b. All Blocks created shall be Primitive (i.e., Not Complex) and shall be placed Absolute (i.e. NOT Relative).

c. The Contractor's specific block libraries shall be transmitted to Engineer together with an associated block library list containing the filename (max. 6 characters) and block description. The contractor shall ensure that the library is regularly updated and circulated to all other users, together with the associated library listing.

d. All Blocks of a common type, symbols or details should initially be created within a CAD "Model Space File" specifically utilized for that purpose. These files will be made available on request by Engineer.

e. All Blocks created will typically be 2D unless 3D is specifically requested. In both instances they shall have an origin at a logical point located within the extents of each Block's masked area or volume.

b) CAD Dimensioning

Automatic CAD Dimensioning will be used at all times. Any dimensional change must involve the necessary revision to the model space file. If the CAD Quality Control Checks find that the revisions have not been correctly carried out, the rejection of the entire CAD submission will result.

c) CAD Layering

All CAD elements shall be placed on the layers allocated for each different discipline. The layer naming convention to be adopted by the Contractor shall be submitted for acceptance and inclusion within these standards.

d) Global origin, Location & Orientation on the Alignment Drawing.

Location or Plan information in "Model Space" files shall coincide with the correct location and orientation on the Project grid for each specific contract.

Location plans shall have at least three setting out points shown on each CAD "Model Space" file. Each setting out point shall be indicated by a simple cross-hair together with related Eastings and Northings co-ordinates. The Civil Contractor(s) will establish the three setting out co-ordinates for their respective works, which will then be used by all other contractors including the Contractor.

e) Line Thickness and Colour

To assist plotting by other users, the following colour codes will be assigned to the following line thickness/pen sizes.

Colour	Code No	Line Thickness
Red	10	0.18
White	7	0.25
Yellow	2	0.35
Brown	34	0.5

Blue	130	0.7
Orange	30	1.0
Green	3	1.4
Grey	253	2.0

f) CAD Utilization of 2D & 3D Files

Although the project standard is 2D CAD files, certain disciplines and contractors may use 3D CAD files for specific applications or where the isolated use of 3D aids the design and visualization process (i.e. Architecture, Survey and Utilities). In these specific instances 3D CAD data will only be transmitted if all other users can use this data. If this is not the case, a 3D to 2D translation shall be processed by the creator prior to issue.

g) CAD File Numbering

Contractors CAD File Numbering shall be described in 5.2.1 above. Employer CAD File Numbering Unlike most of the contractors, Employer will not be required to produced numerous CAD files. This will follow the numbering system Except that the status of the drawing in 5.2.1 (E) shall be "E".

h) CAD File Naming Convention – General
CAD "Model Space" files shall be named in accordance with general drawing conventions

APPENDIX- 10

CONSTRUCTION & SITE MANAGEMENT

10. THE SITE

10.1 Location and Boundaries

10.1.1 Works Areas are those areas identified in Appendix 3 to these Employer's Requirements and on the Drawings.

10.1.2 Within 28 days from Commencement Date, the contractor shall submit detailed and comprehensive Site Environmental, Social, Health and Safety plan (Appendix 13 of Employer's Requirements) based on Environmental, Social, Health and Safety (ESHS) manual.

10.1.3 Within 28 days of the date commencement, the contractor shall submit detailed Quality Plan (Appendix 11 of Employer's Requirements) demonstrating the proposed method of achieving the required quality standards of the Employer as defined in the Employer's Requirements.

10.1.4 Normal working hours at site will be as stated in the Contract Data. However, the Contractor, if required, shall carry out work during night hours or in shifts with the approval of the Engineer. No increase in rates or extra payments shall be admissible for night work.

10.2 ACCESS TO THE SITE

10.2.1 The Contractor shall be deemed to have inspected, examined and made himself fully familiar with the access routes necessary for the proper execution of the Works and accounted for in the Accepted Contract Amount any costs arising in connection with the accessibility to the ROW. The Employer will not be responsible for any claims which may arise from the use of or otherwise in connection with any access route. The Employer does not guarantee the suitability or availability of any particular access route and will not entertain any claim for any non- suitability or non-availability of any such route for use (whether continuous or otherwise) during the Contract Period.

10.2.2 The Contractor shall make its own arrangements for access required to the Site. The Contractor shall negotiate with the landowners or other appropriate government agencies to seek temporary occupation of land and seeking necessary permission for construction of temporary access roads.

10.3 CONTRACTOR OPERATIONS OUTSIDE THE SITE

10.3.1 The Contractor shall be solely responsible for acquiring any additional land (land in addition tothe Site) required by him for his Temporary Works areas outside the ROW, at his own expense,including maintaining and reinstating the same on completion of the Works to the entire satisfaction of the land owner and the Engineer.

10.3.2 The Contractor shall make the necessary arrangements with landowners and relevant government authorities for any work to be undertaken outside the Site. Two copies of all the relevant documents/ permissions/ agreements, etc., as required by the Engineer in respect of the land arranged by the Contractor outside the Site, shall be submitted to the Engineer. Before commencing operations, the Contractor shall also submit to the Engineer a detailed plan and a programme of the Works to be carried out in the works area, including areas outside the Site.

10.3.3 When using and/or occupying works areas on existing public roads, the Contractor shall undertake all necessary procedures and mitigation measures as per the requirements set by the relevant authorities.

10.3.4 The Contractor shall submit to the Engineer proposals for the use and occupation of such works areas. Any such proposal shall be submitted to the Engineer at least twenty-eight (28) days prior to the start of the programmed use of the specific works area.

10.3.5 On completion of the Works, the land arranged by the Contractor outside the Site shall be restored back to its original condition to the entire satisfaction of the land owner and the Engineer.

10.4 SITE SECURITY

10.4.1 The Contractor shall be wholly responsible for security on the Site and any other areas being used by him or any Subcontractors for the purposes of the Contract. The Contractor shall implement and cause Subcontractors to implement proper security management procedures in accordance with the approved security management plan described in Appendix 13 (Environmental, Social, Health and Safety Management Manual)

10.4.2 The Contractor shall assign on the Site an appropriate safety and security organisation headed by experienced and professionally qualified safety and security personnel, who shall be primarily responsible for the Contractor's security services and shall fully cooperate with the Employer's security organization throughout the Time for Completion.

10.4.3 The Contractor shall prepare and submit to the Engineer for approval a security management plan (it may be included in the Environment, Social, Health and Safety Management Plan) fully complying with not only the relevant applicable Laws but also the regulations of the Employer which may be imposed from time to time on the Project within twenty-eight (28) days after the Commencement Date or at least one week before commencing the Works on the Site or any other area being used by the Contractor (whichever is the earlier). The plan shall include detailed procedures for daily security management operations as described in Appendix 13 (ESHS Manual) of General Specifications.

10.5 Possession of Third Parties Facilities

10.5.1 The definition of "Possession" to be applied in this Clause is 'possession of a segment or stretch of the Works and/or Indian Railways (IR) track(s) and/or other related authorities required by the Contractor from the Employer and/or IR and/or other related authorities for execution of the Works during the Time for Completion and/or after issue of the Taking- Over Certificate and during the Defects Notification Period for maintenance / rectification of any defects in the Works.

10.5.2 While undertaking construction activities within an existing railway line or road under the Contractor's Possession, the Contractor shall abide by the rules/guidelines included within the relevant manuals of Indian Railways and/or the National Highways Authority of India (NHAI)/Public Works Department (PWD)/ Panchayats/ Municipal Corporations and/or any other authority.

10.5.3 The Contractor shall undertake any construction activities on existing 'live' or operating lines only after the grant of Possession by the relevant authorities.

10.5.4 An area under the Contractor's Possession is the sole responsibility of the Contractor and all issues relating to safe working within that area, including the movement of traffic, are his responsibility.

10.5.5 If the Contractor has more than one work front within the same Possession, one person shall be nominated by the Contractor as the person responsible for the coordination for all work fronts within the Possession.

10.5.6 The Contractor shall ensure that construction activities shall be undertaken strictly within the area which is under the Contractor's Possession.

10.5.7 The Contractor shall appoint a responsible person who shall coordinate with the Employer, IR/ relevant authorities, Interfacing Contractors and Interfacing Parties as applicable and who shall act as the Possession Coordinator for the Contractor. The person appointed shall have experience of IR/ relevant authorities operations and shall be fully aware of IR Rules and Regulations related to possession of track for construction of railway works and in accordance with IR/ relevant authorities regulations to issue Possession requests. For the purposes of the Works, such person shall be duly certified in accordance with the said Rules and Regulations, if required.

10.5.8 The Contractor shall use Possessions on the line as follows:

10.5.9 For each particular Possession and depending on the duration and the location of the Possession, alternative route(s) may be required, such alternative diversion route(s) if required to be constructed, shall be at the Contractor's cost.

10.5.10 The normal alternative mode of transport will be proposed by the Contractor, and the route and timings of this alternative transport are to be agreed with the Engineer / IR / Road Authorities / Panchayat prior to obtaining Possessions.

10.5.11 The Employer shall provide assistance necessary to the Contractor to enable him to obtain the Possessions required by him, subject to being approved by IR, NHAI or relevant authorities. No claim shall be entertained by the Employer on this account.

10.5.12 The Contractor's request for Possession shall include a technical and organizational schedule and submit the same to the Engineer for his consent.

10.5.13 The Contractor shall submit his requests for Possessions well in advance as per requirements of relevant authorities.

10.6 Damage and Interference

10.6.1 General

Work shall be carried out in such a manner that there is no damage to or interference with:

a) watercourses and drainage system,

b) Utilities,

c) Structures (including foundations), roads including street fixtures or other properties;

d) Public or private vehicular or pedestrian access, and

e) Monuments, graves or burial grounds other than to the extent that it is necessary for themto be removed and reinstated to permit the execution of the Works.

10.6.2 Heritage structures shall not be damaged or disfigured on any account. The Contractor shall inform the Engineer as soon as practicable of any items which are not stated in the Contract to be removed or diverted but which the Contractor considers necessary to be removed or diverted to enable the Works to be carried out. Such items shall not be removed or diverted until the approval of the Engineer has been obtained.

10.6.3 Assets/ items of the Employer, Indian Railway (IR), Other Contractors and any other entities and relevant authorities which include, but are not limited to, water, sewage, gas authority, electrical, OFC communication cables etc. carried out shall be replaced /

reinstated by the Contractor to the same condition as existed before the Works started and to the satisfaction of the Engineer and the concerned entity.

10.6.4 In case of damage to the existing cables, the Contractor shall have suitable procedure for cable joining under the technical supervision of IR or the relevant authority.

10.6.5 The Contractor shall indemnify the Engineer, Employer, Indian Railway, Other Contractors and relevant authorities against any damages or any penal action, any claim or legal action as a result of the damages.

10.7 Utilities

The Contractor shall follow the requirements on care for utilities as specified in this Appendix below.

10.8 Structures, Roads and Other Properties

10.8.1 The Contractor shall carry out a precondition survey of all roads and structures and drainage channels adjacent to the Site. Contractor originated deterioration of the roads and damage to adjacent structures and drainage facilities shall be reported to the Engineer with appropriate records.

10.8.2 The Contractor shall maintain / replace / reinstate to the same condition as existed before the Works started and to the satisfaction of the Engineer and the concerned entity.

10.9 Access

10.9.1 Where existing access to premises either public or private is damaged or unusable, alternative access shall be provided by the Contractor to enable the Works to proceed. The arrangements for the alternative access shall be as agreed by the Engineer, the relevant authorities and the owners of the premises affected.

10.9.2 Unless agreed otherwise, the permanent access shall be reinstated as soon as practicable after the Works are complete and the alternative access shall be removed immediately when it is no longer required, and the ground surfaces reinstated. Proper signage and guidance shall be provided for traffic/ users diversions.

10.10 Trees

10.10.1 Materials, including excavated materials, shall not be banked around trees. Trees shall always be protected from damages.

10.10.2 Unless otherwise consented to by the Engineer, trees shall not be trimmed or cut as stated in Appendix 13 [ESHS Manual]

10.11 Removal of monuments, graves, burial grounds and other obstruction

If any graves and other obstructions are required to be removed in order to execute the Works and such removal has not already been arranged, the Contractor shall draw the Engineer's attention to them in good time to make the necessary arrangement for authorization for removal.

10.12 Protection of the Other Adjacent Structures and Works

The Contractor shall take all necessary precautions during the construction to protect structuresor works being carried out by others, adjacent to or within the Site from the effects of vibrations,undermining or any other earth movements or the diversion of water flow, arising from its work

10.13 Defined Area and Train Operation

10.13.1 When the Project under construction has been made available for track and system related installation works, the area will be classified as a Defined Area for train movement. The definedarea shall be controlled by the Lead Contractor (as nominated by Engineer) with regard to access.

10.13.2 All persons whose duties require them to work within a Defined Area must have been required to be examined for safety knowledge and to have been safety inducted. Evidence of safety induction must be exhibited whenever present or working in a defined area. All persons present in defined areas are required to observe safety rules and procedures to be defined by the Contractor and reviewed without objection by the Engineer.

10.13.3 The Contractor shall ensure that the necessary rules and procedures for all persons are published from time to time and communicated to the workers and/or agents and the Interfacing Contractors on the Site. The Contractor shall also ensure that all such rules and procedures are being followed during the course of all works and construction activities at the Site.

10.13.4 When overhead lines are energized, Train Sets/Cars may be moving in the Defined Area. No work shall be undertaken on the tracks when Train Sets/Cars are moving. Procedures for obtaining access to the energized tracks will be detailed in the rules. The Contractor shall make requests for obtaining access to the energized track or in the vicinity of the tracks as per the approved and notified rules and procedures.

10.13.5 After overhead lines are installed, the lines are energized, the Contractor shall comply with the rules / measures against electric shock.

10.14 Site Clearance

The Contractor shall clear the Site as required by demolishing all buildings, structures, *Borewells/wells* (above and below ground such as brick, concrete, steel, etc.) and removing all rubbish *outside the ROW. Dismantled structure shall be the property of the Contractor. Borewell/Wells shall be filled with sand in layers and watered.* If any payment/compensation is payable to the structures owner, the same shall be paid by the Employer to the structures owner. The Site shall also be cleared of vegetation, trees, stumps roots, etc. Cutting of *trees and dismantling of structures* within ROW *in entire C-5 Package* wherever required for execution of the Works shall be done by the Contractor. Permission for cutting of trees will be obtained by the Employer. Compensatory plantation is not included in the Scope of the Works. All material so cleared from the site shall be *the property of the Contractor and shall be* disposed off by the Contractor outside the ROW. The list of structures to be demolished is given in Section VII:8-Tender Drawings and Documents, Part-2 Employer's Requirements. The above list is indicative and the Contractor shall visit the site and ascertain all the existing structures required to be demolished for clearing the site. *The cost for above items shall be deemed to be included in Lumpsum cost of Schedule 'A' for the whole C-5 Package.*

10.15 MOBILIZATION AND DEMOBILIZATION

10.15.1 General

a) The Contractor shall mobilize to the Site the Contractor's Equipment and the Contractor's Personnel as appropriate for the execution and completion of the Works in strict accordance with the requirements of the Contract.

b) The Contractor shall demobilize Contractor's Equipment and Contractor's Personnel from the Site as appropriate when they are no longer required to be on the Site.

10.15.2 Engineer's Consents

a) The Contractor shall inform the Engineer regarding mobilization of Contractor's Equipment, including that required for use by any Subcontractor, at least seven (7) days before the date planned for the mobilization of same to the Site. The Contractor should note that:
   i. the Contractor shall be solely responsible for the consequence of any such mobilization;
   ii. the relevant insurances shall be in place as evidenced by insurance documents included in the application;

b) The Contractor's Equipment shall be mobilized to the Site complete with all necessary spare parts, consumables and the like indispensable for proper operation and maintenance thereof. The Contractor shall provide maintenance facility complete with qualified maintenance personnel on or in the vicinity of the Site.

c) The Contractor shall obtain a written consent from the Engineer before removing any of the Contractor's Equipment from the Site or any managerial person among the Contractor's Personnel mobilized exclusively for the Contract. Provided that the proposed demobilization is in accordance with the Contractual Works Programme to which the Engineer has given consent and that the Contractor shall be solely responsible for any consequences of such demobilization, the Engineer shall not unreasonably withhold consent.

d) Although they are deemed intended for exclusive use on the Works as set forth in Sub-Clause4.17 of the General Conditions of the Contract, the Contractor may divert any of the Contractor's Equipment to other uses within the Site, provided that the Contractor's written undertaking to return the same to the Works whenever needed is submitted to the Engineer and the Engineer's written consent to such diversion is granted.

10.16 Records

In addition to the Monthly Progress Reports described in Appendix 7 of the Employer's Requirements, the Contractor shall submit to the Engineer, on a daily basis, details of the mobilization and demobilization of any of the Contractor's Equipment or any managerial person among the Contractor's Personnel.

Without undue delay after demobilization from the Site, the Contractor shall submit to the Engineer copies of certified evidence of lawful re-export from the Country of any Contractor's Equipment imported into the Country on a temporary basis exclusively for use on the Contract.

10.17 Mobilization

10.17.1 The Contractor shall mobilize to the Site the Contractor's Equipment and the Contractor's Personnel as appropriate for the execution of the design, construction and completion of the Works. An Initial Mobilization Plan for the 3 months following the Commencement Date shall be submitted to the Engineer within 7 days after the Letter of Acceptance has been received by the Contractor. An overall Mobilization Plan for the Works shall be submitted to the Engineer for his approval within 90 days after the Commencement Date.

10.17.2 In the event that manufacturing activities are to be carried out outside the Republic of India, the Contractor shall submit detailed organizational structure(s) for such manufacturing teams. This submission shall include the organization of such teams and details of the key personnel, including contact address, i.e., the addresses of the locations where such manufacturing activities are carried out and the e-mail address of each key personnel.

10.17.3 The Mobilization Plan shall include, but not be limited to the following:

a) Details of each major item of Contractor's Equipment, i.e., the name, size and capacity etc. of each item.

b) The number of each equipment and the time of mobilization and duration of the use of each equipment.

c) The name and details of key personnel for each section of the Works and their responsibilities.

d) Details and time for installation of temporary facilities for the Works including temporary facilities for the Employer and the Engineer.

e) The numbers of Contractor's Personnel, including site engineers, administrative staff and labour in each trade category.

10.18 Demobilization

Demobilization shall be carried out in accordance with the provision of Sub-Clause 4.22 [Contractor's Operation on Site], and Sub-Clause 11.11 [Clearance of Site] of General Conditions. Upon receiving the Performance Certificate under Sub-Clause 11.9 [Performance Certificate], the Contractor shall carry out the Clearance of the Site and the Contractor shall inform in writing to the Employer the completion of Demobilization or Clearance of Site and obtain the consent of the Employer. In case the Clearance of Site has not been completed in a specified period by the Contractor, the Employer may carry out the Clearance of Site. The Employer shall be entitled subject to Sub-Clause 20.2 [Claims for Payment and/or EOT] to payment by the Contractor of the costs reasonably incurred in connection with, or attributable to, such sale or disposal and reinstating and/or cleaning the Site, less an amount equal to the moneys from the sale (if any). In case the Taking-Over is conducted section by section, the Contractor shall inform in writing to the Employer the completion of Demobilization of the section and obtain the consent of the Employer or the Engineer as a representative or on behalf of the Employer.

10.19 SITE ACCOMMODATION FOR THE EMPLOYER/ ENGINEER

10.19.1 One Site Accommodation (total area 250 sqm) for the Engineer's & Employer's Staff including Meeting Room shall be provided. In addition, one resting accommodation of about 300 sqm area consisting of four suites with attached toilet facilities, drawing, dining, kitchen and other incidental facilities along with full furnishing shall also be provided by the Contractor. The land for the above accommodation shall be provided by the Employer free of cost. The Contractor shall provide one cook and one housekeeping staff round the clock at the resting accommodation. In office, one pantry staff and one housekeeping shall be provided round the clock.

10.19.2 Offices shall be accessible only from a corridor within the building. The corridor and reception area shall be provided with an external double door. The office will be provided with electronic surveillance system as approved by Engineer.

10.19.3 Materials for the construction shall be new, robust and durable. The building shall be weather proof, vermin proof, well insulated thermally and acoustically. Internal walls shall be soundproof. Electrical power/lighting, shall be provided to each room, including air-conditioning and heating to maintain the internal temperature within the range of 20 to 24 degrees Celsius at all times.

10.19.4 Internal doors shall be flush, fitted with door closers, mortice locks with keys and lever handles.

10.19.5 External doors shall be a pair of solid core doors, external quality, hung on heavy duty hinges, one leaf fitted with barrel bolts top and bottom and the other leaf fitted with a Yale or similar lock.

10.19.6 Windows, of area not less than 10% of the floor area, shall be provided to all rooms, securely barred, fitted with blinds and having opening sections fitted with locks and mosquito screens.

10.19.7 The building shall be provided with a continuous water supply and drainage to Kitchen, Washroom and Toilets. The Toilets shall be equipped with low level suites and be adequately ventilated through the ceiling.

10.19.8 The Kitchen shall be fitted out with a 2-drainer stainless steel double sink unit, worktop with cupboards under, tiling above the sank and worktop and wall mounted cupboards.

10.19.9 Fire and Safety regulations shall be complied with and fire fighting equipment shall be provided in accordance with the statutory requirements.

10.19.10 The Contractor shall provide, erect, and maintain appropriate name boards as specified, for each of the offices. The working shall be agreed with the Engineer.

10.19.11 The Contractors shall provide the following new furniture and equipment for the exclusive use of the Engineer's Staff:

No.	Item	Nos
	Furniture	
1	Sofa set	2
2	Desk with side drawers.	10
3	Swivel Office Chair with arm rests	8
4	Swivel Office chair without arm rests.	10
5	Typist Chair	12
6	Visitor's Chair	1
7	3-Shelf Bookcase	2
8	4-Drawer Lockable Filing Cabinet	5
9	Lockable Cupboard 2m high, with shelves.	10
10	Table	3
11	Book shelf 2000x850x350mm (5 shelves)	5
12	White Board 2000x1000mm	4
13	TV set LED Screen	1
14	Projector Screen for Meeting Room (72"x72")	1
15	Wall Clock	2
16	Coffee Machine	1
17	Cupboard Table height	1
18	Printer cum scanner cum Photocopier A4/A3 capable of reduction	2

19	Wifi internet connectivity with 100mbps	1 set
20	Desktop Computers (Dell, HP) with following configuartions: Processor- i5 12th GEN Intel; Operating System- Windows 11 Professional 64 bit; Video Card- intel; Memory- 16 GB Ram, DDR4; Hard Drive-1TB SSD; Monitor- 22 inch	4
21	Paper shredder	1
22	Desk Tray sets	2
23	Desk mounted pencil sharpeners	4
24	4-hole paper punches	4
25	Wastepaper baskets	2
26	Refrigerator 400 litres	1
27	Potable Water-cooler cum dispenser	1
28	Microwave oven (700W)	1
29	Cups, glasses, plates, cutlery for 12 persons,	2 sets
30	Electric kettle, coffee and tea pots	As required
31	Office consumables for the duration of site activities	As required
32	Front Door Mat	As required
33	Flashlight	1
34	Locker with Key (900x300x500)	For 10 Persons

10.19.12 The Contractor shall provide 04 SUV type vehicles (Innova/Scorpio/XUV500) having make not later than 2022 for use of the Employer's Staff from the Commencement Date till completion of the Contract. The vehicles shall be replaced after two years with vehicles of current make. The Contractor shall also bear the expenditure of deploying experienced drivers along with fuel and other incidental expenses associated with the operation of the vehicle. The approximate kilometers to be run every month will be 3000 km for each vehicle. Only experienced drivers shall be deployed. Vehicles along with drivers shall be made available round the clock throughout the Contract period.

10.19.13 The Contractor shall provide brand new protective clothing and safety equipment for 30 persons for exclusive use of the Engineer's/Employer's Staff, comprising, as a minimum – Safety Helmets Safety Harness, Steel-toed construction boots (size to be notified), Gum boots, Day-Glo waistcoat, industrial safety goggles, Ear protectors. These shall be replaced as and when required, however, they shall be replaced at least once a year. The consumables for PPE kit i.e mask, ear plugs etc. shall be supplied on daily basis.

10.19.14 The Contractor shall provide an adjacent shaded parking area for 5 cars.

The Contractor shall arrange for upkeep, service and security of the offices and compound. The office area shall be thoroughly cleaned and rubbish and waste to be removed, at least once a day as per current rules and regulations.

10.20 SURVEY AND SETTING OUT

10.20.1 General

a) A survey shall be carried out of the Site to establish its precise boundaries and the existing ground levels within it. This survey shall include a drone cum photographic survey sufficient to provide a full record of the state of the Site before commencing the work with particular attention paid to those areas where reinstatement will be carried out later on. The survey shall be carried out before the site clearance wherever possible and in any case prior to the commencement of work in any Works Area. The survey shall be carried out by the Contractor and agreed with the Engineer. Survey by drone shall also be done at all work places every one month as per Outline Construction Specifications (OCS)-Civil & BLT for Civil & BLT Works.

b) The Contractor shall plan and programme for the validation of any Site data provided by the Employer and develop a Survey Plan and Programme. The Contractor shall submit a Survey Plan and Programme to the Engineer for consent within 28 days after the Commencement Date. Generally, the contents of the Survey Plan and Programme shall comprise the following:

(1) The Contractor shall revalidate/derive the elevations of Secondary Control Points (SCPs) and Tertiary Control Points (TCPs) using the Reduced Level (RL) of the Standard Benchmark (Type M) at SDC Quarters, Palwal with MSL value of 195.41 metres. Survey and levelling should be done using Total Station and Digital level. Thereafter, the Contractor shall establish a horizontal and vertical control system (x, y, z) at the Site which shall be approved by the Engineer. Final drawings and profiles shall be prepared based on the above Reduced Levels.

(2) The Contractor shall carry out validation of the Site data provided by the Employer, and any additional topographic surveys considered necessary by the Contractor, in order to:

i. validate the Horizontal and Vertical Alignment with no change in alignment;

ii. prepare Alignment "Plan and Profile" Drawings; and

iii. review the data with which the Contractor shall eventually draw up the cross-section drawings at required locations.

The Contractor shall summarize the results of their validation of the Site data and any additional surveys carried out in a Survey Report and develop a Site Location Map, and aStructure Setting-Out Map and submit them to the Engineer for consent. Finally, the Contractor shall set out the Works to commence the construction with consistent accuracy and entirely throughout the construction stages.

10.20.2 Horizontal and Vertical Control System

a) A set of the benchmarks comprising a horizontal control system (x, y) and vertical control system (z) shall be established at the Site based on the Temporary Bench Marks which are established and maintained by the Employer only after revalidation is done as per Sub-Clause 10.20.1 (b) of Appendix 10, Section VII-9: Appendices and the Global Navigation Satellite System (GNSS) Survey, applying the Universal Transverse Mercator (UTM) coordinate system and World Geodetic System 84 (WGS 84). A description of the various benchmarks along the route alignment has been provided by the Employer along with their height above Mean Sea Level. The Contractor shall ensure that the horizontal and vertical position (x, y. z) of each HORC benchmark shall not be subject to any interference and that they shall not be affected by any of the Permanent and Temporary Works.

b) All pillars shall be of CC in dimensions of 450 mm x 450 mm x 900 mm with a projection of 300 mm above ground . The exposed surfaces of the pillars shall be appropriately painted with enamel paint of a colour as specified by the Engineer so as to be easily identifiable. The foundation shall be as indicated in the Reference Information/Reports. Details shall be developed by the Contractor and be submitted to the Engineer for review. Each pillar shall be protected by retractable fencing or other similar measures so as to prevent the occurrence of any movement, disturbance, interference and/or damage.

c) The Contractor shall establish additional benchmarks (x, y, z) which shall be staked and identified, and clearly painted in a different colour from the HORC benchmarks as approved by the Engineer. These temporary benchmarks shall be used for running a closed traverse for checking the HORC benchmarks. The pillars for additional benchmarks shall be staked at an interval of 500 m on both sides of the alignment at ROW and at abutment locations of major RUB.

d) The Contractor shall plan and programme to establish a horizontal and vertical control system at the Site by GNSS and correlate and adjust the system based on the benchmarks provided by the Employer or with reference to the existing control points as specified by the Engineer. The Contractor shall develop such plan and programme as part of the Survey Plan and Programme and submit to the Engineer. The Survey Plan shall include, but not be limited to, details of survey methods, error adjustment/correction, accuracy achieved, means to maintain accuracy, and coordination with others with respect to consistent accuracy in entirety.

e) The Contractor shall summarize the Traverse Survey results with verification studies in a HORC Benchmark Establishing Report.

f) Upon establishing the HORC Benchmarks and completing all necessary adjustments, the final and detailed survey data of the HORC Benchmarks shall be submitted to the Engineer for consent. Upon receipt of the Engineer's consent to the HORC Benchmark Establishing Report, the system shall be the sole horizontal and vertical control system (x, y, z), with reference pillars provided with coordinates (x, y, z), as described herein and shall be referred to as the HORC Benchmarks which shall be consistently applied to the Works under this Contract. A HORC Benchmark Establishing Report containing Traverse Survey results shall also be included as part of the Survey Report.

g) The HORC Benchmarks shall be periodically checked (at such intervals as consented to by the Engineer) by running closed traverses and closed level works. The Contractor shall submit the results to the Engineer for review. The periodical checks shall include the nearest equivalent benchmarks established by Interfacing Contractor(s), with whom the Contractor shall communicate and coordinate. If any discrepancy deemed to be crucial is found, the Contractor shall carry out appropriate corrective measures under the instruction of the Engineer.

h) The equipment to be used in the survey to establish the horizontal control system shall be Static GNSS System (horizontal/vertical) and Total Stations of 1" accuracy and to establish the vertical control system shall be Digital Level (and/or auto levels) which have sufficient accuracy to meet the requirements given hereinafter. The Contractor shall submit a certificate from the manufacturer or his authorized service agent for the equipment and peripherals. The date of the calibration certificate shall not be more than one (1) month from the date of commencing the survey. The calibration shall be checked and re-validated at pre-determined intervals, and in any event before the expiry of the calibration certificate.

i) Universal Transverse Mercator & Global Coordinates of TBM are described in Reference Information/Reports for the Contractor's reference.

10.20.3 Requirements for Horizontal Control

a) The Contractor shall establish a horizontal control system at the Site by GNSS, providing each HORC Benchmark with a horizontal coordinate (x, y). The horizontal coordinate (x, y) shall be checked with reference to the existing control points, if available. The Contractor shall coordinate with adjacent Interfacing Contractor(s) to ensure that the HORC Benchmarks established by the Contractor and the equivalent benchmarks established by the Interfacing Contractor(s) are consistent. The Contractor shall include the survey results and the description in the Survey Report as described in the following paragraphs. Upon consent of the Engineer, the system shall be the sole horizontal control system for the Works under this Contract.

b) The horizontal control system shall be developed by GNSS and by running a closed traverse on the HORC Benchmarks and the temporary benchmarks along the alignment.

c) The maximum length of a traverse to be closed shall be around 5km and the number of azimuth courses within an azimuth check shall not exceed twenty-five (25). The Contractor shall compute angular closing error of the traverse followed by linear error. Limits of traverse for horizontal control shall have the following accuracy:

Angular error of closure:	15" (N)0.5 (N: number of angles measured) Where N shall not exceed twenty-five (25)
Total linear error of closure:	1 in 25,000 (after angular adjustment)

d) The error within the permissible limits of the traverse line shall be balanced by the Transit Method. In case the errors are beyond the above permissible limits, a traverse survey shall be carried out until the resulted error is within the permissible limits.

e) The Contractor shall summarize the established coordinates (x, y) with necessary adjustments of all HORC Benchmarks, along with raw observation data downloaded from the Total Station, together with the calculation process and descriptions of all HORC Benchmarks and submit them to the Engineer for his review.

10.20.4 Requirements for Vertical Control

a) The Contractor shall establish a vertical control system at the Site by Direct Levelling, providing each HORC Benchmark with a vertical coordinate (z). The vertical coordinate (z) shall be established using the Reduced Level (RL) of the Standard Benchmark (Type M) at SDC Quarters, Palwal with MSL value of 195.41 metres, to ensure the entire vertical control system is consistent, including the equivalent system of adjacent Interfacing Contractor(s). The Contractor shall include the survey results and the description in the Survey Report as described in the following paragraphs. Upon consent of the Engineer the system shall be the sole vertical control system for the Works under this Contract.

b) The vertical control system shall be developed by running a closed level work on the HORC Benchmarks and the temporary benchmarks along the alignment. The Contractor shall close the level work at an appropriate interval and find out the closing error as described in the following paragraph.

c) Each level work shall be connected with the HORC Benchmarks which have consistent accuracy and entirety in the system and the system of adjacent Interfacing Contractor(s)

and shall be properly maintained at the Site. The closing error of loop closure shall not exceed 12 (K)0.5 [mm], where K is the circuit length in kilometres, where K shall not exceed 5 kilometres. In case the accuracy of loop closure exceeds the limit defined herein, the entire loop shall be repeated until the desired accuracy is achieved.

d) The Contractor shall summarize the established coordinates (z) of all HORC Benchmarks with necessary adjustments along with raw observation data, calculation sheets and descriptions of all control marks in spreadsheet (MS Office Excel) format and submit to the Engineer for review.

10.21 Topographic Survey

a) The Contractor shall be responsible for carrying out validation of any Site data provided by the Employer and any additional surveys considered necessary by the Contractor for the execution of the Works, and shall ensure that the topography of the Site has been accurately recorded so that he can be fully satisfied to commence and proceed with the Works. The HORC Benchmarks as established by the Contractor shall be consistently used for surveys.

b) The Contractor shall confirm and locate all the Right of Way (ROW) marks given by the Employer at the Site and provide them with coordinates (x, y, z) so that both the Alignment and ROW are located based on the same horizontal control system.

c) The Contractor shall develop the documents including all reports, drawings, and maps. The Contractor shall summarise the results of Validation of Data, Additional Survey and Setting Out in the Survey Report. The submittals to be developed by the Contractor shall include but not be limited to the following:

a) the HORC Benchmark Establishing Plan;

b) the Survey Plan;

c) the HORC Benchmark Establishing Report;

d) the Survey Report;

e) the Site Location Map;

f) the Structure Setting-out Map;

g) the As-Built Alignment Plan and Profile Drawings; and

h) the Cross-Section Alignment Drawings (as required).

d) During the traversing of peripheral areas, the Contractor shall survey and record the broad alignment of important geographical and other features such as roads, watercourses and the locations of important buildings and facilities, etc., whenever considered necessary for development of the design.

10.22 Horizontal Alignment Staking

a) The Horizontal Alignment defined by the coordinates (x, y) of the centerline of the track shall be staked at an interval of twenty (20) meters in addition to TPTC, TP, TPCC points along the proposed alignment. While staking the Horizontal alignment at Site, the Contractor shall confirm the Right of Way (ROW) staking already done by the Employer at Site and provide and install any missing stakes. The Contractor shall ensure that staking of the ROW is carried out as per the relevant provisions of Indian Railways Engineering Code.

b) The Contractor shall use the TBMs provided by the Employer only after revalidation is done as per Sub-Clause 10.20.1 (b) of Appendix 10, Section VII-9: Appendices, in addition to the benchmarks established by the Contractor for staking the alignment.

c) Upon completing the Horizontal Alignment staking and providing all the ROW marks with coordinates (x, y, z), the Contractor shall submit to the Engineer the final coordinates (x, y, z) data of the Vertical Alignment at an interval of twenty (20) meters, the ROW coordinates (x, y, z) at an interval approximately twenty (20) meters, horizontal alignment calculation report including curve details at every twenty (20) meters (transition curves, circular curves, IP coordinates (x, y, z) and direction).

d) The Contractor shall summarize the survey results of the Right of Way marks given to the Contractor by the Employer and the Centre Line Survey and the Right of Way staking and submit to the Engineer for his consent.

e) Upon the consent of the Engineer to the report, the confirmed Alignment and Right of Way marks, including maps and drawings which confirm the ROW as well as any control points established by the Centre Line and Right of Way staking, shall become the responsibility of the Contractor. The Contractor shall ensure that these marks and control points are protected and maintained and remain consistent throughout the Time for Completion.

10.23 Setting Out

a) The Contractor shall set out the Works at the Site. The Contractor shall ensure that all the

b) Permanent Works are accurately set out.

c) The setting-out of the Works shall be carried out based upon the Drawings which have been issued with a approval and have been issued to the site ''For Construction''

d) The Contractor shall consistently apply the HORC Benchmarks to the setting-out.

10.24 Auxiliary Works

In addition to the requirements specified elsewhere in the Employer's Requirements and the Conditions of Contract, the Contractor shall follow good industry practice when carrying out surveying, setting out and associated activities, which includes but is not limited to the following:

a) performing all necessary calculations accurately and presenting all computations and results clearly in order to facilitate verification by the Contractor and Engineer;

b) removing machinery and obstructions from required sight-lines;

c) prior to carrying out surveys, setting out or similar works, stopping or relocating any operating machinery, drilling, blasting, pile driving or the like which may cause ground or structure vibration; and stopping any activity which could generate smoke, dust, gas, etc., thereby obscuring clear views or causing refraction, which would thereby interfere with such survey works;

d) restricting or stopping pedestrian and/or vehicular traffic near instruments or in sight-lines during instrument observations, as required;

e) providing adequate equipment, labour and materials as deemed necessary and suitable to carry out control and any other surveys required.

10.25 Geotechnical/Geological Survey

a) Contractor's Surveys

b) The Contractor shall be responsible for carrying out validation of any Site data provided by the Employer and any additional geotechnical/geological or other surveys which, in the Contractor's opinion, are considered necessary for the execution of the Works.

c) Geotechnical Interpretative Report

d) The Contractor shall prepare and submit to the Engineer for review a Geotechnical Interpretative Report which includes site investigation results and the geotechnical interpretation of site investigation work including that undertaken by the Contractor in sufficient detail to confirm and justify parameters used in the design of temporary works. The report shall include full borehole logs, geological profile and descriptions of confirmatory boreholes drilled by the Contractor. The requirements for this Report are described in the Employer's Requirements.

10.26 Other Related Surveys

The Contractor shall be responsible for carrying out validation of any Site data provided by the Employer and any other surveys considered necessary by the Contractor for the execution of the Works. Such surveys may include, but are not limited to, the following:

a) Topographic Survey

b) Utilities Survey including Adjacent Structures and Works with Works Areas

c) Environmental Survey

d) Hydrological/ Hydro-Meteorological Survey

10.27 Temporary Facilities

10.27.1 General

a) The Contractor shall be entirely responsible for the provision, erection, maintenance and removal on completion of all required temporary facilities, as part of the Temporary Works, which are required for the proper execution and completion of the Permanent Works. Such temporary facilities shall include the Contractor's offices, laboratories, workshops, stores, utilities, services, accommodation, canteens, recreational and welfare facilities, health, safety, security and environmental protection facilities and the like, whether on or off the Site.

b) The Contractor's Personnel shall not be allowed to live on the Site. A limited number of security personnel designated to secure the Contractor's facilities will be permitted to stay after working hours subject to the approval of the Engineer. The Contractor shall make all necessary arrangements for suitable off-Site accommodation and transportation for the Contractor's Personnel.

c) All of the Contractor's temporary facilities on the Site or elsewhere within the Project site shall be designed, provided, erected, maintained and removed to the satisfaction of the Engineer and in strict accordance with applicable Laws. The Contractor shall obtain all necessary approvals and permits from the relevant authorities having jurisdiction for the provision, erection, operation, maintenance and removal of the Contractor's temporary facilities.

d) All of the Contractor's temporary facilities, other than those designated to remain, are to be removed on the completion of the Works and the ground surfaces reinstated to the satisfaction of the Engineer.

e) When deemed essential for the preservation or maintenance of health, safety, security and/or environmental protection, the Engineer may instruct the Contractor to modify the Contractor's temporary facilities, regardless of any approvals or consents previously given, and the Contractor shall promptly comply with such instructions. These instructions shall not constitute Variations.

10.28 Location of Area for Temporary Facilities

10.28.1 The Contractor shall be aware that the area for temporary facilities is not for the Contractor's exclusive use, and the Contractor shall cooperate fully with the Interfacing Contractors if it becomes necessary for the efficient use of a limited area among the said Interfacing Contractors.

10.28.2 The precise locations of the Contractor's Temporary Works including the temporary facilities within and outside the Site area shall be proposed by the Contractor and approved by the Engineer.

10.28.3 The Contractor shall submit drawings showing the proposed locations and outlines of the proposed temporary facilities. Drawings and details of the Temporary Works for a particular part of the Permanent Works may be submitted as part of the shop or working drawings and/or the work method statements forming part of the Contractor's Documents. These locations and outline drawings for the temporary facilities shall be submitted twenty-eight (28) days before commencing the construction of any temporary facility or twenty-eight (28) days after the Commencement Date. These drawings and outlines shall be updated whenever addition or removal of any facility is planned. Detailed drawings for any particular temporary facility, showing all necessary utilities and services, shall be submitted at least fourteen (14) days before the planned commencement date of construction thereof.

10.28.4 The areas for the Contractor's temporary facilities may also be used for temporary storage of excavated material suitable for reuse in embankment or fill for the Works, or for use by the Employer in future projects or on other works packages.

10.28.5 The Contractor shall dispose of all surplus topsoil and all subsoil materials arising from the Works in the designated area wherever available within the ROW of the Project as agreed by the Engineer. In case area for disposal of surplus soil is not available, the Contractor shall make his own arrangements outside the ROW and the Contractor shall bear all costs including royalty for using/disposing of excavated material unless otherwise specified in the Contract.

10.28.6 The Contractor is free to make his own arrangements for any additional areas required for the proper execution of the Works, and the costs of same shall be borne by the Contractor.

10.29 Site Offices

10.29.1 The Contractor shall be responsible for identifying and establishing suitable facilities for the Contractor's office facilities as approved by the Engineer.

10.29.2 The Contractor's Site offices and facilities shall be provided within or in the vicinity of the work site, with all necessary facilities including furniture, office equipment, office supplies, utility services, sanitary system and vehicle parking. The Engineer will have one

(1) Sub-Site Office established for this Contract. The Contractor shall establish the same number of Sub-Site Office and Site Huts in close proximity to the Engineer's Offices.

10.30 Project Information Signboards

10.30.1 The Contractor shall provide project profile sign board at each of the Site Offices and at prominent public places along the alignment of the project as directed by the Engineer of a size, minimum 1.5 m x 2.5 m, and maintain them in good condition. All information on the signboards will be written in English and local language for separate signboard. The signboards will be positioned on a steel frame as directed by the Engineer. The Contractor shall submit proposals for the signboard materials, the text layout (in English and local language) and installation of the signboards at the Site Offices of the Engineer and the Contractor for Engineer' s approval. Each sign board shall show:

a) The name of the Project and the Works,
b) The Location Map,
c) The name of the Bank,
d) The name of the Employer,
e) The name of the Engineer,
f) The name of the Contractor,
g) Date of Commencement of the Works,
h) Time for Completion,
i) Cost of the Works and
j) All other details as required by the Engineer

10.30.2 The Contractor shall maintain the sign boards and remove them on completion of the Works or when instructed by the Engineer. The Contractor shall clean, update, maintain and replace the signboards if damaged, throughout the duration of the Contract. No additional payment shall be applicable for damaged signs which are required to be replaced.

10.30.3 Within twenty eight (28) days from the Commencement Date, the Contractor shall provide and install a Project information sign, as per the requirements for signboards at the Employer's/Engineer's Site Offices, at each of the entrance points to each Site Office location (both the Contractor's and Employer's/Engineer's offices) and the Site entrances, or, as directed by the Engineer.

10.30.4 The Contractor shall maintain the signboards and remove them on completion of the Works or when instructed by the Engineer, so as to inform the public of the implementation of the Works and the Project and to advise road users of on-going construction.

10.30.5 The Contractor shall clean, update, maintain and replace the signboards if damaged, throughout the duration of the Time for Completion. No additional payment shall be applicable for damaged signs which are required to be replaced.

10.31 First Aid Station

10.31.1 The Contractor shall construct, equip, and maintain First Aid stations at a sufficient number of appropriate locations on the Site and at each labour camp.

10.31.2 The Contractor shall comply with all requirements specified in the Employer's Requirements (including Appendix 13 [Environmental, Social, Health and Safety Management]) and the Conditions of Contract.

10.32 Labour Accommodation Camps

10.32.1 The Contractor shall supply, equip and maintain facilities as necessary for the living accommodation, feeding and welfare of its employees by providing, servicing, and maintaining a camp at appropriate location(s), as necessary.

10.32.2 The Contractor shall comply with all requirements specified in the Employer's Requirements (including Appendix 13 [Environmental, Social, Health and Safety Management]) and the Conditions of Contract.

10.33 Site Storage and Yards

10.33.1 The Contractor's Site storage areas and yards shall be utilized for, among other things, material and equipment storage, casting of precast structural elements, workshops, warehouses and secure storage.

10.33.2 The Contractor shall erect a 2.0 metres high chained security fence around the Site storage areas and yards, complete with suitable lighting and lockable gates.

10.33.3 The location of each Site storage area and yard shall be determined prior to the commencement of the works and the Contractor shall propose the locations and details of same and submit to the Engineer for consent.

10.34 Borrow Areas and Quarries

10.34.1 It shall be the responsibility of the Contractor to arrange for borrow areas (for fill material) and quarry sites (for ballast, aggregate and rock material) using his own resources. The Contractor shall be responsible for carrying out his own investigations to verify the availability, sufficiency, quality and quantity of materials from such sources. The Contractor may also arrange any additional borrow areas and quarry sites as required by him, all at his own discretion. No claim whatsoever shall be entertained by the Employer in this regard.

10.34.2 All costs and charges, including but not limited to permits, royalties, duties, taxes, rental or other costs associated with land or the temporary use of same, etc. as applicable, for arranging borrow areas and quarry sites and access thereto, including for the extraction of material therefrom, shall be borne by the Contractor.

10.34.3 Before commencing operations in each of the borrow areas and quarry sites, the Contractor shall submit a detailed plan of his operations and demobilization/grading and finishing/reinstatement, etc. in respect of the same to the Engineer for his approval, together with relevant drawings.

10.34.4 The quality of fill material, aggregates, etc. extracted from borrow areas and quarry sites shall meet the Employer's Requirements and be subject to the consent of the Engineer.

10.34.5 Borrow areas, quarry sites and the installation of rock crushers shall not be permitted within the ROW.

10.34.6 On completion of the Works, the Contractor shall leave borrow areas in a safe and stable condition.

10.34.7 The Contractor shall indemnify the Employer against all claims in relation to borrow areas and quarry sites both during the Time for Completion and after the Works are completed and taken over.

10.35 Stockpile Areas

10.35.1 The land available, if any, within the ROW may be used by the Contractor for storage of materials required for the project, subject to the consent of the Engineer.

10.35.2 The Contractor may also arrange any additional stockpile areas as required by him at his own discretion and cost.

10.35.3 The location and size of stockpile areas proposed by the Contractor shall be subject to consent of the Engineer. The Engineer's consent may be withheld, if:

a) in the opinion of the Engineer, a stockpile area or access thereto may be such as:
   i. would have a detrimental effect on the natural and social environment;
   ii. would disturb drainage system(s) around the stockpile areas;
   iii. would constitute a danger to the public; or
b) at the Engineer's discretion, a stockpile would become too high.

10.35.4 Before commencing operations, the Contractor shall submit detail drawings of the proposed stockpile areas, together with the proposed method of operation, including stockpile heights, angles of repose, runoff / dust control measures, access road layouts, drainage, measures to be taken for restoration, all verified by appropriate calculations and analysis.

10.35.5 On completion of stockpiling operations, the Contractor shall reinstate stockpile area(s) to a safe and stable condition.

10.35.6 The Contractor shall indemnify the Employer against all claims in relation to stockpile area(s), both during the Time for Completion and after the Works are completed and taken over.

10.36 Contractor's Plants.

10.36.1 The Contractor shall plan, install, erect, maintain, dismantle and remove all plants required for the Works, including but not limited to major items such as concrete batching/mixing plants, rock crushers, casting yard, curing yard, stacking yard etc. of sufficient number and capacity to meet planned peak requirements during construction. The capacity of such plants shall be subject to consent by the Engineer. The location of concrete batching plants is subject to environmental approval from the appropriate authorities and shall not able to operate until such approval is obtained. All control and measuring equipment shall be regularly checked and calibrated and the Contractor shall regularly submit calibration certificates for same to the Engineer.

10.36.2 The land available, if any, within the ROW may be used by the Contractor for storage of materials, concrete batching/mixing plants, casting yards, curing yard and stacking yards subject to the consent of the Engineer. The Contractor shall arrange any additional areas as required by him at his own discretion and cost.

10.37 Material Testing Laboratories

10.37.1 The Contractor shall design, construct, equip, maintain, dismantle and remove all required material testing laboratories and associated facilities on the Site and / or at work areas as are required for the sampling and testing of materials as required in the Employer's Requirements. The Engineer's consent shall be obtained to the location of material testing laboratories.

10.37.2 Laboratory buildings shall be supplied with adequate electricity, water, air-conditioning, etc., and shall have sufficient area(s) for storing samples.

10.37.3 The laboratory equipment to be supplied and the methods of testing shall be in accordance with relevant International, Indian and/or other standards and codes as detailed in the Works' Requirements. All apparatus and equipment shall be brand new and of the latest design and manufactured by a reputable manufacturer. The proposed type and number of

items of laboratory equipment shall be submitted to the Engineer for review and consent prior to purchase.

10.37.4 The laboratory equipment and apparatus shall be checked and calibrated before testing starts and thereafter at regular intervals as specified by the manufacturer and as directed by the Engineer. The Contractor shall regularly submit calibration certificates for same to the Engineer.

10.37.5 The Contractor shall complete the design, construction and installation of the laboratory facilities for operation within one hundred and forty (140) days after the Commencement Date and operate and maintain the facilities until the issue of Taking-Over Certificate, unless otherwise authorized by the Engineer. The Contractor shall also make all facilities and services available to the Engineer as required. All sampling and testing to be undertaken shall be under the direct supervision of the Engineer. The material testing laboratory shall be staffed by Contractor's personnel fully experienced in the sampling and testing of materials, and quality control.

10.37.6 Any testing which may be required in accordance with the Employer's Requirements and which cannot be performed in the Contractor's laboratory due to lack of time or equipment shall be assigned to an independent organization having NABL accreditation and as duly consented to by the Engineer. The Contractor shall accept all results, instructions or restrictions stipulated by the Engineer based on such tests.

10.38 Wheel Washing Facilities

10.38.1 In and around residential and commercial area, the Contractor is required to install wheel washing area within ROW at the "Exit" points/gates of the construction area to ensure the removal of wheel/band dirt from construction vehicles and machines. Wheel washing area design shall be proposed in CEMP. As a part of the Contractor's method statement for the site preparation plans, wheel washing area shall be proposed and approved by the Engineer before the commencement of the work. The facilities are required to have access for cleaning out the sludge which collects together with provision for 2 high pressure hose connections and adequate water supply.

10.39 Temporary Roads

10.39.1 The Contractor at his own discretion construct and dismantle/alter/dispose of the temporary roads after the completion of Contract as directed by the Engineer.

10.39.2 Before constructing any temporary roads outside the ROW, the Contractor shall make all necessary arrangements, including payment if required, with the public authorities or landowners concerned, for the use of the required land and shall obtain the consent of the Engineer. Such consent will be dependent on the Engineer being satisfied with the Contractor's proposals for items such as capacity, signage, lighting and surface quality of the temporary road, together with proposed maintenance arrangements. Such consent shall not relieve the Contractor from any of its responsibilities under the Contract.

10.39.3 The Contractor shall note that temporary road shall not be for the Contractor's exclusive use and shall be subject to relocation or restrictions at his cost during the execution of the Works as and when such relocation or restriction is inevitable. Except in an emergency, the Contractor will be given a prior notice of any such relocation or restriction. The road layout and design proposal shall be revised and re-submitted to the Engineer for consent whenever road arrangements are to be modified for whatsoever reasons.

10.39.4 Within forty-two (42) days after the Commencement Date and consequent to the surveys performed by the Contractor, the Contractor shall submit for the Engineer's review and approval of the proposed design, including layout, and details of the temporary road,

fences, protection to underground pipes and culverts at road-crossing points and all additional temporary pipes and culverts that shall be provided by the Contractor, to sustain road traffic, irrigation and drainage flow in all existing streams, irrigation canals and ditches, drainage canals and ditches, and utilities or services, whether buried or exposed, all of which, in the opinion of the Engineer, are necessary for the proper execution of the Works.

10.39.5 During the transportation of Goods and Contractor's Personnel, the Contractor shall be responsible for keeping all railways, roads, bridges, watercourses, utilities services, etc. free from damage and from spillage of construction materials, detritus, oils, etc. and shall repair any damage howsoever caused to any such structure or property (whether on or off the Site) by Contractor's Equipment (including that of any Subcontractor). In that respect the Contractor will be required to carry out a condition survey of all roads and other facilities in and adjacent to the works area which will show in detail the state of those items prior to the commencement of construction. The full records shall be submitted to the Engineer and the status monitored throughout the course of construction with further records maintained.

10.39.6 At the junction of temporary roads with existing roads, the Contractor shall provide suitable traffic marshals to warn and regulate the traffic as per the requirements.

10.39.7 The Contractor shall be responsible for upholding and protecting all slopes at the boundaries of the Site against slippage into adjacent properties. As adjacent areas may be irrigated, this requirement will also therefore include the provision of temporary coffering as appropriate.

10.39.8 All temporary roads, culverts, ditches and the like required for the Contractor's or Subcontractors' or any other Contractor's operations shall be provided and maintained by the Contractor, kept in good condition by cleaning, watering, rolling, grading, repairing and maintaining, all to the approval of the Engineer.

10.39.9 If the Engineer has provided drawings or details of any temporary works, then such drawings or details shall be understood to be indicative of the minimum required standard only. The Contractor shall remain responsible for the design of Temporary Works.

10.39.10 Unless otherwise approved by the Engineer, the demolition of any existing roads, culverts, etc. shall not commence until the replacement facilities therefore have been completed by the Contractor.

10.39.11 When any of the temporary approach roads are no longer required, or earlier if so directed by the Engineer, the Contractor shall carefully dismantle the temporary bridge or road, and remove and dispose of all surplus materials in compliance with the applicable Laws, and reinstate the area to its original condition to the approval of the Engineer.

10.40 Vehicles

10.40.1 The Contractor shall provide all necessary vehicles required for the transportation and movement of Goods and Contractor's Personnel, including but not limited to trucks, cranes, trailers, cars, motorcycles, etc.

10.40.2 The Contractor shall provide competent and licensed drivers and operators for all such vehicles. Vehicles shall be licensed and insured in accordance with the applicable Laws and the Contractor shall be responsible for all servicing, repairs and maintenance required.

10.41 Contractor's Equipment

10.41.1 The Contractor shall ensure that all Contractor's Equipment whether on or in the vicinity of the Site, including apparatus, machinery, vehicles and other similar things to be

operated by him or his Sub-Contractors for the execution and testing of the Works, are maintained and operated in a good and safe condition.

10.41.2 All lifting and hoisting equipment shall be regularly certified in accordance with the applicable Laws, and the safe working load limits shall not be exceeded.

10.41.3 The Contractor shall operate and maintain an equipment repair facility within or in the vicinity of the Site, so that downtime of Contractor's Equipment can be minimized. Temporary fuel and lubricant stores shall be properly designed, constructed, secured, fire- and spill-guarded, and be well ventilated so as to comply with the relevant applicable Laws.

10.42 Utilities for Temporary Facilities

10.42.1 Power Supply and Lighting:

i. Electric power supplies for the Contractor's temporary facilities, including but not limited to Contractor's camps, offices, Site, work areas and other facilities as described herein, shall be arranged by the Contractor.

ii. The Contractor shall install, operate and maintain its own electrical distribution systems for the electrical supply required for his temporary facilities as described in paragraph (1) above.

iii. The Contractor shall also furnish, install and keep operational the diesel power generating facilities of such capacity as the Contractor considers necessary to prevent any interruption to the progress of the Works.

iv. The Contractor shall ensure adequate lighting is provided for all his operations at the Site and the temporary facilities and camp according to the National Building Code of India (2016).

10.42.2 Water Supply

i. The Contractor shall design, install, operate and maintain water supply systems including pumps, piping systems, valves, storage tanks etc., at the Site with respect to:

   a) Industrial water supply system
   For construction use the water quality shall meet the quality requirements in the Employer's Requirements.

   b) Potable water supply system
   For supply to all the Contractor's temporary facilities including but not limited to Contractor's camps, offices, Site, work areas and other facilities for human consumption and use.

ii. In case the Contractor plans to install bore well(s) for water supply, he shall thoroughly investigate the relevant legislation and regulations imposed by the competent authorities and the installation shall be subject to approval by the said competent authorities and/or consent of the Engineer.

iii. Throughout the Time for Completion the Contractor shall take samples from all water supplies at regular intervals and test it for suitability for the intended use.

10.42.3 Sanitation and Sewerage

i. All operational parts of the Site, offices, workshops, fabrication yards, laboratory, camp and other facilities, etc. shall be provided with sanitation and sewage handling and disposal systems complying with the statutory requirements and applicable Laws, codes and standards.

ii. If required, portable sanitary facilities including chemical toilets shall be provided and maintained by the Contractor for the use of all personnel at all work locations.

iii. All the requirements of the Employer's Requirements (including Appendix 13 [Environmental, Social, Health and Safety Management] of the General Specifications) and the Conditions of Contract shall also be complied with.

10.42.4 Waste and Garbage Disposal

i. The Site and the work areas shall be kept clean and free of detritus at all times.

ii. The Contractor shall collect waste material and garbage from Site, camp, offices, yards, workshops, etc. on a daily basis and dispose of same in an approved disposal area(s) and as per guidelines prescribed by local and governmental authorities having jurisdiction. No waste of any kind shall be deposited in any watercourses.

iii. All the requirements of the Employer's Requirements (including Appendix 13 [Environmental, Social, Health and Safety Management Management] of the General Specifications) and the Conditions of Contract shall also be complied with.

10.42.5 Fencing, Site Security and Safety

i. The Contractor shall be responsible for the security and safety of the Site. Accordingly, the Contractor's temporary facilities including offices, workshops, fabrication yards and storage compounds, campsites, all construction areas, storage areas shall be adequately fenced, gated, lighted and guarded on a twenty-four hour, seven days a week basis. Firefighting equipment shall be provided in accordance with the applicable Codes and the requirements of local authorities.

ii. Any storage facilities for explosives shall comply with the relevant Laws and regulations of India and shall be situated at locations approved by the competent authorities. Detonators and fuses shall be stored in facilities separate from explosives. In no case shall detonators and fuses be transported in the same vehicle as explosives. Storage facilities for explosives, detonators, fuses, etc. shall be secure, kept locked and the keys shall be accounted for at all times.

iii. All the requirements of the Employer's Requirements (including Appendix 13 [Environmental, Social, Health and Safety Management Management] of the General Specifications) and the Conditions of Contract shall also be complied with.

iv. The Contractor shall be responsible for any losses occurring within the Site premises.

10.42.6 Inspection by the Employer or Engineer

The Employer and the Engineer have the right at any time to inspect any part of the Contractor's temporary facilities and to require immediate rectification to comply with the specified requirements.

10.42.7 Final Clean-Up

i. Upon the completion of Works, or when any of the Contractor's Equipment and/or temporary facilities have fulfilled or completed their function, the Contractor shall dismantle and demobilize such Contractor's Equipment and/or temporary facilities and remove all equipment, machinery, materials, refuse, debris, objectionable material, and reinstate, including filling, grading and dressing all areas to their original condition prior to completion of the Works.

ii. The Contractor shall not proceed with any demobilization and/or removal of temporary facilities and equipment without the prior consent of the Engineer.

10.43 Maintenance of Temporary Facilities

10.43.1 The Contractor shall provide all necessary maintenance requirements and shall keep the temporary facilities and other areas established for the Works, clean, tidy and litter-free.

10.43.2 The Contractor shall be responsible throughout the Time for Completion for keeping the Site and temporary facilities to the satisfaction of the Engineer.

10.43.3 The Contractor shall maintain all existing security fences required for the Works until completion of the Works. Existing fences which interfere with construction operations, shall not be relocated or dismantled, until written permission has been obtained from the fence owner.

10.44 Damage to Existing Property

10.44.1 The Contractor shall be responsible for any and all damage that may occur to any existing structures, works, materials, or equipment that is due to any operation(s) for which the Contractor is responsible, including any operation(s) of any Subcontractor.

10.44.2 The Contractor shall repair or replace any damaged structures, works, materials, or equipment to the satisfaction of the Engineer.

10.44.3 The Contractor shall be responsible for all damage to roads, railway infrastructure, curbs, sidewalks, highways, shoulders, embankment, ditches, drains, culverts, bridges, or other public or private property, which may be caused by their construction activities and shall indemnify for losses due to such damages.

10.45 UTILITIES

10.45.1 General

a) The Contractor shall at all times work with due diligence to ensure the safety of all personnel and property from injury and damage from known ("Charted Utilities") and unknown utilities ("Uncharted Utilities").

b) The Contractor shall always take care of concerning buried Charted and Uncharted Utilities and if any such Utilities infringe the work, the Contractor shall make the area affected safe and ensure that no unauthorised member of the workforce or members of the public shall enter such area.

c) Contractor shall be responsible for relocation/diversion/shifting/modification of all charted (except specified otherwise) and uncharted utilities infringing the Works.

d) Contractor shall indemnify the Employer against any losses/claim/damage cost to any damage to utility/services during execution of Works.

10.46 Utilities, Services and Facilities

10.46.1 The Utilities are categorised as (i) Charted Utilities, which have been identified by the Employer and may be affected during the execution of the Works. and, (ii) Uncharted Utilities, which are not known and would get identified during the execution of the Works.

10.46.2 Charted Utility

The Charted Utilities identified by the Employer are enclosed in Part 2, Section VII-8-Employer's Requirements, Tender Drawings and Documents. These are further categorised as discussed under:

i. Overhead Electrical Crossings

a. **LT and HT Crossings:** These are Overhead Electrical Crossings, traversing the proposed HORC alignment and likely to infringe during execution of the work primarily due to inadequate ground clearance. The Employer has already taken action to remove these infringements by either raising or laying underground cables. *50%* of infringements due to LT and HT (up to 33 KV) utilities shall be removed by the Employer within *120* days of the Commencement Date. Balance *50%* shall be removed in a phased manner within *240* days of the Commencement Date. It is pertinent to point out that these infringements are of minor nature and are unlikely to significantly hamper the progress of the work. Hence, for any delay in removal of any of these utilities, no claims on these grounds by the Contractor shall be accepted. The Contractor shall plan his works taking this aspect into consideration. The Crossings shifted underground shall normally be laid within ten (10) meters of the chainages given in the list of Overhead Electrical Crossings except at locations where stations and buildings of HORC are proposed. At the stations and HORC buildings, the utility will be shifted beyond the structure area. For cables crossing the HORC alignment, extra length of 3m to 5m is being provided on both sides, so that cable can be slewed if required during construction. The Contractor shall consider the effect of these shifted utilities in his work planning and price. The coordinates of the new locations where utilities have been shifted will be shared with the Contractor once the shifting is completed. Electrical utilities which have been laid underground will be considered as charted utilities. The Contractor shall design the span in such a way that further utility shifting is avoided unless inescapable. *However,* in case such utilities are not dismantled by the Employer and which may affect execution of work, the Contractor will be asked for relocation /diversion/ shifting/ modification of utilities. The cost of relocation/diversion/ shifting/ modification of utilities shall be payable by the Employer *under Provisional Sum.* If any payment/compensation is payable to the utility owner, the same shall be paid by the Employer to the Utility owner.

b. **EHT:** The infringements due to EHT (above 33 KV) Utilities will be progressively removed by the Employer *through utility owner agencies* and is likely to be completed within 12 months from the Commencement Date. It is pertinent to point that these infringements are of minor nature and are unlikely to significantly hamper the progress of the work. Hence, for any delay in removal of any of these utilities, no claims on these grounds by the Contractor shall be applicable. The Contractor shall plan his works taking this aspect into consideration.

c. List of LT/HT & EHT crossings is given in Table 3. List of Charted Utilities, VII-8B:Documents of Section VII – 8 Tender Drawings and Documents.

10.46.3 Uncharted Utility

i. The Uncharted Utilities will be those unknown utilities which get identified during execution of the Works. These may be identified during Ground Penetration Survey or anytime during execution of the Works.

ii. Underground S&T Cables

S&T signal and telecom cables of DFCCIL runs generally parallel to HORC alignment approximately between Chainage (-) 2296m to 10000m in Prithla yard of DFC and between Prithla and Silani stations. These cables will get buried under the HORC embankment and will be required to be shifted. Shifting of cables shall be done by the Contractor and shall be paid under Schedule 'D'.

10.46.4 The Contractor shall do a general survey and Ground Penetrating Radar (GPR) Survey of the Site after possession and notify the Engineer of Charted & Uncharted Utilities, which may obstruct the works and need to be relocated.

10.46.5 For all Charted & Uncharted Utilities requiring relocation identified by the Contractor in the Utilities survey, the Contractor shall inform the Engineer and provide relevant details, including but not limited to, the following:

i. location of the Utility;

ii. date on which Utility was encountered;

iii. nature and size of the Utility;

iv. condition of the Utility

v. type of the Utility & its owner:

a) Electrical cables;

b) OFC & Telecom cables;

c) Gas pipelines;

d) Water/sewerage/drainage/storm water/hume pipelines;

e) Irrigation pipelines/channels;

f) Telecom towers;

g) Overhead Water tanks and others overhead tanks;

h) Others, if any

vi. Reasonable estimate of time required for shifting of Unchartered Utilities.

vii. The information shall also cover the details of the agency/department carrying out the utility shifting.

10.46.6 The trial trenching, arrangements and working methods to be employed in respect of such Charted & Uncharted Utilities which warrants removal/relocation, including proposed protection measures, diversions, reinstatements in consultation with utility owner shall be done within 56 days after Handing Over of the Site by the Employer. The Contractor shall provide relevant justification for the identified utilities (Charted & Uncharted) which require removal/diversion for proceeding with the works.

10.46.7 The Engineer will accord approval within 21 days to the Contractor for initiating required action for the utilities warranting removal/relocation/modification.

10.46.8 The Contactor shall be responsible for taking prompt necessary action for such identified utilities (Charted & Uncharted) including the following but not limited to:

i. Identification of the extent of the utility to be relocated

ii. Coordinate and get permissions from utility owner & all relevant authorities.

iii. Preparation and submission of relevant documentation to the authorities.

iv. Mitigate the situation and re-arrange the work to minimise the effect on the timeline of the Works

v. Continue with other related works in as much as possible to maintain the timeline of the Works.

10.46.9 The relocation/removal/diversion of identified Uncharted Utilities shall be assigned to the Contractor to be carried out through the utility agencies, or their specified contractor or by the Contractor himself. The cost of relocation/removal/diversion of Uncharted Utility shall be paid by the Employer as mentioned below:

i. If Uncharted Utility relocation/removal/diversion is carried out by Utility agency or theirspecified contractor, the Contractor shall make the payment to such agency or specified contractor. The Employer shall reimburse such amount as Specified Provisional Sum based on invoices.

ii. If Uncharted Utility relocation/removal/diversion is carried out by Contractor himself, then he shall be paid under Specified Provisional Sum.

10.46.10 The Contractor shall not divert, remove or relocate any such identified Charted & Uncharted Utilities without having first received the Engineer's consent to such diversion, removal or relocation.

10.46.11 The Contractor shall liaise and co-ordinate with the relevant Utilities Companies to ensure that all the above-mentioned works of relocation/diversion, support and protection are executed satisfactorily. Contractor shall obtain necessary clearances from the Utility company/owner prior to the start of any relocation/removal/diversion works of the utilities. The same shall be submitted to the Engineer prior to start of the works.

10.46.12 Throughout the execution of the Contract, the Contractor shall reasonably comply, in all respects, with the requirements of all the utility owners and authorities regarding the handling, protection and maintenance of the utility facilities. The responsibility in respect of diversion/ modification/ relocation/ protection etc. of the Utilities (Charted or Uncharted) to facilitate safe construction lies with the Contractor. If required, the employer shall provide support to facilitate approvals/permits from utility owner/concerned department for the proposed diversion/relocation of utilities.

10.47 Prevention of Damage and Interference

10.47.1 Temporary supports and protection methods proposed by the Contractor and agreed by the utility owner shall be provided to the utilities. The permanent supports and protection shall be provided wherever required for the safety and security of the utility service.

10.47.2 The Contractor shall not interfere in any manner with the Utility lines and services without prior approval of the Utility owner and Engineer. Whenever the interfering necessity arises, the Contractor shall submit a proposal to the Engineer for his approval. Any unintentional interference caused shall be immediately corrected without causing danger and trouble to any on-going operations or the existing utility lines or services. The Contractor shall immediately inform the Engineer and the utility agencies of:

i. damage to utilities;

ii. leakage of utilities;

iii. discovery of utilities not previously identified; and

iv. Any hazardous material found during the excavation.

a) location of utility

b) date on which the utilities were encountered;

c) nature and sizes of the utilities;

d) condition of utility;

e) temporary or permanent supports provided; and

f) diversions made –temporary or permanent

The Contractor shall include the details (plan, location, ownership, size and material) of all suchutilities in the As-built Drawings.

10.48 Drainage Systems

10.48.1 All existing drainage systems that are affected by the Temporary and the Permanent Works shall be protected, relocated and/or diverted as required for the Works, by the Contractor.

10.48.2 Such protection, relocation or diversion works shall be carried out by the Contractor, and his designs shall be approved by the utility owners / relevant authorities and the Engineer.

10.48.3 Upon completion of the works, all the diverted or temporarily diverted drains/box culverts and canals shall be fully reconstructed to their original size or to a revised size as required by the utility owners /relevant authorities. However, if the utility owner or relevant authority requires to keep the Utility at the original location, the same shall be reconstructed at the original location.

10.49 Building Service Connections

10.49.1 Building service connections shall be maintained and protected or if required to be shifted, shall be informed to the Engineer during the execution of the works. The Contractor shall take necessary steps to ensure these services with the approval of utility owner and the Engineer.

10.49.2 Building service connections shall include the branch pipes from the main water pipe, water meter chambers/bulk meter, sewer and drainage discharge pipes, grease traps, etc.

10.49.3 Building service connections shall be identified by trial trenches or other methods approved by the relevant Utility Companies. Where these service connections interfere with the works, the Contractor shall follow the methodology as approved by the relevant Utility Companies and the Engineer.

10.50 Street Furniture and Minor Service

Where street furniture, including lamp posts, traffic lights, fire hydrants, signage, minor electrical cables, water services, etc. are required to be dismantled and stored or relocated temporarily or permanently, the Contractor shall propose such works to the Engineer and Utility Companies or relevant authorities for their approval.

10.51 TRAFFIC MANAGEMENT PLANS

10.51.1 General

a) The Contractor shall thoroughly acquaint itself with existing traffic conditions and understand the importance of maintaining traffic safety and the avoidance of excessive traffic delay. The Contractor shall co-operate with the relevant agencies regarding traffic control and all details shall be subject to the Engineer's approval.

b) The requirements concerning temporary road works shall include, but not be limited to, construction of detours, temporary bridge approach roads, traffic control devices and services for the control and protection of traffic through areas of construction.

c) The Contractor shall be responsible for investigating and establishing the requirements for traffic control and ensuring safety at each site and shall submit such details in the form of a Temporary Traffic Control Plan for the Engineer's review and consent.

d) All temporary roadworks and traffic management shall be as specified in this appendix, unless specified otherwise elsewhere in the Contract or local Indian regulations and standards, and the more onerous provision shall apply.

10.52 Temporary Traffic Control Plan (TCP)

10.52.1 Submission, Consent and Change

a) Within twenty-eight (28) days after the Commencement Date, the Contractor shall submit a Temporary Traffic Control Plan (TCP) to the Engineer for review and consent. The Engineer's consent shall be obtained prior to the start of Works on Site.

b) The Contractor shall comply with the TCP which has received the Engineer's approval and any Engineer's instructions issued concerning traffic control.

c) Should the Contractor propose any to change to the TCP which has received the Engineer's approval, the Engineer shall be notified in writing at least seven (7) calendar days prior to the date planned for the implementation of any such proposed change. Changes proposed are subject to receipt of the Engineer's consent. If the Engineer makes any subsequent recommendations or issues instructions concerning the TCP in writing, the Contractor shall revise the TCP accordingly.

10.52.2 Contents of Temporary Traffic Control Plan

a) The main contents of the Temporary Traffic Control Plan shall include, but not be limited to,the following:

i. Type and main specifications of traffic control devices and facilities;

ii. A scale plan of the location(s), clearly identifying existing road(s), proposed diversions ofpedestrian and road traffic, locations of warning signs and traffic control measures;

iii. Details of all lane widths, temporary surfaces, etc.;

iv. Construction details of any proposed diversion(s);

v. Safety measures including signage and staffing;

vi. Program for installation and erection of traffic control devices and facilities;

vii. Traffic control means during non-working time and during night time;

viii. Protection/diversion of any existing utilities;

ix. Environmental measures to be implemented, e.g. dust suppression, noise abatement,

x. watercourse diversion and the like; and

xi. Person responsible for overseeing implementation of all aspects of the TCP.

b) In addition to the above and prior to the implementation of any Site-specific traffic control schemes, the Contractor shall obtain any necessary approval letters from relevant authorities who have jurisdiction over or ownership of the existing traffic way including the Traffic Police, NHAI, PWD and any other local government/authorities and other related parties having jurisdiction, as applicable and as required.

10.52.3 Number of Lanes for Traffic Control

a) The existing traffic on roads at the Site must be maintained at all times during the execution of the Works and if diversions are required these must be of the same traffic capacity as the original road. Notwithstanding the above, the Engineer may give consent to reductions in traffic capacity if the Contractor can demonstrate that such will not cause excessive delays to traffic flow. If such consent is given, the Engineer may specify the hours during

the day when the reduction in capacity may be applied and it should be anticipated by the Contractor that these hours will not include any peak periods for the traffic movement.

b) The Contractor shall cooperate with relevant authorities having jurisdiction regarding traffic control and all details will be subject to receipt of the Engineer's consent.

10.52.4 Temporary Traffic Ramps and Speed Breakers

a) In locations where it is necessary (for example, pipeline crossing a road above ground), the Contractor shall construct and maintain temporary traffic ramps.

b) In cases where it is necessary (for example, requirement by an agency having jurisdiction) or required by the Engineer, the Contractor shall provide and maintain temporary speed breakers.

10.52.5 Traffic Control for Public Roads

a) The Contractor shall maintain close liaison with the Traffic Police, NHAI, PWD and any other local government/authorities and other related parties having jurisdiction, as applicable to traffic control requirements and shall comply with all approval and permit requirements from such authorities.

b) In order to facilitate traffic through or around the Works, or wherever ordered by the Engineer, the Contractor shall erect and maintain at prescribed points on Site roads and at approaches to the Works, a temporary fence made of corrugated metal sheet supported by hard posts with foundations and horizontal bars, traffic signs, lights, barricades, traffic cones with traffic warning lamps and other facilities for the direction and control of traffic. The fence is to be painted and maintained in good condition. Drawings and details of the fence are to be prepared and submitted to the Engineer for review and issue of a approval.

c) Where required, or as directed by the Engineer, the Contractor shall provide competent flagmen whose sole duties shall consist of directing the movement of traffic through or around the Works.

d) In addition to the requirements as described above, the Contractor shall furnish and erect, within or near Works areas, such warning and guide signs as may be ordered by the Engineer.

e) For all traffic safety precautions, the Contractor shall refer to Traffic Management and Site Barricading. The Contractor shall refer to Section VII-8, Tender Drawings and Documents for details of barricading.

f) The repair of any existing roads that have been damaged by the Contractor during the execution of the Works (including any damage caused by Contractor's Equipment) shall be at the risk and cost of the Contractor.

10.53 Extraordinary Traffic

The Contractor shall be responsible for carrying out any necessary investigations and the obtaining of approvals, licenses, escorts and any other necessary facilities in order to enable extraordinary traffic to be moved on the roads in the Works area.

10.54 Maintenance and Protection of Traffic

10.54.1 During the execution of the Works the Contractor shall keep open to traffic existing roads, provided that where required or as directed by the Engineer, the Contractor shall arrange detours subject to the consent of the Engineer. The Contractor shall at all times keep roads and footpaths affected by its operations, free from obstruction and nuisance and suitable for public use.

10.54.2 The Contractor shall take necessary care at all times during the execution of the Works to ensure the convenience and safety of residents along and adjacent to public roads and highways that may be affected by the Works. Street lighting shall be relocated as necessary to maintain the same standard of lighting during the course of the Works, until new lighting facilities are brought into operation.

10.54.3 Any failure of the Contractor to meet these requirements will entitle the Engineer to carry out such works as he deems to be necessary and to charge the Contractor with the full cost thereof plus ten percent of such cost, which sum will be deducted from any money due or which may become due to the Contractor under the Contract.

10.55 Vertical Clearance

In general, any Temporary Works placed over roads or diversions used by public traffic shall maintain a vertical clearance of at least 5.5 metres unless otherwise directed by the Engineer. Where required by the Engineer the Contractor shall erect and maintain suitable check-gates, fitted with warning signs indicating the vertical clearance.

10.56 Materials

Materials and other specifications related to traffic control devices shall conform to IRC Standards unless otherwise specified elsewhere in the Contract.

10.56.1 Retro-reflective Material

Unless otherwise specified in the Contract, sign panels, barricades, traffic cones, vertical panels, and flagmans' paddles shall have retro-reflective sheeting, as consented to by the Engineer.

10.56.2 Sign Panels

Sign panels shall be yellow with black legend unless otherwise specified in the Contract or local Indian regulations and standards.

10.56.3 Sign Posts

Sign posts shall be fabricated from materials as acceptable to the Engineer. Signs shall be provided with suitable foundations and be designed so as to be capable of remaining in position during normal traffic flow and wind conditions.

10.56.4 Barricades

The Contractor shall erect barricades demarketing public areas to ensure safety of pubic and vehicular traffic in accordance with the Tender drawings.

10.56.5 Traffic Cones

a) Traffic cones shall be capable of withstanding impact without damage to the cones or vehicles. All cones shall be orange with highly reflective white bands which is easily visible both in daylight and darkness. Traffic cones shall be capable of remaining visible and in position during normal traffic flow and wind conditions in the area where they are used. Lamps for cones shall be suitable for purpose.

b) Where traffic cones are used for the diversion of pedestrians the cones shall be fitted with yellow/black reflective cone bars to prevent pedestrians walking outside the protected walk area.

c) All cones shall be as above unless otherwise specified in the Contract or local Indian regulations and standards, whichever is more onerous.

10.56.6 Warning Lights (flashing or steady-burn)

High visibility traffic warning lights shall be provided and used at all locations where Works are being carried out and visible warnings are required, i.e. road works, excavations, pedestrian diversions, etc. The requirements for warning lights shall be:

i. Lens colour shall be amber;

ii. Lens diameter shall be not less than 185mm;

iii. Flashing shall be 110 per minute;

iv. Suitable for fitting to traffic cones;

v. Battery operated; and

vi. Continuous operation of more than 600 hours.

10.57 Construction Requirements

10.57.1 The Contractor shall keep the length of construction areas to manageable lengths such that traffic will be accommodated safely. Traffic control devices and services shall be provided and maintained both inside and outside the limits of work as required to facilitate traffic guidance, should this be necessary. The provision of traffic control devices and services shall comply with the provisions of the Employer's Requirements and the Conditions of Contract and local Indian regulations and standards.

10.57.2 Prior to the start of construction operations, the Contractor shall erect such signs, barricades, and other traffic control devices as may be required by the Employer's Requirements and the Conditions of Contract or as directed by the Engineer. Traffic control devices shall be operated only when required and only those devices that apply to conditions actually in existence shall be operable.

10.57.3 Wherever required or directed by the Engineer, temporary fences shall be placed to provide a visual barrier between the work area and adjacent traffic or buildings.

10.57.4 Any devices provided under this clause that are lost, stolen, destroyed, or deemed unacceptable while in use on the Works shall be replaced by the Contractor at the Contractor's risk and cost.

10.57.5 During non-working hours and following completion of a particular construction operation, all warning signs, except those necessary for the safety of the public, shall be removed or entirely covered with either metal or plywood sheeting so that the sign panel will not be visible.

10.57.6 Retro-reflective sheeting on signs, barricades, and other devices shall be kept clean. Stretches, rips, and tears in the sheeting shall be promptly corrected by the Contractor. Retro-reflective sheeting shall have a maintained retro-reflection.

10.57.7 Nighttime operations shall be illuminated by a lighting system which has received the Engineer' s consent. The lighting system shall be positioned and operated to avoid glare to road users. The heat produced by any lighting system shall be considered and allowed for. The use of lights with flames (such as gas-powered lighting) will not be permitted.

10.57.8 The Contractor shall ensure that no Contractor's Equipment leaves the work sites with mud, debris or rock that may drop or be deposited on a public highway or private right-of-way, and the roads in the vicinity of the Site shall be kept clean. Suitable vehicle washing facilities shall be provided by the Contractor.

10.58 PACKAGING STORAGE SHIPPING AND DELIVERY

10.58.1General

a) Unless otherwise required by the Particular Conditions, Plant and the Materials shall be delivered to the Site at the most suitable time(s) in accordance with the Works Programme and Procurement Work Segment Programme, so as to avoid undue damage and/or deterioration due to a storage period of excessive duration.

b) All Plant and the Materials, if manufactured or assembled off-Site, shall be properly and securely packed at the point of origin, in order to prevent damage during transport to the Site and due to storage in the weather conditions to be encountered at the Site.

c) The Contractor shall securely crate or box all consignments for ocean shipment in a manner suitable to protect them from damage in transit and shall be responsible for and rectify any and all damage due to any improper packing. Crates shall have external markings identifying the Contract reference number, origin, destination, contents and consignee.

d) The Contractor may be required to furnish the Employer, by courier or other approved means with advance copies of shipping documents, invoices and other pertinent papers showing the date and origin of shipment, a description of the Goods, the shipping weight of each item, destination, name of the vessel and other pertinent information.

e) The Contractor shall also be responsible for the trans-shipment up till the delivery to the installation sites.

f) The Contractor shall ensure, prior to delivery of Plant or Material, that adequate storage facilities and/or areas are available on Site to properly store and protect the Plant or the Material so as to prevent any damage or deterioration. Air-conditioned or other controlled-environment storage shall be provided for Plant items sensitive to high humidity and/or temperature.

g) Materials of an inflammable, explosive, toxic or similarly hazardous nature shall be securely stored separately at approved locations. The Contractor shall provide adequate security and safety control at such locations throughout the storage period. Before delivery of such Materials to Site, all necessary permits and licenses shall have been obtained from the authorities having jurisdiction, all in accordance with the applicable Laws.

h) When Plant or Materials arrive on Site it shall as soon as practicable be inspected by the Contractor in the presence of the Engineer, for damage or deterioration. The Contractor shall be responsible for unpacking and re-packing in an appropriate manner and for provision of all necessary equipment, tools, materials and labour at his own expense. If damage or deterioration has occurred as determined by the Engineer, payment for shall not be made for such damaged or deteriorated Plant or Materials, and such shall be removed from the Site and repaired or replaced according to the instructions of the Engineer, at the Contractor's risk and cost.

i) For the Plant or the material which is subject to deterioration after opening the packing, appropriate alternative inspection measures shall be determined on Site between the Engineer and the Contractor. No payment shall become due to the Contractor for those uninspected Plant or Material, unless otherwise determined by the Employer.

j) Packing materials shall remain the property of the Contractor and shall be removed from the Site immediately when no longer required on the Site, as determined by the Engineer.

k) The Contractor shall be responsible for the safe and secure storage and handling of Plant and Materials on Site until the issuance of the Taking-Over Certificate for the relevant part of the Works, regardless of any transfer of ownership thereof to the Employer.

l) Any action taken by the Engineer in inspecting Plant or Materials upon arrival on Site or any determination subsequently made by the Engineer shall not relieve the Contractor of any of his responsibilities under the Contract.

10.59 Storage of Plant and Materials

10.59.1 The Contractor shall provide and maintain storage facilities at acceptable locations in consultation with the Engineer, for the equipment and materials of all kinds intended for use in carrying out the Permanent Works or for incorporation into the Permanent Works.

10.59.2 The Contractor shall prepare, protect, provide security and store in an agreed manner for all Works, Contractor's Equipment, equipment and materials until the Project completion so as to safeguard them against any loss, damage and any other hazards arising during shipment, storage on/off the Site or climatic influences.

10.60 Crating

The Contractor shall provide all packing, crates and markings. In doing so, it shall comply with the following requirements:

a) Each case, crate or package shall be waterproof, rot, insect and rodent proof. It shall be of robust construction and fit for its intended purpose. The Contractor shall, in determining the packaging materials to be used, take into consideration the climatic conditions likely to occur during the period of transport, shipment and storage.

b) Each case, crate or package shall be legibly and indelibly marked in large letters with the Site address, Contract number, "right way up", opening points and other markings as necessary to permit materials to be readily identified and handled during transit and when received at the Site.

c) Each case, crate or package shall contain a comprehensive packing list showing the number, mark, size, weight and contents, together with any relevant drawings. A second copy of the packing list shall be enclosed in a watertight enclosure on the outside of each case, crate or package. Distribution of additional copies of each packing list shall be in accordance with the Engineer's instructions.

d) All items heavier than 100 kg shall be marked on the outside of the case, crate or package, indicating the gross and net weights, the points for slinging, and where the weight is bearing.

e) Care shall be taken to prevent movement of items within cases, crates or packages by the provision of bracing, straps and securing bolts as necessary. Bags of loose items shall be packed in cases and shall be clearly identified by well-secured metal labels on which the quantity and name of the parts and their index or catalogue number have been stamped.

f) All packing shall be free from sharp edges to prevent injury to persons or other objects.

g) Each bulky/heavy case, crate or package shall include wedge(s) for easy loading and unloading by mechanical handling equipment such as forklift truck.

h) Electronic circuit boards, integrated circuits and the like shall be well protected by using appropriate packing, e.g. anti-static bubble wrap or similar.

i) Rubber products and the like shall be suitably packed to avoid damage including but not limited to hardening, deformation and peel-off.

10.61 General Precautions

10.61.1 Spare parts shall be tropicalized in their packing for prolonged storage in accordance with appropriate international/ Indian standards and shall be suitably and individually labelled to indicate:

a) Name of parts;

b) Shelf life and date of manufacture;

c) Type or condition(s) of storage and special handling information;

d) Description of item and relevant part number;

e) Serial number, if applicable;

f) Inspection/test certificate number and batch number; and g) Contract number, order number and item number.

10.61.2 Tubes, cable, conductor and other similar openings shall be properly sealed and blanked off to prevent ingress of dirt or moisture.

10.61.3 Spare ball and roller bearings and similarly protected items shall not be removed from the manufacturer's wrappings or packing.

10.61.4 Fragile materials shall be packed in such a way that they shall not be damaged during transit and when they are properly unpacked for quality inspection. Glass items shall be capable of being easily re-packed without removing the original wrappings or packing for long- term storage within the same packing case.

10.61.5 Appropriate precautions in accordance with the Contractor's safety regulations, the regulations of the Employer, Appendix 13 [Environmental, Social, Health and Safety Manual] and statutory regulations in respect of all hazardous, toxic, inflammable, etc. materials.

10.62 Packaging Procedures

10.62.1 All required inspection/test certificates shall be supplied and packed together with individual materials. All packaging materials and procedures shall be subject to review by the Engineer.

10.62.2 All empty cases, crates or packages, whether or not returnable, shall be removed from the Site by the Contractor or stored by the Contractor in such a way that they do not interfere with the progress of the Works.

10.63 Shipping

10.63.1 The Contractor shall notify the Engineer at least fifteen (15) days in advance of any expected shipment date and give further notification of the actual shipment date and routing when such information is subsequently established. This shall complement the inspection requirements prior to delivery as specified herein.

10.63.2 Two (2) copies of packing lists and quality certificates shall be attached with each case or package to be shipped. One copy shall be placed inside the package and the second copy shall be enclosed in a watertight enclosure on the outside of each case or package. A copy of packing lists and quality certificates shall be sent to the Engineer after each package of the Works, the equipment, spare parts and other items have been shipped.

10.63.3 Without prejudice to any other provisions of the Contract, the Contractor shall be responsible for all legal requirements, insurance, customs, duties, dues, taxes and other such requirements and expenditures required for the plant, equipment, spare parts and other items to be supplied under the Contract.

10.64 Delivery

10.64.1 The Contractor shall deliver Plant and Materials required for the Works and all items to be supplied under the Contract to the Site.

10.64.2 The Contractor shall unload all items to be supplied under the Contract at the designated delivery point and place them in position or store them.

10.64.3 Any part of the Works or any item to be supplied under the Contract that is damaged in transit shall not be considered as delivered until repairs or replacements have been made and all necessary spare parts or items have been delivered to the Site.

10.64.4 All documents, manuals, drawings and other deliverables shall be delivered to an address to be designated by the Engineer in writing.

10.64.5 The Contractor shall store and secure Plant and Materials until the same have been inspected by the Engineer and are considered delivered at the designated point.

10.64.6 The Contractor shall remove temporary fittings required for shipment and re-assembly of Plant and Materials and shall complete this prior to the inspection of same and before they are considered delivered.

10.64.7 An item shall be considered delivered when all damage has been repaired and all documentation and post-delivery preparation has been completed.

APPENDIX 11

WORKS QUALITY MANAGEMENT PLAN

11.1. General

The Contractor shall implement a Project Quality Management Plan in accordance with ISO-9001 "Quality System - Model for Quality Assurance in Design/Development, Production, Installation and Servicing" to ensure that all materials, workmanship, plant and equipment supplied and work done under the contract meets the requirements of the contract. This plan shall apply to all activities related to the quality of items, including designing, purchasing, inspecting, handling, assembling, testing, storing, and shipping of materials and equipment and different elements of construction work and installations of system components.

The Quality Plan to be prepared by the Contractor and submitted to the Engineer shall follow the requirements of ISO 9000 and address each element therein.

Registration of the Contractor's organisation, or subcontractors or subconsultants is not required for this Project but the Project Quality Management Plan as submitted shall meet the intent of the ISO 9000 requirement in that there is a comprehensive and documented approach to achieving the project quality requirements.

11.2. Works Quality Management Plan

The Works Quality Management Plan (WQMP) shall as a minimum address the quality system elements as required by ISO 9001, generally noting the applicability to the Contractor's Works Programme for the Project. Procedures or Quality Plans to be prepared by others (Suppliers, Subcontractors, Subconsultants) and their incorporation in the overall WQMP shall be identified.

The Contractor shall provide and maintain a Quality Assurance Plan (QA) to regulate methods, procedures, and processes to ensure compliance with the Contract requirements. The QA Plan, including QA written procedures, shall be submitted to the Engineer for his review.

Adequate records shall be maintained in a readily retrievable manner to provide documented evidence of quality monitoring and accountability. These records shall be available to Employer at all times during the term of the Contract and during the Defects Liability Period and for a five-year period thereafter.

The Plan shall identify:

- Design Process: that control, check and verify the accuracy, completeness and integration of the design shall be performed by certified personnel and in accordance with documented procedure that have the written consent of the Engineer.
- Special Processes: that control or verify quality shall be performed by certified personnel and in accordance with documented procedures that have the written consent of the Engineer;
- Inspection and Test: Inspection and testing instructions shall provide for reporting nonconformances or questionable conditions to the Engineer; Inspection shall occur at appropriate points in the installation sequence to ensure compliance with drawings, test specifications, process specifications, and quality standards. The Engineer shall designate, if necessary, inspection hold points into installation or inspection planning procedures;
- Receiving Inspection: These procedures shall be used to preclude the use of nonconforming materials and to ensure that only correct and accepted items are used and installed;
- Identification and Inspection Status: a system for identifying the progressive inspection status of equipment, materials, components, subassemblies, and assemblies as to their acceptance, rejection, or non-inspection shall be maintained;

- Identification and Control of Items: an item identification and traceability control shall be provided;
- Handling, Storage, and Delivery: provide for adequate work, surveillance and inspection instructions.

The Plan shall ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, and defects in materials and equipment shall be promptly identified and corrected.

The Plan shall provide for establishing, and maintaining an effective and positive system for controlling non-conforming material including procedures for the identification, segregation, and disposal of all non-conforming material. Dispositions for the use or repair of non-conforming materials shall require the Engineers consent.

11.3. Plan Implementation and Verification

The Plan shall clearly define the QA Organisation. Management responsibility for the QA shall be set forth on the Contractor's policy and organisation chart. The Plan shall define the requirements for QA personnel, their skills and training. Records of personnel certifications shall be maintained and monitored by the QA personnel. These records shall be made available to the Engineer for review, upon request.

The QA operations shall be subject to the Engineers, Employer or Employer's authorised representative's verification at any time, including: surveillance of the operations to determine that practices, methods and procedures of the plan are being properly applied; inspection to measure quality of items to be offered for acceptance; and audits to ensure compliance with the Contract documents.

Monthly Quality Report (MQR): The contractor shall submit the Monthly Quality Report to the Engineer. MQR will contain, apart from the Material Testing Reports, the following major items:

a) Status of Approval of Method Statements: The Contractor shall submit Method Statements including check lists & ITP (Inspection & Test Plan) for execution of each and every item of work including temporary works at least four weeks before their execution, conforming to the Outline Construction Specifications (OCS) -Civil & BLT given in the contract document for review and approval by the Engineer. (copies of sample Method Statements are available with the Engineer).

b) Quality Walk: Quality Walk of the project site shall be held once in a week by the employer/Employer's authorized representative.

c) Weekly Quality Report (WQR): The contractor shall submit the Weekly Quality Report for review of the quality by the Engineer in weekly progress review meeting. The WQR will be based on the lines of MQR.

d) Internal Quality Audit (IQA): The contractor shall conduct an internal audit of the quality of the project by the quality team of their HQ every month and shall submit the report to the Engineer.

e) External Quality Audit (EQA): The contractor shall get conducted the External Quality Audit quarterly by the reputed agency approved by the Engineer and shall submit the report to the Engineer.

f) Calibration of Batching Plant: The contractor shall be done the calibration of batching plant, immediately after installation of the batching plant and at an interval of six months thereafter, by a reputed external agency approved by the Engineer. However, the contractor shall check the calibration in presence of Engineer's authorized representative on regular basis at least once in a month.

g) Laboratory at Site: The contractor shall get calibrated the Laboratory equipment and their dial gauges from the reputed agency/laboratory accredited by NABL and approved by the Engineer. The calibration certificate including their validity shall be displayed near each and every equipment of the Lab.

h) External Laboratory for Conducting Tests: The contractor shall get conducted the tests of materials and elements of the work for which testing facility is not available in the field Lab, from the external laboratories having valid accreditation of NABL approved by the Engineer. In addition to this, the contractor shall get conducted 5% of the tests, for which testing facility is available in field Lab also, in the external Lab, to facilitate independent review.

i) Water: The contractor shall get the water tested, from the reputed external laboratory approved by the Engineer, at the start of the work and at an interval of three months thereafter. The contractor shall also conduct the testing of the water at least once in a month in the field laboratory.

j) Status of deployment of Machinery and other T&P (Tools & Plants): The contractor shall deploy machinery and other T&P as per the provisions of the contract. Method statements approved by the Engineer and as per the requirement of the site. The contractor shall indicate the schedule of deployment of the machinery and other T&P in the Monthly Quality Report. The fitness of the machinery and other T&P shall be regularly got checked by the contractor by external inspection/Audit Team.

k) NCNs (Non-Conformity Notice) of quality issued by Engineer/Employer & NCR's (Non-Conformity Report) of quality raised by the Contractor: The status of NCNs and NCRs of quality shall be included by the contractor in the Monthly Quality Report.

The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out on-site and off-site surveillance of Quality Assurance Audits to verify that the quality system which has the consent of the Engineer is being implemented fully and properly.

APPENDIX 12

CONTRACTOR'S SITE LABORATORY

12. SITE LABORATORY

12.1 The Site Laboratory shall be approximately 250m^2 in area. It shall consist of the following accommodation:

1 concrete laboratory	60 m^2 floor area
1 Soil laboratory	30 m^2 floor area
2 office	each 15 m^2 floor area
1 storeroom	10 m^2 floor area
1 kitchen	10 m^2 floor area
Male & female toilets, changing room & shower	sufficient for 6 persons

12.2 The remainder of the 250m^2 shall consist of storage area for concrete cube curing tanks. The laboratory, office etc. shall be in one building; the curing tank storage building may be in a separate building, but if so, it shall be adjacent to the laboratory building & connected to it by a level, weatherproof passageway. In addition, an area of covered hard standing of 50m^2 for motor vehicles shall be provided adjacent to the laboratory.

12.3 STANDARD OF CONSTRUCTION

12.3.1 The laboratory shall be constructed to the best Engineering practice and as approved by the Engineer. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be in areas as agreed with the Engineer.

12.3.2 A water tank with minimum capacity of 2000 litres shall be installed, as a source of constant water pressure (15 kPa minimum) for each laboratory.

12.3.3 In the case of sinks used for washing samples, adequate trapping and/or separating devices shall be provided to ensure the proper functioning of the facility.

12.4 FURNISHINGS AND FIXTURES

The contractor's site laboratory shall be provided with required furnishings and fixtures.

12.5 LABORATORY EQUIPMENT

12.5.1 The laboratory equipment, as listed below, shall be approved by the Engineer. The Contractor shall submit for the Engineer's approval within 2 weeks of the order to commence work the name of the supplier it intends to use for each piece of apparatus together with the relevant catalogue number. All the equipment shall be ISI marked. The list of equipment for earthwork shall be as per Annexure-VIII and Appendix -N of RDSO Specification No. RDSO/2020/GE:IRS-0004, September 2020. Equipment for concreting shall conform to specification given in relevant IS codes.

12.5.2 The layout of the equipment in the testing laboratory shall be instructed by the Engineer. The equipment shall be maintained to an accuracy appropriate to the required testing methods with routine calibration by an accredited organization as recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.

12.5.3 The Contractor's site laboratory shall be equipped with the following material testing equipment as a minimum. The nature and quantity of equipment required for testing may be varied by the Engineer depending on the detail of the Contractor's Design and

Construction methods or for any other reason which he deems to be valid and necessary for the proper control of quality:

S. No	Description	Unit
1.	Determining Liquid Limit	1 complete set.
2.	Liquid limit device (Casagrande type)	2 Set.
3.	Cone penetrometer	2 Nos.
4.	Grooving tools	3 Nos.
5.	Evaporating dish	2 Nos.
6.	Spatula 100mm blade	2 Nos.
7.	Laboratory balance, capacity 500 gm, (Sensitivity 0.01 gms.)	1Nos.
8.	Wash bottle, capacity 500 ml.	3 Nos.
9.	Wash bottle, capacity 1 lit.	2 Nos.
10.	Moisture cans, capacity 50 ml.	36 Nos.
11.	Determining Plastic Limit	(1 complete set)
12.	Glass plate 50cm x50cm x10 mm	3 Nos.
13.	Stainless steel rods, 3 mm dia.	2 Nos.
14.	Determining Moisture Content	1 complete set.
15.	Micro Oven- thermostatically controlled to maintain a temperature 105 to 110 °c.	1 No.
16.	Electronic weighing machine capacity 200 gm., sensitivity 0.01 gm.	2 Set.
17.	Lab. Tongs	1 No.
18.	Moisture cans 75ml. with lid	36 Nos.
19.	Compaction Characteristics	1 complete set.
20.	Standard compaction mould 100mm dia.	6 Nos.
21.	Modified compaction mould 150mm dia.	6 Nos.
22.	Standard compaction Rammer, 2.6 kg.	2 Nos.
23.	Modified compaction Rammer, 4.89 kg.	2 Nos.
24.	Straight edge 300mm long	2 Nos.
25.	Sample ejector for 100mm and 150mm mould	2 Nos.
26.	Sample tray 60 x 60 x 8 cm	10 Nos.
27.	Wash bottle, 500 ml.	2 Nos.
28.	Moisture cans 250 ml.	80 Nos.
29.	Density of soil in-place by sand cone method	2 complete set.
30.	Sand density cone apparatus, 150mm	2 Nos.
31.	Plate, 300mmx300mm with center hold 150mm	2 Nos.
32.	Glass jug for sand cone	2 Nos.
33.	Chisel 25mmx 150mm	6 Nos.
34.	Hammer	6 Nos.
35.	One-gallon field cans	24 Nos.
36.	Sampling spoon	3 Nos.
37.	Soft hairbrush	3 Nos.

S. No	Description	Unit
Sieve Analysis		
38.	Electric Sieve shaker (portable)	1 unit
39.	Coarse sieves in Sizes from 100mm to 10mm (As per IS 383 table no. 2) Fine Sieves 10mm, 4.75mm, 2.63mm, 1.18mm, .600mm, .300mm, .150mm) Pans & Covers Specific Gravity and Absorption of Coarse Aggregate Wire basket, 200mm dia.	1 Set each
40.	Heavy duty suspension balance, 20 kg x 1 gm. with accessory for weight in water.	2 Set.
41.	Suitable water container	1 Nos.
42.	Unit Weight of Aggregate Balance, 100 kg. capacity with 10 gm precision	1 No.
43.	Tamping rod 16mm diameter x 600mm long	3 Nos.
44.	Measuring containers (3,10,15,30 liters)	1 each
45.	Flakiness and Elongation Flakiness gauge, elongation index	2 Set.
46.	Soundness Test	
47.	Sodium sulphate	25 Kg.
48.	Soaking tank	1 Nos.
49.	Balance, Capacity 3 kg., Sensitivity 0.1 gm.	1 Set.
Concrete		
50.	Buckets for concrete sampling	12 Nos.
51.	Slump cone	12 Nos.
52.	Tamping rod	12 Nos.
53.	Base plate	12 Nos.
54.	Mixing pan for concrete	2 Nos.
55.	Scoop for general purpose	6 Nos.
56.	Concrete thermometer	6 Nos.
57.	Concrete cylinder mould, 150 mm * 300 mm;	30 each
58.	150 mm * 200 mm	30 each
59.	Concrete cube mould, 100 mm cube & 150 mm cube	10+100 each
60.	Adjustable spanners for dismantling cube moulds	6 Nos.
61.	Capping set	2 Nos.
62.	Capping Compound	As per requirement
63.	Riffle	1 No.
64.	Concrete curing tank with capacity for 270 cubes, temperature controlled, with circulation system drain and lockable cover	2 Nos.
65.	Schmidt test hammer	1 No.
66.	Compression testing machine (Fully automated)	1 No.
67.	Mould oil	As per requirement
68.	Temperature chart recorder	1 No.
Miscellaneous		
69.	Vernier calipers to measure up to 200mm, with elongated jaws	5 Nos.
70.	Steel rule, 300 mm long graduated	2 Nos.
71.	Rubber gloves	10 pr.
72.	Cotton working gloves	20 pr.

S. No	Description	Unit
73.	First aid kit	1 Set.
74.	Wire brush	6 Nos.
75.	Steel tape, 3m, 5m, 30m	3 each.
76.	Ball peen hammer, 1 kg	2 Nos.
77.	Paint scraper. Approx. 100mm wide	8 Nos.
78.	Float, steel Approx.280 x 120 mm	8 Nos.
79.	Sack barrow	1 No.
80.	Shovel: Square Mouthed	2 Nos.
81.	Round Mouthed	2 Nos.
82.	24- wheel trolley, heavy duty, approx. 0.7m x 1.0m long pneumatic tyred type	2 Nos.
83.	Wheelbarrow, rubber tyred	1 Nos.
84.	Comprehensive tool kit. To include screwdrivers, pliers, claw hammer, multi-grips, spanners (adjustable)	1 No.
85.	Type NR Schmidt Hammer and tester with recording device	1 No.
86.	Testing Anvil for Schmidt Hammer test (SHT)	1 No.
87.	Chart recording paper for SHT	10 pkts.
88.	Cover meter for detecting metal objects to depth of 100mm below the surface of non-magnetic objects	3 Nos.
89.	Noise meter	1 No.
90.	RCPT Testing Machine with mould	1 No.
91.	Permeability Testing Machine	1 No.
92.	Rain Gauge	1 Set.
93.	Loss angeles abrasion machine	1 Set.
94.	Mortar cube casting machine	1 Set.
95.	Cement testing kit as per Is-4031	1 Set.
96.	Nuclear Moisture Density Gauge (NMDG) Apparatus	2 Set.
97.	Core cutter with dolly and hammer (as per appendix D od RDSO-004)	4 Set.

S. No.	Consumable Item
1	Sieve brush Wire brush
2	Sodium carbonate
3	Sodium hexa meta phosphate.
4	Kerosene Mercury

S. No.	Additional Equipment
1	Hand auger 150mm dia with extension rod
2	Sampling tube 100mm dia. And 450mm length

Note: All machines and equipment should have a Calibration Certificate.

Appendix 13

Environment, Social, Health and Safety Management Manual

Table of Contents

1.0 ESHS FRAMEWORK

1.1 General

1.1.1. The Contractor shall be responsible for the Environment, Social, Health and Safety (ESHS) on the Site and any other areas being used by him for the purposes of the Contract. Each Contractor shall develop his own contract specific ESHS Management Plan, which will represent his approach to the management of ESHS activities on his work sites under the Contract with the Employer. The ESHS Management Plan should contain all the measures as given in the project Environmental and Social Management Plan (ESMP) which is part of the project ESIA.

1.1.2. The Contractor shall ensure that all appropriate ESHS measures are implemented throughout the execution of the Works.

1.2 Scope

1.2.1 The ESHS Manual defines the principal requirement of the Employer and forms an essential part of the overall Environment, Social, Health and Safety Management System proposed to be employed by the Employer for the construction of the Project.

1.3 Application of This Document

1.3.1 This document applies to all aspects of the Contractor's Scope of Work including Sub-contractors and all other agencies. There shall be no activity associated to the Contract, which is exempted from the purview of this document.

1.4 Purpose of This Document

1.4.1 The objective of these guidelines is to ensure that adequate precautions are taken for incident/occupational illness free safe work execution as well as to avoid harmful effects on the environment and social during construction.

1.4.2 This document:

a) Describes the Environment, Social, Health and Safety interfaces between the Engineer and the Contractor.

b) Details the processes by which the Contractor shall manage Environment, Social, Health and Safety issues while carrying out the work under the contract.

1.4.3 These requirements shall be read together with, ISO 45001: 2018 Occupational Health and Safety Management System and ISO 14001: 2015 Environmental Management Systems.

1.4.4 The Contractor shall be responsible for obeying all Laws, Rules & Regulations in force at any point of time regarding the Environment, Social, Health & Safety of workers.

2.0 ESHS MANAGEMENT

2.1 General

2.1.1 This document defines the principal requirements to be practiced at the Site at all times.

2.2 ESHS Targets and Goals

2.2.1 Following ESHS targets and goals shall be set and achieved by the Contractor/Sub-contractor based on time bound work plan:

a) Zero total recordable injuries;

b) Zero non-conformances in respect of statutory laws related to Environment, Health, Social and Welfare measures, living conditions and Safety regulations;

c) Total compliance of recording and reporting of all types of incidents;

d) 100% compliance on Safety Induction of all personnel;

e) Total compliance of conducting inspections and audits as per approved ESHS Management Plan;

f) 100% incident recording and reporting;

g) 100% adherence to usage of appropriate PPEs at work;

h) Executing construction work with least disturbance to the environment, adjoining road users and traffic;

i) Minimize waste generated at sites and maximize reuse of materials;

j) Maintaining environment conditions of site as per statutory requirement of HPCB, NGT etc. to avoid penalty;

k) To achieve construction site as zero discharge site as far as possible.

2.3 Contractor's Obligation to Abide by Mandatory Legislations and Standards

2.3.1 The construction works shall be undertaken in accordance with the Employer's ESHS Management Policy and Management Systems as amended from time to time.

2.3.2 The construction works shall be undertaken in accordance with all updated applicable legislation listed below, but not limiting to:

a) Indian Electricity Act 2003 and Electricity Rules, 2005;

b) National Building Code, 2016;

c) Factories Act, 1948 and state respective factory Rules;

d) Motor Vehicles Act as amended in 1994 and The Central Motor Vehicles Rules,1989;

e) Indian Road Congress Code IRC: SP: 55-2014 'Guidelines on Safety in Road Construction Zones';

f) The Petroleum Act, 1934 and Rules, 1976;

g) Gas Cylinder Rules, 2003;

h) Indian Explosives Act, 1884, along with the Explosives Substance Act, 1908 andthe Explosives Rules, 1983;

i) Environmental and Social Legislations as listed in Clause 6.0 of this document.

2.4 Contractor's Environmental, Social, Health and Safety Management Policy and Plan

2.4.1 The Contractor as per Rule 39 of the BOCW Central Rules shall formulate an Environment,

Social, Health & Safety policy and display it at conspicuous places at work sites in English and Hindi so that the policy shall be understood by majority of the construction workers.

2.4.2 The Contractor shall revise the policy whenever any modification having implication on the Environment, Social, Health and Safety of the workers is made or any new construction work, substances, or technique are introduced which have implication on environment, health and safety of workers.

2.4.3 The contractor shall submit the ESHS Management plan for review by the engineer within 28 days after the commencement date.

2.4.4 The Contractor shall revise and submit the ESHS Management Plan if at any time the ESHS Management Plan is insufficient in the Engineer's opinion. The Contractor, within 7 days of such intimation shall submit the revised ESHS Management Plan to the Engineer for review.

2.4.5 Any omissions, inconsistencies, and errors in the ESHS Management Plan or the Engineer's acceptance or rejection of the ESHS Management Plan and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to site ESHS and shall not be excused for any failure by the Contractor to adopt proper and recognized ESHS practices throughout the execution of the Works. The Contractor shall adhere to the ESHS Management Plan and shall ensure, as far as practically possible, that all supervisors and sub-contractors of all tiers have a copy of the ESHS Management Plan on the Site and comply with its provisions.

2.4.6 The details of contents to be covered in the ESHS Management Plans are given in Clause 8.0, Attachment -1[Contents of ESHS Management Plan] of this document.

2.5 Designer's Role

2.5.1 The Designer's primary role includes to minimize the risk to Environment, Social, Health and Safety of those who are going to construct, maintain, clean, repair, dismantle or demolish the structures and anyone else like adjoining road users/public, who might be affected by the work.

2.5.2 Every temporary structure like scaffold, temporary deck, earth retaining structures etc. shall be properly designed.

2.6 Site ESHS Organisation

2.6.1 The Contractor shall appoint the required ESHS Management Personnel as prescribed in the Contract.

2.6.2 **Conduct and Competency**

The Contractor shall ensure that all personnel are competent to perform the job assigned to them. In the event that the Contractor is unable to demonstrate the competency of any person whose activities can directly impact the Works' ESHS performance, the Engineer shall remove that person from the Site without any procedural formalities.

2.6.3 **Approval from The Engineer**

The name, address, educational qualification, work experience of each ESHS personnel deployed shall be submitted to the Engineer for approval well before the start of the Works or before deployment whichever is earlier. These personnel are authorized to work only after approval of the Engineer. In case any ESHS personnel leaves the Contractor, the same shall be intimated to the Engineer within a week. The Contractor shall recruit new personnel and fill up the vacancy before relieving a person. Proper handing over of all the documents shall be ensured before relieving an ESHS person.

2.7 Responsibility of ESHS Personnel

2.7.1 The Contractor ESHS Management Personnel shall report to Contractor's ESHS Expert who shall always report directly to the Contractor's Project Manager. Their primary role is to oversee Environment, Social, Health and Safety aspects at work Site. The Engineer shall always monitor

adherence to this procedure.

2.7.2 No Contractor shall engage ESHS manpower from any outsourcing agencies as in that case the effectiveness would be lost. All ESHS manpower shall be on the payroll of the main contractor only and not on the payroll of any sub-contractor or outsourcing manpower agencies etc.

2.8 ESHS Committee

2.8.1 The Contractor shall form Site ESHS Committee within 60 days of award of the Contract and notification regarding the same shall be communicated to the members.

2.8.2 The Terms of Reference for the Site ESHS Committees shall be as follows:

a) To oversee implementation of the Contractor's Environment, Social, Health and Safety policies and practices;

b) To monitor the adequacy of the Contractor's ESHS Management Plan and ensure its implementation;

c) To review ESHS training;

d) To review the Contractor's ESHS monthly reports;

e) To identify probable causes of accident and unsafe practices in construction work and to suggest remedial measures;

f) To stimulate interest of the Workers in ESHS by organizing environment/safety week, safety competition, talks and film-shows on environment/safety, preparing posters or taking similar other measures as and when required or as necessary;

g) To go around the Site with a view to check unsafe practices and detect unsafe conditions and to recommend remedial measures for their rectifications including first-aid medical and welfare facilities;

h) Committee team members should perform a site inspection before every committee meeting and to monitor ESHS inspection reports;

i) To bring to the Notice of the Engineer hazards associated with use, handling and maintenance of the equipment used during the course of construction work;

j) To suggest measures for improving environment, social, health and safety in construction work at the Site;

k) To investigate the health hazards associated with handling different types of explosives, chemicals, and other construction materials and to suggest remedial measures including personal protective equipment; and

l) To review the last ESHS committee meeting minutes and the remedial measures taken for Non-Compliance.

m) Following shall be the composition of the Site ESHS Committee:

2.8.3 Site ESHS Committee meeting shall be conducted once in a calendar month and participation of following members shall be ensured.

Chairman	Project Manager
Secretary	ESHS Expert (Will be nominated by Project Manager)

Members	i) Contractor's ESHS staff. ii) Labour Welfare Officer; iii) In -charge of Plant and Machinery & Site Electricals; iv) In-charge of Special Work Operations (e.g. bridge, viaduct, and tunnel, etc.); v) In-charge of Stores; vi) Subcontractor's representative; and vii) Workers' representatives;
Engineer's Representatives	To be nominated by the Engineer

2.8.4 **Minimum time between two monthly ESHS Committee meetings**

A minimum period of 21 days shall be maintained between any two ESHS monthly committee meetings.

2.8.5 **Agenda**

The Secretary shall circulate the agenda of the meeting at least seven working days in advance of the scheduled date of the meeting to all members as well as to the Employer.

2.8.6 The agenda should broadly cover the following:

a) Chairman's overview of ESHS Management Performance;
b) Confirmation of minutes of last meeting;
c) Previous month ESHS statistics;
d) Incident and accident investigation/Dangerous occurrence/Near miss report;
e) Site ESHS inspection and compliance report;
f) The Contractors' ESHS issues;
g) Report from the Employer and Engineer;
h) Non-compliances raised by Engineer/Statutory Authorities;
i) Report and compliance of GRC; and
j) Any other concern.

2.8.7 In case of station and other contiguous areas where more than one main Contractor is working together, the Engineer shall instruct the other Contractors/ Sub-contractors to join for the monthly ESHS committee meeting of the main civil Contractor, to discuss and decide about the common provision of safety, security, lighting, toilet, drinking water etc. and sharing the maintenance cost of the same etc.

2.8.8 The Minutes of the Meeting shall be prepared as per the format provided and sent to all members within 2 working days by mail. Minutes of ESHS Committee Meeting shall also be displayed on the notice board for wider publicity to all concerned.

2.9 ESHS Induction Training and ID Card

2.9.1 The Contractor shall ensure that all personnel working at the Site receive an ESHS induction

training immediately on the first day of joining explaining the nature of the work, the hazards that may be encountered during the site work. Personnel shall only be deployed at site once he/she has completed ESHS induction training. The training shall cover the contents as given in Clause 8.0, Attachment-4 [General Instruction: ESHS/GI/001].

2.9.2 All personnel shall be issued a photo identity card as per the format given in Clause 8.0, Attachment-4[General Instruction: ESHS/GI/002].

2.9.3 The Contractor shall also issue a Personnel pocket ESHS Booklet in a language known to the Workers, which provides information on ESHS and emergency procedures.

2.10 Other ESHS Training

2.10.1 The Contractor shall organize the ESHS trainings to managers, supervisors and other personnel in behavioral change and improve ESHS performance.

2.10.2 The Contractor shall provide a training/workshop on ESHS to all its workers/staff/employees/subcontractors of at least 2 days. It shall be completed in various modules and each employee/worker shall have a record of completing all modules.

2.10.3 On-the spot practical skill development training on height safety including scaffold safety, crane safety, welding safety, electrical safety, and traffic safety for marshals shall also be conducted.

2.10.4 Every employee including workman shall take a ESHS oath followed by toolbox talk every day.

2.10.5 All vehicles and machine drivers including heavy work vehicle and machine operators shall be trained on defensive driving with necessary certificate or license.

2.11 ESHS Inspections

2.11.1 The Contractor shall evolve and administer a system of conducting ESHS inspection and other risk management analysis on a periodical basis.

2.11.2 The purpose of ESHS inspection is to identify any deviation in construction activities and operations, machinery, plant and equipment and processes against the ESHS Management Plan and its supplementary procedures and programs.

2.11.3 The Contractor shall initiate a monthly joint site ESHS Management inspection with the Engineer and report shall be generated on the same day with the corrective action and accepted target date (within a week) by the Engineer.

2.11.4 The Contractor project manager & ESHS expert with site team shall be participating in the ESHS inspection.

2.11.5 The Compliance of the joint inspection "Non-Conformance" shall be witnessed/accepted by the Engineer.

2.11.6 The Contractor shall submit follow up compliance report of the ESHS inspection report within six days of the date of Inspection in a coloured soft copy.

2.11.7 Following ESHS inspections program shall be adopted:

a) Planned general inspection;

b) Routine inspection;

c) Specific inspection; and

d) Other inspection.

2.11.8 **Planned general inspections** are performed at predetermined intervals. Inspections that will be

classified under this inspection program are:

a) Monthly Contractor and sub-contractor's Site ESHS committee inspection;

b) Weekly ESHS inspection by construction supervisors (the Contractor and the Subcontractor); and

c) Daily ESHS inspection by the Contractor Site ESHS team.

2.11.9 **Routine inspections** are often referring to the inspection of the Site, equipment and temporary structures performed by the Site and equipment operators and temporary structure erectors.

Inspections that will be classified under this inspection program are:

a) Daily inspection of plant and equipment by operators;

b) Weekly inspection of scaffold by scaffolding supervisors;

c) Monthly Inspection of electrical hand tools by competent electrical supervisors;

d) Quarterly inspection of temporary electrical systems by competent electrical supervisors; and

e) Half-yearly inspection of lifting machinery, lifting appliances, equipment and gears by Govt. approved competent persons.

f) Quarterly inspection of lifting gears, tools tackles and appliances.

g) Quarterly colour coding of lifting gears, tools & tackles. The recommended colour coding for the 4 quarters of the years shall be as under

i) January – March: GREEN

ii) April – June: YELLOW

iii) July – September: BLUE

iv) October – December: WHITE

2.11.10 The list mentioned above is not exhaustive. The Contractor may add additional categories. The ESHS Expert shall ensure that a system of routine inspections is carried out periodically to all plants, equipment, powered tools and any other temporary structures that will pose a hazard to operators and workmen.

2.11.11 **Specific Inspection**

Specific inspections are performed on activities without a predetermined date. Competent supervisors usually perform inspections for ensuring an activity whether it is executed in accordance to a general set of rules; Method Statement submitted or developed procedures.

The following are examples that will be commonly performed as required on the Site:

a) Inspection performed before a heavy lifting operation;

b) Inspection performed before and after the entry of person into a confined space;

c) Inspection performed before and after a welding and gas cutting operation;

d) Inspection of formwork before concreting by formwork erector.

2.11.12 The list mentioned above is not exhaustive. The Contractor shall ensure that a competent supervisor inspects all high-risk processes and activities.

2.11.13 **Other inspections** include the following:

a) Mandatory inspections by Labour Department of Government of Haryana; and

b) HRIDC/Engineer site ESHS management team.

c) Inspections by Central Pollution Control Board, Haryana Pollution Control Board, Ministry

of Environment and Forest and Climate Change, National Green Tribunal etc.

2.11.14 The Contractor shall prepare all required ESHS inspection checklists for all activity operations and equipment. Checklists will be prepared based on the Indian SafetyStandards, Rules and Regulations and the Works requirements.

2.11.15 All inspection records and reports will be properly kept and filed for audit purpose. Inspection reports of planned general inspection and routine inspection will be used for discussion during safety committee meetings.

2.12 ESHS Audit

2.12.1 The purpose and scope of ESHS Audit is to assess potential risk, liabilities and the degree of compliance of the ESHS Management Plan and its supplementary procedures and programs against applicable and current ESHS legislation regulations and the Works requirements.

2.12.2 The Contactor's project manager shall hold the ultimate responsibility in ensuring implementation of ESHS audit program during the construction work.

2.12.3 Monthly Audit Rating Score (MARS)

2.12.4 Monthly Audit Rating Score (MARS) will be performed once in a month. A team consisting of the Contractor's project manager, ESHS experts and the Engineer's representative based on the pre-designed score-rating format will conduct it.

2.12.5 This Monthly ESHS Audit Rating Score (MARS) report will enable the Engineer to evaluate the general compliance by the Contractor with the Conditions of Contract, and the ESHS Management Plan. A Minimum Compliance level to achieve 75% overall Audit Rating is essentially required. Failing this, the Engineer will take punitive action which includes non-processing of running account bills.

2.12.6 **Timing**

The Monthly Audit Rating Score (MARS) should be conducted at least 7 days prior to the scheduled date of monthly ESHS Committee Meeting.

2.12.7 **Evaluation**

The numerical scoring has been weighed on a 1-10 scale. The audit team will use their observations noted in evaluating the points to be awarded against each of the elements of the audited section. Wherever some topics and sub-topics are not applicable the score rating need not be given. The overall audit ratings shall be achieved by:

$$\text{Overall Audit rating} = \frac{\text{Actual Score Achieved}}{\text{Maximum Possible Score}} \times 100$$

The criticality of the required actions for the respective sections of the Audit will be classified as:

S.No.	Score	Description	Action
1	< 60%	Immediate	Require the Contractor to rectify within 24 hours
2	< 75%	Improvement Necessary	The Contractor rectification within 7 days and confirmed in writing to the Engineer
3	< 90%	Improvement Desirable	The Contractor rectification within 1 month and confirmed in writing to the Engineer

2.12.8 **Report**

A copy of each Audit Report will be sent to the Engineer and to all subcontractors, with whom it will then be discussed in detail at the monthly ESHS Committee Meeting to ensure that any corrective actions are agreed upon.

2.12.9 **External ESHS Audit**

External ESHS Audit is to be conducted by external agencies that are competent with ISO qualified auditors with the prior approval of the Engineer.

a) Areas of Competence of Audit Team

i) The Audit team shall have practical understanding of BOCWA/R statutory requirements on health/medical and welfare of workmen, construction hazards and its prevention and control, traffic management, electrical safety, rigging, safety of construction equipment and environment and social management.

ii) The Audit team shall have a Team leader and at least one Team member.

iii) Audit shall be conducted as per the guidelines of ISO, ILO and national standards. Audit report shall also be presented as per the formats given in thestandards; and

iv) External ESHS Audit shall be conducted on a quarterly basis throughout the currency of the Contract.

b) Targets of ESHS Audit

The contents and coverage of the audit shall include the following items:

i) ESHS Management:

- ESHS Organization;
- ESHS Policy and Plan;
- ESHS committee;
- ESHS orientation;
- ESHS training;
- ESHS communication and motivation;
- ESHS submittals to the Employer;
- ESHS promotional and awareness program;
- Incident reporting &investigation;
- Onsite/offsite emergency preparedness plan;
- Hazard identification and risk assessment;
- Implementations of work permit system.

ii) Technical

- Work Method Statement;
- Operational control procedures/ Safe operating procedures;
- Working at height;
- Hand tools and power tools;
- Electrical safety;
- Fire prevention and control;

- Housekeeping;
- Overhead protection;
- Slipping, tripping, cutting, drowning and falling hazards;
- Lifting appliances and gear, tools and tackles;
- Lifting and launching operation;
- Construction plant and machinery;
- Machine and area guarding;
- Material handling;
- Hot work;
- Demolition;
- Excavation and tunnelling;
- Work permit system;
- Traffic management;
- Chemical handling;
- Dangerous and harmful Environments;
- Maintenance matrix of mechanical and electrical machines / equipment;
- Working on or under water;
- Working near or under high tension line;
- Personal protective equipment;
- Visitors at Site;
- Occupational health and welfare measures;
- All statutory forms, returns under various statutes;
- First-aid and medical facilities;
- Welfare measures; and
- Environmental and Social management.

c) Audit Documents

The Contractor shall make the below itemized documents available for review by the Audit team;

a) ESHS Policy;

a) ESHS Management Manual;

b) ESHS Rules and Regulation;

c) ESHS Organization chart;

d) Annual ESHS objectives/programs;

e) Accident/near miss statistics and analysis;

f) ESHS training program/records for all personnel;

g) Operating manuals and maintenance manual of all equipment;

h) Safe worthiness certificates of all lifting appliances and gears;

i) Medical fitness record for all personnel;

j) Risk identification, assessment and control details;

k) Environmental and Social management reports;

l) Emergency management records including mock drill;

m) Housekeeping inspection records;

n) Minutes of ESHS committee meetings;

o) Calibration and testing records;

p) Records of previous audits;

q) ESHS inspection records;

r) First Aid, medical facilities and other welfares measures;

s) Maintenance procedure of plant &machinery;

t) Records of Industrial hygiene surveys (noise, ventilation, and illumination level, airborne and toxic substances, explosive gases).

d) Audit Preparation

i) Audit team members are required to gather information by observations through interviews and by checks of documentation.

ii) Audit team shall prepare checklist to cover all parts based on ESHS legislations Rules and Regulations and ESHS Conditions of Contract requirements.

iii) Audit team members shall verify the facts and findings of leading to the identified gaps and weakness.

iv) Audit leader has overall responsibility for reaching a conclusion**.**

e) Reporting

Audit report shall be prepared and directly sent to the Engineer within 7 days of conducting the audit.

f) Report Contents

a) *Executing Summary* - Based on the finalized checklists as written the findings to the Engineer by the audit team members, the audit leader will compile a concise and accurate summary of observations and findings;

b) *Introduction* - This will contain basic information regarding the facilities or organization audited, the specific audit dates (inclusion of those for preparation and post-audit activities);

c) *Principal Positive Findings* - This will contain the summary of positive aspects as observed by the auditors. It will also contain highlights of those issue, which may warrant dissemination as best practice regarding methodology used or achievement;

d) *Audit Findings* - All audit findings as detailed in the audit checklists shall be grouped together as priority 1 and 2 as detailed below in a separate listing:

i. *Priority 1*: Actions to rectify gaps or weakness should generally be implemented within two-weeks' time if risk potential is high or unacceptable; and

ii. *Priority 2:* Actions should be generally implemented or rectified with a maximum of 3- 4 weeks, if not rectified would create a likelihood of minor injury or business loss.

g) Conformity Report Action to the Engineer

a) The auditor shall inspect the Site after 14 days of conducting initial audit for checking the adequacy of implementation of items maintained under priority 1 by the Contractor and shall submit a Conformity/Non-conformity Report to the Engineer within 7 days ;

b) The auditor shall again inspect after 28 days of conducting initial audit for checking the adequacy of implementation of items mentioned under priority 2 by the Contractor and shall submit a Conformity/Non-conformity Report to the Engineer within 7 days; and

c) In case of non-conformity of items mentioned by auditor, the Engineer shall take necessary steps including stoppage of work and suggestion for corrective action to the Contractor.

2.13 ESHS Communication

2.13.1 The Contractor shall make every effort to communicate the ESHS Management measures through posters campaigns/billboards/banners/glow signs being displayed around the Site as part of the effort to raise ESHS awareness amongst the work force. Posters should be in Hindi, English and other suitable language deemed appropriate. Posters/billboards/ banners/glow signs should be changed at least once in a month to maintain the impact.

2.13.2 The Contractor shall also observe important days as listed in Clause 8.0, Attachment-4 [General Instruction: ESHS/GI/003] and printing and displaying ESHS signage and posters as listed in Clause 8.0, Attachment-4 [General Instruction: ESHS/GI/004].

2.14 ESHS Submittals

2.14.1 The Contractor's ESHS Management shall send the following reports to the Engineer periodically in soft copy:

a) Daily reporting of total number of workmen;

b) Monthly ESHS Report;

c) Minutes of ESHS Committee meeting;

d) ESHS inspection and compliance reports; and

e) ESHS audits reports;

- Monthly Audit Rating Score (MARS) reports;
- External ESHS audits;

2.14.2 The Contractor shall prepare a Monthly ESHS Report consisting of the following within 7th of next month to the Engineer:

a) Monthly man-hour details as specified in the ESHS Management Plan;

b) Monthly accident/incident details as specified in the ESHS Management Plan;

c) ESHS committee details;

d) ESHS inspection and compliance report;

e) ESHS internal audit details;

f) ESHS communication activities undertaken in the month indicating the number of posters displayed and balance availability in stock;

g) Monthly Environment (including air, noise, water and soil testing results) and Social Report;

h) Graphical representation of monitored results over past four reporting periods;

i) Details of Clearance/ Permission//Permit obtained;

j) Compliance status for conditions of all relevant clearances /permissions / consents/permits for the Work, including quarries, etc.;

k) Tree felling, transplanting and compensatory planation details;

l) Details of consumption of construction material, energy and water;

m) Details of different types of waste and scrap generated during the month and sold to authorised recyclers;

n) Summary of complaints, results of investigations and follow-up actions;

o) Gender: Number of female workers, percentage of female workforce, gender issue raised and dealt with;

p) HIV/AIDS: Provider of health services, information& training;

q) GBV/SEA: Details of training conducted;

r) Grievances: List of grievances received in the reporting period and unresolved past grievances by date received, complaint how received, to whom referred to for action, resolution and date (if completed), date of resolution of community grievances if any.

s) Toolbox talks details;

t) PPE details: Quantity purchased, issued to the workmen and stock available;

u) Details on IP 44 panel boards, lighting poles, welding and cutting equipment, Ladders, Hoists, Tools & Tackles;

v) Monthly lux meter study results;

w) Housekeeping;

x) Barricade maintenance details;

y) No of critical excavations;

z) Health and welfare activities;

aa) ESHS activities planned for next month.

2.15 Accident Reporting and Investigation

2.15.1 All accidents and dangerous occurrences shall immediately be informed through message to the Engineer. This will enable the Engineer to reach the scene of accident/dangerous occurrences to monitor/assist any rescue work and/or start conducting the investigation process so that the evidences are not lost.

2.15.2 Reports of all accidents (fatal/injury) and dangerous occurrences shall also be sent to the Engineer within 24 hours by the Contractor.

2.15.3 In addition to the above verbal and written reporting to the Engineer, as per Rule 276 of HBOCWR, notice of any accident to a worker at the Site that:

a) Causes loss of life; or;

b) Disables a worker from working for a period of 48 hours or more immediately following the accident; shall forthwith be sent by telegram, telephone, fax, orsimilar other means including special messenger within 4 hours in case of fatal accidents and 72 hours in case of other accidents, to:

i) The Assistant Director, Industrial Safety and Health having jurisdiction in the area in which the establishment in which such accident or dangerous occurrence took place is located. The Assistant Director, Industrial Safety and Health shall be the authority

appointed under section 39 of the Act;

ii) Board with which the building worker involved in accident was registered as a beneficiary;

iii) Chief inspector; and

iv) The next of kin or other relative of the Worker involved in the accident.

2.15.4 Further, notice of any accident shall be sent in respect of an accident which:

a) Causes loss of life; or;

b) Disables the injured worker from work (for a period of more than 10 days) to;

i) The Officer-in-charge of the nearest police station;

ii) The District Magistrate or, if the District Magistrate by order so desires to;

iii) The Sub-Divisional Magistrate.

2.15.5 In case of an accident-causing minor injury, first-aid shall be administered, and the injured worker shall be immediately transferred to a hospital or other place for medical treatment.

2.15.6 Where any accident-causing disablement that subsequently results in death, notice in writing of such death, shall be sent to the authorities within 72 hours of such death.

2.15.7 The following items are defined as dangerous occurrences and shall be reported to the inspector having jurisdiction, whether any disablement or death caused to the Worker, namely:

a) Collapse or failure of lifting appliances, or hoist, or conveyors, or similar equipment for handling of building or construction material or breakage orfailure of rope, chain or loose gears; or overturning of cranes used in construction work;

b) Falling of heavy objects from height;

c) Collapse or subsidence of soil, tunnel, pipelines, any wall, floor, roof or any other part of any structure, launching girder, platform, staging, scaffolding or means of access including formwork;

d) Fire and explosion causing damage to any place on the site where the Workers are employed;

2.15.8 In case of failure of launching girder, lifting appliance, loose gear, hoist machinery and transport equipment at the site, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the Inspector having jurisdiction.

2.15.9 Every notice given for fatal accidents or dangerous occurrences shall be followed by a written report to the concerned Authorities under Section 39 of BOCWA and the Chief Inspector of Government of Haryana in the specified Form **XLVI** of the **HBOCWR.**

2.15.10 Actions to be taken post incident/accident:

a) In case any incident/accident happens at site leading to injury to the worker, the worker/s is/are required to be taken to the nearest hospital immediately;

b) Project Manager/ESHS Manager/Labour Welfare Officer of the Contractor needs to report the incident to the Engineer immediately without fail for all the death cases including natural deaths;

c) In case of fatal accident, doctor from the nominated hospital is the only authorized person to declare the death of the worker. It is not to be decided suo-moto by any other person. FIR should be registered for all the fatal cases which happen at the Site/labour camp;

d) Post Mortem of the dead body is mandatory in all the death cases i.e. whether it is natural or due to any incident / accident;

e) Family members of the injured / deceased worker are to be informed immediately;

f) In case of fatal accident, the dead body is to be handed over to the family members. Arrangement of sending the dead body to the native place shall be made by the contractor including cash payment for meeting out last rites expenses as per Rules;

g) Fatal accident report is to be sent to State Labour Authority in Form EE (as per workmen's compensations act) within seven days and to the Licensing Authority in Form XLVI within 24 hours of the incident/accident;

h) Copy of all the documents deposited with any labour authority, FIR, Post Mortem, Medical Reports etc. shall be submitted to the Engineer in duly approved Labour Welfare Fund (LWF) Form;

i) The Contractor shall be liable for getting disbursement of Provident Fund benefits, compensation under Employee compensation Act, benefits of ESI Act to the workman/dependents of the deceased workman. The Contractor shall also provide accommodation and transportation to dependents of the deceased workman or to the disabled workman who come for settlement ofterminal claims.

2.15.11 **Accident Investigation:**

a) Investigations shall be conducted in an open and positive atmosphere that encourages the witnesses to talk freely. The primary objective is to ascertain the facts with a view to prevent future and possibly more serious occurrences;

b) Accidents and dangerous occurrences which result in death, serious injury or serious damage must be investigated by the Contractor immediately to find out the cause of the accident/occurrence so that measures can be formulated to prevent any recurrence; and

c) Near misses and minor accidents should also be investigated by the Contractor as soon as possible as they are signals that there are inadequacies in the ESHS Management System.

2.15.12 Procedure of Incident Investigation

It is important after any accident or dangerous occurrence that information relating to the incident is gathered in an organized way. The following steps shall be followed:

a) Take photographs and make sketches;

b) Examine involved equipment, work piece or material and the environmentalconditions;

c) Interview the injured, eye-witnesses and other involved parties;

d) Consult expert opinion where necessary; and

e) Identify the specific Contractor or subcontractor involved.

2.15.13 Having gathered information, it is then necessary to make an analysis of incident:

a) Establish the chain of events leading to the accident or incident;

b) Find out at what stage the accident took place;

c) Considering all possible causes and the interaction of different factors that led up to the accident and identify the most probable cause, the cause of an accident should never be classified as carelessness; and

d) The specific act or omission that caused the accident must be identified.

2.15.14 The next stage is to proceed with the follow-up action:

a) Report on the findings and conclusions;

b) Formulate preventive measures to avoid recurrence; and

c) Publicize the findings and the remedial actions taken.

2.15.15 The Engineer's Independent Incident Investigation

In case of fatal/dangerous occurrence, the Engineer shall also conduct independent investigation. The Contractor and his staff shall extend necessary co-operation and testify about the accident.

2.15.16 The Contractor shall take every effort to preserve the scene of accident till the Engineer completes the investigation.

2.15.17 All persons summoned by the Engineer in connection to witness recording shall obey the instructions without delay. Any wilful suppression of information by any person shall be removed from the site immediately and/or punished.

2.16 Emergency Preparedness Plan

2.16.1 The Contractor shall prepare, as required under BOCWR, an Emergency Response Plan for the Site as a part of the Contractor ESHS Management Plan. The plan shall integrate the emergency response plans of the Contractor and all other Subcontractors. The Emergency Response Plan shall detail the Contractor's procedures, including detailed communication arrangements, for dealing with all emergencies that could affect the Site. The plan shall address items such as injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue.

2.16.2 The Contractor shall ensure that the Emergency Response Plan is prepared to deal with emergencies arising out of, but not limited to:

a) Fire and explosion;

b) Collapse of lifting appliances and transport equipment.

c) Collapse of building, sheds or structure etc.

d) Landslides getting workers buried, floods, earthquake, storms and other natural calamities etc.

The above list is not exhaustive and other emergencies can also be included.

2.16.3 Arrangement shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the Contractor with their telephone numbers and addresses for quick communication shall be adequately publicized and conspicuously displayed in the workplace.

2.16.4 The Contractor shall require to tie-up with the hospitals and fire stations located in the neighbourhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.

2.16.5 The Contractor shall conduct an onsite emergency mock drill once in every quarter for all his workers and his sub-Contractor's workers.

2.16.6 It shall be the responsibility of the Contractor to keep the Local Law and other Authorities informed and seek urgent help to mitigate the consequences of an emergency. Prompt communication to the Employer and Engineer, through telephonically initially and followed by a written report, shall be made by the Contractor.

2.17 Experts/Agencies for Environment, Social, Health & Safety Services

2.17.1 The Contractors may utilise the services of experts/agencies empanelled for the purpose of training, audit and any other ESHS services with prior approval of the Engineer. This approval can be withdrawn by the Engineer at any time if the quality of output of the agency is found not satisfactory.

3.0 LABOUR PROTECTION

3.1 General

3.1.1 The Contractor shall comply in full of the project Workplace Policy as described in Attachment-2 [Work Place Policy on HIV/AIDS, Prevention & Control] and Attachment -3 [Covid 19 policy].

3.2 Engagement of Staff and Labour

3.2.1 The Contractor shall ensure that the employees deployed by him in the premises of the Employer are physically and mentally fit and do not have any criminal record.

3.3 Payment of Minimum Wages

3.3.1 The Contractor shall ensure payment of at least the minimum wages as prescribed and applicable from time to time under the Minimum Wages Act, 1948 in the presence of an authorised representative of the Engineer and shall maintain proper records of their timely disbursement. These records shall be preserved for a period of at least 3 years and made available even after the Contract is over for any verification by the statutory authorities.

3.4 Conditions of Labour

3.4.1 The Contractor shall observe conditions of labour that are no less favourable than those established for the relevant trade or industry.

3.4.2 During the work, the Contractor shall afford all employees all basic rights enumerated in the conventions of the International Labour Organisation, including freedom of association, right to freedom from forced labour, and right to freedom from discrimination based on race, colour, sex, religion, political opinion and social origin.

3.4.3 The Contractor shall ensure coverage of his employees under the Employees Provident Fund and Miscellaneous Provisions Act, 1952 and the Employees State Insurance Act, 1948 via independent code numbers allotted to them by the Central Provident Fund Organisation and Employees State Insurance Corporation respectively.

3.4.4 The Contractor shall insure all his employees under Group Personal Accident Insurance scheme through a recognised and registered insurance company.

3.5 Labour Laws

3.5.1 The Contractor shall ensure that all his employees and the Subcontractors obey applicable following laws and regulations, including those concerning safety at work.

a) Minimum Wages Act, 1948;

b) Payment of Wages Act, 1936;

c) Equal Remuneration Act, 1976;

d) Employees Provident Fund and Miscellaneous Provisions Act, 1952;

e) Employees State Insurance Act, 1948;

f) Maternity Benefit Act, 1951;

g) Child Labour (Prohibition and Regulation) Act, 1986;

h) Building and Other Construction Workers (Regulation of Employment of Service) Act, 1996;

i) Haryana Building and Other Construction Workers (Regulation of Employment and

Conditions of Service) Rules, 2005;

j) Building and Other Construction Workers Welfare Cess Act, 1996;

k) Building and Other Construction Workers Welfare Cess Rules, 1998;

l) Haryana Major Accident, Hazard Control Rules, 2009; and

m) Workmen's Compensation Act. 1923;

3.5.2 The Contractor shall comply with all other statutory requirements, rules, regulations and notifications in relation to employment of his staff and workers that may be issued from time to time by the concerned government authorities.

3.6 Working Hours

3.6.1 No work shall be carried out beyond the statutory limit given under BOCWA, 1996.

3.6.2 No work shall be carried out outside the normal working hours stated in the Contract unless otherwise:

a) The Engineer gives his consent in writing for additional work; and

b) The work is unavoidable or necessary for the protection of life or property or forthe safety of the Works, in which case the Contractor shall immediately inform the Engineer.

4.0 SAFETY GENERAL

4.1 General

4.1.1 The following standards whichever is more stringent shall be applicable:

a) The BOCW Acts 1996 and the Haryana BOCW Rules 2005 framed there under;
b) Other relevant National Legislations & IS Codes.

4.2 Housekeeping

4.2.1 General Housekeeping shall be carried out by the Contractor and ensured always at the Site, Construction Depot, Batching Plant, Labour Camp, Stores, Offices and Toilets/Urinals.

4.2.2 Full height fence, barriers, barricades etc. shall be erected around the Site to prevent the surrounding from excavated soil, rubbish etc., which may cause inconvenience to and endanger the public. The barricade especially those exposed to public shall be aesthetically maintained by regular cleaning and painting as directed by the Engineer. These shall be maintained in one line and level.

4.2.3 All surplus earth and debris are removed/disposed of from the working areas to officially designated dumpsites. Trucks carrying sand, earth and any pulverized materials etc. to avoid dust or odour impact shall be covered while moving. The tyres of the trucks leaving the site shall be cleaned with water, wherever the possibility of spillage on carriageways meant for regular road traffic exists

4.2.4 No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.

4.2.5 Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete, chips and brick etc. shall not be allowed on the roads to obstruct free movement of road traffic

4.2.6 Proper and safe stacking of material are of paramount importance at yards, stores and such locations where material would be unloaded for future use. The storage area shall be well laid out with easy access and material stored/stacked in an orderly and safe manner. Lumber with protruding nails shall be bent/removed and properly stacked.

4.2.7 Drip pans of suitable size shall be used to collect oil leakages and spills while plants/equipment/machinery maintenance.

4.2.8 The Contractor shall make available Material Supply Data sheet (MSDS) for material/chemicals/substances used at Site. Such material/chemicals/substances used shall be treated, handled, stored, transported and disposed off, by the Contractor, in a manner specified in the MSDS

4.3 Working at Height

4.3.1 Working at height means work in any place, including a place at or below ground level.

4.3.2 The Contractor shall ensure that work at height is properly planned, appropriately supervised, and carried out in a safe manner and without any appreciable risk. Appropriate care shall be taken during bad weather.

4.3.3 Adequate protection in the form of working platform with railing, toe board, safe access, safety net, roof ladder etc. shall be provided. Where fall hazards cannot be eliminated, use fall-arrest systems while erecting, modifying, and dismantling scaffolds.

4.3.4 A trained and certified person shall check working platform, railing, toe board, safe access, safety net, roof ladder etc. after erection and once in a week. A certificate shall be tagged on this equipment.

4.3.5 Employees involved in the erection, dismantling, moving, repairing, etc., of scaffolding and also workers who perform work on a scaffold shall receive training from a competent person. The purpose of the training is to recognize any hazards associated with the work.

4.3.6 When the height of a scaffold exceeds three times of the smallest width of the base, secure it to the building or structure at every other lift and every 9.0 m horizontally. The scaffold and scaffold working platform with handrails approximately 1.0 m high, mid rails, and toe boards, all secured rigidly by both ties and braces to prevent movement. Working platforms should be completely decked with safety planks, manufactured scaffold decking, or metallic planks.

4.3.7 Only metal frame working scaffold is permitted. Steel stairs are used as a means of raising and lowering the metal frame working scaffold, except for special cases. It is prohibited to directly raise and lower the framework with limbs or to use only ladder.

4.3.8 The Contractor shall ensure that following areas are clearly indicated:

a) where a workplace contains an area in which, owing to the nature of the work, there is a risk of any person at work;

b) Falling a distance; or

c) Being struck by a falling object:

4.3.9 The Contractor shall ensure that work equipment exposed to conditions causing deterioration, which is liable to result in dangerous situations, is inspected at suitable intervals and after any exception occurrence jeopardizing the safety of work/equipment.

4.3.10 In relation to work at height involved in construction work;

a) The top guard-rail or other similar means of protection shall be at least 1100 mm above the edge from which any person is liable to fall;

b) Toe-boards shall be suitable and sufficient to prevent the fall of any person, or any material or object, from any place of work; and

c) Any intermediate guardrail or similar means of protection shall be positioned sothat any gap between it and other means of protection does not exceed 550 mm.

4.3.11 Requirements for all Working Platforms:

a) Every working platform requires a firm & stable supporting structure for holding it;

b) A working platform shall possess a suitable surface and be so constructed that the surface of the working platform has no gap through which a person/material/object could fall;

c) A working platform and any supporting structure shall not be loaded to give rise to a risk of collapse or to any deformation, which could affect its safe use;

d) When altered or modified, it should be so altered or modified as to ensure that it remains stable;

e) A working platform shall be of sufficient dimension to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work being carried out there;

f) Depending on the complexity of the scaffolding selected, a responsible person shall draw up an assembly, use and dismantling plan;

g) A copy of the plan, including any instructions it may contain, shall be kept available for the use of persons concerned in the assembly, use, dismantling or alteration of scaffolding until

it has been dismantled; and

h) While a scaffold is not available for use, including during its assembly, dismantling or alteration, it shall be marked with general warning signs in accordance with and be suitably delineated by physical means preventing access to the danger zone.

4.3.12 Requirements for collective safeguards for arresting falls:

a) Collective safeguard is a safety net, airbag or other collective safeguard for arresting falls;

b) A safeguard shall be used only if:

i) A risk assessment has demonstrated that the work activity can (so far as is reasonably practicable) be performed safely while using it and without affecting its effectiveness;

ii) The use of other safer work equipment is not reasonably practicable; and

iii) A sufficient number of available persons have received adequate training specific to the safeguard, including rescue procedures.

4.3.13 Requirements for personal fall protection systems:

a) A personal fall protection system shall be used only if a risk assessment hasdemonstrated that;

i) The work can (so far as be reasonably practicable) be performed safely while using that system; and

ii) The use of other safer work equipment is not reasonably practicable.

The user and a sufficient number of available persons have received adequate training specific to the operations envisaged, including rescue procedures; and

b) A personal fall protection system designed for use with an anchor shall be securely attached to at least one anchor, and each anchor and the means of attachment thereto shall be suitable and of sufficient strength and stability to supporting any foreseeable loading.

4.3.14 Requirements for Ladders:

a) Every Contractor shall ensure that a ladder is used for work at height only if a risk assessment has demonstrated that the use of more suitable work equipment is not justified because of the low risk;

i) The short duration of use;

ii) Existing features on the Site, which he cannot alter;

b) Only metal ladders shall be allowed. Bamboo ladders are prohibited;

c) Any surface upon which a ladder rests shall be stable, firm, of sufficient strength and of suitable composition safely to support the ladder so that its rungs or steps remain horizontal, and any loading intended to be placed on it;

d) A ladder shall be so positioned as to ensure its stability during use;

e) A suspended ladder shall be attached in a secure manner and so that, with the exception of a flexible ladder, it can not be displaced and swinging is prevented.

f) A portable ladder shall be prevented from slipping during use by:

i). Securing the stiles at or near their upper or lower ends;

ii). An effective anti-slip or other effective stability devices; or

iii). Any other arrangement of equivalent effectiveness.

g) A ladder used for access shall be long enough to protrude sufficiently above the place of landing to which it provides access, unless other measures have been taken to ensure a firm

handhold.

h) No interlocking or extension ladder shall be used unless its sections are prevented from moving relative to each other while in use;

i) Where a ladder or run of ladders raises a vertical distance of 9.0 m or more above its base, there shall, where reasonably practicable, be provided at suitable intervals sufficient safe landing areas or rest platforms;

4.4 Overhead Protection

4.4.1 The Contractors shall provide overhead protections as per BOCW Act & Haryana BOCW Rules.

4.5 Slipping, Tripping, Cutting, and Falling Hazards

a) The Contractor shall follow guideline of Slipping, Tripping, Cutting and falling hazards as Per Rule 98 of HBOCWR.

b) Sharp projections or any protruding nails or similar objects shall be suitably guarded or shall even be avoided to make the place safe to work and All places should be free from dust, debris or similar materials;

c) Suitable safety net shall be provided at places of material / man falling is possible in accordance with national standards.

d) Reinforcement of pier/columns/walls/abutments shall be secured from the risk of tilting through provisioning of minimum four guy wires ropes/ steel bracing anchored to any concrete block/counterweight of sufficient capacity.

e) The Collapse of formwork in the construction industry has the potential for severe injury and death. The four stages of the use of formwork (erection, adjustment, concrete placement and dismantling) all need to be managed in a risk assessment framework. Implementing suitable control measures can eliminate or reduce the potential for events such as the collapse of formwork. Suitable control measures include:

i). Keeping the documentation for the formwork at the workplace;

ii). Follow the schematic drawing for erection of formwork;

iii). Erecting the formwork on foundations which will support the loads to be imposed on the formwork;

iv). Not erecting formwork near excavation;

v). Ensuring materials used in the erection of formwork are not defective;

vi). Securing loose material which may be dislodged as a result of inclement weather;

vii). Inspecting the formwork assembly before and during the placement of concrete;

viii). Not attaching equipment to the formwork assembly unless specifically designed for this purpose; and not using a stripping process which may cause damage to the permanent structure.

4.6 Lifting Appliances including Cranes

4.6.1 Lifting appliances means a crane, hoist hydra, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, lifting machinery sheaves, pulley blocks, hooks or other equipment used for lifting materials, objects or the Workers and lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eye nuts and other accessories of a lifting appliance.

4.6.2 Each of the lifting appliances and lifting gear including all parts thereof, whether fixed or moveable shall be thoroughly tested and examined by a competent person once at least in every 6 months or after it has undergone any alterations or repairs liable to affect its strength or stability. Within

the validity, if the lifting appliances are shifted to a new site, re-examination by the competent person for ensuring its safety shall also be done.

4.6.3 The Contractors shall utilize the services of any competent person as defined in Factories Act, 1948 with the permission of the Engineer.

4.6.4 No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered adequate:

a) The weights, dimensions and lift radii of the heaviest and largest loads;

b) The maximum lift height, the maximum lift radius and the weight of the loads that must be handled at each;

c) The number and frequency of lifts to be made;

d) How long the crane will be required on site;

e) The type of lifting to be done (for example, is precision placement of loads important;

f) The type of carrier required (this depends on ground conditions and machine capacity In its operating quadrants: capacity is normally greatest over the rear, less over the side, and non-existent over the front;

g) Whether loads will have to be walked or carried;

h) Whether loads will have to be suspended for lengthy periods;

i) The site conditions, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impede access or operation.

4.6.5 The Contractor shall ensure that a valid certificate of fitness issued is available for all lifting appliances including synchronized mobile jacks, pre-stressing hydraulic jacks, jacks fitted with launching girders etc. and the Engineer approval is obtained before inducting to the site. Only after obtaining the approval from the Engineer any lifting appliances and gear shall be used.

4.6.6 The laminated photocopies of fitness certificate issued by competent person, the Engineers approval letter, the operators photo, manufactures load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.

4.6.7 All lifting appliances and loose gears shall be clearly marked for its safe working load and identification by stamping or other suitable means.

4.6.8 The Contractor shall also maintain a register containing a system of identification of all tools and tackles, its date of purchase, safe working load, competent person date of examination etc.

4.6.9 Sufficient lighting arrangement shall be ensured at all lifting operations.

4.6.10 **Qualification of operator of lifting appliances etc.:** The Contractor shall not employ any person to drive or operate a lifting machine-like crane, hydra etc. whether driven by mechanical power or otherwise or to give signals to work as an operator of a rigger or derricks unless he:

a) Is above 21 years of age and possesses a valid heavy transport vehicle driving license as per Motor Vehicle Act and Rules;

b) Is competent and reliable;

c) Possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance acceptable to the Engineer; and

d) Is medically examined periodically as specified in schedule VII of BOCW Rules.

4.6.11 All hydraulic piping and fittings shall be maintained leak proof.

4.6.12 Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting.

4.6.13 Hand spliced slings up to 32mm diameter shall not be used at site for any lifting purpose. The slings used shall confirm to IS 2762: 2009 Wire rope slings and sling leg specification.

4.6.14 No load shall be slewed over public areas without stopping the road traffic first.

4.6.15 Automatic safe load indicator (ASLI) to be provided in crane with audible and visible warning system and made functional and calibrated by the manufacturer or its authorized representative every 6 months or after repair of the lifting equipment.

4.6.16 **Automatic safe load indicators and data logger in lifting appliances**

As stipulated in Rule 123 of HBOCW Rules, every lifting appliances and gears like cranes, hydras etc., if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise, shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/International certifying bodies which gives a warning to the operator whenever the load being handled exceeds the safe working limit.

a) Provision of functional data logger with alert facility through SMS and web in all cranes shall be mandatory;

b) Cut-out shall be provided which automatically arrests the movements of thelifting parts of every crane if the load exceeds the safe working limit.

4.6.17 The crane should have a substantial/durable safe working load chart which has clearly legible characters in English and Hindi and figures displayed inside the crane and is easily visible to the crane operator.

4.6.18 General Requirements

The sweep area (work area) of the construction machinery shall be always free from obstructions. All hydraulic piping and fittings shall be maintained leak proof. The operator cab shall posses good and safe:

a) Structure, windows and windshield wipers;

b) Drivers chair and footrest;

c) Control handles;

d) Cab instrumentation;

e) Telecommunication;

f) Cab outfitting;

g) Wind indicator with an adjustable set point shall be in a position representative for the wind on the crane. The indicator shall give continuous information regarding constant speeds and gusts.

4.6.19 Mandatory Rigging requirement

a) Rigging shall be done under experienced and qualified rigger only. All Load shall be adequately and safely rigged to prevent any danger;

b) The primary requirement in rigging shall be to assess the weight of load before attempting any lift;

c) All hooks shall be fitted with Master Rings having certificate of fitness from the competent person, so that the hooks are subjected to balanced vertical loading only;

d) Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting;

e) Requirements of outriggers

i) All outriggers shall be fully extended and at all tyres are clear of theground;

ii) Heavy duty blocking having large bearing area shall be necessary to prevent sinking of floats;

iii) Provision of heavy steel plates/ high density interconnected wooden logs of required dimension shall be used to uniformly distribute the load;

iv) The crane shall be setup on fully compacted ground;

4.6.20 Pick & carry operation

Prohibition on Use of "Tractor transmission type Pick and Carry Hydra Crane": Tractor transmission type Pick and Carry-1st Generation model is prohibited at HORC Project works. Contractor shall mobilize "Truck transmission type" Pick and Carry (Hydra)Crane– minimum 2nd Generation model only or higher model.

4.6.21 Operation of lifting appliances

Every Contractor shall ensure that:

a) The complete lifting operation shall be governed by signals as per established standards;

b) Adequate measures to be taken to ensure that no workers is allowed to stand, pass, rides or sit under the suspended load;

c) No lifting appliances shall be left by the operator while power is on or load is suspended;

d) After completion of the lifting operation, all doors of the appliances shall be closed by the operator and ignition/operation key should be handed over to competent reliever operator or site In-charge;

e) All loads are provided with minimum two tag lines to ensure that the load can be controlled at all times;

f) No close working to any live over head power line is permitted without system of a 'Permit to Work' and prior permission of the engineer shall be obtained before performing such operation;

g) Danger zone shall be identified and cordoned off for all lifting appliances during their operation;

h) All lifting gears & slings shall be stamped or appropriate tags for their identification no & SWL;

i) Knotting/wrapping of chains & slings shall not be allowed at site;

j) Lifting appliances shall not be used for any dragging or pulling purposes. Contract shall refer to 75% capacity load chart for ascertaining the suitability of crane for safe lifting of load;

k) During tandem lift, available capacity of crane in respect of SWL shall be considered after reduction of 15% for 75% (DIN) load chart respectively. In addition, additional de rating as advised by third party testing and certified agency shall also apply;

l) During hoisting of long material, use of suitable lifting beam is recommended;

m) Only original equipment manufacturer (OEM) supplied/provided load chart shall be used during lifting operation;

n) Before performing any lifting operation, all electronic devices, control levers, hydraulic oil, wind pressure etc. shall be checked and necessary spare parts to be kept in stock to handle any breakdown during time bound lifting operation;

o) Lifting point shall be considered on the I-Girders/U Girder/C Girder/Steel girder/parapet etc.

during the casting of the same. Design load calculation for the same should be conducted;

p) All lifting activities shall be stopped in case of high speed wind and similar adverse whether condition or as prescribed by the crane manufacturer; and

q) All cranes shall be provided with fail safe devices to avoid any hoist free fall in case of brake failure.

4.7 Launching Operation

4.7.1 As launching operation is one of the riskiest jobs, the Contractor shall take utmost precaution at all stages like; planning, establishing casing yard, casting segments, transporting segments, fabrication and erection of launching girders, launching of segments, pre-stressing, auto launching of girders and dismantling of launching girders.

4.7.2 The Contractor shall prepare a comprehensive Method Statement for the launching operation, adhering to the ESHS conditions laid down in conditions of contract on the ESHS Management Manual. Reference shall be made to the provisions on working at height. As the entire process of launching must be undertaken at an elevated level the safety of workers and the girder is paramount important. In addition to general precautions, such as trained personnel, PPE, etc. listed in earlier clauses, the following general guidelines shall be adhered to throughout the launching operation:

a) The segments shall rigidly secure to the truck with necessary wooden wedges and necessary red indicators/safety tapes provided so that the vehicle is clearly seen by other road users both in day/night time;

b) Every launching operation shall have a responsible engineer on duty all the time;

c) All the time from erection to dismantling the area between the two piers wherein launching is in progress shall always be barricaded;

d) Auto launching shall be done only after approval from the Engineer. After every auto launching the stability of launching girder shall be ensured;

e) The vertical deflection of launching girder shall be monitored at all critical stages like with/without loads and after every auto launching;

f) A register containing all important operational details from erection to dismantling of launching girders shall be maintained and made available to the Engineer whenever called for;

g) Driver shall also have undergone proper medical examination as per sub-Clause-5.2 (Medical Facilities) and checked for influence of alcohol before any kind of lifting operation;

h) Test certificate for all lifting gears including Macalloy Bars shall be maintained at a

i) location closer to the launching girder itself so that it can be referred during all inspections;

j) Proper & safe access stairways shall be maintained for safe ascending /descending of workmen /engineers to or from launchers;

k) Adequate collective and personnel fall protection measures like provision of safety nets while working over live roads/railways, lifeline for anchoring of safety harness, safe means of access on main box girder shall be ensured;

l) Before starting of the launching, valid third party test certificate of the launcher hoist shall be available;

m) Safe and fully deck working platform duly covered from all side shall be ensured for stressing work at front support;

n) Safety checklist for all activities of launching cycle shall be prepared, got approved & implemented;

4.8 Construction Machinery

4.8.1 Construction machineries may include dumpers and dump trucks, lift trucks and telescopic handlers, piling rigs, vibration hammers, rail welding equipment, mobile elevating work platforms, cranes, tipper lorries, lorry loaders, skip wagons, 360° excavators, 180° backhoe loaders, crawler tractors, scrapers, graders, loading shovels, trenchers, side booms, pavers, planers, chippers, road rollers, locomotives, tankers and bowsers, trailers, hydraulic and mechanical breakers etc.

4.8.2 Every construction equipment shall be in sound mechanical working condition and certified by either competent person under Factories Act or manufacturers' warranty in case of brand new equipment or authorized persons/firms approved by the Engineer before induction to any site.

4.8.3 Fitness of the machine shall be carried out on regular basis or after every maintenance work excluding any minor service/oil or filter change and be documented properly. The certificate shall be available in operator/driver cabin.

4.8.4 All vehicles shall be fitted with audible reverse alarms and maintained in good working condition. Reversing shall be done only when there is adequate rear-view visibility or under the directions of a banksman.

4.8.5 **General operating procedures:** Drivers entering site shall be instructed to follow the safe system of work adopted on site. These shall be verbal instructions or, preferably, written instructions showing the relevant site rules, the site layout, delivery areas, speed limits, etc.

a) No passengers shall be carried, unless specific seating has been provided in accordance with the manufacturer's recommendations;

b) Working on gradients beyond any equipment's capability shall not be allowed.

c) Prevention of dumper and dump truck accidents should be managed by providing for adequate lateral clearances, wheel stops at a sufficient distance from the edgesof excavations, spoil heaps, pits, markers, etc.;

d) No construction material, other than soil shall be carried in excavator buckets;

e) When two or more scrapers are working on the same job, a minimum distance of at least 25m shall be kept between them;

f) Every contractor shall ensure that Competency certificate for driver/operatorsshall be issued by their Plant and Machinery In-charge. The certificate shall be pasted on the machine body in such a way that drivers/operator vision is nothindered;

g) Checklist shall be prepared for all construction machinery and be filled on daily basis by the operator and be counter signed by plant & machinery person;

h) Provision of helper is mandatory for each construction appliances and vehicles during their movement inside and outside of site; and

i) All wood working machines shall be fitted with suitable guards and devices such astop guard, riving knife, push stick, guards for drive belts and chains, and emergency stop switch easily accessible by the operator.

4.9 Machine Guarding

4.9.1 The Contractor shall ensure at the site all motors, cog wheels, chains and friction gearing, fly wheels, shafting, dangerous and moving parts of machinery are securely fenced or legged.

4.9.2 Fencing of dangerous parts of machinery shall not be removed while the machinery is in use or in motion and when removed, it shall be replaced as soon as practicable and in any case before the machinery is again brought into use.

4.10 Site Electricity

4.10.1 The Contractor shall refer to the applicable guideline "Indian Electricity Rules, 1956" and any

amendment thereafter. ESHS requirements are:

a) Graduate Electrical Engineer having Electrical Supervisory Competency Certificate.

b) Diploma Electrical Engineer having Electrical Supervisory Competency Certificate.

c) ITI Certificate Holder Electrician with Wiremen Permit; and

d) Assessment of Electrical Load and properly designed power distribution system;

4.10.2 The Contractor shall assess the size and location of the electrical loads and the manner in which they vary with time during the currency of the Contract.

4.10.3 The Contractor shall elaborate as to how the total supply is to be obtained/generated. The details of the source of electricity, earthing requirement, substation/panel boards, distribution system shall be prepared and necessary approval from the Engineer obtained before proceeding of the execution of the job.

4.10.4 The main Contractor shall take consideration, the requirements of the Subcontractors' electric power supply and arrive at the capacity of main source of power supply from diesel generators.

4.10.5 No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.

4.10.6 Adverse or Hazardous Environments:

a) Power supply from public utility service provider is preferable;

b) The Contractor shall provide sufficient ELCBs (maintain sensitivity 30 mA)/ Residual Current Circuit Breakers (RCCBs) for all the equipment (including Potable equipment), electrical switchboards, distribution panels etc. to prevent electrical shocks to the Workers;

c) Lightening Protection for all structures, gantry, metal portable cabins, silos etc; Lighting ought not to introduce the risk of electric shock. Therefore, 230V supplies should be used for those fittings, which are robustly installed, and well out of reach e.g. flood lighting or high-pressure discharge lamps;

d) No single insulation cable shall be used;

e) Cables shall be selected after full consideration of the condition to which they shall be exposed and the duties for which they are required. Supply cable up to 3.3 kV shall be in accordance with BS 6346:1997;

f) Cables buried directly in the ground shall be of a type incorporating Armor or metal sheath or both;

g) Cabling passing under the walk way and across way for transport and mobile equipment shall be laid in ducts at a minimum depth of 0.6 m;

h) The Contractor shall ensure plugs, socket-outlets, and couplers available in the Site as "splash EM proof" type. The minimum degree of Ingress Protection should be of IP44 in accordance with BS EN 60529;

i) Only plugs and fittings of the weather proof type shall be used and they should be colour coded in accordance with the Internationally recognised standards for example as detailed as follows:

   i) 110 volts: Yellow;

   ii) 240 volts: Blue;

   iii) 415 volts: Red.

j) No loose connections or tapped joints shall be allowed anywhere in the Site, office area, stores and other areas also;

k) All equipment shall have the provision for major switch/cut-off switch in the equipment itself;

l) Isolate exposed high-voltage (over 415 Volts) equipment, such as transformer banks, open switches, and similar equipment with exposed energized parts and prevent unauthorised access;

m) All temporary metal structures like barricade boards, temporary metal containers/shed etc. shall be adequately earthed through suitable means;

n) All the earth pits shall be properly numbered along with display of resistance value and inspection records of the same shall be maintained

4.10.7 Work on or near live conductors

No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless-

a) It is unreasonable in all the circumstances for it to be dead;

b) It is reasonable in all the circumstances for him to be at work on or near it while it is live; and

c) Suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.

4.10.8 Whenever pilling work is undertaken manually through tripod in the influence zone of live OHE, method statement shall be prepared, submitted and got approved before start of work.

4.10.9 All electrical equipment should be permanently numbered, and a record kept of the date of issue, date of last inspection and recommended inspection period.

4.10.10 Appropriate electrical protection shall be provided for all circuits, against overload, short circuit and earth fault current.

4.10.11 For supplies to mobile or transportable equipment where operating of the equipment subjects the cable to flexing, the cable shall conform to any of these codes BS 6007/BS 6500/BS 7375.

4.10.12 Flexible cords with a conductor cross sectional area smaller than 1.5 mm2 shall not be used and insulated flexible cable shall conform to BS 6500 and BS 7375.

4.10.13 Power Tools:

The Contractor shall ensure that:

a) Electric tools are properly grounded or/and double insulated;

b) Ground Fault Circuit Interrupters (GFCIs)/Residual Current Circuit Breakers (RCCBs) shall be used with all portable electric tool operated especially outdoors or in wet condition;

c) Only trained employees shall use explosive actuated tools and the tool shall also be

d) unloaded when not in use;

e) Usage of such explosive actuated tools shall be avoided in case of places where explosive/flammable vapours or gases may be present;

f) Explosive actuated tools and their explosives shall be stored separately and be taken out and loaded only before the time of immediate use; and

g) Misfired cartridges of explosive actuated tools must be placed in a container of water and be removed safely from the project.

4.11 Illumination

4.11.1 The Contractor shall provide sufficient site lighting, of the right type and at the right place for it to be properly effective as per the relevant national standards & guidelines.

4.12 Welding and Cutting

4.12.1 Gas cylinders in use shall be kept upright on a custom-built stand or trolley fitted with a bracket to accommodate the hoses and equipment or otherwise secured. The metal cap shall be kept in place to protect the valve when the cylinder is not connected for use.

4.12.2 Test Certificate for cylinders and Vendor license shall be obtained. Gas Cylinder Act & Rules shall always be followed at workplace.

4.12.3 All gas cylinders shall be fixed with pressure regulator and dial gauges. clamp or clip shall be used to connect hoses firmly in both sides of cylinders and torches.

4.12.4 Non-return valve and flashback arrester shall be fixed at both end of cylinder and torch.

4.12.5 Domestic LPG cylinders shall not be used for gas welding and cutting purpose.

4.12.6 Dry Chemical Pressure (DCP) or CO2 type Fire Extinguisher not less than 5 kg shall be fixed at or near to welding process zone in an easily accessible location. Fire extinguisher should confirm to IS 2190:1992.

4.12.7 Oxygen cylinders and flammable gas cylinders shall be stored separately, at least 6.6 m (20 feet) apart or separated by a fireproof, 1.5 m (5 feet) high partition. Flammable substances shall not be stored within 15m of cylinder storage areas.

4.12.8 Welding grounds and returns should be securely attached to the work by cable lugs, by clamps in the case of stranded conductors, or by bolts for strip conductors. The ground cable will not be attached to equipment or existing installations or apparatus.

4.12.9 All electrical installations shall meet the IS: 5571: 1997 and NFPA 70 for gas cylinder storage area and other hazardous areas.

4.12.10 Use firewatchers if there is a possibility of ignition unobserved by the operator (e.g. on the other side of bulkheads).

4.12.11 Transformer used for electrical arc welding shall be fixed with ammeter and voltmeter and fixed with separate main power switch.

4.12.12 Use a low voltage open circuit relay device if welding with alternating current in constricted or damp places.

4.12.13 The current for Electric arc welding shall not exceed 300 A on a hand welding operation.

4.13 Excavation General

4.13.1 References:

a) The Haryana Building and other construction workers (Regulation of Employment of conditions of Service) Rules, 2005;

b) IS: 3764 -1992 (Re-affirmed 1996): Code of Safety for Excavation Work;

c) IS: 4756 -1978 (Reaffirmed 1996): Safety Code for Tunnelling Work;

d) IS 4081:2013 Blasting and related drilling operations-code of safety.

4.13.2 The Contractor shall ensure:

a) Where any construction & building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than 1.5 m above his footing, such worker shall be protected by adequate piling and bracing against such bank or side;

b) Undercutting during excavation shall be avoided. Whenever it is inescapable and banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank;

c) Excavated material is not stored at least 0.65 m from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank;

d) Metal ladders and staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where, the depth of such excavation exceeds 1.5 m and such ladders, staircases or ramps comply with the IS 3696 Part 1&2 and other relevant national standards;

e) Trench and excavation is protected "against falling on a person by suitable measures if the depth of such trench or excavation exceeds 1.5m and such protection is an improved protection in accordance with the design and drawing ofa professional engineer, where such depth exceeds 4.0m;

f) Full height fence, barriers etc. will be installed at the site in order to preserve the surrounding area from excavated soil, rubbish etc. which may cause inconvenience to public.

4.13.3 Warning Signs and Notices:

The Contractor shall ensure that suitable warning signs or notices, required for the safety of workers carrying out the work of an excavation, shall be displayed or erected at conspicuous places in Hindi and in a language understood by most of such workers at such excavation work.

4.14 Material Transportation

4.14.1 The Contractor shall develop the method statement for heavy/big material/machinery transportation such as Rolling Stock, Transformer, and Bridge Main Girder, etc.

4.14.2 The Contractor shall ensure that the person in charge should inspects the safety implementation like properly fixing of wire with vehicle slab bed, condition of vehicle breaks etc. before starting the job.

4.14.3 The Contractor shall ensure that every vehicle/moving machinery should have a signal man who has a whistle, a flag or a signal light (in the night) with striking clothes and stands at a safe visible place from a machine operator by means of the proper signal and way determined.

4.14.4 Training related to moving and parking safely should be given to driver/operator like parking construction vehicles at a specified place with a parking brake and making sure to put a drag.

4.15 Foundation Works

The Contractor is required to evaluate the risk in each activity and suggest a control measures of piling works:

a) Covering of bore holes with adequate warning signs;

b) Cage to be lowered by using crane;

c) The auxiliary hook of the rig shall not be used to pull or lower the cage in bore hole;

d) The tremie pipe lowering and lifting after concreting shall be done by using crane;

e) Control measure to arrest polymer spillage from the Site to avoid contaminating the surface drains;

f) An entry restraining fence shall be provided around the pier excavation completion;

g) No man suffering from any chronic disease, alcoholic excess, ear or heart troubles or having a sluggish blood circulation or who has excess of fat should be employed as a diver;

4.16 Batching Plant and Casting Yard

The Contractor is required to evaluate the risk in each activity and suggest Control Measures:

a) Adequate space between the casting bed, segment storage area and the adjoining road shall be

maintained so that a steel railing could be installed to segregate the gantry crane movement area from the road;

b) All safety precautions stated in Sub-Clause 4.8 [Construction Machinery], Automatic Safe Load Indicator (ASLI) for crane and gantry shall be complied during erection of gantry crane and other equipment;

c) The aggregate/sand storage area shall be kept under the full coverage of effective water sprinkler to avoid dust generation;

d) The entire batching plant/aggregate storage Area shall be adequately walled of sufficient height, above which the Contractor is required to erect green dust protective net. This is a mandatory requirement to avoid dust in surrounding environment;

e) The batching plant and casting yard required to obtain ''Consent to Establish'' and ''Consent to Operate'' certificate from State Pollution Control Board;

f) LOTO (Lock Out Tag Out) system shall be installed.

g) The batching plant/casting yard shall be barricaded and made as a compulsory Personal Protective Equipment (PPE) zone;

h) Time office, canteen, drinking water, toilet and rest place shall be suitably located for the easy access to workers. All the facilities shall be properly cleaned and maintained during the entire period of operation;

i) Drainage shall be effectively provided, and waste water shall be disposed after proper treatment; and

j) Manual handling of cement shall be avoided. Whenever it is necessary the workmen shall be given full body protection, hand protection and respiratory protection as a basic measure of ensuring better health.

4.17 Form Works

a) Ensure the inspection of formwork assembly before and during the placement of concrete; and

b) Ensure no attaching equipment to the formwork assembly unless specifically designed for this purpose; and not using a stripping process which may cause damage to the permanent structure.

4.18 Concrete Works

a) Concrete pumping equipment, trucks etc. are not to be washed down on site and any waste-water, concrete slurry or other contaminants are to be contained, ball catcher should be used during washing of the concrete; and

b) These contaminants are not to be discharged into or onto roadways, footpaths, gutters, drainage systems, watercourses or any other surface area that will result in damage to the environment or contravenes environmental legislation.

4.19 Pier Casting Works

a) Using crane to hold the pier reinforcement during the time gap between de-staging and placement of shutter; and

b) Location and pier height specific securing arrangement and specific Method Statement for pier more than 9.0 m shall be submitted and approved by the Engineer.

4.20 Bridge Erection Works

4.20.1 References:

a) The BOCW Acts and Rules;

b) The Haryana BOCW Rules 2005;

c) Indian Railways Bridge Manual; and

d) Safety Assessment with regard to Steel Bridge Erection Works 1985, Ministry of Health, Labour and Welfare;

4.20.2 General

As bridge erection works are one of the riskiest jobs, the Contractor shall take utmost precaution at all stages like; planning, establishing temporary yard, casting segments, transporting segments, fabrication and operation of erection machinery, if any, launching of segments/lifting of segments, pre-stressing, cutting and welding, auto (or manual) launching and dismantling of erection machineries. For pre-stressed concrete bridges, the Contractor shall further ensure that:

a) a responsible person should be appointed for post-tensioning works testing and inspection of tendon tensioning devices and using material;

b) installation of protective board behind a tensioning jack and keep out behind a jack during tensioning;

c) use of protective glasses, laver gloves, and masks during grouting for safety of the Workers; and

d) fall prevention installation of overall boarding at the bottom of a bridge and installation of funnel type boarding at the side of a bridge during construction in case of RFO (Railway Flyover) or ROB (Road over Bridge) for preventing the flying and fall of materials and tools by safety net, should be ensured.

4.20.3 The Contractors Obligation

The Contractor shall prepare a comprehensive method statement for the bridge erection works, adhering to the ESHS conditions laid down herein. Particular reference shall be made to the provisions on working at height. As the entire process of launching/lifting has to be undertaken at the Site especially during night time, the safety of workers is of paramount important. Daily inspection of scaffold structure and mechanical equipment for the traveller crane should be done.

4.20.4 Basic Consideration under Site Condition:

Erection works over or adjacent roads or highways:

a) The work area should be demarcated properly, and route map and traffic management plan should be developed and implemented with proper signages and

b) caution;

c) The Contractor shall ensure the implementation of proper stop traffic and detour plan;

d) The Contractor shall arrange the proper guide and signs to be followed while working on highway or adjacent roads, railways; and

e) The Contractor should plan and establish all the required measures for the protection of overhead wires and buried utilities.

i) The regular inspection is done for all the installed protection equipment;

ii) The movement restriction site plan to be developed with defined operation path for safe working at site;

iii) watchmen should be appointed who are given training related to all type of traffic management and all signals used for smooth traffic flow and site transportation and works;

iv) The railway schedule is taken in consideration while planning the site works and ensures the safe management system with the details given regarding the kind of works suspended while a train is passing and clarifying the way of opening or closing railway in case of track

closure works. For steel truss bridges;

v) The Contractor must install the protective net just after erecting truss upper chord material;

vi) The Contractor must install safety operation path to an end of erected member and a cross point of lateral bracing;

The Contractor may use any of the erection methods. However, following general points will be kept in view and ensured as applicable-

A. The Contractor should develop and confirm the Engineer his Method Statement with details of position of bearing, jacking operation, roller passing etc.;

B. Detailed inspection report related to the movement and condition of superstructure from the place of launching equipment and rollers should be given to the Engineer;

C. The Contractor shall give confirmation of binding situation such as a bolting erection member;

D. The Contractor shall give confirmation of displacement per every erection phase;

E. The Contractor shall give confirmation of fixing situation for bearings;

F. The Contractor must take measures to avoid a fall and lateral buckling of member; and

G. The Contractor shall take measures of fall prevention for main superstructure.

4.21 Building and Roof Erection Works

4.21.1 The Contractor shall prepare plan, erection sequence and work procedures properly under competent and experienced personnel to ensure the safety of workers and prevent structure failure during erection:

a) Contractor shall develop and confirm with the Engineer his method statement with details;

b) The stability of structural members is to be ensured by means of ties, braces, anchor/fixing bolts, or other suitable means before releasing lifting gear, slings, chains etc;

c) Tag lines must be attached to the ends of components/loads to maintain control during crane lifting operations;

d) Structure stability is to be ensured always. Unattended and incomplete buildings/structures are NOT to be left in an unsafe and hazardous condition, to pose a risk to the safety and health of site personnel or the public;

e) The Workers placing and securing roof battens are to be protected and are to work from an enclosed environment (e.g. scaffolding, deck guardrail or equivalent) and work up from the bottom of the truss/rafter towards and finish at the ridge /peak of the roof framing; and

f) When the spacing of trusses and roof battens exceed 600mm the appropriate procedures are to be considered and applied after conducting a risk assessment to provide the optimum fall protection.

4.22 Overhead Contact Wire Works

4.22.1 During starting of works using rack vehicle/moving scaffold/ladder/insulation tower/step ladder, etc., the Contractor's operation in charge shall confirm as follows:

a) The work sequence shall be determined while using Ariel Track vehicle. Communication system between drivers and conductors shall be developed and adopted;

b) A deck which must be used by workers, shall have enough capacity of carry necessary loads for work at a high place with a pre-operation inspection;

c) The workers shall be given the safety protection equipment which has enough capacity to hold necessary loads to prevent any accidental fall with a pre-operation inspection;

d) State of electrical equipment installation and a route of going up and down from ground;

e) The Worker is given required training for electrical works at height and the Worker must use a safety rope, an auxiliary rope, a fall prevention equipment such as a rolip which is a fall arrest device for a fixed rope when they work at high place;

f) The Worker shall fix the grip of an auxiliary ropes at the upper position of their safety ropes and uses special wires or a lift when delivering materials and tools from ground to high place;

g) The Contractor shall ensure that no one lean out of the rail of the track vehicles, or take a foot on the rail; and Shall take all the precautions for self-propellant or roll prevention when bringing the track vehicle to a stop;

h) The installation of medium rail at the place where handrail is more than 85cm high;

i) The training is given to all, for putting on a foot brake when bringing the rolling tower to a stop or working on the deck of the rolling tower suspended;

j) Putting on a foot brake and fixing the insulation tower by an assistant when bringing the insulation tower to a stop or working on its suspension;

4.22.2 While going up and down along an Electric Pole, Power Pylon or a High Steel Structure or working above it, the Contractor shall ensure the safety precautions mentioned below:

a) Use of a safety rope, an auxiliary rope and a fall prevention equipment with using an exclusive scaffold when going up and down along the electric pole;

b) Use of an escort rail, or both a Full Body Harness and an auxiliary rope when going up and down along the power pylon or the high steel structure;

c) While working on a Beam, the Contractor shall ensure the safety precautions mentioned below:

i. Use of a horizontal rope on working consecutively on the beam or painting the beam surface without an auxiliary rope; and

ii. Use of a safety rope and an auxiliary rope when moving on the beam under unavoidable circumstances.

4.23 Locomotives and Wagons

4.23.1 Speed limit is determined, and traffic signs of speed limits, lights and related hazards signage and cautions shall be installed at work place.

4.23.2 Person in charge shall be nominated as maintenance officer to inspect and repair temporary rails or track surface situation regularly.

4.23.3 Ensure the installation of an alarm device such as a horn and a buzzer, a head light, and a flood light for the driver's seat.

4.23.4 Training and education shall be given to the driver and the signal man regarding how to send standard signal and operate vehicle diagram and turning off and putting on the brakes while the driver leaves his seat. And making sure to set wheel stoppers when stopping or parking at the slope track.

4.23.5 Each locomotive shall carry an extinguisher for fires

4.24 Fire Protection

4.24.1 The contractor shall ensure that the construction site is provided with—

a) Fire extinguishing equipment sufficient to extinguish any probable fire at such construction site;

b) An adequate water supply at ample pressure as per national standards;

c) Number of trained persons required to operate the fire extinguishing equipment provided;

and

d) Is properly maintained and inspected at regular intervals of not less than once in a year by the responsible person and a record of such inspections is maintained.

4.24.2 The extinguishers shall be chosen as per type of fire load and surrounding location.

4.24.3 All construction machinery including crane shall carry a portable fire extinguisher in operator's cabin.

4.24.4 The Contractor shall prepare an emergency plan and Fire Evacuation plan and same shall be a part of Site ESHS Management Plan. Mock drills should be held on a quarterly basis to ensure the effectiveness of the arrangements and as a part of the programme, the telephone number of the local fire brigade should be prominently displayed near each telephone on site.

4.24.5 Recharging of fire extinguishers and their proper maintenance should be ensured and as a minimum should meet Indian National Standards.

4.24.6 All drivers of vehicles, foreman, supervisors and managers shall be trained on operating the fire extinguishers and firefighting equipment.

4.25 Demolition

4.25.1 All demolition works shall be carried out in a controlled manner under the management of experienced and competent supervision.

4.25.2 The concerned department of the Government or local authority should be informed, and permission obtained wherever required.

4.25.3 All glass or similar materials or articles in exterior openings should be removed before commencing any demolition work and all water, steam, electric; gas and other similar supply lines must be disconnected.

4.25.4 No demolition work should be performed if the adjacent structure seems to be unsafe unless and until remedial measures life sheet piling, shoring, bracing or similar means to be ensured for safety and stability for adjacent structure from collapsing.

4.25.5 Debris/bricks and other materials or articles should be removed by means of chute, bucket or other safe method.

4.25.6 No person other than the Workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition and the area be provided with substantial barricades.

4.26 Permit to Work

4.26.1 The Contractor shall develop work permit system, which is formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken.

4.26.2 Work Permits form an essential part of safe systems of work for many construction activities. They allow work to start only after safe procedures have been defined and they provide a clear record that all foreseeable hazards have been considered. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments.

4.26.3 A permit is needed when construction work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work.

4.26.4 Examples of high-risk activities include but are not limited to:

a) Entry into confined spaces;

b) Hot work;

c) To dig where underground services may be located;

d) Work with heavy moving machinery;

e) Heavy lifting operations and lifting operations closer to live electric power line;

f) Work with using track motor vehicles etc.; and

g) Work under electric facility and overhead electric (OHE) line energized.

4.26.5 The Contractor shall prepare operation manuals above mention and implement training course at any time based on such manuals to the Workers given completion of certificates before the commencement of works.

4.26.6 The permit-to-work system should be fully documented, laying down:

a) How the system works;

b) The jobs it is to be used for;

c) The responsibilities and training of those involved; and

d) How to check its operation.

4.26.7 A work permit authorization form shall be completed with the maximum duration period not exceeding 12 hours or end of shift, which is earlier.

4.26.8 A copy of each permit to work shall be displayed at work place. during its validity, in a conspicuous location in close proximity to the actual works location to which it applies.

4.27 Traffic Management and Site Barricading

4.27.1 The basic objective of the following guiding principles is to lay down procedures to be adopted by the Contractor to ensure the safe and efficient movement of traffic and also to ensure the safety of workmen in the all work areas.

4.27.2 The guiding principles to be adopted for safety in construction zone are to:

a) Warn the road user clearly and sufficiently in advance;

b) Provide safe and clearly marked lanes for guiding road users;

c) Provide adequate traffic marshals to regulate the movement of traffic;

d) Provide safe and clearly marked buffer and work zones; and

e) Provide adequate measures that control driver behaviour through construction zones.

4.27.3 In all cases, the Contractor shall take proper precautions. Wherever operations undertaken are likely to interfere with public traffic, Specific Traffic Management Plans shall be drawn up and implemented by the Contractor in consultation with the approval of Local Police Authorities and/or the concerned politburo/Civil Authorities and followed to the IRC: SP;55- 2014 (Guidelines on Traffic Management in work zones) & IRC: 67 (Code of Practice for Road Signs).

4.27.4 Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from danger due to construction equipment and other temporary structures.

4.27.5 All barricades shall be conspicuously seen in the dark/nighttime by the road users so that no vehicle hits the barricade. Conspicuity shall be ensured by affixing retro reflective stripes of required size and shape at appropriate angles at the bottom and middle portion of the barricade at a minimum gap of 1000mm. In addition minimum one red light blinker or rope light should be placed at the top of each barricade.

4.28 Working near Railway

4.28.1 The details of Safe work procedure for work near Railway Track are given in Clause 8.0,

Attachment -5 of this document.

4.29 Other Works to be Scrutinized

4.29.1 Other works including, but not be limited to, the works in the Site (the ROW), the works in the Borrow Pit, the works in the Quarry and Works on road shall be included to be scrutinised with respect to the accident prevention.

4.29.2 If blasting is anticipated in excavation in rock, preventive measures against accidents and protective measures against environmental/social impacts shall be of paramount importance.

4.29.3 The Contractor shall include all those items as well as work elements to formulate the preventive and protective measures considering envisaged conditions, situations, and activities of the works which may induce accidents or hazard to environment and/or society.

4.30 Personal Protective Equipment

4.30.1 The Contractor shall provide required PPEs to workmen to protect against safety and/or health hazards. Primarily PPEs are required for the following protection:

a) Head protection (Safety helmet with a chin strap);

b) Foot protection (Safety footwear, Gumboot, etc.);

c) Body protection (High visibility clothing (Waistcoat/Jacket), Apron, etc.);

d) Personal fall protection (Full body harness, Rope-grip fall arrester, etc.);

e) Eye protection (Goggles, Welders Glasses, etc.);

f) Hand protection (Gloves, Finger coat, etc.);

g) Respiratory protection. (Nose mask, Self-contained breathing apparatus, etc.); and

h) Hearing protection (Ear plugs, Ear muffs, etc.).

4.30.2 The PPEs and safety appliances provided by the Contractor shall be of the standard as prescribed by Bureau of Indian Standards (BIS). If materials conforming to BIS standards are not available,.

4.30.3 The Contractor shall provide the PPEs which the Contractor deems necessary including; but not be limited to, safety helmets, safety shoes and Hi-Viz to all the Contractor's Employees including workmen (including those of its sub-contractors). High visibility clothing as per the following requirement.

a) Hi-visibility jacket covering upper body and meeting the following requirements as per BS EN 471:1994;

b) Background in fluorescent orange-red in colour;

c) Jackets with full-length sleeves with two bands of retro reflective material, which shall be placed at the same height on the garment as those of the torso. The upper band shall encircle the upper part of the sleeves between the elbow and the shoulder; the bottom of the lower band shall not be less than 5cm from the bottom of the sleeve;

d) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm2;

e) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm2;

f) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back;

g) The bottom strip shall be at a distance of 5cm from the bottom of the vest; and

h) Strips shall be retro reflective and fluorescent.

Safety Helmet Colour Code (Every Helmet should have the LOGO*affixed/painted)	Person to use
Hard hat with company Logo (Employees)	Hard hat with reflective tape (Marshals)
White	Employer/Engineer
Grey	All designers, Architect, Consultants, etc.
Violet	Main Contractors (Engineers/Supervisors)
Blue	All subcontractors (Engineers/Supervisors)
Red	Electricians (Both Contractor and Subcontractor)
Green	Safety professionals (Both Contractor and Subcontractor)
Orange	Security guards/Traffic marshals
Yellow	All workmen
White (with "VISITOR" sticker)	Visitors
Safety Shoes (Anyone at the Siteincl. Marshals)	
All employees of the contractor including workmen	Traffic marshals

Note: LOGO·

a) Logo shall have its outer dimension 2"X2" and shall be conspicuous
ii) Logo shall be either painted or affixed
iii) No words shall come either on Top / Bottom of Logo

Logo of the corresponding main contracting company for their employees and sub-contracting company for their employees shall only be used.

4.30.4 In addition to the above any other PPEs required for any specific jobs like, welding and cutting, working at height, tunnelling etc. shall also be provided to all workmen and also ensure that all workmen use the PPEs properly while on the job.

4.30.5 The Contactor shall not pay any cash amount in lieu of PPEs to the workers/sub- contractors and expect them to buy and use during work.

4.30.6 The Contactor shall at all-time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Engineer during the inspections.

4.30.7 It is always the duty of the Contactor to provide the required PPEs for all visitors. Towards this required quantity of PPEs shall be kept always at the security post.

4.31 Visitor at Site

4.31.1 No visitor can enter the Site without permission. All authorised visitors should report at the Site office. The Contractor shall provide visitor's helmet (White helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the Site.

4.31.2 The Contractor shall be fully responsible for safety and health of all visitors within the Site.

4.32 Site Security

4.32.1 The Contractor shall be wholly responsible for security on the Site and any other areas being used by him or the Subcontractor's for the purposes of the Contract.

4.32.2 The Contractor shall assign on the Site a security officer (adequately trained person,) and his alternate(s), who shall be primarily responsible for the Contractor's security services and fully cooperate with the Engineer's security organization throughout the Time for Completion.

4.32.3 Where necessary, the Contractor shall install, modify, maintain the temporary security fences, gates, posts, security lightings and other facilities required for proper security control, in addition to those to be constructed as part of the Works. The Contractor shall operate these facilities to properly control ingress to and egress from the areas under his control throughout the Time for Completion. This control shall apply to every person including the Employer's Personnel.

5.0 OCCUPATIONAL HEALTH AND WELFARE

5.1 Physical Fitness of Workmen

5.1.1 The Contractor shall ensure that his employees/workers subject themselves to such medical examination as required under the law or under the contract provision and keep a record of the same.

5.1.2 The Contractor shall not permit any employee/workers to enter the work area under the influence of alcohol or any drugs.

5.1.3 The Contractor shall maintain the confidential records of medical examination or the physician authorized by the Engineer.

5.1.4 No worker is charged for the medical examination and the cost of such examination is borne by the Contactor employing such worker.

5.2 Medical Facilities

5.2.1 Occupational Health Centre (First Aid Station)

The Contractor shall ensure at the construction Site an occupational health center, mobile or static is provided and maintained in good order. Services and facilities as per the scale lay down in Schedule IV of HBOCWR. A construction medical officer appointed in an occupational health center, possess the qualification as laid down in Schedule V Rule no 113 of HBOCWR:

5.2.2 The Contractor shall appoint appropriate full-time staff including one nurse, one dresser- cum-compounder, one sweeper-cum-ward boy with each construction medical officer.

5.2.3 The Contractor shall communicate the complete details including name, qualification and experience of the construction medical officer, to the inspector having jurisdiction under HBOCWR.

5.2.4 Ambulance Room, Ambulance Van and Stretchers:

The Contractor shall ensure at a construction site of a building or other construction work that an ambulance van and room are provided at such construction Site, or an arrangement is made with a nearby hospital for providing such ambulance van for transportation of serious cases of accident or sickness of workers to hospital promptly and such ambulance van and room are maintained in good repair and is equipped with standard facilities specified in Schedule VI of Rule 114 & Schedule VII of Rule 115 of HBOCWR.

5.2.5 The Contractor shall provide enough stretchers at each site for use in an emergency.

5.2.6 First Aid Boxes and Emergency Care:

The Contractor shall ensure at construction site one First-aid box for 100 workers for providing first-aid to the workers. Every First-Aid box is distinctly marked "First-Aid" and is equipped with the articles specified in Schedule IX of Rule 119 of HBOCWR. Adequate no. of trained first aid persons shall be available at each work site in each shift.

5.2.7 HIV/AIDS Prevention and Control:

a) The Contractor shall adopt the Employer's "Workplace Policy on HIV/AIDS Prevention and Control for Workers Engaged by Contractors" and implement it. A copy of the policy is given in Clause 8.0, Attachment-2 [Workplace Policy on HIV/AIDS Prevention & Control];

b) The Contractor shall prepare and submit the plan for HIV/AIDS Prevention and Control for his workers in terms of the aforesaid Employer's Policy within 28 days of the date of notification of the Contract.

c) The Contractor shall organize awareness program for labourers on the risks of AIDS and STDs in coordination with Haryana State AIDS Control society.

5.2.8 COVID -19 Prevention and Control

The Contractor shall ensure that the latest guidelines issued by Ministry of Health and Family Welfare (MoHFW), local government and the district administration are strictly followed at the construction works site. The Workplace Policy on COVID-19 Prevention and Control is given in Clause 8.0, Attachment-3 [Workplace Policy on COVID-19 Response]. The Contractor shall undertake a COVID-19 risk assessment of project area and prepare and submit COVID-19 Response and Management Plan.

5.2.9 Prevention of Mosquito Breeding

Measures shall be taken to prevent mosquito breeding on the Site. The measures to be taken shall include:

a) Empty cans, oil drums, packing and other receptacles, which may retain water, shall be deposited at a central collection point and shall be removed from the site regularly;

b) Stagnant water shall be treated at least once every week with oil to prevent mosquito breeding;

c) The Contractor's equipment and other items on the site, which may retain water, shall be stored, covered, or treated in such a manner that water could not be retained; and

d) Water storage tanks shall be provided.

5.2.10 Posters in local language, Hindi and English, which draw attention to the dangers of permitting mosquito breeding, shall be displayed prominently on the Site.

5.2.11 The Contactor at periodic interval shall arrange to prevent mosquito breeding by fumigation/spraying of insecticides, and the ideal larvicide etc.

5.2.12 Alcohol, Smoking and Drugs

a) The Contactor shall always ensure that no employee is working under the influence of alcohol/drugs which are punishable under BOCWR;

b) Smoking at public places by any employee is also prohibited as per Government Regulations. The Contractor shall comply with the legal provisions in this regard, such as; Prohibition of Smoking in Public Places Rules, 2008. He shall be solely responsible for any penalty or punitive action by the government authorities because violations of the provisions contained in these rules by him or his representatives or his employees or his Subcontractors. Requisite notice boards, posters, etc., shall be put by him, as per the Rules.

5.3 Welfare Measures for Workers

5.3.1 Latrine and Urinal Accommodation:

a) Latrine and urinals shall be provided as per Chapter VI, Part – II of Rule 80 of Haryana BOCWR and shall also comply with the requirements of public health authorities; and

b) When women are employed, separate latrine and urinals accommodation shall be provided.

5.3.2 Moving Sites:

a) In case of works like track laying, the zone of work is constantly moving. In such cases,

mobile toilets with proper facility to drain the sludge shall be provided at reasonably accessible distance; and

5.3.3 **Canteen**

In every workplace wherein not less than 250 workers are employed, the Contractor shall provide an adequate canteen conforming to Chapter VI, Part – II of Rule 81 of Haryana BOCWR

5.3.4 **Drinking Water.**

As per Section 32 of BOCWA, the Contractor shall make in every site, effective arrangements to provide sufficient supply of wholesome drinking water. Quality of the drinking water shall conform to the requirements of national standards on Public Health Laws. While locating these drinking water facilities due care shall be taken so that these are easily accessible from the place of work for all workers at all location of the Site. All such points shall be legible marked "Drinking Water" in a language understood by most of the workmen employed.

5.3.5 **Crèche**

In every workplace where in more than 50 female workers are ordinarily employed, there shall be provided and maintained a suitable room for use of children under age of 6 years, conforming to the provisions of Section 35 of BOCWA.

5.3.6 Labour Accommodation Camps

The Contractor shall prepare Labour camp management plan as part of site ESHS plan. Where workers are based some distance from their normal place of residence, the Contractor shall provide them with suitable and safe accommodation free of charge and shall take all necessary precautions to protect their health and welfare. The accommodation shall conform to the requirements of Section 34 of BOCWA and include but not be limited to the further measures specified hereunder.

5.3.7 All accommodation camps shall be provided always with a sufficient supply of clean drinking water (of potable quality according to national legal standards), in suitable and easily accessible locations:

5.3.8 The quality of drinking water shall be tested once a fortnight as prescribed in IS 10500:2012and immediate remedial action shall be taken if quality falls below the standard. Test results shall be provided to the Engineer at least monthly.

5.3.9 The Contractor shall provide all accommodation camps with clean and properly equipped and staffed kitchen and canteen facilities to supply meals for workers.

5.3.10 The Contractor shall provide sufficient toilet and bathroom facilities for the numbers of workers accommodated in each camp. Separate accommodation and toilet/bathroom facilities shall be provided for men and women and all facilities shall be kept in full working order always and cleaned and re-equipped daily.

5.3.11 The Contractor shall provide a laundry facility at the Labour Accommodation Camps.

6.0 ENVIRONMENT AND SOCIAL MANAGEMENT

6.1 General Conduct of the Works

6.1.1 The purpose and objective of these guidelines is to outline how the project will avoid, minimise or mitigate effects on the environment and surrounding area. These guidelines detail the implementation of measures in accordance with environmental and social commitments of HRIDC. These guidelines will be 'live' guidelines that will be reviewed and updated at regular intervals throughout the project life cycle. These guidelines will ensure that the development is compliant with current Environmental and Social legislations and will guide and assist the Contractor in exploring all reasonable and feasible means for reducing construction related Environmental and Social impacts.

6.1.2 The Contractor shall comply with the Environment and Social Management Plan (ESMP) given in the Environmental and Social Impact Assessment (ESIA) report available on HRIDC portal for information disclosure and will note and implement any requirements therein, in addition to those found in this specification.

6.1.3 The Contractor is required to build good public relations before the commencement of the Works particularly with the local level representatives such as the Gram Panchayat, by informing the expected impacts by the Works and their schedule and dispute resolution mechanism known as GRM set by the Employer.

6.2 Environmental Legislation

6.2.1 The Contractor shall always comply with all relevant National and State legislations regarding environmental protection, pollution prevention and control, waste management and other relevant environmental matters, including but not necessarily limited to, the following with their latest amendments:

a) The Environment (Protection) Act, 1986 and Rules 1986

b) The Indian Wildlife (Protection) Act, 1972;

c) The Forest (Conservation) Act, 1980 &Rules;

d) Punjab Land Preservation Act, 1900;

e) The Noise Pollution (Regulation and Control) Rules, 2000;

f) Notification on Control of Noise from Diesel Generator (DG) sets, 2002;

g) The Air (Prevention and Control of Pollution) Act, 1981and Rules 1981;

h) The Water (Prevention and Control of Pollution) Act, 1974 and Rules 1974;

i) Guidelines to control and regulate ground water extraction in India, 24th September2020, Central Ground Water Authority;

j) The Solid Management Rules, 2016;

k) The Construction and Demolition Waste Management Rules, 2016;

l) The Hazardous and Other Wastes (Management and Transboundary Movement)Rules, 2016;

m) The Bio-medical Waste Management Rules, 2016;

n) Plastic Waste Management Rules, 2016;

o) E-Waste (Management) Rules 2016;

p) The Batteries (Management and Handling) Rules, 2001;

q) Manufacture, Storage, and Import of Hazardous Chemical (Amendment) Rules,1989;

r) Ancient Monuments and Archaeological Sites and Remains (Amendment andValidation) Act 2010;

s) Fly ash utilization notification, Sept 1999;

t) Applicable NGT Guidelines issued time to time; and

u) Provisions of Graded Response Action Plan notified by the MoEF&CC.

6.2.2 The Contractor shall comply the Environmental and Social Framework (ESF) of Asian Infrastructure Investment Bank (AIIB) February 2016.

6.2.3 If the requirements stated in this document are in conflict or inconsistent with the requirements of applicable laws, the more stringent requirements shall apply.

6.2.4 It is also the Contractor's responsibility to obtain all environmental clearances, official approvals, consents, or other authorizations as may be necessary to comply with the relevant statutes, and to pay all related fees and other costs. The Contractor shall obtain all authorizations in a timely manner and submit to the Engineer as the evidence for the regulatory obligations before commencement of any related construction activity. The indicative clearances/permission/permit are presented in Table below and Contractor is required to take any other clearance as required for its construction activities.

Clearance/ Permission/Permit	**Relevant Acts/Rules**	**Concerned Agency**
Consent to Establish and Consent to Operate batching plants and casting yards	• The Water (Prevention and Control of Pollution) Act, 1974, and its amendments; • The Air (Prevention and Control of Pollution) Act 1981 and its amendments	Haryana Pollution Control Board
Authorization for generation, handling, storage, and transportation of hazardous waste	Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016	Haryana Pollution Control Board
Permission for extraction of ground water	Central Ground Water Authority guidelines to regulate and control ground water extraction in India, 24th September, 2020	Haryana Water Resources (Conservation, Regulation and Management) Authority
Pollution Under Control Certificate	Central Motor and Vehicle Act 1998 Vehicular Exhaust Norms, CPCB 2007	Department of Transport, Government of Haryana
Construction and Demolition Waste Management Plan	Construction & Demolition Waste Management Rules, 2016	Local Authority (Municipal Corporation)

6.3 Environmentally Friendly Construction Practices

6.3.1 Containment of Air Pollution

a) All construction equipment's should be cleaned of visible dirt/mud before exiting the construction sites and streets shall be promptly cleaned by manual sweeping, or by deploying electro – mechanical devices if such material has been dropped;

b) The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction depots and batching plants. This facility will be provided with efficient drainage, water re-circulation apparatus and silt traps to prevent any excessive buildup of water. Where wheel-washing facility is not possible, the Contractor shall ensure manual cleaning of wheels by wire brushes or similar suitable means;

c) The Contractor shall ensure that vehicles carrying dust generating material shall be covered with tarpaulin, shall have properly fitted side and tailboards and dust potential material shall not be loaded to a level higher than the side and tail boards;

d) Materials should not be dropped from more than 1.5 m to limit fugitive dust generation;

e) Necessary water sprinkling to be carried out for dust control. For water sprinkling, emphasis should be given on use STP treated water or RO reject water;

f) Stockpiles of sand and aggregate greater than 20m3 for use in concrete manufacture shall be enclosed on three sides, with walls extending above the stockpile and two (2) meters beyond the front of the stockpile;

g) Areas within the Site such as construction depots and batching plants, where there is a regular movement of vehicles shall have an approved hard surface that is kept clear of loose surface material;

h) Unless the Engineer has given notice otherwise, the Contractor shall restrict all motorised vehicles on the Site to a maximum speed of 15 kilometers per hour and confine haulage and delivery vehicles to the designated roadways inside the site;

i) The Contractor shall erect hoardings as specified in Engineer requirements securely around all construction work sites during the main construction activity, to contain dust within the site area and also to reduce air turbulence caused by passing traffic. The hoarding shall be safely secured to the ground to prevent from toppling with minimum gap between the base of hoarding and ground surface.

j) Water spray should be used to control dust during breaking of rock/concrete;

k) The contractor shall take all necessary actions to control air pollution as per guidelines issued by the Commission for Air Quality Management (CAQM) in National Capital Region time to time;

l) The contractor shall take necessary actions as per the provisions of Graded Response Action Plan (GRAP) issued from time to time.

6.3.2 **Containment of Water Pollution and Efficient Use of Water**

a) List of sources (surface/ground) to be provided for approval from Engineer;

b) A water meter shall be installed to quantify the consumption of water;

c) Prior to use of source, written permission to be obtained from authority to use the water in construction activity, and submit a copy to Engineer;

d) During construction only permitted quantity (permission taken) from approved sources to be used in construction activity;

e) A Drainage system should be constructed during the commencement of the works, drain off all surface water at the site into suitable drains;

f) At construction depots and batching plants temporary drainage works should be maintained, removed, and reinstated as necessary and all other necessary precautions should be taken for avoidance of damage by flooding and silt;

g) The Contractor shall provide a hard surface with suitable drainage system for Transit Mixture washing at Casting Yard and/or Batching plant. The slurry water from Transit Mixture washing area shall go to sedimentation tank of suitable capacity to treat the slurry water. The contractor shall ensure the facility remains functional till the end of the contract;

h) The Contractor shall take measures to prevent discharge of oil on land and in water bodies. Oil separator/interceptors shall be provided at Batching Plant and Construction Depot location for vehicle maintenance to prevent the release of oils and grease into the drainage system. These shall be cleaned on a regular basis;

i) Rainwater pumped out from trenches or foundation excavation should be discharged into storm water drains after obtaining notice of no objection from the Agency controlling the system;

j) The Contractor shall always ensure that all existing wells, stream courses and drains within, and adjacent to the site are kept safe and free from any debris and any excavated materials arising from the Works;

k) The Contractor shall discharge wastewater arising from site offices, canteens or toilet facilities constructed by him into sewers after obtaining prior notice of no objection of agency controlling the system;

l) The Contractor shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited/drained in the watercourses but are suitably treated and effluents and residue disposed off in a manner approved by local Regulatory Authorities;

m) Construction works should be programmed to minimize soil excavation works in rainy season. If carried out during rains, temporarily exposed slope surfaces should be covered by tarpaulin, and temporary access roads should be protected by crushed stone or gravel, as excavation proceeds.

n) Wastewater from Concrete Batching & Precast Concrete Casting and that generated from the washing down of mixer trucks and drum mixers and similar equipment should wherever practicable be recycled. The discharge of wastewater should be kept to a minimum;

o) The road between the vehicle washing bay and the public road should be paved to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains;

p) R.O. rejected water will be used for following purposes:

- TM washing,
- Batching Plant washing,
- Toilets and Urinals,
- Gardening activity,
- Wheel Washing ,
- Sprinkling water for dust control, and
- Any other feasible use

Proper arrangement will be made at Batching plant area for storage of RO reject water.

6.3.3 **Containment of Noise and Vibration**

a) Contractor shall minimize the use of impact devices, such as jackhammers, and pavement breakers and instead use concrete crushers or pavement saws;

b) Equip noise producing equipment such as jackhammers and pavement breakers with acoustically attenuating shields or shrouds recommended by the manufacturers thereof, to meet relevant noise limitations;

c) Use hydraulic tools instead of pneumatic impact tools and electric instead of diesel-powered equipment. If pneumatic impact tools and equipment are used, they shall have intake and exhaust mufflers recommended by the manufacturers thereof, to meet relevant noise limitations;

d) Provide mufflers or shield panelling for other equipment, including internal combustion engines, recommended by manufacturers thereof;

e) Employ prefabricated structures instead of assembling on-site;

f) Provide enclosures for stationary equipment and barriers around noisy areas;

g) Locate and operate stationary equipment in such a way, so as to minimize noise and vibration impact on community, sensitive locations and nearby buildings.

h) Schedule truck loading, unloading, and hauling operations in such a way so as to minimize noise impact near noise sensitive locations and surrounding communities;

i) Plan noisier operations during times of highest ambient noise level, keep noise levels relatively uniform and avoid excessive and impulse noises;

j) Use only well-maintained, regular serviced plant/equipment, and not to be kept idling when not in use;

k) Maintain equipment such that parts of vehicles and loads are secure against vibrations and rattling;

l) Grading of surface irregularities on construction sites to prevent the generation of impact noise and ground vibrations by passing vehicles;

m) If back-up alarms are used on construction equipment, their noise emission level near noise sensitive receptors such as residences, schools, hospitals and similar areas where calmness is essential, should be regulated, especially at night time;

n) Avoid operating truck on streets that pass by schools during school hours;

o) Efforts to be made to bring down the noise levels due to the DG set, outside the premises, within the ambient noise requirements by proper setting and control measures;

p) The Contractor shall ensure that all necessary permissions/ approvals/consent is obtained from relevant authorities before installation and operation of Generator set;

q) A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacture;

r) At all times noise levels of DG sets shall comply the standards set out by CPCB/SPCB;

6.3.4 **Containment of Waste**

a) Construction activities are expected to generate a variety of waste such as:

   i) General refuse;

   ii) Construction and Demolition waste including waste from excavated material;

   iii) Chemical waste;

   iv) Hazardous waste; and

   v) Biomedical waste.

b) The Contractor is required to develop, institute and maintain a Waste Management Plan (WMP) during the construction of the project for his works. Such mechanism is intended to ensure that the designated area for the segregation and temporary storage of reusable and recyclable materials are incorporated in the WMP. The WMP shall be prepared and submitted to Engineer for approval.

General Refuse

c) General refuse like paper and food waste shall be stored in enclosed bins.

d) The refuse shall be stored and transported in accordance with good practice and disposed at licensed landfills;

e) An authorized waste collector shall be employed by the Contractor to remove general refuse from the site, on a daily basis to minimise odour, pest and litter impacts;

f) The Contractor shall not burn debris or vegetation on the site.

Construction and Demolition (C&D) Waste

g) C&D Waste would mainly arise from the project construction activities and from the demolition of existing structures where necessitated. It will include: material and equipment wrapping packaging material, unusable/surplus concrete/grouting mixes, damaged/contaminated/surplus construction materials, wood from formwork and false work, concrete rubble, plastics, metal, glass, asphalt, wood and refuse obtained from demolition of houses.

h) The Contractor shall be responsible for collection, segregation, storage and disposal of C&D waste as directed or notified by the concerned local authority in consonance with the Construction & Demolition Waste Management Rules, 2016;

i) The Contractor shall ensure that there is no littering, deposition and disposal of C&D waste along the natural drainage and in water body;

j) The C&D waste should be disposed off either when the quality of C&D waste is 15 Tons from entire contract or such C&D waste has been stored for 15 days (irrespective of quantity) whichever is earlier;

k) A proper arrangement for record keeping has to be maintained to ensure disposal of C&D waste to C&D waste recycling plant. Contractor shall submit the record of C&D waste disposal to recycling facility, in his Monthly Environment Report;

Hazardous Waste

l) Hazardous waste would mainly arise from the maintenance of equipment. These may include, but not be limited to: Used engine oils, hydraulic fluids, waste fuel, spent mineral oils/cleaning fluids from mechanical machinery, scrap batteries or spent acid/alkali, spent solvents/solutions. Hazardous waste shall be disposed off in a manner in compliance with the procedure given in "Hazardous Waste (management, handling and trans-boundary movement) rules, 2016" only to authorized recyclers under intimation to the Employer's Representative;

m) Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act;

n) The hazardous waste shall be stored on an impermeable surface with containment bunding to retain leaks, spills and ruptures;

o) All waste collection containers shall be of appropriate size with a closed lid. Each container will be clearly labelled with a colour code system in local language and English. Original labels of empty containers should be completely covered and the contents of the type of waste stored in the used containers clearly indicated;

p) Drip pans of suitable size and numbers shall be used to collect oil leakage and spills. The area shall be cleaned after completion of maintenance/repair and generated waste disposed off in approved manner.

Bio medical waste

q) Collection, segregation, storage and disposal of Bio Medical waste shall be in accordance with The Bio-medical Waste Management Rules, 2016;

r) Storage time of waste shall be as less as possible so that waste storage, transportation and disposal is done within 48 hours;

s) The contactor shall ensure that Posters/ placards for bio-medical waste segregation are installed at the point of generation;

t) Disposal of biomedical waste shall be through a licensed waste collector, duly authorized by MoEF&CC or Haryana Pollution Control Board as the case may be. License of the waste collector shall be shown to the Employer's Representative on demand. Staff handling the biomedical waste shall be provided with PPEs;

Colour coding of Waste storage bins

u) All waste shall be stored in different coloured bins as per table below:

Type of Waste	**Colour**
Wet/Organic/ Bio-Degradable Waste	Green Bins with lids
Dry/Recyclable waste (excluding Bio-medical waste/ hazardous waste)	Blue
Bio-Medical waste	Red with lids
E-Waste	Black
Hazardous Waste	Brown
COVID Waste	Yellow

6.3.5 **Landscape, Greenery and Aesthetics**

a) As far as is reasonably practicable, the Contractor shall maintain ecological balance by preventing deforestation and defacing of natural landscape. In respect of ecological balance, the Contractor shall observe the following instructions.

i) Prevent any avoidable destruction, scarring or defacing of natural surroundings in the vicinity of work;

ii) Any damage shall be repaired, replanted or otherwise corrected at Contractor's expense.

iii) Directional shielding for light used for illumination shall be used to prevent from striking adjacent areas, where feasible;

b) Tree Felling

i) All trees and shrubs, which are not specifically required to be cleared or removed for construction purposes, shall be preserved and protected from any damage by use of protective barriers or other methods approved by Engineer;

ii) The Contractor shall not fell, remove or dispose of any tree or forest produce in any land handed over to him for the construction of works and facilities related to project except with the previous permission obtained from the Forest Department;

iii) Trees shall not be used for anchorage.

6.3.6 **Energy Management**

a) The Contractor shall use energy efficient pumps and motors. The efficiency shall be measured during installation and also periodically;

b) The Contractor should rigorously follow the maintenance regime of his DG sets;

c) The Contractor shall maximize the use of energy efficient luminaries such as LED's, metal halide lamps and ensure optimum illumination levels to save energy;

d) The Contractor shall make provision of Earth Leakage Circuit Breakers (ELCBS) to prevent loss of excessive earth currents which are unsafe;

e) The Contractor shall plan in advance and select locations to receive and store material such that these are at the least distance from place of use;

f) The Contractor shall design site offices for maximum daylight and minimum heat gain.

6.3.7 **Archaeological And Historic Resources**

a) If any archeological and historic structure is likely to be affected, a resource protection plan shall be prepared by the Contractor in consultation with the Archaeological Survey of India (ASI) to identify and assess construction effects and seeks ways to avoid, minimize or mitigate adverse effects on such monuments;

b) The Contractor shall stop work immediately and notify the Engineer if, during construction, an archaeological or burial site is discovered. The work will not recommence until approval of the Engineer is obtained for the same.

6.3.8 **Fly Ash**

MoEF&CC fly ash notification dated September 1999 and its subsequent amendments makes it mandatory for use of fly ash-based products in construction activities located within 300Km from coal or lignite based thermal power plants. The Contractor shall use fly ash as a percentage substitution of cement, in concrete for certain structures and works as prescribed in the latest amendment. The Contractor shall provide details of usage of such products to Engineer and shall maintain a detailed record of usage of Fly Ash.

6.4 Environmental Monitoring

6.4.1 **Baseline Study:** Before commencement of actual construction work, all items and parameters as specified in ESHS manual shall be monitored once as the baseline of the environmental condition prior to the construction and compared with the monitored values during the construction period;

6.4.2 **Qualification of Monitoring Agency:** Monitoring shall be conducted by MoEF&CC approved or NABL accredited laboratory and approved by the Engineer;

6.4.3 **Enforcement of the Monitoring**: Monitoring plan shall be proposed in the Contractor's ESHS Management Plan and must be approved by the Engineer before commencement of the monitoring. If the monitoring results are more than baseline and standards, cause analyses and necessary counter measures shall beproposed to the Engineer in the monitoring reports;

6.4.4 **Parameters, Location and Frequency of the Monitoring:** Environmental Monitoring parameters, locations and frequency is given in following table.

Parameters, Standards, Location and Frequency of Monitoring

Parameters	Sampling Standards	Location	Frequency
Air (PM_{10}, $PM_{2.5}$)	CPCB (2011) Guidelines for the Measurement of	One representative location within each construction yard and batching plant	Monthly

Parameters	Sampling Standards	Location	Frequency
	Ambient Air Pollutants, Manual Sampling & Analyses	Closest residential or commercial area (one location) within 100m from each active construction site or representative locations approved by theEngineer.	Monthly
		$PM_{2.5}$ In Tunnel portion	Bi-weekly
Noise **Day Time** (6 AM – 10PM) L_{max}, L_{min}, L_{eq}, L_{10}, L_{90}, L_{50} **Night Time** (10PM – 6AM) L_{max}, L_{min}, L_{eq}, L_{10}, L_{90},L_{50}	CPCB (2015) Protocol for Ambient Level Noise Monitoring	One representative location within each construction yard and batching plant	Weekly
		Closest residential or commercial area (one location) within 100m from each active construction site or representative locations approved by the Engineer.	Weekly
Vibration (in mm/s orVdB)	IS 14884 (2000)	During complaints or as directed by employer.	
Drinking/GW (pH, Total Alkalinity, Electrical Conductivity, Total Dissolved Solids, Fluoride, Arsenic, Nitrate, Iron, Lead, Cadmium, E-coli)	IS 3025 (2008) & IS 10500 (2012)	**Drinking water**: construction yard, batching plant andlabour camps	Quarterly (April, July, October, January)
		Groundwater: one representative tube/bore well in the adjacent residential area or within 100m from each active construction site	Quarterly (April, July, October, January)
Surface Water pH, Total Dissolved Solids, Fluoride, Arsenic, Iron, Lead, E-coli	IS 3025 (2008) & IS 2296 (1982) & CPCB (2012) Guide Manual Water and Wastewater Analysis	Upstream and downstream of the river/stream if any. Any natural water course (ex. Pond etc.) located or within 100 m of each a) construction yard,	Quarterly (April, July, October, January)

Parameters	Sampling Standards	Location	Frequency
		b) labour camp, and c) active construction site	
Waste	Not available but fully complying with monitoring the quantities of wastes specified by the Solid Management Rules 2016 & the Construction and Demolition Waste Management Rules 2016	Each construction yard and construction site	Quarterly (April, July, October, January)
Hazardous waste	Not available but typed reporting (not handwriting) fully complying with monitoring the quantities of wastes specified by the Hazardous and Other Wastes (Managementand Transboundary Movement) Rules 2016,	Each construction yard and active construction site	Quarterly (April, July, October, January)
Complaints if any		All Works' related locations	Weekly

6.5 Complaint Response Process

6.5.1 Enquiries, complaints and requests for information can be expected from a wide range of individuals and organisations both private and government. Most complaints are likely to be received by HRIDC, although the site offices are also likely to be contacted;

6.5.2 The objective of complaint process is to ensure that public and agency complaints are addressed and resolved consistently and expeditiously;

6.5.3 The Contractor's Project Manager will be notified immediately on receipt of complaint that may relate to environmental impacts. The Project Manager will immediately inform the Engineer;

6.5.4 Field investigation shall determine whether the complaint has merit, and if so, action shall be taken to address the complaint;

6.5.5 The outcome of the investigation and the action taken shall be documented on a complaint Performa prepared by the Contractor and submitted for notice by the Engineer in advance of the works;

6.5.6 Where possible, a formal response to each complaint received shall be prepared by the Contractor within seven days to notify the concerned person(s) that action has been taken.

6.6 Social Legal Requirement

6.6.1 The Contractor shall always comply with all relevant national and state legislations regarding social safeguard including but not necessarily limited to, the following with their latest amendments.

a) National Policy for the Empowerment of Women, 2001;

b) The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013;

c) The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Rules, 2013;

d) The Protection of Children from Sexual Offences Act, 2012;

e) The Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome (Prevention and Control) Act, 2017;

f) Child Labour (Prohibition & Regulation) Act 1986

Some of the key International instruments for the protection of women include the following:

a) United Nations General Assembly, Resolution 52/86 on Crime Prevention and Criminal Justice Measures to Eliminate Violence Against Women, 2 February1998;

b) United Nations Security Council Resolution 1325 on Women, Peace and Security, 31 October 2000;

c) Environmental and Social Framework (ESF) of Asian Infrastructure Investment Bank (AIIB) February 2016

6.7 Gender equality

6.7.1 The Contractor is responsible for providing equal opportunities to both genders and end gender related discrimination, if any. The ESHS Committee will proactively identify cases of gender discrimination with key focus on the following topics:

a) Gender based violence, including sexual harassment at the workplace;

b) Disparity in benefits provided;

c) Termination on account of pregnancy.

6.7.2 The Contractor shall enhance female workforce participation and maintain sex -disaggregated data for periodic reporting.

6.7.3 The Contractor shall ensure that women workers are paid at par with male workers

6.7.4 If women workers are deployed at site then day crèche facilities shall be provided to facilitate the women with infant working on site.

6.8 Labour Requirements

6.8.1 The contractor shall use unskilled labour drawn from local communities to avoid any additional stress on the existing facilities (medical services, power, water supply etc.)

6.8.2 The recruitment of women and members of vulnerable groups shall be prioritized.

6.8.3 The Contractor shall provide training to build the skills of locally recruited labour.

6.8.4 All staff, skilled and unskilled labours employed on a site shall be required to sign Code of Conduct that shall ensure compliance with the ESHS provision (Refer 6.11).

6.9 Cultural and Religious Issues

6.9.1 Disturbance from construction works to the cultural and religious sites, and Contractors lack of knowledge on cultural issues cause social disturbances. The Contractor shall

a) Communicate to the public through community consultation, informing the peers and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction;

b) Not block access to cultural and religious sites and sites of importance for livelihood activities, wherever possible;

c) Need to take mitigation measures while working near religious place/ educational institutions close to the construction sites;

d) Provide freedom to construction workers to observe their cultural and religious practices;

e) Monitor and be responsible for the behaviour of construction workers especially migrant workers towards the community. The workers must be debriefed well regarding local aspects and need to follow good behaviours, and informed regarding unexpected behaviours at the time of employing;

f) Provision of cultural sensitization training for migrant labours regarding engagement with local community;

g) Resolve cultural issues in consultation with local leaders and Project Manager;

h) Establish a mechanism that allows local people to raise grievances (directly and indirectly) arising from the construction process;

i) Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters.

6.10 Guidelines for Addressing GBV in Projects

6.10.1 The Contractor's ESHS Plan shall include implementation of Gender Based Violence (GBV), Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH) Prevention and Response Action Plan. This action plan shall describe Code of Conduct (CoC), mechanism to address such incidents, assess the project scenario and potential risks of GBV/SEA/SH, training plan for workers on GBV/SEA/SH and awareness programme amongst workers regarding socially, culturally appropriate behaviour that would ensure that the project community and women in particular are safe, secured, and not vulnerable to abuse. A sample GVB/SEA/SH action plan is given in Table below.

Table - GBV/SEA/SH Prevention Action Plan

Objective	Activity	Responsibility
Assess Potential Riskof GBV	Rapid assessment of worksite, project footprint (e.g. community structure, local self-governance, national regulations, history of incidence), type of workers (local or migrant) for possible GBV risk.	As part of the social impact assessment (to be updated at the time of construction).

Objective	Activity	Responsibility
Inclusive development	• Engage women in project planning and implementation • Incorporate women's feedback in project designand construction schedule • Organize systematic consultations with women to ensure continuous feedback on projects and identify any gender- sensitive adverse impacts	
Training – women	• Sensitization of women on GBV and women's rights to avoid/avert such incidents • Sensitization of women on actions to be taken in case of GBV	
Training – men	• Sensitization of male workers on GBV and women's rights to avoid/avert such incidents. • Sensitization of maleworkers on actions to be taken in case of GBV • Sensitization of male workers on appropriate socially and culturally acceptable behaviour towards women • Training of managers on methods of dealing with cases of GBV.	
Awareness generation	• Distribution of leaflets propagating gender-appropriate behaviour. • Signing of self-declaration format on commitment towards gender-sensitive behaviour. • Awareness raising programme to the local communities on GBV/SEA,HIV/AIDS,COVID-19 and Human Trafficking.	

6.10.2 The Contractor shall constitute an appropriate Grievance Redress Mechanism (GRM) for addressing grievances at worksite. Grievances of workers will be first brought to the attention of supervisor at site. Grievances not redressed by the supervisor within 7 days will be brought to the Grievance Redress Committee (GRC). The composition of GRC will have representatives from workers, women representative, ESHS staff of the Contractor ESHS staff of GC. The main responsibilities of the GRC are to: (i) provide support to workers on problems arising at worksite, (ii) record workers grievances, categorise, prioritize grievances and resolve them, (iii) immediately inform the Engineer of serious cases and (iv) report to workers on development regarding their grievances and decisions of GRC. The panel of the GRC will function without any prejudice or fear of retaliation. The well-being of the panel members will be protected by HRIDC. The GRC will redress the grievances within 14 days. The Contractor shall provide grievance box at Project Site Office.

6.10.3 This project has zero tolerance of any form of:

a) **Gender-based violence (GBV)**, that is perpetrated against a person's will and that is based on socially ascribed gender-related differences between people.

b) **Sexual exploitation and abuse (SEA**) which is attempted abuse of a position of vulnerability, differential power, or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.

c) **Sexual harassment (SH**) which is unwelcome sexual advances, requests for sexualfavors, and other unwanted verbal or physical conduct of a sexual nature.

6.10.4 Any incidence of GBV, SEA or SH should be reported to the Grievance Redress Committee (GRC). The panel of the GRC should take appropriate gender-sensitive actions to verify authenticity of the incident with due consideration to the safety, security, and dignity of the offended person. The investigation should be concluded within three days of receiving the report or as reasonably possible. Depending on the severity of the incident, the panel may report the case to appropriate authorities.

Following the investigation, the GRC shall recommend appropriate actions to the company which may include but not limited to:

a) Informal warning

b) Formal warning

c) Additional training

d) Loss of up to one week's salary

e) Suspension of employment (without payment of salary), for a minimum period of one month up to a maximum of six months

f) Termination of employment

6.10.5 The affected person will be provided with appropriate support (e.g. psychological counselling, medical support and any other support as needed).

6.10.6 A self-declaration format for adherence to gender-sensitive behaviour should be signed by all contractors, subcontractors, employees, and senior managers, engaged by the Project to avoid GBV/SEA/SH at worksite. A self-declaration format is given in below:

6.10.7 **Commitment Statement for all Project Workers**

(to be translated into local language or explained in a manner that is appropriate for general understanding of the signee)

I, (name of person), acknowledge that preventing Gender-Based Violence (GBV), Sexual exploitation and abuse (SEA) and Sexual harassment (SH) is essential, and that preventing it is my responsibility. At [Company], GBV activities constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. All forms of GBV are unacceptable, be it on the worksite, the worksite surroundings, at workers' camps, or inthe community. Prosecution of those who commit GBV may be pursued if appropriate.

I agree that while working on the [Project], I will:

- Cooperate with any relevant investigations.
- Treat women, children (definition of "child" shall be as specified in Child Labour (Prohibition and Regulation) Act, 1986) and men with respect regardless of race; color; language; religion; political or other opinion; national, ethnic or social origin; sexual orientation or gender identity; disability; birth or other status.

- Not use language or behaviour towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.
- Not request or engage in sexual favors - for instance, making promises or favorable treatment dependent on sexual acts, in or outside the work site.
- Refrain from abusive and violent behaviour, in the workplace, labor camp or surrounding communities.
- Attend and actively partake in training courses related to HIV/AIDS, GBV, SEA and SH as requested by my employer.
- Report through the grievance redress mechanism or to my manager any suspected or actual GBV by a fellow worker, whether in my company or not, or any breaches of this Code of Conduct.

[Company] recognizes that false accusations of sexual harassment can have serious effects on innocent persons. If, after the investigation, it is found that the complainant has maliciously or recklessly made a false accusation, the complainant will be subject to appropriate sanctions. In such a case, the company will also take appropriate action to restore the reputation of the accused.

I understand that it is my responsibility to use common sense and avoid actions or behaviours

that could be construed as GBV or breach this Self-declaration format. I do hereby acknowledge that I have read the foregoing Self-declaration format, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to GBV. I understand that any action inconsistent with this Self-declaration format or failure to act, as mandated by this Self-declaration format may result in disciplinary action and may affect my ongoing employment.

I have familiarized myself with the contents of this Self-declaration format. By my signature below, I acknowledge, understand, accept and agree to comply with the information contained in the Self-declaration format provided to me.

I hereby confirm I have read and understand the Self-declaration format.
Name (Employee)

Signature
Date

6.11 Code of Conduct for Contractor's Workers

6.11.1 The Contractor shall have a Code of Conduct for the Contractor's Personnel. The Contractor shall ensure that each Contractor's Personnel is provided a copy of this Code of Conduct, written in a language comprehensible to that person, and shall seek to obtain that person's signature acknowledging receipt of the same. Reference code of conduct is place below:.

Code of Conduct for Contractor's Workers

We are the Contractor, [*enter name of Contractor*]. We have signed a contract with [*enter name of Employer*] for [*enter description of the Works*]. These Works will be carried out at [*enter the Site and other locations where the Works will be carried out*]. Our contract requires us to implement measures to address environmental and social risks related to the Works, including the risks of sexual exploitation and abuse and gender-based violence.

This Code of Conduct is part of the measures to deal with environmental and social risks involving

the workers, related to the labor camps and the workplace. It applies to all our staff, laborers and other employees at the Works Site or other places where the Works are being carried out. It also applies to the personnel of each subcontractor and any other personnel assisting us in the execution of the Works. All such persons are referred to as "**Contractor's Personnel"** and are subject to this Code of Conduct.

This Code of Conduct identifies the conduct that is required from all Contractor's Personnel.

Our workplace is an environment where unsafe, offensive, abusive, or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

Contractor's Personnel shall:

1. Make earnest efforts to understand his/her responsibilities detailed in this Code of Conduct and any other documents and training, as directed by the Employer. Proactive seek clarifications to enable work to be undertaken in strict compliance with this Code of Conduct.
2. Carry out his/her duties competently and diligently.
3. Comply with this Code of Conduct and all applicable laws, regulations, and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Workers and any other person.
4. Maintain a safe working environment including by:
    a. ensuring that workplaces, machinery, equipment, and processes under each person's control are safe and without risk to health.
    b. wearing required personal protective equipment.
    c. all works are conducted with safety clearance and under appropriate supervision.
    d. using appropriate measures relating to chemical, physical, and biological substances and agents.
    e. following applicable emergency operating procedures.
    f. providing separate, safe, and easily accessible working and accommodation facilities for women and men working on the site.
5. Report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health.
6. Treat other people with respect, and not discriminate against specific groups such as women, gays, people with disabilities, migrant workers, or children.
7. Not engage in sexual harassment which includes unwelcome sexual advances, requests for sexual favors, and other unwanted verbal or physical conduct of a sexual nature.
8. When engaging with the community and/or project affected persons, this should be done professionally and with utmost respect. Intimidation, threats, and coercive behavior will not be tolerated.
9. Not engage in sexual exploitation and abuse, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.
10. Not engage in sexual assault, which means any form of non-consensual sexual contact.
11. Not engage in any form of sexual activity with individuals under the age of 18.

12. Not make any inappropriate and unwanted sexual advances to people in the adjoining communities or settlements.
13. Not work or be present in the worksite(s) under the influence of any intoxicating substances, such as alcohol or drugs.
14. Not possess alcohol or any other intoxicating substances while on duty or in the labor camps.
15. Return to the labor camp no later than 22:00, unless working on night shift.
16. Complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, Gender-based violence (GBV), Sexual Exploitation, Abuse and Harassment (SEAH).
17. Report violations of this Code of Conduct.
18. Not retaliate against any person who reports violations of this Code of Conduct, whether to AIIB or the Employer, or who makes use of the grievance mechanism for Contractor's Workers or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact [*enter name of the Contractor's Social Expert*] in writing at this address [X] or by telephone at [X] or in person at [X]; or
2. Call [X] to reach the Contractor's hotline *(if any)* and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in [X] language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact [*enter name of Contractor's contact person with relevant experience in handling gender-based violence*] requesting an explanation.

Name of Contractor's Personnel: [insert name]

Signature: _____
Date: (day month year): _____

Countersignature of authorized representative of the Contractor: [insert name]
Signature: _____
Date: (day month year): _____

7.0 FINANCIAL DEDUCTION/WITHHOLDING

7.1 Financial deductions from Contractor on occurrences of an incident.

7.1.1 Table No. 1 below indicates ESHS incidents and the corresponding deductions to be made from the Contractor under Sub-Clauses 20.1 [Employer's Claims], Sub-Clauses 14.3 [Application for Interim Payment], Sub-Clauses 14.6 [Issue of Interim Payment Certificates] and Sub-Clauses 14.7 [Payment] of the General Conditions of Contract.

7.1.2 The affected part of the Works shall remain suspended until all necessary investigations are completed as prescribed in Clause 2. [ESHS Management], Sub-Clause 2.15 Accident Report and Investigation and as per the related local laws of the state.

7.1.3 Upon submission of the Contractor's Request for Inspection (RFI), a joint inspection of the affected part of the Works shall be carried out by the Engineer and the Contractor. On receipt of the Engineer's Consent (Notice of No Objection: NONO), the Contractor may resume the work.

7.1.4 The Contractor shall not be entitled to any extension of time or to the payment of any cost or profit due to any suspension in accordance with this Sub-Clause 8.5 [Extension of time for Completion]

7.1.5 The maximum amount of delay damages set out in Sub-Clause 8.8 [Delay Damages] of the General Conditions of Contract shall not be applicable where the cause of delay to completion is suspension of part of the Works due to the Contractor's non-compliance as described in this clause 7.1.

7.1.6 The Engineer may issue a notice to the Contractor in accordance with Sub-Clause 3.5 [Engineer's Instruction] of the General Conditions of Contract to rectify any unsafe act or condition (including but not limited to error, default, or omission) upon discovery of same on the Site by the Engineer, in a form of Nonconformity Report.

7.1.7 The Contractor shall promptly comply with such notification, investigate the noncompliance of the Condition of Contract on ESHS and Project ESHS Manual as soon as possible (but no later than 7 days, or within such other period from receipt of the Engineer's notification as may be approved by the Engineer), submit to the Engineer for review full details of the proposed correction, prevention and any other measures (hereinafter referred to as the "measures") to be taken by the Contractor to rectify and close-out the matter and to prevent re-occurrence. Such measures shall be to the satisfaction of the Engineer.

7.1.8 The Contractor shall not proceed with the affected works until its measures are accepted by the Engineer.

Table No. 1: Incidents

Sl. No.	Incident		Financial deductions from the Contractor in Indian Rupees
1.	Injury and Incidence reporting	i) Fatal accidents	i) Rs.100,000 for the first fatality and Rs.200,000 for every subsequent fatality.
		ii) Injury accident	ii) Rs.50,000 for first grievously injured person and Rs.75,000 for every subsequent grievously injured person (Grievous Injury as defined by Workmen's Compensation Act)

8.0 ATTACHMENT

Attachment -1 Contents of ESHS Management Plan

1.0 General

1.1 The Contractor shall prepare an Environment, Social, Health and Safety (ESHS) Management Plan, which provides measures to protect the Environment, Health and Safety of workers and the public.

1.2 The Contractor's ESHS Management Plan shall be based on Environment, Social, Health and Safety considerations submitted with the Tender and shall have the content shown in the following section [Contents of ESHS Management Plan].

1.3 The Contractor shall submit his ESHS Management Plan for review by the Engineer within 28 days after the Commencement Date and shall amend the ESHS Management Plan to address any comments made by the Engineer and submit a Final ESHS Management Plan within 14 days of receipt of comments.

1.4 The Final ESHS Management Plan shall be binding on the Contractor for the duration of the Contract.

2.0 Content of ESHS Management Plan

2.1 The Contractor's ESHS Management Plan shall cover the following aspects:

Site ESHS Management Plan	
Contract No.	
Contractor Name	
Project Name	
1	Project Highlights i) Title of the content; ii) Contract number; iii) Brief scope of work; iv) Location map/key plan; v) Period of the project;
2	ESHS Management Policy
3	Site organization chart Chart indicating reporting of ESHS Management personnel, appointment, duties, and responsibilities
4	Roles &responsibility Individual responsibility of the i) The Contractor's representative ii) Health & Safety Expert/manager iii) Environment Expert/manger

	iv) Social expert v) Construction manager vi) ESHS Committee members vii) ESHS Engineer viii) Site Engineer ix) Bridge Engineer x) Construction Supervisors xi) Subcontractors
5	ESHS Site Committee i) Details - Chairman, secretary, members, and employer's representative ii) Procedures for effective conduct of meeting
6	ESHS Training
7	Subcontractor Evaluation, Selection, Control and ESHS Code of Conduct
8	ESHS Inspection and audit
10	Accident, Incident, Near miss, Dangerous occurrence, investigation reporting procedures
11	First Aid, Occupational Health and Emergencies measures
12	Staff and labour welfare measures
13	Hazards and Risks with Risk assessment and mitigation procedures
14	Safe Work Procedures e.g. i) Excavation ii) Structural steel erection iii) Form works iv) Concrete placement v) Work at height vi) Switch-over works vii) Floor, wall openings and stairways viii) Welding, cutting and bracing ix) Lifting appliances x) Electrical equipment xi) Mechanical equipment xii) Fire prevention xiii) Hazardous chemicals and solvent

	xiv) Lighting xv) Abrasive blasting xvi) Launching operation/girder erection.
15	Work permit system
16	List of standard job specific PPEs to be used in the site
17	Maintenance of regime for construction equipment and machinery
18	Traffic management plan
19	Housekeeping
20	i) Environmental and Social Management ii) Applicable National and State legislation and regulations iii) Specific procedures for achieving environmental and social performance requirements as given in the Employer's requirements on Environment. iv) Details on air monitoring and noise monitoring control plan which details mitigation measures / corrective action / preventive action and monitoring schedule. v) The ESHS Management Plan must contain procedures on prevention and control of water pollution, storage, handling and disposal of waste, including municipal, C&D, plastic, bio-medical, chemical and hazardous wastes, reuse/recycle of waste, selling to authorised recyclers and records thereof, preservation of landscape disturbed due to construction, housekeeping/Environmental sanitation and traffic management as required under the contract. vi) Procedures for recording environmental complaints and response process. vii) Waste Management Plan viii) HIV Prevention and Control Plan ix) Gender Based Violence (GBV) and sexual Exploitation and Abuse (SEA) Prevention and Response Plan x) COVID-19 Response and Management Plan xi) Labour Camp Management Plan
21	Emergency Response plan
22	Visitors and security arrangement
23	Safety and Health promotion and awareness;
24	Safety and Health equipment and Safety and Health of the Contractor's construction and office equipment;

Note: -The Environment, Social, Health and Safety (ESHS) Management Plan shall be incorporated

in the relevant sections.

Attachment -2 Workplace Policy (on HIV/AIDS Prevention & Control)

Haryana Rail Infrastructure Development Corporation Limited (HRIDC) recognizes HIV/AIDS as a developmental challenge and realizes the need to respond to it by implementing regular HIV/AIDS prevention programmes and creating a non- discriminatory work environment for HIV infected workmen engaged by Contractors. For the purpose of making conscientious, sensitive and compassionate decision in addressing the realities of HIV/AIDS, HRIDC has established these guidelines based on ILO code of practice on HIV/AIDS.

- Creating awareness through professional agency using IEC (Information, Education and Communication) package specially designed for migrant workers.
- Institutional capacity building by training the project implementation team, Environmental, Social, Health & Safety (ESHS) Managers, establishing linkages for deficient diagnosis and treatment of the affected workers, effective monitoring of implementation and documentation for further learning.
- Establishing peer educators by selecting them in consultation with Contractors and training them through professional agencies so that they become focal point for any information, education and awareness campaigns among the workmen throughout the contract period.
- Promotion of social marketing of condom

Attachment -3 Workplace Policy on COVID-19 Prevention and Control

It is likely that Corona virus Disease 2019 (COVID-19) will continue to occur in the community in the foreseeable future. It is therefore necessary to have a plan/policy in place to prevent the spread of this virus within the workplace. In order to reduce the risk of infection, Haryana Rail Infrastructure Development Corporation Limited (HRIDC) recommends to the Contractor to consider the following measures:

a) The Contractor shall ensure that the latest guidelines issued by Ministry of Health and Family Welfare (MoHFW), local government and the district administration are strictly followed at the construction works site.

b) On day 0, before resuming the work on sites post lockdown period, mandatory medical check-up will be arranged for all workers.

c) Only medically fit workers will be deployed at site and medical assistance will be arranged for unfit workers.

d) A unique photo identity card with serial number will be issued to all the workers and their family members staying at site.

e) All the essential items will be made available to them at site only. Mandatorily wear face masks while working on site or going outside.

f) No outside worker will be allowed to stay at site without following proper procedure and instructions.

g) The workers staying outside (which are always nearby) shall reach the site either by walking or by their individual mode of transport (bicycle, two-wheeler etc.).

h) During attendance, training and other sessions, social distancing guidelines will be followed along with provision of no-touch attendance.

i) All workers may be advised to take care of their own health and look out for respiratory symptoms/fever and, if feeling unwell, shall leave the workplace immediately after informing their reporting officers.

j) Workers shall not shake hands when greeting others and while working on the site.

k) Avoid large gatherings or meetings. Maintain at least 1 metre (3 feet) distance from persons, especially with those having flu-like symptoms, during interaction.

l) Workers shall clean hands frequently by washing them with soap and water for at least 40 seconds.

m) Workers shall not share their belongings like food, water bottles, utensils, mobile phones etc. with others.

n) The utensils shall be washed properly post use at designated places.

o) Post work, workers shall change their clothes before leaving the site and clothing shall not be shook out.

p) Avoid touching your eyes, nose, or mouth with unwashed hands.

Attachment -4 Reference for ESHS Activities

General Instruction: ESHS/GI/001

Topics for ESHS Orientation Trainings for Workmen for First Day at Work

1) **Hazard Identification Procedure**

Hazards on site:

- Working at Height, Electricity, lifting work, Work close to railway tracks or roads, Construction machinery and Safety of nearby located structures.

2) **Personal Protective Equipment**

- What is available?
- How to obtain it?
- Correct use and care.

3) **Health**

- Site welfare facilities;
- Potential health hazards;
- First Aid/Cardiopulmonary Resuscitation (CPR). /Automated External defibrillator (AED).

4) **Duties of the Contractor**

- Brief outline of the responsibilities of the Contractor by law;
- Details of the Contractor's ESHS Policy;
- The Employer ESHS Management Manual (if any);
- Building and other Constructions Welfare Law.

5) **Employee's Duties**

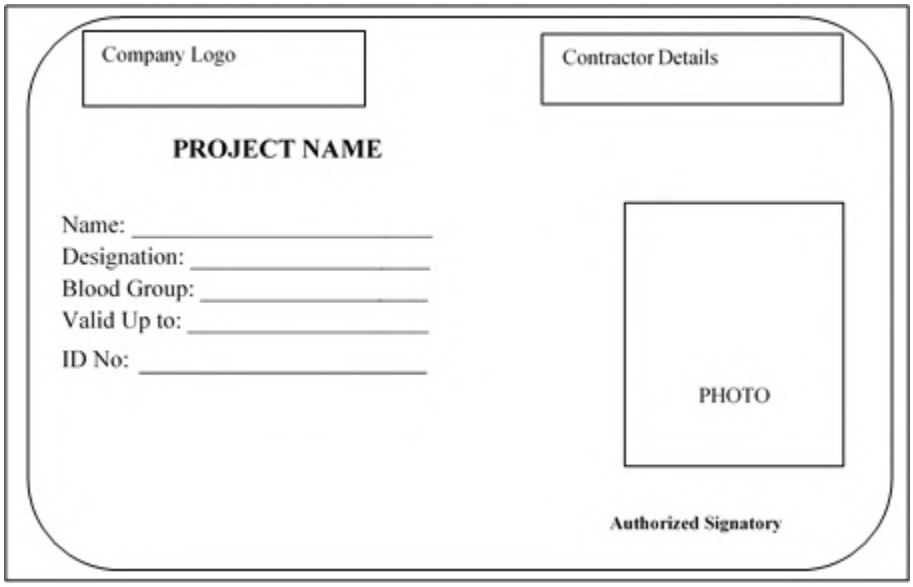
- Brief outline of responsibilities of employee under law

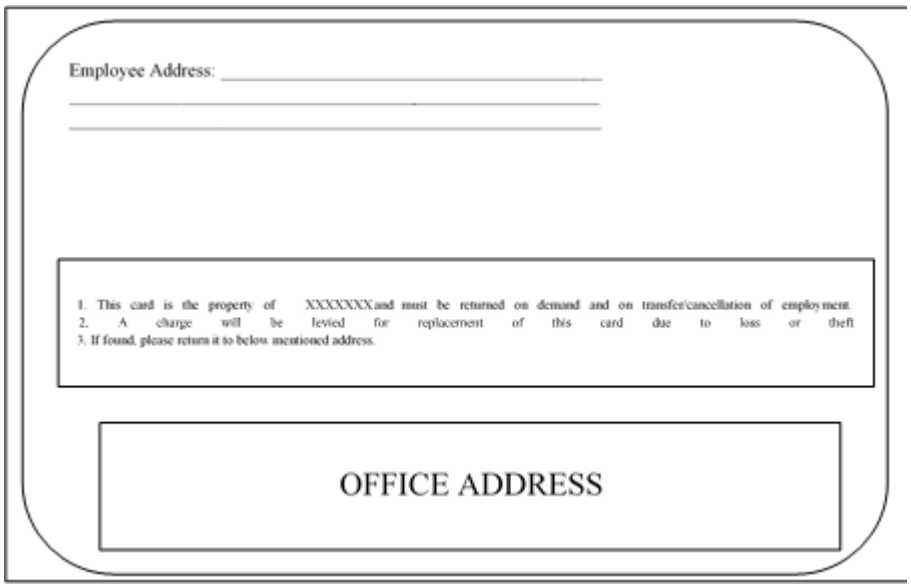
6) **Environment And Social**

- Contractor's Environment Policy
- Key legal requirements
- Avoidance of Nuisance
- Environmental Sanitation
- Dust Control Measures
- Water Pollution and Control
- Occupational noise mitigation
- Waste Management and Disposal
- Gender Based Violence and Sexual Exploitation and abuse (GBV/SEA)
- HIV/AIDS prevention
- Grievance Redressal Mechanism for GBV/SEA

General Instruction: ESHS/GI/002

ID CARD FORMAT (85 mm x 55mm) FRONT SIDE OF ID CARD:





General Instruction: ESHS/GI/003

WEEK/DAYS TO BE OBSERVED FOR CREATING ESHS AWARENESS

1st Monday to Sunday of January	Road Safety Week (Subjected to confirmation from Ministry of Road Transport, Govt. of India every year.)
16th February	Kyoto Protocol Day
March	Red Cross Month
4th March	National Safety Day
8th March	International Women's Day
22ndMarch	World Water Day
7th April	World Health Day
14th April	Fire Safety Day
18th to 22nd April	Earth Week
20th April	Earth Day
20th April	Noise Awareness Day
28th April	ILO World Day for Safety and Health at Work Day
1st to 7th May	Emergency Preparedness Week
5th June	World Environmental Day
12th June	World Day against Child Labours
21st June	World Yoga Day
9th July	Occupational Health Day
17th October	World Trauma Day
1st December	World AIDS Day

General Instruction: ESHS/GI/004

Minimum Requirements of ESHS Communication Posters/Signage/Video:

a) Every Contractor shall prepare a ESHS Communication Plan as a part of site specific ESHS Management Plan and shall include the following minimum requirement of Posters/Signage/Video as applicable. In case readymade posters are available in any of the category from National Safety Council or any other safety related organizations they may procure the same and display it. In case the same is not available, then the Contractors shall make necessary arrangements to get the posters designed and printed on their own. All posters shall each be in Hindi, English and the regional language; and

b) All the above is to be detailed in the Contractor's ESHS Management Plan and he shall obtain the Engineer's prior consent for the numbers, contents, locations, etc.

Table No.: 1 - Minimum No. of Posters

Sl. No	ESHS Poster Title	No. of Posters/Signages
1.	Daily Safety Oath	5
2. a)	Signage to display the messages like PPE ZONE,NO PPE ZONE, HARD HAT AREA etc.	5
b)	Helmet	5
c)	Shoe	5
d)	Goggles & Ear Protection	5
e)	Full Body Harness	5
f)	Hi-Vi Jacket	5
3.	Working at Heights	5
a)	Ladder, Stairway, Scaffold -Signage to display the messages like SAFE, UNSAFE, FIT FOR USE, AVOID USE etc.	5
4.	Site Electricity	5
5.	Crane Safety	5
6.	Rigging Procedures	5
7.	Excavation	5

7.	Occupational Health (Mosquito Control, HIV/AIDS awareness, DustControl, Noise Control, No Smoking/Spitting, etc.)	5
8.	First – Aid	5
9.	Labour Welfare Measures (Payment of Minimum Wages, Avoidance of Child labour, signing in the MusterRoll, in case of accidents- what to do? Etc.	5
10.	Traffic Safety (Speed limit, safe crossingand working within barricaded area etc.)	5
11.	Environmental Management	5

Note: The above minimum numbers are for guidance only. The actual number, material of posters/signages will be as per project specific requirement.

Table No.: 2 – Size of Posters/Signage

Sl. No	Item	Size
1.	Posters – Standard	17"x22" –135 GSM 4 Colour Printing
2.	Posters – Special (Wherever required)	17"x22" card laminated FA Poster
3.	Posters - Mega size (Wherever required)	32"x40" Flex FA Poster
4.	First-Aid Booklet	6"x4"
5.	Safety Handbook	6"x4"
6.	Signage	Small: 12"x6" Big: 24"x12"
7.	Road Traffic Sign Boards	Strictly as per Indian Road Congress (IRC) specifications

Table No.: 3 – Safety Signage Colour (as per IS: 9457)

Sl. No	Type of signage	Colour
1	Mandatory	Blue
2	Danger	Yellow
3	Prohibitory	Red
4	Safe conditions	Green

Attachment -5 Safe Work Procedure for Work Near Railway Track

1.0 Safety precautions and measures to be observed during execution of ROB/ RUB/ Viaduct/ any other works in Railway and adjoining areas:

1.1 The Contractor(s) shall not allow any road vehicle belonging to him or his suppliers, etc. to ply in HRIDC/railway land next to the running line. If for execution of certain works viz. earthwork for parallel railway line and supply of ballast for new or existing rail line gauge conversion, etc. road vehicles are necessary to be used in railway/HRIDC land next to the railway line, the Contractor(s) shall apply to the Engineer-in-Charge for permission giving the type and number of individual vehicles, names and license particulars of the drivers, location, duration and timings for such work/movement. The Engineer-in-Charge or his authorized representative will personally counsel, examine and certify the road vehicle drivers, Contractor(s)' flagmen and supervisors and will give written permission giving names of road vehicle drivers, Contractor(s)' flagmen and supervisors to be deployed on the work, location, period and timing of the work. This permission will be subject to be following obligatory conditions:

1.2 **Construction Activities and Safety:**

a) The 'Methodology of Working' shall be incorporated in GAD and Temporary Arrangement Drawings.

b) The activities of work to be taken up during the railway traffic block/under speedrestriction, etc. should be clearly mentioned in such drawings. If at any stage of execution, any discrepancy is found in the drawing with respect to the site condition affecting safety or some new activity of work is required to be done, the same should be brought to the notice of Railway & HRIDC Engineers and such works should be done only after approval by Railways & HRIDC representative. In such cases, scheme may be modified and, if required, fresh CRS sanction shall have to be obtained.

1.2.1 The works required to be done under traffic block protection, are to be carried out only in the presence of Railway & HRIDC Engineering Officials. The Railway's and HRIDC's Supervisor has to certify safe conditions for passage of trains before resumption of traffic. The works to be done under traffic shall be carried out under the provision of banner flag and protection by Engineering Flagman.

1.2.2 Following important activities of works shall be carried out under supervision of Railway/HRIDC Engineer or his nominated Supervisor:

a) Excavation at foundation/ground level near to railway track

b) Concrete casting and/or masonry work very close to railway track

c) Erection of temporary structures near to running lines.

d) Casting of structures like girder/slab over railway track

e) Stage-prestressing of girders when placed across railway tracks properly supported

f) Launching of precast/pre-assembled girders across railway tracks

g) Any work of lifting, side shifting and slewing of girders over the railway track

h) Dismantling of temporary structures, shuttering, scaffolding, etc. adjacent to and above the railway track. For carrying out activities of casting, erection, launching, handling, and dismantling as listed above, the Contractor's Engineer shall furnish the Construction Programme in advance to HRIDC Supervising Engineer & Engineer representative. No such work should be taken up in absence of the HRIDC Supervising Engineer & Engineer representative. For the activities which are to be done in presence of the HRIDC Engineer and prior intimation shall be given in writing and acknowledgement obtained from HRIDC's representative.

1.2.3 To ensure 'Safety' during construction activities, HRIDC Site Engineer & Engineer representative may direct the Contractor's Supervisor/Engineer or their nominated representative for safe working procedures/ instructions, notwithstanding the contractual or MOU conditions prevailing between/ among Railways/other Departments like NHAI/Contractors/ Concessionaire.

1.2.4 All the records of Quality Assurance/Quality Control, testing of the materials and satisfactory completion of an activity shall be maintained at site by the Contractor's Engineer and Supervisor. On the basis of these records, HRIDC Site Engineer shall do stage-wise clearance of the works at following stages:

i) Completion of foundation

ii) Completion of substructure

iii) Completion of superstructure

Without such stage clearance, the work in next stage of construction shall not be allowed by the HRIDC Supervisor, unless proper system of check and exercise is followed at the site.

1.2.5 Normally, the high beam PSC girders are designed with wider top flange and shorter bottom flange with very high beam which makes the girder unsuitable during lowering, slewing and launching time.

1.2.6 During launching of girders and subsequent adjustments for placement of bearing, special attention and precautions are required at site to be followed rigorously without resorting to shortcut practice or leaving the work at site to untrained or inexperienced Engineers. Normally, end diaphragms are not cast for the extreme both side girders. These shall be cast minimum 300mm on both sides for all 'I' beam girders to provide temporary supports for ensuring stability.

"OR"

For side adjustments and bearing placements below 'I' section girders, end brackets made of steel angles should be provided for all 'I' beams sequentially to avoid side titling of individual girders. End brackets shall be removed only after placing girders on bearing and casting of diaphragms.

1.2.7 During lowering, the jacks shall be operated duly keeping wooden packing of various thicknesses fixing the amount of lowering to the barest minimum, so that even if the jack fails, the wooden packing will take load and further stability of girder is not endangered.

1.2.8 Temporary crib support staging shall be interlaced with clamps and angles. Adequate base width shall be maintained proportionate to the height of stage, which is very essential for avoiding the oblong effect during launching of girders. During launching by RH girder method, the movement of the PSC girders shall be controlled both from front and rear with sync mechanism having simultaneous operation, so that the speed of the launching is always under the control. Spare hydraulic jacks shall always be kept at site. Lowering of girder shall always be carried out at one end only. Further, other end should be adequately secured by wire ropes, end brackets, etc. Thereafter, the process shall be continued alternately.

1.2.9 As far as possible, launching of girders by temporary staging shall be avoided and launching by heavy capacity cranes, wherever feasible, shall be adopted.

1.2.10 Steel girder launcher if used for launching of PSC girders should be pre-tested for the critical loading (likely to be encountered during actual launching) before deployment on the approaches regarding its strength as well as amount of permissible deflection using actual test PSC girder as a testing load. Connections at supports shall be inspected and certified prior to actual launching. It shall be adequately secured to the base support system

on the pier cap.

1.3 General Construction Safety:

1.3.1 General safety precautions as applicable for civil works shall be adopted in field.

1.3.2 Working near running line: Safe practices at site and at all times non-infringement to moving trains shall be ensured. Road vehicles, material trolleys, dollies with any tendency to roll off towards the running lines to be checked by providing chains, locking arrangements, blocks, etc. shall be ensured and the Site-in-Charge of the Contractor shall be primarily responsible, secondary responsibility being of Contractor's Consultant.

1.3.3 Testing of cranes, lifting jacks and other equipment: All equipment like cranes, lifting jacks shall be tested, duly calibrated and certified prior to the use at construction site.

1.3.4 Routine safety checks, validity of test certificates for load bearing equipment especially for cranes outsourced from third party shall be ensured prior to deployment.

1.3.5 Construction workers at site shall be provided with personal safety gear like reflective vest, helmet, Safety shoes, gloves & eyewear approved as per construction industry standards. For persons working at pier top/girder level, temporary supports, hand railing, protection with help of ropes, slings and temporary railings shall be provided.

2.0 **Safety Guidelines and Precautions for working close to Railway tracks**

2.1 A large number of men and machinery are deployed by the contractors for track renewals, gauge conversions, doublings, bridge rebuilding etc. It is therefore essential that adequate safety measures are taken for safety of the trains as well as the work force. The following measures should invariably be adopted.

A. The contractor shall not start any work without the presence of HRIDC Engineer at site.

B. Wherever the road vehicles and/or machinery are required to work in the close vicinity of railway line, the work shall be so carried out that there is no infringement to the Railway's schedule of dimensions. For this purpose, the area where road vehicles and/or machinery are required to ply, shall be demarcated and acknowledged by the contractor. Special care shall be taken for turning/ reversal of road vehicles/machinery withoutinfringing the running track. Barricading shall be provided wherever justified and feasibleas per site conditions.

C. The look out and whistle caution orders shall be issued to the trains and speed restrictions imposed where considered necessary. Suitable flagmen/detonators shall be provided where necessary for protection of trains.

D. The supervisor/workmen should be counseled about safety measures. A competency certificate to the contractor's supervisor as per Performa annexed shall be issued by DGM/HRIDC, which will be valid only for the work for which it has been issued.

E. The unloaded ballast/rails/sleepers/other P-Way materials after unloading along track should be kept clear off moving dimensions and stacked as per the specified heights and distance from the running track.

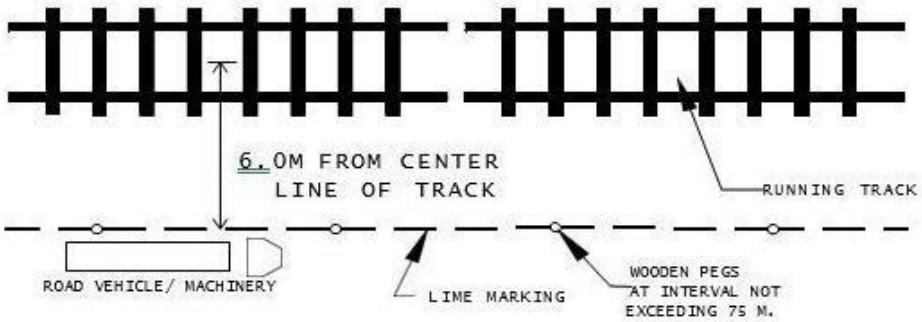
F. Supplementary site-specific instructions, wherever considered necessary shall be issued by the HRIDC's representative.

2.2 PLYING OF ROAD VEHICLES AND WORKING OF MACHINERIES CLOSE TO RUNNING TRACKS

A. Normally, the road vehicles shall be run, or machinery shall be worked so as not to come closer than 6.0m from centre line of nearest running track.

B. The land strip adjacent to running tracks, where road vehicle is to ply or machinery is to work, shall be demarcated by lime in advance in consultation with the Railway's &

HRIDC's Engineer. Wooden pegs at interval not exceeding 75mtr. shall be provided along the line marking as permanent marks. The road vehicles shall ply or machinery shall work so as not to infringe the line of demarcation.



C. If a road vehicle or machinery is to work closer to 6.0m due to site conditions or requirement of work, following precautions shall be observed:

a) In no case the road vehicle shall run or machinery shall work at distance less than 3.5m from centre line of track.

b) Demarcation of land shall be done by bright colored ribbon/nylon cord suspended on 120 cm high wooden/bamboo posts at distance of 3.5 m from centre line of nearest running track.

c) Presence of an authorized HRIDC's representative shall be ensured before plying of vehicle or working of machinery.

d) Railway's Supervisor shall issue suitable caution order to Drivers of approaching train about road vehicles plying or machineries working close to running tracks. The train drivers shall be advised to whistle freely to warn about the approaching train. Whistle boards shall be provided wherever considered necessary.

e) Lookout men shall be posted along the track at a distance of 800m from suchlocations who will carry red flag and whistles to warn the road vehicle/machinery users about the approaching trains.

f) On curves where visibility is poor, additional lookout men shall be posted.

D. If vehicle/machinery is to be worked closer to 3.5m from running track - Under unavoidable conditions, if road vehicles is to ply or machinery is to work closer to 3.5m due to site conditions or requirement of work, following precautions shall be observed:

a) Plying of vehicles or working of machinery closer to 3.5m of running track shall be done only under protection of track. Traffic block shall be imposed wherever considered necessary. The site shall be protected as per provisions of Para No. 806 & 807 of P-Way Manual as case may be.

b) Presence of a Railway's/, HRIDC's Supervisor shall be ensured at worksite.

c) Railway's& HRIDC's Supervisor shall issue suitable caution order to Drivers of approaching train about road vehicles plying or machineries working close to running tracks. The train drivers shall be advised to whistle freely to warn about the approaching train.

E. Precaution to be taken while reversing road vehicle alongside the track

The location where vehicle will take a turn shall be demarcated duly approved by Railway's/HRIDC's representative. The road vehicle driver shall always face the Railway track during the course of turning/reversing his vehicle. Presence of an authorized

Railway/HRIDC representative shall be ensured at such location.

F. Road vehicle shall not be allowed to run along the track during night hours generally. In unavoidable situations, however, vehicles shall be allowed to work during night hours only in the presence of an authorized Railway's/HRIDC's representative and whereadequate lighting arrangements are made and where adequate precautions as mentioned earlier have been ensured.

G. Road vehicles/machinery/plant etc. when stabled near running tracks shall be properly secured against any possible roll off and always be manned even during off hours.

2.3 EXECUTION OF WORKS CLOSE TO OR ON RUNNING LINES

A. Any work close to or on running tracks shall be executed under the presence of a HRIDC's Supervisor only.

B. **Precaution to be taken to ensure safety of trains while execution of work close to the running line or on running lines**.

a) Such works shall be planned and necessary drawings particularly with regard to infringement to moving dimensions shall be finalized duly approved by competent authority before execution of work. The work shall be executed only as per approved procedure and drawings.

b) All temporary arrangements required to be made during execution of work shall be made in such a manner that moving dimension do not infringe.

c) Suitable speed restriction shall be imposed, or Traffic block shall be ensured as required. *The requirement of Traffic and Power Blocks shall be submitted by the Contractor to the Engineer for approval. The Traffic and Power Blocks will be finalized in consultation with Delhi Division of Northern Railway. No cost shall be charged for Traffic and Power Blocks from the Contractor.*

d) Necessary equipment for safety of trains during emergency shall be kept ready at site.

C. Precaution to be taken to ensure safety of electrical/signal/ telephone cables while excavating near tracks.

a) Particular care shall be taken to mark the locations of buried electrical/signal/telephone cables on the plans jointly with S & T/Electric supervisor and also at site so that these are not damaged during excavation.

b) Copy of the cable plan should be given to the contractor's authorized representative before handing over the site to start the work.

c) Due care shall be taken to ensure that any part of the equipment or machinery or temporary arrangement does not come close to cables while working.

d) Joint procedure order No. 17/2013 issued by Railway Board vide letter No.2003/Tele/RCIL/1 Pt IX dated 24.06.2013 shall be followed for undertaking digging work in the vicinity of underground signaling, electrical and telecommunication cables.

D. Precaution to be taken during execution of works requiring traffic blocks.

a) Any work, which infringes the moving dimensions, shall be started only after the traffic block has been imposed.

b) Before closing the work, the track shall be left with the proper track geometry so that the trains run safely.

c) After completion of work the released sleeper and fittings should be properly stacked away from the track to be kept clear of moving dimensions.

d) Block shall be removed only when all the temporary arrangement, machineries, tools, plants etc. have been kept clear of moving dimensions.

E. Precaution to be taken during execution of works during night:

The work close to running line, generally, shall be carried out only during day hours. At locations, however, where night working is unavoidable, proper lighting arrangement should be made. The engineering indicator boards shall be lighted during night hours as per the provisions of IRPWM. The staff deputed for night working should have taken adequate rest before deploying them in night shift. We can specify duration of night shift from 20.00 hrs to 04.00 hrs. All other safety precautions applicable for daytime work should be strictly observed during night working.

F. Precautions to be taken to ensure safety of workers while working close to running lines:

a) Necessary lookout men with red flags and whistles shall be provided to warn the workmen about the approaching train.

b) Railway's/HRIDC's supervisor shall issue suitable caution order to Drivers of approaching train for whistling to warn the workers about the approaching train. Whistle boards shall be provided wherever considered necessary.

c) A "First aid kit" shall always be kept ready at site

G. Precaution shall be taken for safety of public or passengers, while executing works at locations, used by passengers and public

The worksite shall be suitably demarcated to keep public and passengers away from work area. Necessary signage boards such as "Work in progress. Inconvenience is regretted" etc. shall be provided at appropriate locations to warn the public/ passengers. Adequate lighting arrangement of worksite wherever required shall be done to ensure safety of public/passengers during night.

H. Precaution to be taken before stacking materials alongside the track to ensure that safety of trains is not affected –

The following precautions shall be taken before stacking the materials along the track for stacking of ballast, rails, sleepers etc.

a) The sites for material stacking should be selected in advance in such a manner as to ensure that no part of the material to be stacked is infringing the Standard Moving Dimensions. A plan of proposed stacking locations be made and signed jointly by an authorized HRIDC's/Railway's representative and contractor's representative.

b) The selected locations shall be marked by lime in advance.

c) Presence of an authorized HRIDC's/Railway's representative while unloading and stacking shall be ensured.

d) The material shall be stacked in such a height so as to not to infringe SOD in case of accidental roll off.

I. Precaution for handling of departmental material trains –

Instructions for working of material trains are contained in Chapter VIII of IRPWM which should be brought to the notice of the supervisors and other staff working on the material trains. In addition to this,following precautions should be taken:

a) Issue of 'fit to run' certificate:

As per Para 848 before a material train is allowed to work, the complete rake should be examined by the Carriage and Wagon staff and a 'fit to run' certificate issued tothe Guard.

b) As per Para 849 of IRPWM, a qualified Engineering official should be deputed on the train to ensure working of the material train as the Guard is not qualified to carry out such duties like Supervising of loading and unloading of materials.

c) As per Para 845 of IRPWM, the material train should not be permitted to work during the period of poor visibility due to fog, storm or any other cause except with the permission of the ADEN/DEN. Working of the material trains carrying labour should not be permitted between sunset and sunrise except in an emergency.

d) While unloading rail panels by the side of the running track, placement of the panels, clear of the maximum moving dimensions should be ensured.

e) Unloading of rail panels should be done by a team of trained staff under the active supervision of competent Supervisor/Officer.

f) Before unloading of rail panels, site should be prepared by way of leveling/removing extra ballast, if any, from the crib and shoulder with the objective to ensure requisite lateral and vertical clearances so as to prevent slippage of rail panels due to vibration during the passage of trains.

g) Reasonably adequate block should be asked and provided for unloading of the material and the work should be done preferably in day light to avoid shortcut in haste which may infringe the safety requirements.

J. Safety aspects to be observed while working in OHE area

a) No electrical work close to running track shall be carried out without permission of HRIDC representative.

b) A minimum distance of 2m has to be maintained between live OHE wire and body part of worker or tools or metallic supports etc.

c) No electric connection etc. can be tapped from OHE.

d) Authorized OHE staff should invariably be present when the relaying work or any major work is carried out.

e) Power block is correctly taken and 'permit to work' is issued.

f) The structure bonds, track bonds, cross bonds, longitudinal rail bonds are not disturbed and if disconnected for the work, they are reconnected properly when the work is completed.

g) The track level is not raised beyond the permissible limit during the work

2.4 PROTECTION OF TRACK DURING EMERGENCY

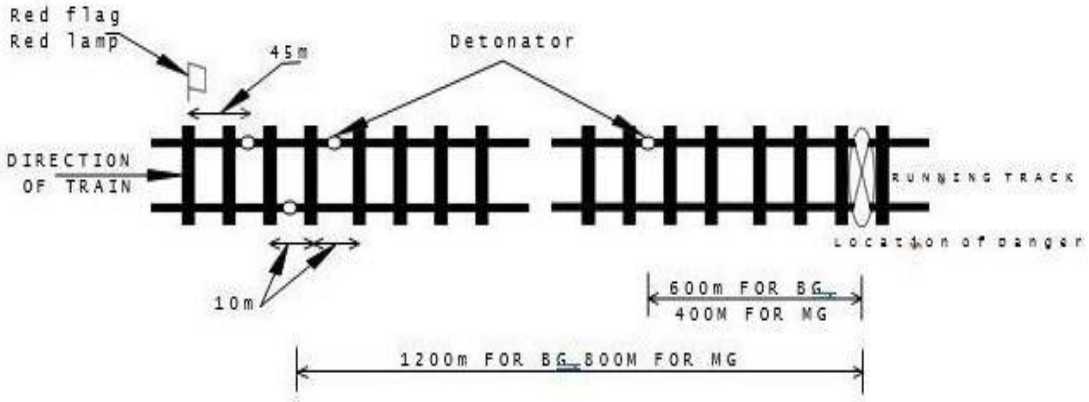
A. Action to be taken when a contractor's supervisor or vehicle operator apprehends any unusual circumstances likely to infringe the track and endanger safe running of trains.

a) At any time if a contractor's supervisor or vehicle operator observes any unusual circumstances likely to infringe the track and apprehend danger to safe running of track, he shall take immediate steps to advise a HRIDC official of such danger and assist him in protection of track.

b) The track shall be protected as under. One person shall immediately plant a red flag (red lamp during night) at the spot and proceed with all haste in the direction of approaching train with a red flag in hand (red lamp during night) and plant a detonator on rail at a distance of 600m from the place of obstruction of BG track (400m for MG track) after which he shall further proceed for not less than 1200m from the place of obstruction from BG track (800m for MG track) and plant three detonators at 10m apart on rails. After this he shall display the red flag (red lamp during night) at a distance of

45m from the detonators.

c) Attempts shall also be made to send an advice to nearest Railway/HRIDC station about the incident immediately.



B. Action to be taken if train is seen approaching to site of danger and there is no time to protect the track as per guidelines mentioned above.

In such a case the detonators shall be planted on rails immediately at distance away from place of danger as far as possible and attention of driver of approaching train shall be invited by whistling, waving the red flag vigorously, gesticulating and shouting.

C. What action shall be taken if more than one track is obstructed.

a) In case of single line protection as above shall be done in both the directions from place of danger.

b) In case of double line or multiple lines, if other tracks are also obstructed, theprotection as above shall be done for other track also.

c) The protection shall be done in that direction and on that track first on which train is likely to arrive first.

d) The Contractor's Supervisors, Operators and lookout men shall be properly explained about the direction of trains on running tracks.

D. Equipment required for protection of track.

Minimum compliment of protection equipment i.e. 10 detonators, 4 red hand flags, 4 red hand lamps, 4 banner flags and whistles etc. shall always be kept ready at worksites for use in case of emergency. HRIDC will arrange to provide detonators, whereas Contractor shall arrange other equipment at his own cost.

E. Arrangement of lookout men and competency required for lookout man to warn labour about approaching train.

a) Contractor will provide lookout men.

b) The lookout men shall be properly trained in warning to staff at worksite about approaching train.

c) Only those lookout men shall be provided at site who have been issued with a competency certificate by the Railway's/HRIDC's Supervisor.

d) In case, it is felt necessary to provide lookout men by Contractor, the charges for the same as fixed by HRIDC Administration shall be recovered from Contractor.

2.5 Training to Supervisors and Operators of Contractor

The Supervisors and Operators of the contractor proposed to be deployed at wok site, which is close to the running track, shall be imparted mandatory training by the HRIDC at site free of cost about the safety measures to be adopted while working in the vicinity of running track. HRIDC's Engineer-in charge of the work shall decide the scale, extent & adequacy of training. In case training is imparted at a recognized Railway training institute, the charges for the same, as decided by HRIDC, shall be recovered from the Contractor. A competency certificate to this effect to the individual Supervisor/Operator shall be issued as given below,by a HRIDC Officer not below the rank of DGM/HRIDC. No Supervisor/Operator of the Contractor shall work or allowed to work in the vicinity of running track that is not in possession of valid competency certificate.

All the labour, materials, tools, plants etc. except detonators, required for ensuring safe running of trains shall be provided by Contractor at his own cost. Wherever lookout men are provided by HRIDC, charges at the rate of Rs. 1000/- per man day shall be recovered from Contractor.

A sample of training competency certificate is provided below for reference:

Competency Certificate

Certified that Shri …… Supervisor/Operator of M/s. ……has been trained and examined in safety measures to be followed while working in the vicinity of running railway track for the work. His knowledge has been found satisfactory and he is capable of supervising the work safely.

This certificate is valid only for the work mentioned in this certificate only.

Signature and designation of the officer

Final Tender Document for Works

(Two-Envelope Tendering Process Without Prequalification)

Procurement of:

Contract Package C-5: Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for:

(i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942;

(ii) Design & Construction of viaduct from km 20.942 to km 24.844;

(iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and

(iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844.

Summary

Specific Procurement Notice (SPN)

PART 1 – TENDERING PROCEDURES

PART 2 – EMPLOYER'S REQUIREMENTS

PART 3 – CONDITIONS OF CONTRACT AND CONTRACT FORMS

PART 3 – Conditions of Contract and Contract Forms

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Section VIII - General Conditions of Contract (GCC)

The General Conditions of Contract governing this Contract shall be the "Conditions of Contract for Plant & Design Build, ("Yellow book, Second Edition 2017", published by the Federation Internationale Des Ingenieurs – Conseils (FIDIC).

An original copy of the above FIDIC publication i.e. "*Conditions of Contract for Plant & Design Build* ", ("Yellow book , Second Edition 2017", (must be obtained from the following address of FIDIC:

International Federation of Consulting Engineers (FIDIC)
FIDIC Bookshop – Box- 311 – CH – 1215 Geneva 15 Switzerland
Fax: +41 22 799 49 054
Telephone: +41 22 799 49 01
E-mail: fidic@fidic.org
www.fidic.org
FIDIC code: ISBN13: 978-2-88432-084-9

Section IX - Particular Conditions of Contract (PCC)

The following Particular Conditions of Contract (PCC) shall supplement the GCC. Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

The PCC consists of three parts:

- Part A – Contract Data
- Part B – Specific Provisions
- Part C – Prohibited Practices

The references to Clauses and Sub-clauses provided in the PCC given below are applicable to the General Conditions of Contract i.e. "Conditions of Contract for Plant & Design Build, ("Yellow Book"), Second Edition 2017" published by the Federation Internationale Des Ingenieurs – Conseils (FIDIC).

Particular Conditions of Contract (PCC)

Part A - Contract Data

S. No.	Conditions	GCC Sub-Clause	Data
1.	Defects Notification Period	1.1.27	(i) 365 days calculated from the date of issue of Taking-Over Certificate for the Works or for part of the Works other than BLT work (ii) 1095 days calculated from the date of issue of Taking-Over Certificate for BLT works
2.	Employer's name and address	1.1.30	Haryana Orbital Rail Corporation Limited (HORCL), Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram, Haryana-122003 E-mail: shivomd_irse@yahoo.com
3.	Engineer's name and address	1.1.35	RITES Limited in Consortium with SMEC International Pty Ltd, 4th Floor, Plot No.144, RITES Limited, Sector-44, Gurugram, Haryana-122003
4.	Sections	1.1.76	Nil
5.	Time for Completion	1.1.86	1095 days
6.	Bank's name	1.1.91	Asian Infrastructure Investment Bank (AIIB)
7.	Borrower/Recipient's name	1.1.92	Haryana Orbital Rail Corporation Limited (HORCL) through Government of Haryana
8.	Electronic transmission system	1.3 (a) (ii)	By e-mail
9.	Address of Employer for communications:	1.3(d)	Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram, Haryana-122003 E-mail:neerajbhandari1974@gmail.com
10.	Address of Engineer for communications:	1.3(d)	4th Floor, Plot No.144, RITES Limited, 'SRIJAN' Sector-44, Gurugram, Haryana-122003
11.	Address of Contractor for communications:	1.3(d)	To be filled in at the time of preparation of Contract Agreement
12.	Governing Law	1.4	The laws of Republic of India
13.	Ruling language	1.4	English

S. No.	Conditions	GCC Sub-Clause	Data
14.	Language for communications	1.4	English
15.	Time for the Parties to sign a Contract Agreement	1.6	35 days after issue of the Letter of Acceptance
16.	Number of additional paper copies of Contractor's Documents	1.8	NIL
17.	Total liability of the Contractor to the Employer under or in connection with the Contract	1.15	Equal to the Accepted Contract Amount
18.	Time for access to the Site	2.1	**Land for Formation** i. Land for formation for about 80% of the length of C-5 Package (main line and connectivities) will be handed over within 7 days after the Commencement Date. ii. In the balance 20% of the length of C-5 package shall be handed over in a phased manner within 240 days of the Commencement Date. iii. In case, the Employer is not able to hand over the complete land at a few isolated locations due to any reasons within *240* days of the Commencement Date and such isolated patches do not affect the progress of work at other locations, no claims shall be accepted by the Employer for delay in handing over of such isolated patches of land. The Contractor shall plan his works taking this aspect into consideration. Notwithstanding the above, where the Contractor considers that the works are likely to be affected due to non-handover of the land at certain locations (being on the critical path), any claim for additional time and cost by the Contractor shall be supported

S. No.	Conditions	GCC Sub-Clause	Data
			by justifications/ calculations with respect to the latest work program, and other schedules which shall be dealt with in accordance with GCC 2.1, 20.1, 3.7 and other applicable provisions of the Contract.
19.	Employer's Financial Arrangements	2.4	A loan from AIIB Bank and counterpart funds through equity partners.
20.	Performance Security	4.2	The Performance Security will be in the form of a "demand guarantee" in the amount(s) of **5%** of the Accepted Contract Amount and in the same currency (ies) of the Accepted Contract Amount. Demand guarantee for the Performance Security shall be in the form as specified in Sub-Clause 4.2, Part B-Specific Provisions, PCC.
21.	Maximum allowable accumulated value of work subcontracted (as a percentage of the Accepted Contract Amount)	4.4(a)	30%
22.	Parts of the Works for which subcontracting is not permitted	4.4(b)	NIL
23.	Period for notification of errors in the items of reference	4.7.2 (a)	28 Days
24.	Number of additional paper copies of progress reports	4.20	One (1)
25.	Normal working hours	6.5	From 8:00 AM to 5:00 PM
26.	Number of additional paper copies of program	8.3	One (1)

S. No.	Conditions	GCC Sub-Clause	Data
27.	Delay Damages payable for each week of delay or part thereof	8.8	0.15% of the Accepted Contract Amount, less Provisional Sum in the currencies and proportions in which the Contract Price is payable for each week or part thereof which shall elapse between the Time for Completion and actual Date of Completion of the Works. Delay Damages for not achieving Key Dates shall be levied as given in Appendix 2, Section VII-9, Part 2- Employer's Requirements for each week or part thereof which shall elapse between the relevant Key Date and actual date of achieving Key Date.
28.	Maximum amount of Delay Damages	8.8	5% of the Accepted Contract Amount, less Provisional Sum.
29.	Percentage rate to be applied to Provisional Sums for overhead charges and profit	13.4(b)(ii)	5%

S. No.	Conditions	GCC Sub-Clause	Data
31.	Total advance payment	14.2	05% of the Accepted Contract Amount less Provisional Sum payable in the currencies and proportions in which the Accepted Contract Amount is payable. The advance payment shall be released against Advance Bank Guarantee in two equal instalments, each of two and half percent (2.5%), of the Accepted Contract Amount less Provisional Sum. i. The first instalment shall be paid against an Advance Payment Certificate, under Sub-Clause 14.2.2. ii. Upon satisfactory utilization of first instalment, the second instalment shall be paid after the Engineer's approval of the Programme (GCC Sub-Clause 8.3), mobilization of Contractor's Representative (GCC Sub-Clause 4.3) and Key Personnel (GCC Sub-Clause 6.12) as per the Employer's Requirements. The Contractor shall submit utilization statement mentioning detailed particulars of expenses made with supporting documents to demonstrate that such amounts are utilized in a purposeful manner in relation to the Works. This shall be supported or endorsed by certified Chartered Accountant under their seal and stamp. It shall be paid against an Advance Payment Certificate, under Sub-Clause 14.2.2.
32.	Number of additional paper copies of Statements	14.3(b)	One (1)
33.	Percentage of retention	14.3 (iii)	10%
34.	Limit of Retention Money (as a percentage of Accepted Contract Amount less Provisional Sum)	14.3 (iii)	5%

S. No.	Conditions	GCC Sub-Clause	Data
35.	Plant and Materials	14.5(b)(i)	Plant and Materials for payment when shipped - NIL
		14.5(c) (i)	Plant and Materials for payment when delivered to the Site: Reinforcement Steel
36.	Minimum Amount of Interim Payment Certificates	14.6.2	NIL
37.	Period of payment of Advance Payment to the Contractor	14.7(a)	07 days
38.	Delayed Payment	14.8	The financing charges shall be calculated at an interest rate equal to "State Bank of India's (SBI) Marginal Cost of fund-based Lending Rate (MCLR)" applicable for the tenure of 01year prevailing on the due date plus three percent.
39.	Number of additional paper copies of draft Final Statement	14.11.1(b)	Two (2)
40.	Forces of nature, the risks of which are allocated to the Contractor	17.2(d)	Earthquake, Floods, rain, wind/storm
41.	Periods for submission of evidence(s) and relevant policy (ies) of insurance (s)	19.2	**Evidence(s):** Within fourteen (14) days from Commencement Date Notice. **Policy(ies):** Within twenty-eight (28) days from Commencement Date Notice.
42.	List of Exceptional Risks which shall not be excluded from the insurance cover for the Works	19.2.1 (iv)	Earthquake, Floods, Rain, wind/storm

S. No.	Conditions	GCC Sub-Clause	Data
43.	Liability for breach of professional duty	19.2.3	AOA (Any One Accident) limit equal to four percent (4%) of the total Contract value against Schedule 'A' of Price Schedule in respect of 'design and construct' with AOY (any one year) limit of 2 accidents in a year. In the Professional Indemnity Insurance Policy, the deductible amount shall not be more than five percent (5%) of the AOA limit. This PII policy shall be valid from the date of commencement of Works, until 5 years after the date of issue of Performance Certificate. Alternatively, the Contractor shall renew the insurance before the expiry of the Yearly Insurance in such a way that the entire validity period is covered. Wherever the Contractor submits policy for shorter period / annual renewable policy, the same shall be renewed before its expiry date. In such situation, the Performance Guarantee shall be retained till required validity period. The Contractor's submission of such shorter period / renewable policy shall be construed as their irrevocable consent for retention of the Performance Guarantee. The Engineer will not issue Final Payment Certificate until the Contractor has produced evidence that coverage of the professional indemnity insurance has been provided for the aforesaid period.
44.	Amount of insurance required for injury to persons and damage to property	19.2.4	INR 0.50 million for any one incident, with number of incidents unlimited
45.	Insurance required for injury to employees	19.2.5	INR 20,000,000/- (Twenty million)
46.	Time for appointment of DAAB	21.1	180 days after signature by both parties of the Contract Agreement

S. No.	Conditions	GCC Sub-Clause	Data
47.	The DAAB shall be comprised of	21.1	Three Members
48.	List of proposed members of DAAB	21.1	i) In case of Indian firm- List of arbitrators empaneled by Northern Railway is enclosed as **Annexure 1** of Section IX- Particular Conditions of Contract. ii) In case of foreign firm- DAAB members shall be appointed from the list obtained from SIAC.
49.	Appointment (if not agreed) to be made by	21.2	(i) In case of Indian firms- President of Indian Council of Arbitration, New Delhi, India (ii) In case of foreign firm- Singapore International Arbitration Centre (SIAC).
50.	Rules of arbitration	21.6	Sub-Clause 21.6 of PART B – Specific Provisions shall apply.

Particular Conditions of Contract (PCC)

Part B - Specific Provisions

Sub-Clause 1.1.9 Contract	"the Contractor's Proposal" is deleted.
Sub-Clause 1.1.27 "Defects Notification Period" or "DNP"	Add the following at the end of **Sub-Clause 1.1.27** **"Defects Notification Period" or "DNP" is synonymous with "Defects Liability Period" or "DLP"**
Sub-Clause 1.1.28 "Delay Damages"	Add the following at the end of **Sub-Clause 1.1.28** **"Delay Damages"** is synonymous with **"Liquidated Damages".**
Sub-Clause 1.1.30 Employer	The following is added at the end of this Sub-Clause: Haryana Rail Infrastructure Development Corporation Limited (HRIDC) has been nominated as the implementing agency for Haryana Orbital Rail Corridor (HORC) Project by the Employer i.e. Haryana Orbital Rail Corporation Limited.
Sub-Clause 1.1.49 Laws	The Sub-Clause is replaced with: "**Laws**" means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority."
Sub-Clause 1.1.77 Site	The Sub-Clause is replaced with: "**Site**" means the places where the Permanent Works are to be executed, including storage and working area, and to which Plant and Materials are to be delivered, and any other places specified in the Contract as forming part of the Site."
Sub-Clause 1.1.79 Statement	On the second line after "Payment Certificate under…", add "Sub-Clause14.2.1 [Advance Payment Guarantee] (if applicable),".
Sub-Clause 1.1.83 Tender	"the Contractor's Proposal" is deleted.
Sub-Clause1.1.86 Time for Completion	Replace the entire Sub-Clause 1.1.84 with the following: "**Time for Completion**" means the time for completing the Works, a Section (as the case may be) or a Key Date (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Contract Data (with any extension under Sub-Clause 8.5 [Extension of Time for Completion]), calculated from the Commencement Date

Sub-Clause 1.1.91 to 1.1.98 are added after Sub-Clause 1.1.90	
Sub-Clause 1.1.91 **Bank**	"**Bank**" means the financing institution (if any) named in the Contract Data.
Sub-Clause 1.1.92 **Borrower**	"**Borrower**" or "**Recipient**" means the person (if any) named as the borrower/recipient in the Contract Data.
Sub-Clause 1.1.93 **ESHS**	"**ESHS**" means Environmental, Social, Health and Safety.
Sub-Clause 1.1.94 **Sexual Exploitation and Assault (SEA)**	"Sexual Exploitation and Assault" "(SEA)" stands for the following: Sexual exploitation is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another. In Bank financed operations/projects, sexual exploitation occurs when access to or benefit from a Bank financed Goods, Works, Non-consulting Services or Consulting Services is used to extract sexual gain. Sexual assault is defined as sexual activity with another person who does not consent. It is a violation of bodily integrity and sexual autonomy and is broader than narrower conceptions of "rape", especially because (a) it may be committed by other means than force or violence, and (b) it does not necessarily entail penetration.
Sub-Clause 1.1.95 **Milestone Certificate**	"Milestone Certificate" means the certificate issued by the Engineer under Sub-Clause 4.26 [Milestone].
Sub-Clause 1.1.96 **Milestone**	"Milestone" means stage of completion of works in a given Cost Centre based on which payment will be made to the Contractor.
Sub-Clause 1.1.97 **Key Date**	"Key Date" means the time for completion for a part of the Plant and/or a part of the Works as described in detail in the Appendix 2 of Part 2 of the Employer's Requirements.
Sub-Clause 1.1.98 **Principal Employer**	Principal Employer means 'Haryana Orbital Rail Corporation Limited".
Sub-Clause 1.2 **Interpretation**	Sub-paragraph (a) is replaced with the following: (a) "Words indicating one gender include all genders;

	"he/she" is replaced with "it"; "him/her" is replaced with "it"; "his" and "his/her" are replaced with "its"; "himself/herself" are replaced with "itself"." Further, "and" is deleted from the end of sub-paragraph (i) and added at the end of sub-paragraph (j). sub-paragraph (k) is added: (k) "The word "tender" is synonymous with "bid" the word tenderer with "bidder" and the words "tender documents" with "bidding documents" or "request for bids documents", as applicable."
Sub-Clause 1.5 Priority of Documents	Replace subparagraphs from (a) to (k) with the following: (a) the Contract Agreement (b) the Letter of Acceptance, (c) the Addenda & Corrigenda issued before opening of the Tender, (d) the Letter of Tender-Financial Part, (e) the Letter of Tender-Technical Part, (f) the Particular Conditions -Part A (Contract Data), (g) the Particular Conditions -Part B (Specific Provisions), (h) the Particular Conditions Part C- Prohibited Practices (i) these General Conditions, (j) the Employers' Requirements, (k) the Schedules, (l) any other documents forming part of the Contract.
Sub-Clause 1.12 Confidentiality	The following is added at the end of the second paragraph: "The Contractor shall be permitted to disclose information required to establish its qualifications to compete for other projects." "or" at the end of (b) is deleted. "or" at the end of (c) is added. The following is then added as (d): "is being provided to the Bank ."

Sub-Clauses 1.17 and 1.18 are added after Sub-Clause 1.16	
Sub-Clause 1.17 Inspections & Audit by the Bank	"The Contractor shall permit and shall cause its agents (whether declared or not), subcontractors, subconsultants, service providers, suppliers, and their personnel, to permit the Bank and/or persons appointed by the Bank to inspect the site and/or the accounts, records and other documents relating to the procurement process, tender submission, proposal submission, and contract execution, and to have such accounts, records and other documents audited by auditors appointed by the Bank."
Sub-Clause 1.18 **Change in Control**	The Contractor or its constituents shall inform the Employer about any change in "Control" during the execution of the Contract.
Sub-Clause 2.4 Employer's Financial Arrangements	The first paragraph is replaced with: "The Employer shall submit, before the Commencement Date, reasonable evidence that financial arrangements have been made for financing the Employer's obligations under the Contract." The following sub-paragraph is added at the end of Sub-Clause 2.4: "In addition, if the Bank has notified to the Recipient that the Bank has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, the Employer shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the Engineer, within 7 days of the Recipient having received the suspension notification from the Bank. If alternative funds will be available in appropriate currencies to the Employer to continue making payments to the Contractor beyond a date 60 days after the date of Bank notification of the suspension, the Employer shall provide reasonable evidence in its notice of the extent to which such funds will be available."
Sub-Clause 3.1 The Engineer	The following is added at the end of the first sub-paragraph: "The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties."
Sub-Clause 3.2 Engineer's Duties and Authority	The third paragraph of Sub-Clause 3.2 is replaced with: The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. However, the Engineer shall obtain the consent in

	writing of the Employer before taking action under the following Sub-Clauses of these Conditions: (a) Sub-Clause 4.12 [Unforeseeable Physical Conditions]: agreeing or determining an extension of time and/or additional cost. (b) Sub-Clause 8.5 [Extension of Time for Completion]: agreeing or determining extension of time. (c) Sub-Clause 11.9 [Performance Certificate]: issue of Performance Certificate. (d) Clause 20.1: [Claims]: agreeing or determining extension of time and/or additional payment. Notwithstanding anything to the contrary contained in this Sub-Clause 3.2, as set out above, if in the opinion of the Engineer, an emergency occurs which adversely affects safety of, (a) life, (b) Works, or (c) any adjoining property, the Engineer may, without obtaining prior approval of the Employer and without relieving the Contractor of any of its duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the aforesaid risk(s). The Contractor shall forthwith comply with such directions of the Engineer despite the absence of Employer's specific approval in this regard. The Engineer shall determine an addition to the Contract Price, in respect of such instruction(s), in accordance with Clause 13 [Variations and Adjustments], and shall notify the Contractor accordingly, with a copy to the Employer. However, in case the concerned emergency as specified in the above para occurs on account of any failure by the Contractor to comply with the terms and conditions of the Contract, including but not limited to, (a) not adhering to the approved scheme of work (b) not taking adequate safety precautions, or (c) by any other reason attributable to the Contractor, no additional amounts shall be paid to the Contractor for attending to such emergencies and the Contractor shall be liable for Employer's claims in this regard".

Sub-Clause 3.3 Engineer's Representative	The following is added at the end of Sub-Clause 3.3: "The Engineer shall obtain the consent of the Employer before appointing or replacing an Engineer's Representative."
Sub-Clause 3.4 Delegation by the Engineer	The following is added at the end of the second paragraph: "If any assistants are not fluent in this language, the Engineer shall make competent interpreters available during all working hours, in a number sufficient for those assistants to properly perform their assigned duties and/or exercise their delegated authority."
Sub-Clause 3.6 Replacement of the Engineer	In the first paragraph, "42 days" is replaced with "21 days"; In the third para, "shall" is replaced with "should".
Sub-Clause 4.1 **Contractor's General Obligations**	The following is inserted after the second paragraph "The Contractor shall provide the Plant (and spare parts, if any)…": "All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country as defined by the Bank." The following is inserted after the fifth paragraph "The Contractor shall, whenever required by the Engineer...": The Contractor shall not carry out mobilization to Site (e.g. limited clearance for haul roads, site accesses and work site establishment, geotechnical investigations or investigations to select ancillary features such as quarries and borrow pits) unless the Engineer gives consent, a consent that shall not be unreasonably delayed, that appropriate measures are in place to address environmental and social risks and impacts, which at a minimum shall include applying the Management Strategies and Implementation Plans (MSIPs) and Code of Conduct for Contractor's Personnel as part of the Contract. The Contractor shall submit, to the Engineer for Review any additional MSIPs as are necessary to manage the ESHS risks and impacts of ongoing Works (e.g. excavation, earth works, bridge and structure works, stream and road diversions, quarrying or extraction of materials, concrete batching and

	asphalt manufacture). These MSIPs shall be included in the Contractor's Environmental and Social Management Plan (C-ESMP). The Contractor shall review the C-ESMP, periodically (but not less than every six (6) months), and update it as required to ensure that it contains measures appropriate to the Works. The updated C-ESMP shall be submitted to the Engineer for Review. The C-ESMP shall be part of the Contractor's Documents. The procedures for Review of the C-ESMP and its updates shall be as described in Sub-Clause 5.2 .1 *[Preparation by Contractor]* and Sub-Clause 5.2.2 *[Review by Engineer]*. If so stated in the Employer's Requirements, the Contractor shall: (i) design structural elements of the Works taking into account climate change considerations; and (ii) apply the concept of universal access (the concept of universal access means unimpeded access for people of all ages and abilities in different situations and under various circumstances. "The Contractor shall provide relevant contract- related information, as the Employer and/or Engineer may reasonably request to conduct Stakeholder engagements. "Stakeholder" refers to individuals or groups who: (i) are affected or likely to be affected by the Contract; and (ii) may have an interest in the Contract. The Contractor may also directly participate in Stakeholder engagements, as the Employer and/or Engineer may reasonably request." "The Contractor shall require that it's subcontractors execute the Works in accordance with the Contract, including complying with the relevant ESHS requirements."
Sub-Clause 4.2 Performance Security	**Replace Sub-Clause 4.2.1 with the following:** The Contractor shall, within 28 days of the date of receiving the Letter of Acceptance, provide to the Employer, the Performance Security in a sum equal to the amount specified in the Contract Data, for the due observance and performance by the Contractor of the Contract. In the event

	the Contractor fails to provide the Performance Security within 28 days from the date of issue of the LOA, it may seek an extension of time for providing the performance security for a period not exceeding a further 14 days on payment of damages for such extended period in a sum calculated at the rate of 0.005% of the Accepted Contract Amount for each day until the Performance Security is provided. The Contractor shall maintain the said Performance Security at its own expense, so that it shall remain in full force and effect until the issue of Performance Certificate. Whenever Variations and/or adjustments under Clause 13 [Variations and Adjustments] result in an accumulative increase or decrease of the Contract Price by more than twenty percent (20%) of the Accepted Contract Amount: (a) in the case of such an increase, at the Employer's request the Contractor shall promptly increase the amount of the Performance Security in that currency by a percentage equal to the accumulative increase. If the Contractor incurs Cost as a result of this Employer's request, Sub-Clause 13.3.1 [*Variation by Instruction*] shall apply as if the increase had been instructed by the Engineer; or (b) in the case of such a decrease, subject to the Employer's prior consent the Contractor may decrease the amount of the Performance Security in that currency by a percentage equal to the accumulative decrease. The cost of obtaining the Performance Security shall be at the expense of the Contractor. The Contractor shall submit the Performance Security in any of the following forms: (a) Unconditional and irrevocable Bank Guarantee from the specified banks in the form appearing in Section X [Contract Forms] as under: (i) a scheduled bank (excluding co-operative banks) in India, or (ii) a Foreign Bank having arrangement with a nationalized bank or scheduled banks (excluding co-operative banks) in India;

	(b) Banker's Cheque or Demand Draft drawn on a scheduled bank (excluding co-operative banks) or nationalized bank in India. The scheduled bank issuing the bank guarantee shall be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the bank guarantee shall invariably be sent by the issuing bank to Employer's Bank through SFMS and only of the same by the Employer's Bank, the bank guarantee shall become operative and acceptable to the Employer. Further, the bank guarantees in original form along with a copy of "MT760COV (in case of bank guarantee message)/ MT767COV (in case of bank guarantee amendment message) Report" sent by the concerned issuing bank sealed in an envelope shall be submitted to the Employer. The Issuing Bank shall send the SFMS to: Beneficiary: Haryana Orbital Rail Corporation Limited. Bank Name: IFSC Code: Note: All the instruments mentioned in (a) & (b) above should be in favour of Haryana Orbital Rail Corporation Limited., Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram. The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied defects, if any. If, (a) the Contractor does not complete the Works for any reasons whatsoever, and (b) the Contractor has not become entitled to receive the Performance Certificate by 28 days prior to the expiry date of the Performance Security, the Contractor shall be bound to extend the validity of the Performance Security until the Works have been completed and the defects have been remedied. If the Performance Security is or becomes invalid or unenforceable for any reason whatsoever, or if such security is withdrawn or expires, the Contractor must

	immediately notify the Employer and obtain within 3 days a replacement guarantee in the form appearing in Section X [Contract Forms] and which is acceptable to the Employer in its absolute discretion. The provision, maintenance and renewal by the Contractor of the Performance Security in accordance with this Sub-Clause 4.2 [Performance Security] shall be a condition precedent to any payment by the Employer to the Contractor under the Contract. If the Contractor fails to provide, maintain and renew the Performance Security in accordance with the Contract, the Employer shall, without prejudice to any other rights and remedies to which it may be entitled, shall have the right to invoke the Performance Security for the value equal to the damages to the Employer as a result of the Contractor's failure and/or by written notice terminate the Contract in accordance with Clause 15.
Sub-Clause 4.3 Contractor's Representative	The following is added at the end of the last paragraph: "If any of these persons is not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer."
Sub-Clause 4.8 Health and Safety Obligations	The following are included after deleting "and" at the end of (f) and replacing "." with ";" at the end of (g): " (i) provide health and safety training of Contractor's Personnel as appropriate and maintain training records; (ii) actively engage the Contractor's Personnel in promoting understanding, and methods for, implementation of health and safety requirements, as well as in providing information to Contractor's Personnel, training on occupational safety and health, and provision of personal protective equipment without expense to the Contractor's Personnel; (iii) put in place workplace processes for Contractor's Personnel to report work situations that they believe are not safe or healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to their life or health. (iv) Contractor's Personnel who remove themselves from such work situations shall not be required to return to

	work until necessary remedial action to correct the situation has been taken. Contractor's Personnel shall not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal; (v) subject to Sub-Clause 4.6, where the Employer's Personnel, any other contractors employed by the Employer, and/or personnel of any legally constituted public authorities and private utility companies are employed in carrying out, on or near the site, of any work not included in the Contract, collaborate in applying the health and safety requirements, without prejudice to the responsibility of the relevant entities for the health and safety of their own personnel; and (vi) establish and implement a system for regular (not less than six-monthly) review of health and safety performance and the working environment." The second and third paragraphs are replaced with the following: "Within 21 days of the Commencement Date and before commencing any construction on the Site, the Contractor shall submit to the Engineer for Review a health and safety manual which has been specifically prepared for the Works, the Site and other places (if any) where the Contractor intends to execute the Works. The procedures for Review of the health and safety manual and its updates shall be as described in Sub-Clause 5.2.1 *[Preparation by Contractor]* and Sub-Clause 5.2.2 *[Review by Engineer]*. The health and safety manual shall be in addition to any other similar document required under applicable health and safety regulations and Laws. The health and safety manual shall set out all the health and safety requirements under the Contract, a) which shall include at a minimum: (i) the procedures to establish and maintain a safe working environment without risk to health at all workplaces, machinery, equipment and processes under the control of the Contractor, including control measures for chemical, physical and biological substances and agents; (ii) details of the training to be provided, records to be kept;

	(iii) the procedures for prevention, preparedness and response activities to be implemented in the case of an emergency event (i.e. an unanticipated incident, arising from both natural and man-made hazards, typically in the form of fire, explosions, leaks or spills, which may occur for a variety of different reasons including failure to implement operating procedures that are designed to prevent their occurrence, extreme weather or lack of early warning); (iv) remedies for adverse impacts such as occupational injuries, deaths, disability and disease; (v) the measures to be taken to avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases, (vi) the measures to be implemented to avoid or minimize the spread of communicable diseases (including transfer of Sexually Transmitted Diseases or Infections (STDs), such as HIV virus) and non-communicable diseases associated with the execution of the Works, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups. This includes taking measures to avoid or minimize the transmission of communicable diseases that may be associated with the influx of temporary or permanent Contract-related labour; (vii) the policies and procedures on the management and quality of accommodation and welfare facilities if such accommodation and welfare facilities are provided by the Contractor in accordance with Sub-Clause 6.6; and b) any other requirements stated in the Specification. The paragraph starting with: "In addition to the reporting requirement of…" is replaced with the following: "In addition to the reporting requirement of sub-paragraph (g) of Sub-Clause 4.20 [*Progress Reports*] the Contractor shall inform the Engineer immediately of any allegation, incident or

	accident in the Site, which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's Personnel. This includes, but is not limited to, any incident or accident causing fatality or serious injury; significant adverse effects or damage to private property; or any allegation of SEA. In case of SEA, while maintaining confidentiality as appropriate, the type of allegation (sexual exploitation, or sexual assault), gender and age of the person who experienced the alleged incident should be included in the information. The Contractor, upon becoming aware of the allegation, incident or accident, shall also immediately inform the Engineer of any such incident or accident on the Subcontractors' or suppliers' premises relating to the Works which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's, its Subcontractors' and suppliers' personnel. The notification shall provide sufficient detail regarding such incidents or accidents. The Contractor shall provide full details of such incidents or accidents to the Engineer within the timeframe agreed with the Engineer. The Contractor shall require its Subcontractors and suppliers (other than Subcontractors) to immediately notify the Contractor of any incidents or accidents referred to in this Sub-clause."
Sub-Clause 4.10 **Use of Site Data**	**Add at the end of paragraph** 1 **of Sub-Clause 4.10.** "Accordingly, the Contractor shall have no claim in this regard." **In paragraph 2 of Sub-Clause 4.10.** Delete the words "To the extent which was practicable (taking account of cost and time)". **Start** the word "the" with a capital letter. Delete "To the same extent" from the fourth line and **Start** the word "the" with a capital letter. **Add following (f) after existing Sub-Clause 4.10 (e) as under:**

	"(f) damage to property adjacent to the Site and the risk of injury to the occupiers of such property due to execution of the Works." The following is added at the end of the Sub-Clause: The Geotechnical and other related data provided by the Employer are based on the investigation conducted by the Employer/Engineer and are for reference purposes only. The Contractor shall conduct further investigations if considered necessary by him at his own cost and should satisfy himself with the data furnished and make his own investigations if required for submitting his offer. Financial cost incurred due to any change in design or construction methodology later during execution on account of change in Geotechnical and other related data provided by the Employer shall be borne by the Contractor.
Sub-Clause 4.15 Access Route	The following is added at the end of Sub-Clause 4.15: "The Contractor shall take all necessary safety measures to avoid the occurrence of incidents and injuries to any third party associated with the use of Contractor's Equipment on public roads or other public infrastructure. The Contractor shall monitor road safety incidents and accidents to identify negative safety issues and establish and implement necessary measures to resolve them.
Sub-Clause 4.18 Protection of the Environment	Sub-Clause 4.18 Protection of the Environment is replaced with: "The Contractor shall take all necessary measures to: (a) protect the environment (both on and off the Site); and (b) limit damage and nuisance to people and property resulting from pollution, noise and other results of the Contractor's operations and/ or activities. The Contractor shall ensure that emissions, surface discharges, effluent and any other pollutants from the Contractor's activities shall exceed neither the values indicated in the Employer's Requirements, nor those prescribed by applicable Laws. In the event of damage to the environment, property and/or nuisance to people, on or off Site as a result of the Contractor's operations, the Contractor shall agree with the Engineer the appropriate actions and time scale to remedy, as practicable, the damaged environment to its former condition. The Contractor shall implement such remedies at its cost to the satisfaction of the Engineer.

	The Contractor shall comply with the Environmental and Social Management Plan, the Code of Conduct, and the Guidelines on Gender Based Violence as given in Appendix13 (ESHS Manual), Section VII-9: Appendices, Part 2, Employer's Requirements."
Sub-Clause 4.20 Progress Reports	Replace "4.20 (g) with: "the Environmental, Social, Health and Safety (ESHS) metrics set out in Appendix 13 (ESHS Manual), Section VII-9: Appendices, Part 2, Employer's Requirements.
Sub-Clause 4.21 Security of the Site	Sub-Clause 4.21 Security of the Site is replaced with: "The Contractor shall be responsible for the security of the Site, and: (a) for keeping unauthorized persons off the Site; (b) authorized persons shall be limited to the Contractor's Personnel, the Employer's Personnel, and to any other personnel identified as authorized personnel (including the Employer's other contractors on the Site), by a Notice from the Employer or the Engineer to the Contractor. The Contractor shall, within 21 days of the Commencement Date, submit for the Engineer's No-objection a security management plan that sets out the security arrangements for the Site. The Contractor shall (i) conduct appropriate background checks on any personnel retained to provide security; (ii) train the security personnel adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct towards Contractor's Personnel, Employer's Personnel and affected communities; and (iii) require the security personnel to act within the applicable Laws and any requirements set out in the Employer's Requirements. The Contractor shall not permit any use of force by security personnel in providing security except when used for preventive and defensive purposes in proportion to the nature and extent of the threat. In making security arrangements, the Contractor shall also comply with any additional requirements stated in the Employer's Requirements."

Sub-Clause 4.22 **Contractor's Operations on Site**	On the third line of the second paragraph before "4.17", "Sub-Clause" is added.
Sub-Clause 4.23 Archaeological and Geological Findings	The first paragraph is replaced with the following: "All fossils, coins, articles of value or antiquity, structures, groups of structures, and other remains or items of geological, archaeological, paleontological, historical, architectural or religious interest found on the Site shall be placed under the care and custody of the Employer. The Contractor shall: (a) take all reasonable precautions, including fencing-off the area or site of the finding, to avoid further disturbance and prevent Contractor's Personnel or other persons from removing or damaging any of these findings; (b) train relevant Contractor's Personnel on appropriate actions to be taken in the event of such findings; and (c) implement any other action consistent with the requirements of the Employer's Requirements and relevant Laws."
Sub-Clause 4.24 to 4.26 are added after Sub-Clause 4.23	
Sub-Clause 4.24 Suppliers (other than Subcontractors)	**4.24.1 Forced Labour** The Contractor shall take measures to require its suppliers (other than Subcontractors) not to employ or engage forced labour including trafficked persons as described in Sub-Clause 6.21. If forced labour/trafficking cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks. **4.24.2 Child labour** The Contractor shall take measures to require its suppliers (other than Subcontractors) not to employ or engage child labour as described in Sub-Clause 6.22. If child labour cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

	4.24.3 Serious Safety Issues The Contractor, including its Subcontractors (if any), shall comply with all applicable safety obligations, including as stated in Sub-Clauses 4.8, 5.1 and 6.7. The Contractor shall also take measures to require its suppliers (other than Subcontractors) to introduce procedures and mitigation measures to address safety issues related to their personnel. If serious safety issues are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks. **4.24.4 Obtaining natural resource materials in relation to supplier** The Contractor shall obtain natural resource materials from suppliers that can demonstrate, through compliance with the applicable verification and/ or certification requirements, that obtaining such materials is not contributing to the risk of significant conversion or significant degradation of natural or critical habitats such as unsustainably harvested wood products, gravel or sand extraction from river beds or beaches. **If a supplier cannot continue to demonstrate that obtaining such materials is not contributing to the risk of significant conversion or significant degradation of natural or critical habitats, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to demonstrate that they are not significantly adversely impacting the habitats.**
Sub-Clause 4.25 **Code of Conduct**	The Contractor shall have a Code of Conduct for the Contractor's Personnel. The Contractor shall ensure that each Contractor's Personnel is provided a copy of this Code of Conduct, written in a language comprehensible to that person, and shall seek to obtain that person's signature acknowledging receipt of the same. The Contractor shall also ensure that the Code of Conduct is visibly displayed in multiple locations on the Site and any other place where the Works will be carried out, as well as in areas outside the Site accessible to the local community and project affected people. The posted Code of Conduct shall be provided in languages comprehensible to Contractor's Personnel, Employer's Personnel and the local community.

Sub-Clause 4.26 **Milestone**	**Sub-Clause 4.26 Milestone** If no Milestones are specified in the Contract, this Sub-Clause shall not apply. The Contractor shall complete the works of each Milestone (including all work which is stated in the Employer's Requirements as being required for the Milestone to be considered complete). The Contractor shall apply, by notice to the Engineer, for a Milestone Certificate not earlier than 14 days before the works of a Milestone will, in the Contractor's opinion, be complete. The Engineer shall within 28 days after receiving the Contractor's notice: (a) issue the Milestone Certificate to the Contractor, stating the date on which the works of the Milestone were completed in accordance with the Contract, except for any minor outstanding work and defects (as shall be listed in the Milestone Certificate); or (b) reject the application, giving reasons and specifying the work required to be done and defects required to be remedied by the Contractor to enable the Milestone Certificate to be issued. The Contractor shall then complete the work referred to in sub-paragraph (b) of this Sub-Clause before issuing a further notice of application under this Sub-Clause.
Sub-Clause 5.1 **General Design Obligations**	**Add the following at the end of Sub-Clause 5.1** The Contractor shall furnish Contractor's Warranty in the in the form included in Section X [Contract Forms]. "All subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontract to be assigned to the Employer under subparagraph (a) of Sub-Clause 15.2.3 [After Termination]
Sub-Clause 6.1 **Engagement of Staff and Labour**	**The following paragraphs are added at the end of the Sub-Clause:** The Contractor shall provide the Contractor's Personnel information and documentation that are clear and understandable regarding their terms and conditions of employment. The information and documentation shall set out

	their rights under relevant labour Laws applicable to the Contractor's Personnel (which will include any applicable collective agreements), including their rights related to hours of work, wages, overtime, compensation and benefits, as well as those arising from any requirements in the Employer's Requirements; and shall also include the Code of Conduct for Contractor's Personnel as set forth in Sub-Clause 4.25. The Contractor's Personnel shall be informed when any material changes to their terms or conditions of employment occur. "The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from sources within the Country."
Sub-Clause 6.2 Rates of Wages and Conditions of Labour	The following paragraphs are added at the end of the Sub-Clause: "The Contractor shall inform the Contractor's Personnel about: (a) any deduction to their payment and the conditions of such deductions in accordance with the applicable Laws or as stated in the Employer's Requirements; and (b) their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of the Country for the time being in force. The Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws. Where required by applicable Laws or as stated in the Employer's Requirements, the Contractor shall provide the Contractor's Personnel written notice of termination of employment and details of severance payments in a timely manner. The Contractor shall have paid the Contractor's Personnel (either directly or where appropriate for their benefit) all due wages and entitlements including, as applicable, social security benefits and pension contributions, on or before the end of their engagement/ employment. If any amenity required to be provided under any Section of Contract Labour (Regulation and Abolition) Act of 1970 for the benefit of the contract labour employed in an establishment, is not provided by the Contractor within the time prescribed therein, such amenity shall be provided by the Principal Employer within such time as may be prescribed. All expenses incurred by the Principal Employer in providing the

	amenities will be recovered from the amount payable under the Contract. In case the Contractor fails to make payment of wages within the prescribed period or makes short payment, then the Principal Employer will make payment of wages in full or the unpaid balance due, as the case may be, to the contract labour employed by the Contractor and recover the amount so paid from the amount payable under the Contract. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of applicable Laws. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/Regulations including amendments, if any, on the part of the Contractor, the Employer shall have the right to deduct any money due to the Contractor including his amount of Performance Security. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer. For the avoidance of any doubt, the Contractor shall be responsible for payment of applicable cess and making timely filings under the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996."
Sub-Clause 6.5 Working Hours	The following paras are inserted at the end of the Sub-Clause: The Contractor shall provide the Contractor's Personnel annual holiday and sick, maternity and family leave, as required by applicable Laws or as stated in the Employer's Requirements." The Contractor, if required, shall take approval of Engineer for carrying out work during night hours or in shifts subject to compliance with applicable Laws and shall be responsible for all necessary safety arrangements with respect to the work being undertaken. However, the Contractor shall not be entitled to any claim for increase in rates or any additional cost and the same shall be deemed to be included in the Contract Price.
Sub-Clause 6.7 Health and Safety of Personnel	In the second paragraph, "The Contractor" is replaced with: "Except as otherwise stated in the Employer's Requirements, the Contractor…"

Sub-Clause 6.9 Contractor's Personnel	The Sub-Clause is replaced with: "The Contractor's Personnel (including Key Personnel, if any) shall be appropriately qualified, skilled, experienced and competent in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative and Key Personnel (if any), who: (a) persists in any misconduct or lack of care; (b) carries out duties incompetently or negligently; (c) fails to comply with any provision of the Contract; (d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment; (e) based on reasonable evidence, is determined to have engaged in Prohibited Practice during the execution of the Works; (f) has been recruited from the Employer's Personnel in breach of Sub-Clause 6.3 [Recruitment of Persons]; (g) undertakes behaviour which breaches the Code of Conduct for Contractor's Personnel (ESHS). If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement with equivalent skills and experience. In the case of replacement of the Contractor's Representative, Sub-Clause 4.3 [*Contractor's Representative*] shall apply. In the case of replacement of Key Personnel (if any), Sub-Clause 6.12 [*Key Personnel*] shall apply Subject to the requirements in Sub-Clause 4.3 [*Contractor's Representative*] and 6.12 [*Key Personnel*], and notwithstanding any requirement from the Engineer to remove or cause to remove any person, the Contractor shall take immediate action as appropriate in response to any violation of (a) through (g) above. Such immediate action shall include removing (or causing to be removed) from the Site or other places where the Works are being carried out, any Contractor's Personnel who engages in (a), (b), (c), (d), (e) or (g) above or has been recruited as stated in (f) above."
Sub-Clause 6.12 Key Personnel	The following is inserted at the end of the last paragraph: "If any of the Key Personnel are not fluent in this language, the Contractor shall make competent interpreters available during

	all working hours in a number deemed sufficient by the Engineer."
The following Sub-Clauses 6.13 to 6.27 are added after sub-clause 6.12	
Sub-Clause 6.13 Foreign Personnel	The Contractor may bring into the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel. The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.
Sub-Clause 6.14 Supply of Foodstuffs	The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Employer's Requirements at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.
Sub-Clause 6.15 Supply of Water	The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.
Sub-Clause 6.16 Measures against Insect and Pest Nuisance	The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.
Sub-Clause 6.17 Alcoholic Liquor or Drugs	The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereto by Contractor's Personnel.
Sub-Clause 6.18 Arms and Ammunition	The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

Sub-Clause 6.19 Festivals and Religious Customs	The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.
Sub-Clause 6.20 Funeral Arrangements	The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of its local employees who may die while engaged upon the Works.
Sub-Clause 6.21 Forced Labour	The Contractor, including its Subcontractors, shall not employ or engage forced labour. Forced labour consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements. No persons shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harbouring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.
Sub-Clause 6.22 Child Labour	The Contractor, including its Subcontractors, shall not employ or engage a child (as defined in Child Labour (Prohibition & Regulation) Act, 1986). The Contractor, including its Subcontractors, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. The Contractor including its Subcontractors, shall only employ or engage children between the minimum age and the age of 18 after an appropriate risk assessment has been conducted by the Contractor with the Engineer's consent. The Contractor shall be subject to regular monitoring by the Engineer that includes monitoring of health, working conditions and hours of work. Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work:

	(a) with exposure to physical, psychological or sexual abuse; (b) underground, underwater, working at heights or in confined spaces; (c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads; (d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise or vibration damaging to health; or under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer.
Sub-Clause 6.23 Employment Records of Workers	The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked, and wages paid to all workers. These records shall be summarised on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].
Sub-Clause 6.24 Workers' Organisations	In countries where the relevant labour laws recognise workers' rights to form and to join workers' organisations of their choosing and to bargain collectively without interference, the Contractor shall comply with such laws. In such circumstances, the role of legally established workers' organizations and legitimate workers' representatives will be respected, and they will be provided with information needed for meaningful negotiation in a timely manner. Where the relevant labour laws substantially restrict workers' organisations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. The Contractor shall not seek to influence or control these alternative means. The Contractor shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organisations and collective bargaining or alternative mechanisms. Workers' organisations are expected to fairly represent the workers in the workforce.
Sub-Clause 6.25 Non-Discrimination and Equal Opportunity	The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to

	any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure non-discrimination and equal opportunity, including for specific groups such as women, people with disabilities, migrant workers and children (of working age in accordance with Sub-Clause 6.22). The Contractor shall give preference to local people including Project Affected Persons (PAPs) for employment opportunity during construction and enhance female work force participation.
Sub-Clause 6.26 Contractor's Personnel Grievance Mechanism	The Contractor shall have a grievance mechanism for Contractor's Personnel, and where relevant the workers' organizations stated in Sub-Clause 6.24, to raise workplace concerns. The grievance mechanism shall be proportionate to the nature, scale, risks and impacts of the Contract. The mechanism shall address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned in a language they understand, without any retribution, and shall operate in an independent and objective manner. The Contractor's Personnel shall be informed of the grievance mechanism at the time of engagement for the Contract, and the measures put in place to protect them against any reprisal for its use. Measures will be put in place to make the grievance mechanism easily accessible to all Contractor's Personnel. The grievance mechanism shall not impede access to other judicial or administrative remedies that might be available, or substitute for grievance mechanisms provided through collective agreements. The grievance mechanism may utilize existing grievance mechanisms, providing that they are properly designed and implemented, address concerns promptly, and are readily accessible to such project workers. Existing grievance mechanisms may be supplemented as needed with Contract-specific arrangements.
Sub-Clause 6.27	The Contractor shall provide appropriate training to relevant Contractor's Personnel on ESHS aspects of the Contract,

Training of Contractor's Personnel	including appropriate sensitization on prohibition of SEA, Gender Based Violence (GBV) and health & safety training referred to in Sub-Clause 4.8. As stated in the Employer's Requirements or as instructed by the Engineer, the Contractor shall also allow appropriate opportunities for the relevant Contractor's Personnel to be trained on ESHS aspects of the Contract by the Employer's Personnel. The Contractor shall provide training on SEA, GBV including its prevention, to any of its personnel who has a role to supervise other Contractor's Personnel.
Sub-Clause 7.3 Inspection	The following is added in the first paragraph after "Employer's Personnel" "(including the Bank staff or consultants acting on the Bank's behalf, stakeholders and third parties, such as independent experts, local communities, or non-governmental organizations)" The following is added as (b) (iv): "(iv) carryout environmental and social audit, and"
Sub-Clause 7.7 Ownership of Plant and Materials	The following is added before the first paragraph: "Except as otherwise provided in the Contract,"

Sub-Clause 8.1 Commencement of Work	The Sub- Clause is replaced in its entirety with the following: "The Engineer shall give a Notice to the Contractor stating the Commencement Date, not less than 07 days before the Commencement Date. The Notice shall be issued promptly after the Engineer determines the fulfilment of the following conditions: (a) signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities of the Country; (b) delivery to the Contractor of reasonable evidence of the Employer's financial arrangements (under Sub-Clause 2.4 [Employer's Financial Arrangements]); (c) except if otherwise specified in the Contract Data, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works; Subject to Sub-Clause 4.1 on the Management Strategies and Implementation Plans and the C-ESMP and Sub-Clause 4.8 on the health and safety manual, the Contractor, shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date, and shall then proceed with the Works with due expedition and without delay."
Sub-Clause 8.2 Time for Completion	The following paragraph shall be added at the end of Sub-Clause 8.2: The Contractor shall complete each Key Date (if any) within the Time for Completion for the Key Date (as the case may be), including completing all work which is stated in the Contract as being required for the Key Date to be considered to be completed for the issuance of key date completion certificate.
Sub-Clause 8.3 Programme	Replace the first sentence of the of the first paragraph of Sub-Clause 8.3 with the following: The Contractor shall submit an Initial *Works* Programme for the execution of the Works to the Engineer *as per the Key Date mentioned in Appendix 2, Section VII-9: Appendices, Part 2-Employer's Requirements.*
Sub-Clause 8.5	Replace the entire first paragraph of Sub-Clause 8.5 with the following:

Extension of Time for Completion	The Contractor shall be entitled subject to Sub-Clause 20.1 [Claims] to an extension of the Time for Completion if and to the extent that completion for the purpose of Sub-Clause 10.1 [Taking Over of the Works and Sections] or for the completion of Key Date specified in Appendix 2, Section VII-9: Appendices of Part 2 Employer's requirements is or will be delayed by any of the following causes:"
Sub-Clause 8.8 Delay Damages	**Replace the entire Sub-Clause 8.8 with the following:** If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to notice under Sub-Clause 20.1 Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be charged for every week of delay or part thereof which shall elapse between the Time for Completion and actual Date of Completion of the Works. Delay damages for not achieving Key Dates stated in Appendix 2 Section VII-9, Part 2 of the Employer's Requirements, shall be the sum stated in the Contract Data. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages stated in the Contract Data. These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination for Contractor's Default] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract. Delay Damages may be recovered by the Employer from any amount of money due from the Contractor under the Contract. The Delay Damages may also be recovered from the amount of Performance Security Bank Guarantee and in that case the Contractor would be liable to replenish the amount of Performance Security Bank Guarantee. The Delay Damages recovered corresponding to any key date will be provisional and would be refunded by the Employer on achievement of subsequent key date on time.
Sub-Clause 11.7 Right of Access after Taking Over	In the second paragraph, "Whenever the Contractor intends to access any part of the Works during the relevant DNP:" is replaced with:

	"Whenever, until the date 28 days after issue of the Performance Certificate, the Contractor intends to access any part of the Works:"
Sub-Clause 13.2 Value Engineering	Not applicable
Sub-Clause 13.3.1 Variation by Instruction	Subparagraph 13.3.1 (a) is replaced with: "a description of the varied work performed or to be performed, including details of the resources and methods adopted or to be adopted by the Contractor, and sufficient ESHS information to enable an evaluation of ESHS risks and impacts;"
Sub-Clause 13.3.1 Variation by Instruction	**Following is added to GC Clause 13.3.1** **Variation in the accepted Contract Amount & deriving rates of new items** **A.** The quantities of items shown in Price Schedule 'B', Schedule 'C' and Schedule 'D' are approximate, and are liable to vary during the actual execution of the work. Some items may have to be added or deleted. The Contractor shall be bound to carry out and complete the stipulated Work as instructed by the Engineer, irrespective of the magnitude of variations including additions or deletion in the Price Schedule. Variations in Price Schedule 'A', Price Schedule 'B', Price Schedule 'C' and Price Schedule 'D' shall be paid as follows: **(I) Price Schedule 'A'** **a)** No variation shall be paid under Schedule 'A' unless Scope of the Works under Schedule 'A' changes. **b**) For any variation in the Scope of the Works in Schedule 'A', cost of additional quantities/items shall be worked out based on the accepted rates of items provided in Schedule 'B' or based on the rates derived by the Engineer as stated in (c) below. In case, items involving variation are not covered in Schedule 'B', rates of such items shall be taken from North Western Railway Unified Standard Schedule of Rates (NWR USSOR)-2019 (for Formation, Viaduct and Bridge works) duly adjusted for escalation @5% per annum from Nov' 2019 and Delhi Schedule of Rates (DSR)-2021 Vol I & II (for items other than Formation and Bridge works) duly adjusted for escalation @ 5% per annum from Apr' 2021. In cases where items involving variation are not covered in DSR or NWR USSOR, the rates of

	such items shall be worked out based on the rates available for similar items in DSR/NWR USSOR. **c) Deriving Rates for New Items / Negotiation** In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. If no rates or prices are relevant for the determination of a new rate or price, the Engineer shall proceed to derive the rate or price based on reasonable Cost of executing the work together with overhead and profit taking into account the following: i) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation. ii) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap. iii) Cost of labour actually used at the site of Work at rates under Payment of Minimum Wages Act for the area of Work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilized at Site and other ancillary and incidental expenses on labour. iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose. v) An amount of 15% of items c) (i), (ii), (iii) and (iv) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor. vi) In all cases where extra items of Work are involved, for which there are no rates in the Accepted Contract Amount, the Contractor shall give a notice to the

	Engineer, of at least 7 days before the need for its execution arises. **(II) Price Schedule 'B' having items rates with quantities:** a) At the accepted rates of the Contract for Positive variation in quantities of items to the extent of *50%*. In case of variation in quantities on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities. For the purpose of variation for quantity of items of all types of cement given in Schedule 'B' shall be considered as on item. *b)* In case the Variation in individual items (except for items under Para c), below) as stipulated above: is more than 50% on plus side, the rate for the varied quantity beyond 50% shall be negotiated between the Engineer and the Contractor as per para (d) below before execution of the extra quantity. c) Variation in the quantity of items individually costing upto 1% of Accepted Contract Amount of Schedule 'A' Schedule 'B', Schedule 'C' and Schedule 'D', or Rs. 1 crore, whichever is less, shall be payable at the accepted rates of the Contract, till the value of such individual item on account of Variation reaches upto 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. Negotiation of rates for such items shall be conducted only for the exceeded quantity beyond 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. **d) Deriving Rates for New Items / Negotiation** In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. If no rates or prices are relevant for the determination of a new rate or price, the Engineer shall proceed to derive the rate or price based on reasonable Cost of executing the work together with overhead and profit taking into account the following: i) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.

	ii) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap. iii) Cost of labour actually used at the site of Work at rates under Payment of Minimum Wages Act for the area of Work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilized at Site and other ancillary and incidental expenses on labour. iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose. v) An amount of 15% of items d) (i), (ii), (iii) and (iv) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor. vi) In all cases where extra items of Work are involved, for which there are no rates in the Accepted Contract Amount, the Contractor shall give a notice to the Engineer, of at least 7 days before the need for its execution arises. **(III) Price Schedule 'C' having items rates with quantities:** a) At the accepted rates of the Contract for Positive variation in quantities of items to the extent of *50%*. In case of variation in quantities on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities. *b)* In case the Variation in individual items (except for items under Para c), below as stipulated above is more than 50% on plus side, the rate for the varied quantity beyond 50% shall be negotiated between the Engineer

	and the Contractor as per para (d) below before execution of the extra quantity. c) Variation in the quantity of items individually costing upto 1% of Accepted Contract Amount of Schedule 'A', Schedule 'B', Schedule 'C' and Schedule 'D' or Rs. 1 crore, whichever is less, shall be payable at the accepted rates of the Contract, till the value of such individual item on account of Variation reaches upto 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. Negotiation of rates for such items shall be conducted only for the exceeded quantity beyond 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. d) **Deriving Rates for New Items / Negotiation** In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. If no rates or prices are relevant for the determination of a new rate or price, the Engineer shall proceed to derive the rate or price based on reasonable Cost of executing the work together with overhead and profit taking into account the following: i) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation. ii) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap. iii) Cost of labour actually used at the site of Work at rates under Payment of Minimum Wages Act for the area of Work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilized at Site and other ancillary and incidental expenses on labour.

	iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose. v) An amount of 15% of items d) (i), (ii), (iii) and (iv) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor. vi) In all cases where extra items of Work are involved, for which there are no rates in the Accepted Contract Amount, the Contractor shall give a notice to the Engineer, of at least 7 days before the need for its execution arises. **(IV) Price Schedule 'D' having items rates with quantities:** a) At the accepted rates of the Contract for Positive variation in quantities of items to the extent of *50%*. In case of variation in quantities on minus side, Contract rates will be payable at the accepted rates of the Contract for the executed quantities. *b)* In case the Variation in individual items (except for items under Para c), below) as stipulated above: is more than 50% on plus side, the rate for the varied quantity beyond 50% shall be negotiated between the Engineer and the Contractor as per para (d) below before execution of the extra quantity. c) Variation in the quantity of items individually costing upto 1% of Accepted Contract Amount of Schedule 'A', Schedule 'B' Schedule 'C' and Schedule 'D') or Rs. 1 crore, whichever is less, shall be payable at the accepted rates of the Contract, till the value of such individual item on account of Variation reaches upto 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. Negotiation of rates for such items shall be conducted only for the exceeded quantity beyond 2% of the Accepted Contract Amount or Rs. 2 crore, whichever is less. d) **Deriving Rates for New Items / Negotiation** In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable

	to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Price Schedules of the Accepted Contract Amount. If no rates or prices are relevant for the determination of a new rate or price, the Engineer shall proceed to derive the rate or price based on reasonable Cost of executing the work together with overhead and profit taking into account the following: i) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation. ii) Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of Work and cost of material released as scrap. iii) Cost of labour actually used at the site of Work at rates under Payment of Minimum Wages Act for the area of Work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilized at Site and other ancillary and incidental expenses on labour. iv) Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose. v) An amount of 15% of items d) (i), (ii), (iii) and (iv) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor. vi) In all cases where extra items of Work are involved, for which there are no rates in the Accepted Contract Amount, the Contractor shall give a notice to the Engineer, of at least 7 days before the need for its execution arises.

	B. Disagreement in Rates for New Items In the event of disagreement of rates of new items/negotiations in respect of items A (I) (d), A (II) (d), A (III) (d) and A (IV) (d) above, the Engineer shall fix such rates of price as are, in his opinion appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to the Contractor. Alternatively, in the event of disagreement, the Contractor shall have no claim to execute extra quantities/new items and the Engineer shall be free to get such additional quantities beyond 50% / new items executed through any other Agency. However, if the Engineer or the Employer so directs the Contractor shall be bound to carry out any such additional quantities beyond the limits stated above original quantities and/or new items and the disagreement or the difference regarding rates to be paid for the same shall be settled in the manner laid down under the conditions for the settlement of dispute.
Sub-Clause 13.4 Provisional Sums	The following is inserted as the penultimate paragraph: "The Provisional Sum shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB. The Contractor shall submit the DAAB members' invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those Statements submitted under Sub-Clause 14.3.
Sub-Clause 13.6 Adjustments for Changes in Laws	The following paragraph is added at the end of the Sub-Clause: "Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the Table of Adjustment Data in accordance with the provisions of Sub-Clause 13.7 [Adjustments for Changes in Cost]."
Sub-Clause 13.7 Adjustments for Changes in Cost	The following paragraph is added at the end of Sub-Clause 13.7

	Price adjustment will also be applicable during the extended period of Time for Completion where such extension has been granted under Sub-Clause 8.5 [Extension of Time for Completion] or it is specifically mentioned that extension is with Price Adjustment.
Sub-Clause 14.1 **The Contract Price**	**Add the following at the end of Sub-Clause 14.1** All Goods imported by the Contractor into the Country shall be exempt from customs and other import duties as per the provision of the Notification No. 84/97 dated 11th Nov 1997, as amended from time to time **(Copy of Notification is enclosed as Annexure 2 of Section IX- Particular Conditions of Contract)**. The Employer shall endorse the necessary exemption documents prepared by the Contractor for presentation in order to clear the Goods through Customs. If an exemption is not granted, the customs duties payable and paid shall be reimbursed by the Employer on submission of documentary evidence by the Contractor. All imported Goods, which are not incorporated in or expended in connection with the Works, shall be exported on completion of the Contract. If not exported, the Goods will be assessed for duties as applicable to the Goods involved in accordance with the Laws of the Country. However, exemption may not be available for: **(a)** Goods which are similar to those locally produced, unless they are not available in sufficient quantities or are of a different standard to that which is necessary for the Works; and **(b)** any element of duty or tax inherent in the price of goods or services procured in the Country, which shall be deemed to be included in the Accepted Contract Amount. Port dues, quay dues and, except as set out above, any element of tax or duty inherent in the price of goods or services shall be deemed to be included in the Accepted Contract Amount.

Sub-Clause 14.2.1 Advance Payment Guarantee	**Replace the first para of Sub-Clause 14.2.1 with the following:** The Contractor shall obtain (at the Contractor's cost) an Advance Payment Guarantee or Security in amounts and currencies equal to the advance payment and shall submit it to the Employer with a copy to the Engineer. The Guarantee in accordance to the form attached to the Contract can be split up in four (4) Guarantees to be released on repayment. The Contractor shall submit the Advance Payment Guarantee in any of the following forms: (a) Unconditional and irrevocable Bank Guarantee from the specified banks in the form appearing in Section X [Contract Forms] as under: (i) a scheduled bank (excluding co-operative banks) in India, or (ii) a Foreign Bank having arrangement with a nationalized bank or scheduled banks (excluding co-operative banks) in India; (b) Banker's Cheque or Demand Draft drawn on a scheduled bank (excluding co-operative banks) or nationalized bank in India. The scheduled bank issuing the bank guarantee shall be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the bank guarantee shall invariably be sent by the issuing bank to Employer's Bank through SFMS at the address given below and only after receipt of the same by the Employer's Bank, the bank guarantee shall become operative and acceptable to the Employer. Further, the bank guarantees in original form along with a copy of "MT760COV (in case of bank guarantee message)/ MT767COV (in case of bank guarantee amendment message) Report" sent by the concerned issuing bank sealed in an envelope shall be submitted to the Employer. The Issuing Bank shall send the SFMS to:

	Beneficiary: Haryana Orbital Rail Corporation Limited Bank Name: Account No. IFSC Code: Note: All the instruments mentioned in (a) & (b) above should be in favour of Haryana Orbital Rail Corporation Limited, Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram. Such Advance Payment guarantee shall remain effective until the Advance Payment has been repaid pursuant to provision of this Sub-Clause 14.2, but the amount thereof shall be progressively reduced by the amount repaid by the Contractor as indicated in the Interim Payment Certificate issued in accordance with this Clause 14.
Sub-Clause 14.2.3 Repayment of Advance Payment	**Replace the Sub-Clause 14.2.3 with the following:** **a.** The recovery of Advances shall commence when 30% of the Accepted Contract Amount of the Work has been paid and it will be completed by the time, 90% of the Accepted Contract Amount has been paid or the original completion date whichever is earlier. However, minimum recovery of advances shall be at the rate of 10% (ten percent) of on-account bill. **b.** The Contractor shall always have the option to have the recoveries commenced and/or completed earlier, and/or to have recoveries affected in installments of higher amount and also to repay part or whole of the Advance by direct payment rather than through on-account Bills. However, the recovery of Advances shall be limited to 30% of on-account bill. **c.** In case the Contract is terminated due to default of the Contractor or rescinded / foreclosed, due to any other reason, the Contractor shall return the unrecovered amount of all Advances within 15 days of issue of notice of termination / rescission / foreclosure of the Contract and if the Contractor fails to do so due to any reason whatsoever, then interest at rate equal to State Bank of India's Marginal Cost of fund based Lending Rate (MCLR) applicable for the tenure of 01 year prevailing on the date of issue of notice of termination / rescission / foreclosure plus 3% Penal Interest per annum shall be charged on the unrecovered amount of

	such Advances from 16th day onwards compounded quarterly till the same is returned by the Contractor. **Interest in case of Delay in repayment of Advances** Should there be delay in the progress and completion of Work on account of Contractor, as a result of which it is not possible to recover the Advances and interest thereon, before the date of completion stipulated in the Contract, then the interest to be charged from the Contractor on the remaining portion of the Advances beyond the original completion date specified in the Contract, shall be equal to State Bank of India's Marginal Cost of fund based Lending Rate (MCLR) applicable for the tenure of 01 year prevailing on the original completion date specified in the Contract plus 3% Penal Interest per annum. **Advances to be used only for this work** The advances shall be used by the Contractor strictly for the purpose of the Contract, and for the purpose for which they are paid. Under no circumstances, shall the advances be diverted for other purposes. Any such diversion shall be construed as a breach of the Contract and the Contractor shall be asked to return the advance at once and pay interest at 15% per annum till the advance is recovered back from him. The Contractor shall return the advance and pay the interest in one go without demur. Employer retains the right for any other remedy prescribed for breach of Contract in this regard.
Sub-Clause 14.3 Application for Interim Payment	The following is inserted at the end of (vi) after: *[Agreement or Determination]*: "any reimbursement due to the Contractor under the Dispute Avoidance/ Adjudication Agreement. (Appendix General Conditions of Dispute Avoidance/ Adjudication Agreement)."
Sub-Clause 14.3 Application for Interim Payment	**Add the following at the end, below Sub paragraph '(x)'** (xi) an amount to be deducted for the payments demanded by relevant competent authorities of the Central Government and/or State Government and/or local bodies from the Employer as due payments/ liability of the Contractor as mandated by relevant laws. (xii)Stage Completion/Milestone Certificate issued by the Engineer.

Sub-Clause 14.5 (d) Plant and Materials intended for the Works	**Add new Sub-Clause 14.5 (d) at the end of Sub-Clause 14.5 (c)** The Contractor shall obtain (at the Contractor's cost) Material Payment Guarantee or Security in amounts and currencies equal to the amount to be paid against supply of material for the Works specified under payment Schedules Schedule 'A' and Schedule 'B' in Section IV Tender Forms. Material Payment Guarantee or Security shall be submitted to the Employer with a copy to the Engineer. The Guarantee in accordance to the form attached to the Contract can be split up in upto four (04) Guarantees. The Contractor shall submit the Material Payment Guarantee in any of the following forms: (a) Unconditional and irrevocable Bank Guarantee from the specified banks in the form appearing in Section X [Contract Forms] as under: (i) a scheduled bank (excluding co-operative banks) in India, or (ii) a Foreign Bank having arrangement with a nationalized bank or scheduled banks (excluding co-operative banks) in India; (b) Banker's Cheque or Demand Draft drawn on a scheduled bank (excluding co-operative banks) or nationalized bank in India. The scheduled bank issuing the bank guarantee shall be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the bank guarantee shall invariably be sent by the issuing bank to Employer's Bank through SFMS at the address given below and only after receipt of the same by the Employer's Bank, the bank guarantee shall become operative and acceptable to the Employer. Further, the bank guarantees in original form along with a copy of "MT760COV (in case of bank guarantee message)/ MT767COV (in case of bank guarantee amendment message) Report" sent by the concerned issuing bank sealed in an envelope shall be submitted to the Employer. The Issuing Bank shall send the SFMS to:

	Beneficiary: Haryana Orbital Rail Corporation Limited Bank Name: Account No. IFSC Code: Note: All the instruments mentioned in (a) & (b) above should be in favour of Haryana Orbital Rail Corporation Limited, Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram. This Bank Guarantee shall cover the Contractor's responsibility towards safe transportation, safe custody, and protection against all kinds of damage /loss /theft of materials for which payment has been made by the Employer. The cost of any such loss/damage to the materials, irrespective of the reason thereof, shall be recoverable from the said Bank Guarantee furnished by the Contractor. The Bank guarantees shall remain effective until the materials are installed satisfactorily and the spare materials have been returned by the Contractor. The Bank Guarantee amount can be progressively reduced for the amount of material certified to be installed satisfactorily at site by the Engineer.
Sub-Clause 14.6.1 The IPC	**Replace the Sub-Clause 14.6.1 with the following:** The Engineer shall, within 03 business days after receiving a Statement and supporting documents from the Contractor, issue an IPC to the Employer, with a copy to the Contractor: (a) stating the amount which the Engineer fairly considers to be due; and (b) including any additions and/or deductions which have become due under Sub-Clause 3.7 [Agreement or Determination] or under the Contract or otherwise, with detailed supporting particulars (which shall identify any difference between a certified amount and the corresponding amount in the Statement and give the reasons for such difference).
Sub-Clause 14.6.2 Withholding (amounts in) an IPC	"and/or" from subparagraph (b) is deleted. The following is then added as subparagraph (c) and sub-paragraph (c) of the Sub-Clause is renumbered as (d):

	"(c) if the Contractor was, or is, failing to perform any ESHS obligations or work under the Contract, the value of this work or obligation, as determined by the Engineer, may be withheld until the work or obligation has been performed, and/or the cost of rectification or replacement, as determined by the Engineer, may be withheld until rectification or replacement has been completed. Failure to perform includes, but is not limited to the following: (i) failure to comply with any ESHS obligations or work described in the Works' Requirements which may include: working outside site boundaries, excessive dust, damage to offsite vegetation, pollution of water courses from oils or sedimentation, contamination of land e.g. from oils, human waste, damage to archaeology or cultural heritage features, air pollution as a result of unauthorized and/or inefficient combustion; (ii) failure to regularly review C-ESMP and/or update it in a timely manner to address emerging ESHS issues, or anticipated risks or impacts; (iii) failure to implement the C-ESMP e.g. failure to provide required training or sensitization; (iv) failing to have appropriate consents/permits prior to undertaking Works or related activities; (v) failure to submit ESHS report/s (as described in general specifications, or failure to submit such reports in a timely manner; (vi) failure to implement remediation as instructed by the Engineer within the specified timeframe (e.g. remediation addressing non-compliance/s)."
Sub-Clause 14.7 Payment	At the end of sub-paragraph (b): "and" is replaced with "or" and the following are inserted as (iii) and (iv): "(iii) at a time when the Bank's loan (from which part of the payments to the Contractor is being made) is suspended, the amount shown on any statement submitted by the Contractor within 14 days after such statement is

	submitted, any discrepancy being rectified in the next payment to the Contractor; and" At the end of sub-paragraph (c): "." is replaced with ";" and the following inserted: "or, at a time when the Bank's loan (from which part of the payments to the Contractor is being made) is suspended the undisputed amount shown in the Final Statement within 56 days after the date of notification of the suspension in accordance with Sub-Clause 16.2 [Termination by Contractor]."

Sub-Clause 14.7 Payment	After the sub-paragraphs (c), add (d) with the following: (d) Provisional amount against the Statement specified in Sub-Clause 14.3: i) The Employer shall pay 80% of such amount as provisional payment within 04 business days from the receipt of IPC from the Engineer. The balance 20% shall be paid within 28 days from the receipt of evaluated statement from the Engineer. Next 80% amount of provisional payment shall be made only after 100% payment of preceding interim payment certified has been completed. ii) It shall be the responsibility of the Contractor to claim an amount for the performed services as admissible as per the Contract. If at any time it is observed by the Engineer that the amount claimed in the Statement are higher than the actual admissible performance, the facility of provisional payment will be withheld until such time the excess payment paid is adjusted in the subsequent Interim Payment Certificate. In such a case, warning letter will be issued to the Contractor. iii) If at any time, the Engineer/Employer observes for the second time that the amount claimed in the Statement are higher than the actual admissible performance, the facility of provisional payment will be liable to be withdrawn. *(*e) Payment of GST: The Contractor is responsible for paying all the taxes [including Goods and Service Tax (GST)], duties, cess, etc. as per the Statutory requirements. However, GST levied on the invoices raised by the Contractor will be temporarily withheld at the time of making payment for the invoice. GST withheld will be released by HRIDC/ HORCL on submission of proof, i.e. copy of Form GSTR-1 (reflecting the particular invoice) after due verification from the GST portal by the Employer.

Sub-Clause 14.9 **Release of Retention Money**	The following is added at the end of Sub-Clause 14.9: "Unless otherwise stated in the Contract, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions of Contract or in another form approved by the Employer for the second half of the Retention Money. The Contractor shall submit unconditional and irrevocable Bank Guarantee from the specified banks in the form appearing in Section X [Contract Forms] as under: (i) a scheduled bank (excluding co-operative banks) in India, or (ii) a Foreign Bank having arrangement with a nationalized bank or scheduled banks (excluding co-operative banks) in India; The scheduled bank issuing the bank guarantee shall be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the bank guarantee shall invariably be sent by the issuing bank to Employer's Bank through SFMS at the address given below and only after receipt of the same by the Employer's Bank, the bank guarantee shall become operative and acceptable to the Employer. Further, the bank guarantees in original form along with a copy of "MT760COV (in case of bank guarantee message)/ MT767COV (in case of bank guarantee amendment message) Report" sent by the concerned issuing bank sealed in an envelope shall be submitted to the Employer. The Issuing Bank shall send the SFMS to: Beneficiary: Haryana Orbital Rail Corporation Limited Bank Name: Account No. IFSC Code: Note: Bank Guarantee should be in favour of Haryana Orbital Rail Corporation Limited, Plot No 143, 5th Floor, Railtel Tower, Sector-44, Gurugram.

	The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security in Sub-Clause 4.2. On receipt by the Employer of the required guarantee, the Engineer shall certify, and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release after the latest of the expiry dates of the Defects Notification Periods. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate. If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security."
Sub-Clause 14.12 Discharge	On the seventh line of the first paragraph, "Sub-Clause 21.6 [*Arbitration]*" is replaced with: "Clause 21 *[Disputes and Arbitration]'.*
Sub-Clause 14.15 Currencies of Payment	Throughout Sub-Clause 14.15, "Contract Data" is replaced with: "Schedule of Payment Currencies".
Sub-Clause 15.1 Notice to Correct	"and" is deleted from (b) and "." is replaced by: "; and" in (c). The following is then added as (d) "(d) specify the time within which the Contractor shall respond to the Notice to Correct." In the third para., "shall immediately respond" is replaced with: "shall respond within the time specified in (d)". Further, in the third para., "to comply with the time specified in the Notice to

	Correct." is replaced with: "to comply with the time specified in (c)."
Sub-Clause 15.2.1 Notice	Sub-paragraph (h) is replaced with: "based on reasonable evidence, has engaged in Prohibited Practice as defined in paragraph 2 of the Particular Conditions - Part C –Prohibited Practices, in competing for or in executing the Contract."
Sub-Clause 15.8 Part(s) termination of the Contract	Add New Sub-Clause 15.8 "**Part(s) termination of the Contract**" after Sub-Clause 15.7; **For Part(s) termination of the Contract** If the Contractor fails to demonstrate to the satisfaction of Engineer that they will be able to achieve a specified Key Date(s)/Date of Completion/ remedying any notified defect under the contract, the Engineer may give the Contractor a notice to correct under Sub-Clause 15.1 in writing to expedite such identified work(s) immediately, so as to achieve the Key Date(s)/Date of Completion/ remedying any notified defect under the contract. If the Contractor fails to comply with such notice, the Employer, in his sole discretion, shall be entitled to carry out such identified part of works (Maximum upto 10% original Accepted Contract Amount) under Sub Clause 13.1 (Right to vary) as is necessary to achieve the key Date(s)/Date of completion by his own workmen or by other contractors without prejudice to any other right or remedy(ies). Engineer shall proceed in accordance with Sub clause 3.7.2 (Engineer's Determination) the value of the part work(s) decided to be part terminated. The Engineer shall as soon as practicable after taking such decision, notify the Contractor thereof in writing of the value of the identified Works for the encashment of Performance Security as specified in Sub clause 15.4
Sub-Clause 15.9 Prohibited Practices	Add New Sub-Clause 15.9 "Prohibited Practices" after Sub-Clause 15.8; " 15.9.1 The Bank requires compliance with the Bank's Policy on Prohibited Practices as set forth in Particular Conditions - Part C- Prohibited Practices.

	15.9.2 The Employer requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the tendering process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee."
Sub-Clause 16.1 Suspension by Contractor	The following paragraph is inserted after the first paragraph: "Notwithstanding the above, if the Bank has suspended disbursements under the loan from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer's Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Recipient having received the suspension notification from the Bank."
Sub-Clause 16.2.1 Notice	Sub-paragraph (j) is deleted in its entirety. At the end of sub-paragraph (i): "; or" is replaced with: "." sub-paragraph (f) is replaced with: "(f) the Contractor does not receive a Notice of the Commencement Date under Sub-Clause 8.1 [*Commencement of Works*] within 180 days after receiving the Letter of Acceptance, for reasons not attributable to the Contractor."
Sub-Clause 16.2.2 Termination	The following is added at the end of Sub-Clause 16.2.2: "In the event the Bank suspends the loan from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend work or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice."

Sub-Clause 17.1 Responsibility for Care of the Works	On the fourth and fifth lines of the first paragraph, replace "Date of Completion of the Works" with "issue of the Taking-Over Certificate for the Works".
Sub-Clause 17.3 Intellectual and Industrial Property Rights	On the first line of the second paragraph, replace "notice" is replaced with "a Notice".
Sub-Clause 17.4 Indemnities by the Contractor	Replace the sub-paragraph 17.4(b) (i) of Sub-Clause 17.4 with the following: (i) arises out of or in the course of or by reason of the design, execution, completion and the remedying of any defects of the Works, and
Sub-Clause 17.7 Use of Employer's Accommodation/Facilities	The following Sub-Clause is added as 17.7: "The Contractor shall take full responsibility for the care of the Employer-provided accommodation and facilities, if any, as detailed in the Employer's Requirements, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works) If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Employer is liable, the Contractor shall, at its own cost, rectify the loss or damage to the satisfaction of the Engineer."
Sub-Clause 18.1 **Exceptional Events**	Sub-paragraph (c) is substituted with: "(c) riot, commotion, disorder or sabotage by persons other than the Contractor's Personnel and other employees of the Contractor and Subcontractors;"
Sub-Clause 18.4 Consequences of an Exceptional Event	The following is added at the end of sub-paragraph (b) after deleting the ".": ", including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Exceptional Events, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 19.2 [Insurance to be provided by the Contractor]."
Sub-Clause 18.5 Optional Termination	In sub-paragraph (c), "and necessarily" is inserted after "was reasonably".

Sub-Clause 19.1 **General Requirements**	The following paragraphs are added after the first: "Wherever the Employer is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with terms (if any) agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause."
Sub-Clause 19.2 **Insurance to be provided by the Contractor**	The following is inserted as the first sentence in Sub-Clause 19.2: "The Contractor shall be entitled to place all insurances relating to the Contract (including, but not limited to the insurance referred to Clause 19) with insurers from any eligible source country through an insurance provider that is authorized to provide such insurance coverage in India. The Contractor shall submit all evidence(s) of insurances and policies within the period stated in the Contract Data."
Sub-Clause 19.2.1 **The Works**	On the last line of the second paragraph, "Clause 12 *[Tests after completion]*" is deleted.
Sub-Clause 19.2.5 **Injury to employees**	The second paragraph is replaced with: "The Employer and the Engineer shall also be indemnified under the policy of insurance, against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel."
Sub-Clause 20.1 **Claims**	In a): "any additional payment" is replaced with "payment".
Sub-Clause 20.2 **Claims for Payment and/or EOT**	The first paragraph is replaced with: "If either Party considers that it is entitled to claim under 20.1 (a) or (b), the following claim procedure shall apply:"

Sub-Clause 21.1 **Constitution of the DAAB**	Replace the entire first paragraph of Sub-Clause 21.1 with the following: Dispute shall be referred to a DAAB for decision in accordance with Sub-Clause 21.4 [Obtaining DAAB's Decision]. The Parties shall appoint a DAAB by the date stated in the Contract Data. The date may be changed if both the Parties agree, in writing... In the second paragraph, at the end of the first sentence after deleting: ".", the following is added: ", each of whom shall meet the criteria set forth in Sub-Clause 3.3 of Appendix- General Conditions of Dispute Avoidance/ Adjudication Agreement." After the second paragraph insert the following paragraph: "If the Contract is with a foreign Contractor, the DAAB members shall not have the same nationality as the Employer or the Contractor."
Sub-Clause 21.2 **Failure to Appoint DAAB Member(s)**	For both (a) and (b): "by the date stated in the first paragraph of Sub-Clause 21.1 [*Constitution of the DAAB*]" is replaced with: "within 42 days from the date the Contract is signed by both Parties"

Sub-Clause 21.6 Arbitration	**This clause stands amended and restated in its entirety as follows:** **21.6.1 Disputes shall be settled by arbitration in accordance with the following provisions:** **(A) In case of the Contractor or the Lead member of the Contractor (in the case of a Joint Venture or Consortium) being of foreign origin** If the efforts to resolve all or any of the disputes through amicable settlement fails, then such disputes or differences, whatsoever arising between the parties, arising out of the Contract or relating to effect of the Contract or the breach thereof shall be referred to Arbitration in accordance with the following provisions: **1. Selection of Arbitrators** -Each dispute submitted by a Party to arbitration shall be heard by a sole arbitrator or an arbitration panel comprising three (3) arbitrators, in accordance with the following provisions: (a) Where the Parties agree that the dispute concerns a technical matter, they may agree to appoint a sole arbitrator or, failing agreement on the identity of such sole arbitrator within thirty (30) days after receipt by the other Party of the proposal of a name for such an appointment by the Party who initiated the proceedings, either Party may apply to Singapore International Arbitration Centre (SIAC) for a list of not fewer than five (5) nominees and, on receipt of such list, the Parties shall alternately strike names therefrom, and the last remaining nominee on the list shall be the sole arbitrator for the matter in dispute. If the last remaining nominee has not been determined in this manner within sixty (60) days of the date of receipt of the list by the Parties, SIAC shall appoint, upon the request of either Party and from such list or otherwise, a sole arbitrator for the matter in dispute. (b) Where the Parties do not agree that the dispute concerns a technical matter, the Client and the Contractor shall each appoint one (1) arbitrator, and these two arbitrators shall jointly appoint a third arbitrator, who shall chair the arbitration panel. If the arbitrators named by the Parties do not succeed in appointing a third arbitrator within thirty (30) days after the latter of the two (2) arbitrators named by the Parties has been

	appointed, the third arbitrator shall, at the request of either Party, be appointed by SIAC. (c) If, in a dispute subject to paragraph (b) above, one Party fails to appoint its arbitrator within thirty (30) days after the other Party has appointed its arbitrator, the Party which has named an arbitrator may apply to the SIAC to appoint a sole arbitrator for the matter in dispute, and the arbitrator appointed pursuant to such application shall be the sole arbitrator for that dispute. **2. Rules of Procedure** - Except as otherwise stated herein, arbitration proceedings shall be conducted in accordance with the rules of procedure for arbitration of the United Nations Commission on International Trade Law (UNCITRAL) as in force on the date of this Contract. **3. Substitute Arbitrators** -If for any reason an arbitrator is unable to perform his/her function, a substitute shall be appointed in the same manner as the original arbitrator. **4. Nationality and Qualifications of Arbitrators -** The sole arbitrator or the third arbitrator appointed pursuant to paragraphs 1(a) through 1(c) above shall be an internationally recognized legal or technical expert with extensive experience in relation to the matter in dispute and shall not be a national of the Contractor's home country or of the Employer's home country or of the home country of any of their members or Parties or of the Government's country. For the purposes of this Clause, "home country" means any of: (a) the country of incorporation of the Contractor or of any of their members or Parties; or (b) the country in which the Contractor's or any of their members' or Parties' principal place of business is located; or (c) the country of nationality of a majority of the Contractor's or of any members' or Parties' shareholders; or (d) the country of nationality of the Sub-Contractor concerned, where the dispute involves a subcontract.

	5. Miscellaneous - In any arbitration proceeding hereunder: (a) proceedings shall, unless otherwise agreed by the Parties, be held at Singapore or any other neutral place as mutually agreed by both parties. The cost of Arbitration including the fees of the Arbitrator shall be borne equally by both the parties. (b) the English language shall be the official language for all purposes; and (c) the decision of the sole arbitrator or of a majority of the arbitrators (or of the third arbitrator if there is no such majority) shall be final and binding and shall be enforceable in any court of competent jurisdiction, and the Parties hereby waive any objections to or claims of immunity in respect of such enforcement. **(B) In case of the Contractor or the Lead member of the Contractor (in the case of a Joint Venture or Consortium) being of Indian origin** If the efforts to resolve all or any of the disputes through amicable settlement fail, then such disputes or differences, whatsoever arising between the parties, arising out of the Contract or relating to effect of the Contract or the breach thereof shall be referred to Arbitration in accordance with the following provisions: (a) The Arbitration proceedings shall be assumed to have commenced from the day, a written and valid demand for arbitration is received by Managing Director of the Employer (MD/HORCL). (b) The disputes so referred to arbitration shall be settled in accordance with the Indian Arbitration & Conciliation Act, 1996 and amended by the Arbitration and Conciliation (Amendment) Act, 2015 and any statutory modification or re-enactment thereof. Further, it is agreed between the parties as under: Number of Arbitrators - The Arbitral tribunal shall consist of 3 (three) arbitrators **1. Procedure for Appointment of Arbitrators** The arbitrators shall be appointed as per following procedure:

	a) Within 30 days from the day when a written and valid demand for Arbitration is received by MD/HORCL, the Employer will forward a panel of not fewer than five (05) independent and neutral nominees to the Contractor. These names shall be obtained from those Organizations, for the purpose of nominating them as DAAB Members/Conciliator/Arbitrator, who are also not ex-employees or directly or indirectly associated with the Employer. The Contractor may propose another five members to add to the above list who shall not be an ex-employees or directly or indirectly associated with the Contractor. The Contractor will then give his consent for any one name out of the above panel list to be appointed as one of the arbitrators within 30 days of dispatch of the request by the Employer. b) The Employer will decide the second Arbitrator. MD/HORCL shall appoint the two Arbitrators, including the name of one Arbitrator for whom consent was given by the Contractor, within 30 days from the receipt of the consent for one name of the Arbitrator from the Contractor. In case the Contractor fails to give his consent within 30 days of the request of the Employer, MD/HORCL shall nominate both the Arbitrators from the panel. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the parties out of the panel of Arbitrators finalized in para (a) above who shall act as presiding Arbitrator. In case of failure of the two appointed Arbitrators to reach upon consensus for the appointment of presiding Arbitrator within a period of 30 days from their appointment, then, upon the request of either or both parties, the presiding Arbitrator shall be appointed by the President of Indian Council of Arbitration, New Delhi, India. c) If one or more of the Arbitrators appointed as above refuses to act as Arbitrator, withdraws from his office as Arbitrator, or vacates his/their office/offices or is/are unable or unwilling to perform his functions as Arbitrator for any reason whatsoever or dies or in the opinion of the MD/HORCL fails to act without undue delay, the MD/HORCL shall appoint new Arbitrator/Arbitrators to act in his/their place except in case of new presiding Arbitrator who shall be chosen following the same procedure as mentioned in para (b) above. Such reconstituted Tribunal may, at its discretion, proceed with the reference from the stage at which it was left by the previous Arbitrator(s).

	d) The Employer at the time of offering the panel of Arbitrator(s) to be appointed as Arbitrator shall also supply the information with regard to the qualifications of the said Arbitrators nominated in the panel along with their professional experience, phone nos. and addresses to the Contractor. The minimum qualification and experience of the arbitrators which may be appointed by the Parties in accordance with the contract is set out below: (i) A working/retired officer (not below E-8 grade in a central public sector undertaking in India, with which the Employer has no direct business relationship), of engineering or accounts/finance discipline, having experience in management of construction contracts; or (ii) A retired officer (not below the SAG level in Indian Railways) of any Engineering Services of Indian Railways or Indian Railway Accounts Service, having experience in management of construction contracts; **2. Miscellaneous:** In any arbitration proceeding hereunder: (a) The language of arbitration shall be English. This arbitration shall be governed in accordance with the laws of India. (b) The venue of the arbitration shall be Gurugram, India. The cost of Arbitration including the fees of the Arbitrator shall be borne equally by both the parties. (c) The decision of the majority of the arbitrators (or of the third arbitrator if there is no such majority) shall be final and binding and shall be enforceable in High court at Chandigarh, and the Parties hereby waive any objections to or claims of immunity in respect of such enforcement. 21.6.2 In the event that the Contractor wishes to refer a dispute to arbitration in accordance with this Sub-Clause, it shall be required to serve a notice in this regard to the Managing Director, of the Employer for commencement of arbitration. 21.6.3 Pending the submission of and/or decision on a dispute and until the arbitral award is published, the Parties shall continue to perform their respective obligations under the contract without prejudice to a final adjustment in accordance with such award. 21.6.4 The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or

	valuation of the Engineer, and any decision of the DAAB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute. However, Conciliator cannot be present as a witness by either party in the arbitral proceedings. 21.6.5 Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DAAB to obtain its decision, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction. 21.6.6 Neither party shall be limited in the proceedings before such arbitrators to the evidence or arguments put before the Engineer to obtain his decision. No decision given by the Engineer in accordance with the contract shall disqualify him from being called as a witness and giving evidence before the arbitrators on any matter, whatsoever, relevant to dispute referred to arbitration. 21.6.7 Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DAAB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

Appendix- General Conditions of Dispute Avoidance/Adjudication Agreement

Title	"General Conditions of Dispute Avoidance/Adjudication Agreement" is replaced with "General Conditions of DAAB Agreement".
1. Definitions	Sub-Clause 1.2: In both the first and third lines, "DAA Agreement" is replaced with "DAAB Agreement". Sub-Clause 1.3: -In the first line, "Dispute Avoidance/Adjudication Agreement" or "DAA Agreement" means" is replaced with: "DAAB Agreement" is as defined under the Contract and is". - In the first line of sub-paragraph (c), "DAA Agreement" is replaced with "DAAB Agreement". - In sub-paragraph (c)(ii), "chairman" is replaced with "chairperson". Sub-Clause 1.3 "DAAB Activities" is replaced with Sub-Clause 1.4 "DAAB Activities" and the subsequent Sub-Clauses under Clause 1 "Definitions" renumbered: Sub-Clause 1.7 to 12: Replace all instances of "DAA Agreement" with "DAAB Agreement". In Sub-Clause 1.8 a(i):" authorised representative of the contractor or of the Employer" is replaced with: "Contractor's Representative or authorised representative of the Employer".
3. Warranties	Sub-Clause 3.3 is deleted and replaced with the following: "When appointing the DAAB Member, each Party relies on the DAAB Member's representations, that he/she; a) has at least a bachelor's degree in relevant disciplines such as law, engineering, construction management or contract management; b) has at least ten years of experience in contract administration/management and dispute resolution, out of which at least five years of experience as an

arbitrator or adjudicator in construction-related disputes;

c) has received formal training as an adjudicator from an internationally recognized organization;

d) has experience and/or is knowledgeable in the type of work which the Contractor is to carry out under the Contract;

e) has experience in the interpretation of construction and/or engineering contract documents;

f) has familiarity with the forms of contract published by FIDIC since 1999, and an understanding of the dispute resolution procedures contained therein; and

g) is fluent in the language for communications stated in the Contract Data (or the language as agreed between the Parties and the DAAB)."

7. Confidentiality

In Sub-Clause 7.3: "or" is deleted after sub-paragraph (b), and the following added:

"or (d) is being provided to the Bank."

9. Fees and Expenses

In Sub-Clause 9.1 (c): "business class or equivalent" is replaced with: "in less than first class".

In Sub-Clause 9.4: "and air fares" and "other" are deleted from the first and second sentences respectively.

10. Resignation and Termination

In Sub-Clause 10.3: "the DAA Agreement" is replaced with: "a DAAB member's DAAB Agreement".

Annex- DAAB Procedural Rules

Rule 4.2 On the fourth line, "chairman" is replaced with "chairperson".

Rule 8.3 On the sixth line, "chairman" is replaced with "chairperson".

Form of Dispute Avoidance/Adjudication Agreement

All instances of "DAA Agreement" are replaced with: "DAAB Agreement".

In C (b): "chairman" is replaced with "chairperson".

Particular Conditions of Contract (PCC)

Part C – Prohibited Practices

1. The Bank requires that the Recipient (and all other beneficiaries of the Bank financing), as well as tenderers, suppliers, contractors, concessionaires and consultants under Bank-financed contracts for the Project, observe the highest standard of transparency and integrity during the procurement, execution and implementation of such contracts.

2. Definitions. In pursuance of this policy, the Bank defines the terms set forth below as Prohibited Practices:

   (a) "**coercive practice**" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of a party to influence improperly the actions of a party;
   (b) "**collusive practice**" means an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
   (c) "**corrupt practice**" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
   (d) "**fraudulent practice**" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation.
   (e) "**misuse of resources**" means improper use of the Bank's resources, carried out either intentionally or through reckless disregard;
   (f) "**obstructive practice**" means any of the following practices: (i) deliberately destroying, falsifying, altering or concealing of evidence material to a Bank investigation; (ii) making false statements to investigators in order to materially impede a Bank investigation into allegations of a Prohibited Practice; (iii) failing to comply with requests to provide information, documents or records in connection with a Bank investigation; (iv) threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to a Bank investigation or from pursuing the investigation; or (v) materially impeding the exercise of the Bank's contractual rights of audit or inspection or access to information; and
   (g) "**theft**" means the misappropriation of property belonging to another party.

3. Any occurrence, or suspected occurrence, of a Prohibited Practice in the procurement, award, or implementation of a Bank-financed contract is dealt with in accordance with the provisions of the Bank's Policy on Prohibited Practices. Suppliers, contractors, service providers and consultants selected pursuant to the provisions of Section II and concessionaires selected pursuant to paragraph 14.3 of the Bank's Procurement Instructions for Recipients, as well as the Recipient shall fully cooperate with the Bank (or a cofinancier undertaking an investigation

pursuant to paragraph 6.1 of the Bank's Procurement Instructions for Recipients) in any investigation into an alleged Prohibited Practice to be carried out pursuant to the Policy on Prohibited Practices, and permit the Bank or its representative (including such co-financier) to inspect such of their accounts and records as may be relevant for such investigation and to have such records and accounts audited by the auditors appointed by the Bank.

4. Provisions to this effect are included in the Legal Agreements and the procurement contracts with such entities.

5. If the Project is financed by a sovereign-backed loan, the Bank (or, where relevant, a co-financier having undertaken an investigation pursuant to paragraph 6.1 of the Bank's Procurement Instructions for Recipients):

   (a) may take any of the following additional actions in connection with a Prohibited Practice under the Project:

      (i) reject a proposal for award if it determines that the tenderer recommended for award, or any of its personnel, or its agents, or its sub-consultants, subcontractors, service providers, suppliers or their employees, has, directly or indirectly, engaged in a prohibited practice in competing for the contract in question; and

      (ii) cancel the undisbursed portion of the loan allocated to a contract (and require reimbursement of the disbursed portion of the loan allocated to the contract) if it determines at any time that representatives of the Recipient or of a recipient of any part of the proceeds of the loan engaged in a prohibited practice during the procurement, administration or implementation of the contract in question; and

   (b) requires that a clause be included in tender documents and in contracts financed by the Bank loan, requiring tenderers, suppliers and contractors, and their subcontractors, agents, personnel, consultants, service providers, or suppliers, to permit the Bank (and a co-financier undertaking an investigation pursuant to paragraph 6.1 of the Bank's Procurement Instructions for Recipients) to inspect all accounts, records, and other documents relating to the submission of tenders and contract performance, and to have them audited by auditors appointed by the Bank.

Section X - Contract Forms

Table of Forms

Notification of Intention to Award

[*This Notification of Intention to Award shall be sent to each Tenderer that submitted a Tender.*]

[*Send this Notification to the Tenderer's Authorized Representative named in the Tenderer Information Form*]

For the attention of Tenderer's Authorized Representative

Name: *[insert Authorized Representative's name]*

Address: *[insert Authorized Representative's Address]*

Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]*

Email Address: *[insert Authorized Representative's email address]*

[IMPORTANT: insert below the date that this Notification is transmitted to Tenderers. The Notification must be sent to all Tenderers simultaneously. This means on the same date and as close to the same time as possible.]

DATE OF TRANSMISSION: This Notification is sent by: [*email/fax*] on [*date*] (local time)

Notification of Intention to Award

Employer: *[insert the name of the Employer]*
Project: *[insert name of project]*
Country: *[insert country where Tender is issued]*
Loan No.: *[insert reference number for loan]*
Tender No: *[insert Tender reference number from Procurement Plan]*
Contract Title: *[insert the name of the contract]*

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period you may:

a) request a debriefing in relation to the evaluation of your Tender, and/or

b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Tenderer

Name:	[*insert name of successful Tenderer*]
Address:	[*insert address of the successful Tenderer*]
Contract Price:	[*insert contract price of the successful Tender*]

2. List of all Tenderers *[INSTRUCTIONS: insert names of all Tenderers that submitted a Tender including the successful Tenderer, together with the corresponding Tender price*

as read out at tender opening and the evaluated Tender price (when rated criteria are not used).]

Name of Tenderer	Tender Price	Evaluated Tender Price (if applicable)
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]

Or

List of all Tenderers ***[INSTRUCTIONS: insert names of all Tenderers that submitted a Tender including the successful Tenderer, together with the corresponding Tender price as read out at tender opening and the evaluated Tender price, respective technical and financial scores, combined technical and financial score (when rated criteria are used).]***

Name of Tenderer	Tender Price	Evaluated Tender Price	Technical Score	Financial Score	Combined Score
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]			
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]			
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]			
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]			
[*insert name*]	[*insert Tender price*]	[*insert evaluated price*]			

3. Reason/s why your Tender was unsuccessful

[INSTRUCTIONS: State the reason/s why <u>this</u> Tenderer's Tender was unsuccessful. Do NOT include: (a) a point by point comparison with another Tenderer's Tender, or (b) information that is marked confidential by the Tenderer in its Tender.]

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on [*insert date*] (local time).

You may request a debriefing in relation to the results of the evaluation of your Tender. If you decide to request a debriefing your written request must be made within three (3) Business Days of receipt of this Notification of Intention to Award.

Provide the contract name, reference number, name of the Tenderer, contact details; and address the request for debriefing as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Employer*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

If your request for a debriefing is received within the 3 Business Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (5) Business Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of the Contract Award Notice.

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

Provide the contract name, reference number, name of the Tenderer, contact details; and address the Procurement-related Complaint as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Employer*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

For more information see the Procurement Instructions for Recipients (Annex IV, Complaint Monitoring).

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

The Standstill Period lasts ten (10) Business Days after the date of transmission of this Notification of Intention to Award.

The Standstill Period may be extended as stated in Section 4 above.

If you have any questions regarding this Notification, please do not hesitate to contact us.

For and on behalf of the Employer:

Signature: _____

Name: _____

Title/Position: _____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

INSTRUCTIONS TO TENDERERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form ("Form") is to be completed by the successful Tenderer. In case of joint venture, the Tenderer must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Tenderer is any natural person who ultimately owns or controls the Tenderer by meeting one or more of the following conditions:

- *directly or indirectly holding 25% or more of the shares*
- *directly or indirectly holding 25% or more of the voting rights*
- *directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Tenderer*

Tender No.: [*insert number of Tender process*]

To: **Haryana Rail Infrastructure Development Corporation Limited**

In response to your request in the Letter of Acceptance *dated [insert date of letter of Acceptance]* to furnish additional information on beneficial ownership: *[select one option as applicable and delete the options that are not applicable]*

(i) we hereby provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	Directly or indirectly holding 25% or more of the shares (Yes / No)	Directly or indirectly holding 25 % or more of the Voting Rights (Yes / No)	Directly or indirectly having the right to appoint a majority of the board of the directors or an equivalent governing body of the Tenderer (Yes / No)
[include full name (last, middle, first), nationality, country of residence]			

OR

(ii) *We declare that there is no Beneficial Owner meeting one or more of the following conditions:*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Tenderer

OR

(iii) We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. [If this option is selected, the Tenderer shall provide explanation on why it is unable to identify any Beneficial Owner]

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Tenderer]"

Name of the Tenderer: *[*insert complete name of the Tenderer*] _____

Name of the person duly authorized to sign the Tender on behalf of the Tenderer: **[*insert complete name of person duly authorized to sign the Tender*] _____

Title of the person signing the Tender: [*insert complete title of the person signing the Tender*] _____

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*] _____

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]_____

[*] In the case of the Tender submitted by a Joint Venture specify the name of the Joint Venture as Tenderer. In the event that the Tenderer is a joint venture, each reference to "Tenderer" in the Beneficial Ownership Disclosure Form (including this Introduction thereto) shall be read to refer to the joint venture member.

[**] Person signing the Tender shall have the power of attorney given by the Tenderer. The power of attorney shall be attached with the Tender Schedules.

.

Letter of Acceptance

[letterhead paper of the Employer]

[date]

To: *[name and address of the Contractor]*

This is to notify you that your Tender dated *[date]* for execution of the **"Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844" for the Accepted Contract Amount *[amount in numbers and words] [name of currency]*, as corrected and modified in accordance with the Instructions to Tenderers, is hereby accepted by our Agency.

You are requested to furnish (i) the Performance Security within 28 days in accordance with the Conditions of Contract, using, for that purpose, the Performance Security Form; and (ii) the additional information on beneficial ownership in accordance with TDS ITT 48.1, within eight (8) Business days using the Beneficial Ownership Disclosure Form, included in Section X, Contract Forms, of the Tender Document.

Authorized Signature: _____

Name and Title of Signatory: _____

Name of Agency: _____

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made the _____ day of _____, _____, between _____of _____ *[insert complete name of Employer and full business address]* (hereinafter "the Employer"), of the one part, and _____ of _____ *[insert complete name and nationality of Contractor as well as full business address]* (hereinafter "the Contractor"), of the other part:

WHEREAS the Employer invited tenders for the execution of the Works, described as **"Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844 ".

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

    (a) the Letter of Acceptance;

    (b) the Letter of Tender;-Financial Part;

    (c) the Letter of Tender-Technical Part;

    (d) the Record of Meeting on Contract Negotiation (if any);

    (e) the addenda/Corrigenda Nos _____ (if any);

    (f) the Particular Conditions of Contract;

    (g) the General Conditions of Contract;

    (h) the Employer's Requirements;

    (i) the Drawings*;*

    (j) the Contractor's Technical Proposal;

(k) the Reference Information/Reports, and

(l) the completed Schedules and any other documents forming part of the contract, including, but not limited to:

i. the ESHS Management Strategies and Implementation Plans; and

ii. Code of Conduct (ESHS)**.**

3. In consideration of the payments to be made by the Employer to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of _____ *[insert the name of the Contract governing law country]* on the day, month and year specified above.

For and on behalf of the Employer

Signed: *[insert signature]*
in the capacity of *[insert title or other appropriate designation]*
In the presence of *[insert identification of official witness]*

For and on behalf of the Contractor

Signed: *[insert signature of authorized representative(s) of the Contractor]*
in the capacity of *[insert title or other appropriate designation]*
in the presence of *[insert identification of official witness]*

Performance Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary:

Haryana Rail Infrastructure Development Corporation Limited,
Plot No 143, 5th Floor, Railtel Tower,
Sector-44, Gurugram,
Haryana-122003

Date: _____ *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: _____

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ *dated* _____ with the Beneficiary, for the execution of "**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844".

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (),[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the

[1] *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency(cies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the …. Day of ……, 2…[2], and any demand for payment under it must be received by us at this office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[2] *Insert the date twenty-eight days after the expected completion dateas described in GC Clause 11.9. The Employer should note that in the event of an extension of thisdate for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary:

Haryana Orbital Rail Corporation Limited,
Plot No 143, 5th Floor, Railtel Tower,
Sector-44, Gurugram,
Haryana-122003

Date: _____ *[Insert date of issue]*

ADVANCE PAYMENT GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ *dated* _____ with the Beneficiary, for the execution of "**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844".

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum _____ ( ) is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ ()[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether

[1] *The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.*

in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:

(a) has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number _____ at _____..

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the ___ day of _____, 2___,[2] whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[2] *Insert the expected expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

Materials Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary:

Haryana Orbital Rail Corporation Limited,
Plot No 143, 5th Floor, Railtel Tower,
Sector-44, Gurugram,
Haryana-122003

Date: _____ *[Insert date of issue]*

MATERIAL PAYMENT GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ *dated* _____ with the Beneficiary, for the execution of "**Contract Package C-5:** Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844".

Furthermore, we understand that, according to the conditions of the Contract, payment in the sum _____ ( ) is to be made against material payment guarantee for supply of materials at Site.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ ()[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether

[1] *The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.*

in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:

(a) has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number _____ at _____.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the ___ day of _____, 2___,[2] whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[2] *Insert the expected expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

Retention Money Security

Demand Guarantee

_____ *[Guarantor letterhead or SWIFT identifier code]*

Beneficiary:

Haryana Orbital Rail Corporation Limited,
Plot No 143, 5th Floor, Railtel Tower,
Sector-44, Gurugram,
Haryana-122003

Date: _____ *[Insert date of issue]*

RETENTION MONEY GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ *[insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. _____ *[insert reference number of the contract]*dated _____ with the Beneficiary, for the execution of "**Contract Package C-5:**Composite Contract package in connection with New BG Double Railway Line of HORC project between stations Prithla and Dhulawat for (i) Design and Construction of Civil Works (Earthwork, Bridges, Stations and Retaining Walls) from km -2.296 to km 12.00 & km 18.00 to km 20.942; (ii) Design & Construction of viaduct from km 20.942 to km 24.844; (iii) Design & Construction of Ballastless track from km 20.842 to km 24.844; and (iv) Design, Supply, Installation, Testing & Commissioning of General Electrical Services from km -2.296 to km 12.00 and Km 18.00 to Km 24.844".

Furthermore, we understand that, according to the conditions of the Contract, the Beneficiary retains moneys up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, payment of *[*insert the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention

Money and the amount guaranteed under the Performance Security is to be made against a Retention Money guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ *[insert amount in figures]*()*[amount in words]*[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without your needing to prove or show grounds for your demand or the sum specified therein.

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the second half of the Retention Money as referred to above has been credited to the Applicant on its account number _____ at _____ *[insert name and address of Applicant's bank].*

This guarantee shall expire no later than the …. Day of ……, 2…[2], and any demand for payment under it must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[1] *The Guarantor shall insert an amount representing the amount of the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention Money and the amount guaranteed under the Performance Security and denominated either in the currency(ies) of the second half of the Retention Money as specified in the Contract, or in a freely convertible currency acceptable to the Beneficiary.*

[2] *Insert the same expiry date as set forth in the performance security, representing the date twenty-eight days after the completion date described in GCC Clause 11.9.The Employer should note that in the event of an extension of this date for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

Contractor's Warranty

This Agreement is made on the .....… day of … … … … … … between

(1) [ ] of [ ] [and [see Note 1]] ([jointly] "the Contractor").

(2) the Haryana Orbital Rail Corporation Limited [of/[whose registered office is at] [XXX] Limited, together with its successors and assigns, "the Employer") _____,

WHEREAS

(A) By a contract [_____] dated [_____] ("the Contract") made between

(1) the Haryana Orbital Rail Corporation Limited ("the Employer") and

(2) [("the Contractor") has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defects in the works ("the Works") upon the terms and conditions contained in the Contract.

(B) [See Note 3]
(C) At the request of the Employer and pursuant to the terms of the Contract the Contractor has agreed to enter into this Warranty.

NOW IT IS AGREED as follows:

1. The Contractor hereby warrants and undertakes that:

(a) he will design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defect in the Works in accordance with the terms of the Contract; and;
(b) he owes a duty of care to the Employer in relation to the performance of its duties under the Contract; and
(c) he will replace free of cost to the Employer any defect or failure of equipment /material/services provided in the Works for the duration of Defect Notification Period as per the Contract; and
(d) he agrees that should any design modification be required to any equipment or component as a consequence of failure analysis, for the duration of Defect Notification Period as per the Contract, shall recommence from the date when the modified part is commissioned into service, and such modification shall be carried out free of cost to the Employer in all sub-systems and systems for all sections; and
(e) he shall maintain the manufacture or spare of replacement parts for at least 10 years.

2. The liability of [the companies comprising [see Note 3]] the Contractor under this Warranty [shall be joint and several and [see Note 3]] shall not be released, diminished or in any way

affected by any independent inquiry or investigation into the Works or any matter related to the Contract whether carried out by or on behalf of the Employer or any liability or right of action which may arise out of such inquiry or investigation.

3. Insofar as the copyright or other intellectual property rights in any plans, calculations, drawings, documents, materials, plant, know-how and other information relating to the Works shall be vested in the Contractor, the Contractor grants to the Employer his successors and assigns a royalty free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works or the Project including without limitation the design, manufacture, supply, installation, testing and commissioning (including Integrated Testing and Commissioning) reinstatement, extension and the remedy of any defect in the Works. To the extent that beneficial ownership of any such copyright or other intellectual property rights is vested in anyone other than the Contractor, the Contractor shall use best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. For the avoidance of doubt, any such licence granted shall not be determined if the Contractor shall for any reason cease to be employed in connection with the Works.
4. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Employer may have against the Contractor, whether in tort or otherwise.
5. Nothing contained in this Warranty shall vary or affect the Contractor's rights and obligations under the Contract.
6. The address for service of all documents arising out of or in connection with this Warranty shall be:

(a) upon the Employer, at [_____] India [Note 4];
(b) upon the Contractor, at [_____] India [Note 4].

7. The Employer and the Contractor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All notices must be in writing.
8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
9.

   (1) Any dispute or difference of any kind whatsoever between the Employer and the Contractor arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with the Conciliation and Arbitration rules set out in the General Conditions of Contract. “Dispute” as defined in the Contract shall be deemed to include any such dispute or difference between the Employer and Contractor.
   (2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract (“the Contract Dispute”) then provided that an arbitrator has not already been appointed pursuant to Clause 9(1), the Employer may by notice in writing to the Contractor require and the Contractor shall be deemed to

have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.

(3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objections relating to the dispute.

(4) Subject to the foregoing provisions of this Clause 9, the Employer and the Contractor agree to submit to the jurisdiction of the Courts of India at Gurugram, Haryana.

IN WITNESS where of this Warranty has been executed as a deed on the date written at the head hereof.

THE COMMON SEAL of)

[_____])

was affixed hereto)

in the presence of:)

Notes: (for preparation of but not for inclusion in the engrossment of this Warranty)

(1) If the Contractor comprises more than one company, each such company shall be a party and liability under this warranty will be joint and several, with consequential grammatical changes.
(2) If Note 1 applies, that fact and the joint venture or other relevant agreement must be recited.
(3) Delete if Note 1 does not apply.
(4) The address for service shall be in India.

N.Rly.

Northern Railway

Headquarter Office
Baroda House,New Delhi.

No.Secy/AGM/Retired officer (7)2022-2023 Dated:-19.05.2023

Sh Puneet Kathpalia
Director/BD&F,
HRIDC, Chandigarh.

Sub: - Requirement of Arbitrators Panel for HRIDC.

Ref:-Your office Letter No HRIDC/GGN/KKDE/2020/02 Vol.1 dated 19.05.2023

****

In reference to your letter cited above, list of Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above) is enclosed.

DA/As above

(R.K. Sood)
Secy.to Addl.GM 19/5/23

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
1	RASHMI KAPOOR	AM/FINANCE/RLY.BD.	C-523 gr.floor Chittaranjan Park (near MarketNo.1) New Delhi-110019 Mob-9717649595 E-mail:-rashmikapoor7@gmail.com	07.10.1954	07.10.2024	30.03.2015	IRAS
2	RATNESH KUMAR BARIAR	ED/RP/Rly.BD	431,Nav Sansad Vihar CGHS Ltd,Plot No.4,Sector-22,Dwarka,New Delhi-110077.Contact Tele.No:- 011-2805063 M.No 8527066011. email-bariar@gmail.com	15.10.1954	15.10.2024	30.03.2015	IRSE
3	VIPIN JHA	AGM/NFR	B-1/331,Janakpuri,New Delhi-110058 Mob-9711888774	07.09.1953	07.09.2023	30.03.2015	IRSEE
4	JAI SHANKER GUPTA	Pr.CE/ECOR	B-201,Pragiyotishpur Housing Society,Plot No.7,Sector-10, Dwarka, New Delhi-110057. Mob-9650391708	27.01.1955	27.01.2025	14.08.2015	IRSE
5	A.K.VERMA	GM/SER	601,Rail Shatabdi Vihar, Sector-62 Noida (UP)-201301.Mob 9717888250 email-akverma53@yahoo.com	03.06.1953	03.06.2023	07.03.2017	IRSME

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
6	INDRA GHOSH	GM/ECOR	Plot No.9 &10,Gujrara Mansingh, Do Bachchi Road (Off Sahastradhara Road) ,Dehradun-248001..Mob-7894440000 & 8527980000 email:- indraoffice@gmail.com	08.08.1953	08.08.2023	17.03.2017	IRTS
7	HARSH KUMAR	FA & CAO/CONST	C/o Atul Kumar House 82-L, New Colony, Sector-7, Gurugram-122001. 9999904422 email-harshkumar.iras@gmail.com & harshkumar@live.com	05.05.1955	05.05.2025	18.07.2017	IRAS
8	H.V.SHARMA	RETD. OSD/Public Representative Interface in the Ministry of Rly.BD	A-3605,IREO Victory Valley, Sector-67,Golf Course ,Extension Road, Gurgaon-122101 (HR). 9717644619. email hvsharma54@yahoo.com	14.02.1954	14.02.2024	18.07.2017	IRTS
9	N.K.GUPTA	Director/Finance, RailTel Corporation of India Ltd.Gurgaon	Bungalow No:-30, Railway Officer's Enclave, Sardar Patel Marg, Chanakya puri, New Delhi-110021. Tel-01126870380 & Mob-9717644008 email-narendergupta@yahoo.com	17.03.1957	17.03.2027	22.03.2018	IRAS

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
10	ARADHANA CHAK	Retd. FA&CAO (S&W), Central Railway, Mumbai.	Tulip Violet,Tower No.A-12,7th Floor, Flat No.704, Sector-69,Gurugram. Mob-9987640911 & 7710005279. email aradhanchak@rediffmail.com	08.07.1957	08.07.2027	22.03.2018	IRAS
11	BHUVNESH P KHARE	GM/DLW	47,Shree Golden City Phase-I, Jaatkhedi,Hoshangabad Road, Near Vrindavan Harden, Bhopal-462026. email bpkhare@gmail.com (Mob-7042300388)	22.07.1954	22.07.2024	10.08.2017 again 03.04.2018	IRSE
12	ARUNENDERA KUMAR	CRB	KD-80,Kavi Nagar,Ghaziabad-201002. Mob-9560881000 email-arunendra13@gmail.com	13.12.1954	13.12.2024	03.04.2018	IRSME
13	Y.P.SINGH	AGM/NC Rly, ALD	Dr Yatindra Pal Singh,C/o Dr. Sashi Bala Singh,Director, National Institute of Pharmaceutical Education & Research (NIPER) ,Balanagar, Hyderabad (Telangana)-500037. ypsingh1957@yahoo.co.in Mob 09794603311	01.01.1957	01.01.2027	03.04.2018	IRSE

19/5/2023

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
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14	ANUP SAHU	AGM/NR	G-2204,Ajnara Genx Crossings Republic-Ghaziabad (UP). Mob-09650128740 email- anup-sahu2001@yahoo.co.in	19.10.1954	19.10.2024	03.04.2018	IRSME
15	SURINDER PAL	CAO/N.F.Rly	8-R,Friends Colony, Lane No.1,Near Wadala Chowk, Jalandhar City. Mob-08283908111	24.10.1956	24.10.2026	03.04.2018	IRSE
16	GANGA RAM AGARWAL	AM/Electrical/Rly.BD	Flat No.14254,ATS-I Hamlet,Sector 104,Noida. (UP). Mob-08130161000 & email agarwal_gra@yahoo.co.in	11.11.1956	11.11.2026	21.05.2018	IRSEE
17	K.K.GUPTA	CE/C/ECR	A-64,IDC Apartments,Plot 8C,Sector-11, Dwarka, NDLS. Mob-9811627094 & Email kkg1956@yahoo.co.uk	21.11.1956	21.11.2026	28.5.2018	IRSE
18	SAANDHAY DEEP DAS	FA & CAO/Systems	C-5/7, Ground Floor,Safdarjung Development Area New Delhi-110016.Mob-8826375100 & Email-saandhaydeep@yahoo.com.	31.12.1955	31.12.2025	10.07.2018	IRAS

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
19	ADITYA KUMAR MITTAL	ME/Rly.BD	Flat-C2/10 (3102), Vanashree Plot-1&2, Sector 58A Palm Bcach Road Near Scawoods Estate Nerul, Navi Mumbai-400706. (560527000,9560708000,9560527000 &02227525087). adityakumarmittal@gmail.com	22.08.1957	22.08.2027	28.09.2018	IRSE
20	RAMESH CHANDRA	GM/WCR/Jabalpur	Apartment No 703, Block-01,Uniworld Garden-1, Sector-47,Sohna Road Gurgaon, Haryana-122001. Mob-9971012000. rameshарb18@gmail.com	23.08.1956	23.08.2026	31.12.2018	IRSS
21	A.K.AGARWAL	COS/CR/CSTM	Plot No 94, Shanti Ram Niwas,Arvind Nagar,CBI Colony, Jagatpura, Jaipur-302017. akagr1956@gmail.com Mob-9983089590.	05.10.1956	05.10.2026	31.12.2018	IRSS

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
22	NARENDRA KUMAR TULI	Vice Chairman (Technical) RCT, (Principal Bench) NDLS	Flat 602,Rainbow Apartments,GH Plot 26,Sector 43,DLF Phase 5, Gurugram-122009,Haryana. Mob-9560391672 & 9910906664 E-mail -ntuli_in@yahoo.com (letter dated 31.05.2021)	07.05.1955	07.05.2025	14.03.2019	IRTS
23	VANDANA NANDA	DF/MD,CRIS	381 K P Thacker Block, Asian Games Village, August Kranti Marg, Delhi-110049.Mob-8130279398 & email Kbvn.83@gmail.com	01.02.1958	01.02.2028	25.04.2019	IRAS
24	MAHIPAL SINGH	CBE/NR	H-1603,Pearl Cout Ramprastha Greens,Sector-7,Vaishali,Ghazibad-201010.Mob-8750902286 & 59.mpsing@gmail.com	20.08.1957	20.08.2027	25.04.2019	IRSE
25	SATISH KUMAR	AGM/EASTERN RAILWAY,KOLKATA	A-601,IRWO Classic Apartment,Rail Vihar,Sushant Lok,Ph.III,Sector-57,Gurgaon (HR)-122003. Mob 08420220001 & sk12757@yahoo.co.in	12.07.1957	12.07.2027	25.04.2019	IRSE

N.Rly.

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
26	RAM PRAKASH SHARMA	Pr.CEE/C.Rly/MUMBAI	B-3/1103,Palm Grove Heights,Ardee City, Sector-52,Gurgaon-122011. Mobile-7024116259 & rpsharma582003@gmail.com	01.05.1958	01.05.2028	03.05.2019	IRSEE
27	S.K.SHARMA	AGM/SOUTHERN RAILWAY	Flat No A-402,Oosman Everest Mettiguda Secunderabad, Hyderabad Telangana-500017. Mob 09100140399 agmsrch@gmail.com	25.07.1955	25.07.2025	28.05.2019	IRSE
28	NEERAJ JAIN	CTE/ECR/Hajipur	Flat B-601,Vicinia, Chandivali Farm Road,chandivali, Mumbai-400072.Mob 8096001842 Email:njainrly@yahoo.co.in	23.02.1957	23.02.2027	28.05.2019	IRSE
29	ASHOK KUMAR AGARWAL	GM/ICF/Chennai	E-502,LA lagune,Sec-54,Golf Course Road,Gurgaon (Haryana).Mob-9717873000 & ashokkagarwal@gmail.com	10.06.1956	10.06.2026	03.06.2019	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
30	HARJEET KR.JAGGI	GM/NF Rly./ Guwahati	A 1804,Mahindra Luminare,Sector 59, Gurugram-122011 (Haryana). Mobile - 9910487324 hkjaggi@hotmail.com	17.05.1957	17.05.2027	08.07.2019	IRSE
31	R.K.GUPTA	General Manager/ Eastern Railway / Kolkata	A-402, Prateek Stylome, Sector-45, NOIDA-201301 (U.P.) Mobile -9717637000 rkgv@hotmail.com	22.01.1956	22.01.2026	08.07.2019	IRSE
32	PRAMOD KUMAR	GM/RCF/ Kapurthala	S-901, Amrapali Silocon City, Sector-76, NOIDA, UP-201301 Mobile -7045648804 pramod212@gmail.com	29.04.1955	29.04.2025	08.07.2019	IRSME
33	SUNIL KUMAR SOOD	GM/Central Railway,Mumbai	C2/101 Paras Urbane Park Baskdiakalan, Bhopal Mobile 9004411110 sood73sk@gmail.com	05.05.1956	05.05.2026	08.07.2019	IRSME

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
34	ASHOK KUMAR DUHOON	COS/NC Rly, Allahabad	Flat No.12211, ATS Advantage, 17-Ahinsa Khand, Indirapuram, Ghaziabad, Uttar Pradesh-2021014 Mobile -9717489774 duhoon2001@yahoo.com	10.08.1955	10.08.2025	08.07.2019	IRSS
35	VIJENDER KUMAR JAIN	PCMM, Central Railway/ Mumbai	3rd Floor, Plot No.429,B Block, Sushant Lok, Phase-1,Sector-43,Gurugram,(Haryana)-122009. Mob-9818834729 E-mail vijender126@yahoo.com (as per letter dated 30.11.2021)	14.06.1958	14.06.2028	08.07.2019	IRSS
36	B.P.GUPTA	Retd CAO/C/N/ECR/Patna.	H.No.12, Mangalam Vihar, Colony, ERA Garden Road,PO.B.V.College,Patna-800014. Mob-9771443109. email- bpguptaone@gmail.com	27.02.1957	27.02.2027	14.08.2019	IRSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
37	S.K.JATAV	CTPM	502,Sector-2,Panchukula,Haryana,pin-134112. Mob-09877861093. email-Surendra110155@gmail.com	11.01.1955	11.01.2025	05.09.2019	IRTS
38	HEMANT KUMAR SINGH	Addl.Director General,RDSO/LKO	106A.Ashok Nagar, Basharatpur,Gorakhpur-273004 (UP) Mob.09793907954 & email hemant1958in@yahoo.com	11.08.1958	11.08.2028	05.09.2019	IRSE
39	SURINDER KAUL	Advisor/Bridges,Rly BD	12,Arjun Marg,FF DLF City, Phase-1,Gurgaon-122002 (HR).	13.07.1957	13.07.2027	05.09.2019	IRSE
40	KRISHAN CHAND SAINSI	Retd. Pr.CE./E.C.Rly	244/3-A,Railway officers Flats Panchkuian Road, New Delhi-110001 Mobile -9910559700 krishansainsi@gmail.com	17.10.1958	17.10.2028	18.10.2019	IRSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
41	AJAY KUMAR LAL	FA & CAO/System, Northern Railway, Baroda House, New Delhi	DDA HIG Flat, Block 3 A/101 A, Motia Khan New Delhi-55 Mobile -9560715757 ajay k lal@yahoo.com	13.07.1958	13.07.2028	18.10.2019	IRAS
42	SHAHZAD SHAH	Financial Commissioner (Rly) and ex Officio Secy., Govt of India, New Delhi	c/o Adil Shah, 1903, Fairfield C, Lodha Luxuria, Majiwada, Thane (W)-400601 Mobile -9870327709 ssshah13@gmail.com	13.02.1957	13.02.2027	18.10.2019	IRAS
43	ALOK RANJAN	Addl. Member (Civil Engineering), Railway Board, New Delhi	A-78, Swarn Jayanati Rail Nagar, Plot No. A-1, Sector-50, NOIDA Distt. Gautam Buddha Nagar (UP) PIN-201303 Mobile -9818798381 alok1@yahoo.com	26.06.1958	26.06.2028	18.10.2019	IRSE
44	Vijay Sehgal	AGM/NWR/Jaipur	Flat No.101, Akshat Tower, D-217, Bhaskar Marg, Banipark, Jaipur- 302016. M -9602874845 vijay_sehgalirse@yahoo.com	02.11.1958	02.11.2028	22.11.2019	IRSE

19/07/2023

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
45	Khichchu Mal	Pr.CE./E.C.Rly	Flat No 729,Executive Apartment, Bhawna Estate, Sikandra,Agra,Pin-282007.Mob 8800010978 E-mail kmal.kmaliitian.si@gmail.com	12.01.1958	12.01.2028	22.11.2019	IRSE
46	Mahesh Kumar Jain	Retd. Director/Indian Institute of Electrical Engineers, Nashik	A-11, Swaran Jayanti Rail Nagar, Sector-50, Noida-201301 Mobile -9717009932 maheshkumarjain@hotmail.com	01.07.1953	01.07.2023	22.11.2019	IRSEE
47	K.RAMA SUBRAMONIA PILLAI	FA&CAO/S&W/PER/ SR, Chennai.	Flat No.G4, Morning Rose, Victoria Garden,#1, IAF Station Road,Tambaram East,Chennai-59.Mob 7550088900 & 8248206642 Email-krsp.rly@gmail.com.	05.04.1957	05.04.2027	26.12.2019	IRAS

N.Rly.

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
48	Rajendra Prasad	CAO/C/SR/Ernakulam	Flat No.190-D, 1st Floor, Garud Apartment, Pocket- (Near Mayur Vihar,Phase-1,Metro station), Mayur Vihar Phase-1,Delhi-110091. Mob:-7292053608 Email-rajendrapdirse@gmail.com.	01.07.1958	01.07.2028	03.02.2020	IRSE
49	Satya prakash Piplani	AM/RS	B-11, Vijay CGHS Ltd, Plot 17,Sector 18-A, Dwarka, NDSL-110078 Mob-9810803304 Email-sppiplani@yahoo.co.in	02.09.1955	02.09.2025	03.02.2020	IRSS
50	Lokesh Narayan	AGM/NFR	C-702,Rail Vihar, Sector Alpha1, Greater Noida-201310. Mob:-6901217091 Email-lokeshnarayan2007@rediffmail.com	13.12.1958	13.12.2028	03.02.2020	IRSEE
51	Ompal Singh	CAO/Core/ALD	B3/6,Rail Vihar, Niti Khand - 3,Shipra sun City, Indrapuram,Ghaziabad (UP)-201014. Mob-7042141252. Email-ompal,irsee@gmail.com	07.07.1957	07.07.2027	03.02.2020	IRSEE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
52	B Pandey	PFA/C Rly	Flat No. 1104, Tower No. KNG 001, JP Greens Wish Town Klassic, Noida, UP, PIN 201305.vishwamitram1@gmail.com Mob 8452099000	24.05.1957	24.05.2027	09.03.2020	IRAS
53	Nalini Kak	AM/Budget/Rly BD	Flat No-28,Louvre1, Tata Raisina Residency,P.O.Kaderpur, Sector-59,Gurugram,Haryana-122101. Mob No 9717652123 email:- nalinikak@yahoo.com	11.12.1957	11.12.2027	09.03.2020	IRAS
54	JITENDRA NARAYAN LAL DAS	Pr.CE/S.E.RLY	No.702,North,Udaigiri Apartment Budh Marg,Patna-800001.Email-laldasjn@yahoo.co.in Mob-09523096081	18.01.1959	18.01.2029	26.05.2020	IRSE
55	SHYAM LAL VERMA	CAO/C/NR	E-314,IRCON Apartment, Plot-14,Sector-19A,Dwarka,New Delhi-110078. M-9717666757,9990112591 Email-Shyam2502@gmail.com	13.02.1959	13.02.2029	26.05.2020	IRSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
56	PRAMOD KUMAR SANGEWAR	PrCMM/SCR/sc	H.No.12-5-65/1, Flat No-109,sri Harsha Sethuram Unique,Vijayapuri Colony, South Lallaguds, Secunderabad-500017. M-9573306709 Email-sangewarer@gmail.com	10.02.1959	10.02.2029	08.06.2020	IRSS
57	LALIT KAPUR	CAO/C/NWR	A-502,Riverview Apartments, Mayur Vihar,Phase-1, New Delhi-110091. M-9950000677 email-lkapur214@gmail.com	21.04.1959	21.04.2029	08.06.2020	IRSE
58	Ashok Kumar Harit	GM/DLW/Varanasi	Flat No.A-91,Awarn Jayanti Rail Nagar,Sector-50,Noida-201303. M-8800974444 & email-ashokkharit@gmail.com	28.08.1956	28.08.2026	22.07.2020	IRSE
59	ANURAG KUMAR SACHAN	CAO/C/USBRL/JAT	Flat No 14-A , Railway officers Enclave,S P Road, NDLS-110021. M9560763330 email-aksachan31@gmail.com	31.07.1960	31.07.2030	18.09.2020	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
60	VIRENDRA KUMAR VERMA	CE/CONST./SER	Flat No 1125 Prestige Lvy League , Hi Tech City Road, Besides Epark TCS , Kondapur, Hyderabad-500084. (Telengana). M-7702422822 email- vkverma83@rediffmail.com.	18.01.1960	18.01.2030	18.09.2020	IRSE
61	Siya Ram	CEE/SR&GGM/IRCTC	A-702,Rail Vihar,sector-Alpha-1,Greater Noida,GB Nagar (UP)-201308. M-9717640451 E-mail sr_sachan@yahoo.co.in	01.01.1960	01.01.2030	14.10.2020	IRSEE
62	Saroj Rajware	Addl. Member/Budget	B 301, Rail Vihar, Gurgaon (Haryana)-122001.M-9910487361 Mail: saroj.rajware@gmail.com	10.03.1955	10.03.2025	18.11.2020	IRAS

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
63	Rakesh Goyal	Addl. Member(CE)	Flat No.2094, Joy Apartments, Pocket-2, Sector-2, Dwarka, New Delhi-110075.M-9717644264 Mail:goyal1259@gmail.com	25.09.1959	25.09.2029	18.11.2020	IRSE
64	MAHESH KUMAR GUPTA	AGM/NWR	H. No. 155, Lane-5, Guru Jambheshwar Nagar, Gandhi Path, Vaishali Nagar, Jaipur-302021.M-7525835777 Mail:mkg239@hotmail.com	16.07.1959	16.07.2029	18.11.2020	IRSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
65	Ajay Vijayvargiya	GM/WCR/Jabalpur	M 17-A, SAMSARA, Sector 60, Golf Course Extension Road, Gurugram (Haryana)-122001. M-8800131132 Mail: vijayvargiya.ajay@gmail.com	22.09.1959	22.09.2029	18.11.2020	IRSSE
66	Raghu Nandan Prasad	COS(HAG-NF) SWR	B1/901,Sangath,SKYZ, Bhat-Motera Road,Nr.Koteshwar,ADI-380005.M-9879561690 e-mail raghu82uor@gmail.com	06.10.1959	06.10.2029	28.01.2021	IRSS
67	R.C.Meena	Retd CAO/RWP/Bela (Saran)	Flat No.F-004,Ground Floor, Mahima Panorama,Near SRN International School,Jagatpura,Jaipur,Rajasthan-302017. M-9602503263, 9264459222. e-mail rcmcwe@gmail.com	07.07.1958	07.07.2028	28.01.2021	IRSME

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
68	Anil Kumar Agarwal	Retd AM/Mech.E/RB	H.No 26,Shivakunj Railway Housing Society,Near 12 no BUS Stop,Bhopal-462016.M-9481041666 e-mail akagarwal1259@gmail.com	27.12.1959	27.12.2029	05.02.2021	IRSME
69	Rashmi Goel	Retd. GM/DLW, Varanasi	Flat No.98, Rohit Cooperative Group Housing Society, Plot 30, Sector-10, Dwarka, New Delhi-110075 M-9560195018 Mail: rashmijaingoel9@yahoo.co.in	08.12.1959	08.12.2029	03.03.2021	IRAS
70	Arun Kumar	Retd CE/P&D N.Rly	JAC-1403, Shipra Srishti, Ahinsa Khand-1, Indirapuram,Ghaziabad, PIN-201014 M-9560697004 Mail: thakurji.rajkhand@gmail.com	15.02.1960	15.02.2030	03.03.2021	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
71	Pradeep Kumar	Retd PCMM N.Rly	House No.9226, Sector C-9, Vasant Kunj, New Delhi-110070 M- 8800880768 Mail: pradeepjuly29@gmail.com	29.07.1958	29.07.2028	03.03.2021	IRSS
72	Atul Mohan	Retd FA&CAO/ C/NFR	Flat No.E-1501,"The SPRINGS" Plot No.4,Sector-20,Kalamboli Taloja Link Road,Roadpali, Navi Mumbai-410218. Mob-9678033103 email-mohan_atuk@hotmail.com	07.06.1957	07.06.2027	22.03.2021	IRAS
73	T.P.Singh	Retd GM/NR	5813,Modern Housing Complex, Manimajra, Chandigarh. Mob 8968806000 email tpsing@gmail.com	21.01.1960	21.01.2030	31.03.2021	IRSME

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
74	M.Suresh	Retd AM/Signal/RB	A2/1205,Krishna Apra Gardens,Vaibhav Khand, Indirapuram,GZB (UP)-201010.Mob-9717986159 e-mail mahadevsuresh302@gmail.com	15.09.1954	15.09.2024	09.04.2021	IRSSE
75	Dhanesh Gupta	Retd CE/TSP	OC-1,Flat No.41, Orange Country, Indrapuram,GZB-201014. Ph 0120-4210954 ,Mob-9717700294 & E-mail Dg120256@gmail.com	15.07.1956	15.07.2026	22.04.2021	IRSE
76	Piyush Agarwal	Retd AM/Plg/RB	C-307,Sheetal Vihar CGHS piot-10, Sector-23,Dwarka,NDLS-110077. Mob-9717643653.Email piyushagarwal2@gmail.com	15.03.1960	15.03.2030	22.04.2021	IRSE
77	Akhil Agarwal	Retd DG(Signal & Telecom) RB	Flat No.K 122, Gulshan Vivante,Sector 137,Noida, UP 201304 Mob-9818130000 E-mail akhilag21@gmail.com	23.06.1958	23.06.2028	21.05.2021	IRSSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
78	S.K.Biswas	Retd PCSTE/CR	Flat No.702,Arvind Tower, Grihapravesh Housing Society, Sector 77, Nodia,UP-201301. Mob-9423598897 E-mail:- shyamal.biswas@gmail.com	11.09.1959	11.09.2029	13.07.2021	IRSSE
79	Manju Gupta	Retd AM/Electrical, Railway Board	M-72, Greater Kailash Part-I, New Delhi- 110048. Mob. 9717601514 E-mail:- manjuguptairsee@gmail.com	02.02.1960	02.02.2030	29.07.2021	IRSEE
80	Naveen Chopra	Retd Pr. Chief Engineer/NR	Flat No. 28, 2nd Floor, Palm Grove Apartment, Plot No. F-5, Sector- 50, Noida, U.P.- 201304, M. 9871460200 E-mail:- nchopra.irse@gmail.com	02.02.1959	02.02.2029	29.07.2021	IRSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
81	Subodh Kumar Kulshrestha	Retd Pr. CE/ Central Railway	Flat 304, Aashna Apartments, St. Martin Road, Bandra (West) Mumbai- 400050. Mob. 9819405107 E-mail:- subodhk2003@yahoo.com	14.07.1957	14.07.2027	08.09.2021	IRSE
82	S.P. Upadhyay	Retd PCSTE/ Northern Railway	Flat No. 215, MH7, Mahagun Moderne, Noida, Sector-78, Gautam Buddha Nagar, U.P- 201301. Mob. 7217720000 E-mail:-spu5959@gmail.com	08.01.1959	08.01.2029	08.09.2021	IRSSE
83	Jagdip Rai	Retd CAO/C/NR	A-16,Swarna Jayanti Rail nagar,sector-50, Noida,Pin-201303. Mob-9599701024 E-mail:- jagdip.jagdiprai@gmail.com	25.11.1958	25.11.2028	21.09.2021	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
84	Ajai Kant Rastogi	Retd DRM/Madurai/ S Rly.	Flat No. 209, Rohit Residency, 4C, Vikalp Khand, Gomti Nagar, Lucknow, U.P- 226010. M. 9415647882, 7705004554 E-mail:- ajaikant2@gmail.com	29.01.1960	29.01.2030	14.10.2021	IRAS
85	Surinder Kumar	Retd CE/P&D/NR	Flat No. E-201, The Palm Drive, Golf Course Ext. Road, Sector-66, Gurugram-122018. Mob.-9625619618 E-mail:- ksurinder59@yahoo.com	13.05.1959	13.05.2029	14.10.2021	IRSE
86	C.M.Jindal	Retd DG/IRIFM/Secunderabad	Flat No.505, Palm Grove Apartments, Plot-F-5, Sector-50, Noida (UP), Pin-201301 Mob.7060113444 E-mail:- cmjindal@yahoo.co.in	16.07.1960	16.07.2030	20.10.2021	IRAS

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
87	Ajay Kumar Singh	Retd CAO/WPO/Patna	A-341,sector-47,Nodia. Mob-9867975069	22.03.1960	22.03.2030	20.10.2021	IRSME
88	Mukesh Kumar Garg	Retd CAO/C/NCR	Flat No.2714,Eternia Tower, Mahagun mezzaria,sector-78,Noida (UP).Pin-201301 Mob 8957772177 & 9628786852 E-mail:-mkgarg55559@gmail.com	28.06.1959	28.06.2029	25.11.2021	IRSE
89	Ved Pal	Retd AM/Planning, Railway Board	BH-1202, Amrapali Village, Nyay khand, Indrapuram, Ghaziabad-201014, U.P. Mob. 9717009550 9910237887 E-mail:-vedpal1111@gmail.com	01.10.1958	01.10.2028	20.12.2021	IRSEE
90	Shree Bhagwan Bhamu	Retd PCSTE/NWR, Jaipur	A-15, Rail Nagar, Sector-50, Noida, U.P Mob. 9650277775 E-mail:- sbbhamu@gmail.com	30.08.1958	30.08.2028	20.12.2021	IRSSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
91	B. Srinivasan	Retd FA&CAO/ MTP, Southern Railway	Plot No. 10, Sri Thirumalai Nagar, Kakkalur Village , Tiruvallur, Tamil Nadu-602003	15.06.1958	15.06.2028	10.01.2022	IRAS
92	Rajiv Chaudhry	Retd GM/NCR, Prayagraj	C-129, Sector-50, Noida-201301. Mob.9811303025 E-mail:- rajiv.chaudhry10@gmail.com	27.12.1960	27.12.2030	10.01.2022	IRSE
93	S.P. Virdi	Retd FA&CAO/NR	H. No.A-805, New Cosmopolitian Apartments, Plot No.33,Sector-10 Dwarka, New Delhi-110075	08.01.1957	08.01.2027	08.02.2022	IRAS
94	Arvind Mital	Retd PED/Signal, Raiway Board	Flat No. 101,Tower-1,Palm Olympia GH-02, Sector-16C,Greater Noida(West) Pin-201308 Mob.9910487300E-mail:- mitalarvind@gmail.com	29.07.1959	29.07.2029	08.02.2022	IRSSE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
95	Alok Kumar Tewari	Retd AM/EnHM,Railway Board.	Flat 1702,Block-J Oyster Grand, Sector-102,Gurugram, Pin-122505, Mob.9818798388 E-mail:- alok.tewari60@gmail.com alok_tewari60@hotmail.com	15.08.1960	15.08.2030	08.02.2022	IRSME
96	Girish Chandra Agrawal	Retd GM/WR	A-505,Rail Vihar,IRWO Palm Court,Apha-I,Greater Noida,distt-Gautam Budhha Nagar,U.P-201308. Mob 9971718111	15.02.1957	15.02.2027	23.02.2022	IRSME
97	Kamal Dev Ralh	Retd PCE/ECR	895-A, Surya Enclave Jalandhar,Post Office Chugitti,Near G.T.Road Bypass,Punjab-144009.Mob-9877053179 E-mail kamaldevin@yahoo.com & kamaldevralh@gmail.com	12.12.1960	12.12.2030	23.02.2022	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
98	Pradeep Kumar	Retd Member infrastructure/RB	C-701, Bestech PVS Apartments, Sector-47, Gurugram, Gurgaon, Haryana-122018. Mob. 8130820000 E-mail:- prdeepawasthi1981@gmail.com	03.02.1961	03.02.2031	12.04.2022	IRSSE
99	Yogendra Kumar	Retd CMM/CORE	House No. 104/H-19, Sector-7, Rohini, Delhi- 110085. Mob. 9919208157 E-mail:- yogendrak873@gmail.com	01.05.1958	01.05.2028	12.04.2022	IRSS
100	Narender Kumar Garg	Retd CAO/C/ER	Flat No. 2, Rail Vihar, Sector-33, Noida-201307 Mob. 9004900047 E-mail:- nkgarg786@gmail.com	11.02.1956	11.02.2026	12.04.2022	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
101	Sunil Kumar Sarder	Retd CBE, Eastern Railway	151/C, Garfa Main Road, P.O- Santoshpur, P.S- Survey Park, Kolkata- 700075 Mob. 7044634927 E-mail:- sunil_sarder@yahoo.co.in	03.03.1961	03.03.2031	12.04.2022	IRSE
102	T.Venkatasubramanian	Retd PCME/SR	D4B,Regal Palm Garden, Velachery,Chennai-600042. Mob-9962896452.railwayvenkat@yahoo.com	28.02.1961	28.02.2031	02.06.2022	IRSME
103	Ravindra Kumar Tondon	Retd COM/WR	House No.3113,First Floor, Sector-28-D,Chandigarh-160002. Mob-9004639990 E-mail:- ravindra.tondon@yahoo.co.in	03.07.1954	03.07.2024	23.06.2022	IRTS
104	Dinesh Kumar	Retd Pr.CEE/RCF,Kapurthala	B-411,Karor CGHS Ltd.Plot-39C,Sector-6,Dwarka,New Delhi.PIN-110075.Mob 9821783939.	08.01.1959	08.01.2029	23.06.2022	IRSEE

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
105	Mahesh Mangal	Retd GM/CORE, Allahabad	57, 2nd Floor, Suraj Nagar East, Civil Lines, Jaipur- 302006 (Raj). Mob. 9001344000 E-mail:- mmangal56@gmail.com	21.08.1956	21.08.2026	21.07.2022	IRSSE
106	Anil Kumar Sharma	CME/BBS, ECoR.	B-901, Aakriti Shantiniketan, Sector- 143 B, Noida, Gautam Budh Nagar, Uttar Pradesh-201304 Mob. 8637251235 Email aksharma1512@gmail.com	24.06.1957	24.06.2027	21.07.2022	IRSME
107	Harekrushna Sahu	FA&CAO/SER	Plot -6,Adarsh Vihar (Lane-2), phase-I, KIIt Square, Patia Bhubaneswar-751024. Mob 8276019671. E-mail sahuhk1961@gmail.com	20.06.1961	20.06.2031	16.09.2022	IRAS

Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
108	Santosh kumar Agrawal	DG/IRICEN/Pune	Flat No.101,SaiShrishti Apartment, Sai Dham Marg,Opposite to Tricots Nayraj,Dr CG Road,Chembur,Mumbai-400074. Mob 8318751282 & 9868899312 e-mail:-agrawalsk61@hotmail.com	10.06.1961	10.06.2031	16.09.2022	IRSE
109	Anirudh Jain	AM/WORKS/RB	V-1502,Nimbus Hyde Park, sector-78,Noida.Pin-201301. mob-9717635816 & 9971257907 e-mail anirudhjain1@gmail.com & anirudhjain1@hotmail.com	09.07.1957	09.07.2027	16.12.2022	IRSE
110	Rajiv Kumar	Pr. CEE/ SWR	A1/202 Tower-6, Purvanchal Heights, Greater Noida, Mob. 9441855506 E-mail:-rajivanubha@gmail.com	07.05.1959	07.05.2029	01.02.2023	IRSEE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
111	Rajan Saksena	CEE/PS/ CORE, Prayagraj	Flat no. 804, Block No. 13 Easter Apartments, Mayur Vihar Phase-1 Extension, Delhi 110096 Mob. 9818837722 E-mail:- osdrailways@gmail.com	05.02.1961	05.02.2031	01.02.2023	IRSEE
112	Brijesh Kumar Gupta	PCMM/ East Central Railway	B-203, Antriksh Greens, Sector-50, Noida, Pin-201301 Mob. 8800506633 & 7428646400 E-mail: brijeshanupam@gmail.com	29.10.1961	29.10.2031	01.02.2023	IRSS
113	Vinod kumar Khera	CPD/Works/NWr	V-304,Ground Floor, Rajouri Garden,New Delhi-110027 Mob 9717636820. E-mail vinodkheral@gmail.com	22.11.1961	22.11.2031	10.02.2023	IRSE

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Arbitrators empanelled in Northern Railway (Retired Senior Administrative Grade and above)							
SNO	**Name of the officer MR/MS**	**Designation at the time retirement**	**ADDRESS & PH.NO**	**D.O.B**	**Date of Removing of Panel (attained the age of 70 years)**	**Date of empanelment**	**Services**
114	Aditya Kumar Vajpayee,	PFA/ COFMOW	Flat No. E-4, Hestia Apartments, Gomtinagar Extension, Sector-4, Lucknow (UP)- 226010 Mob. 9120333161 E-mail:- vajpayeeaditya@gmail.com	03.01.1961	03.01.2031	28.03.2023	IRAS
115	Ranjanesh Sahai,	PFA/ COFMOW	Flat No. 1104, Tower-A, Logix Blossom County, Sector-137, Noida Expressway, PIN-201304. Mob. 9717610007 E-mail:- ranjanesh@yahoo.com	10.02.1962	10.02.2032		IRAS

GENERAL EXEMPTION NO. 128

Exemption to Imports by U.N. or International Organisation for execution of projects in India - [Notfn. No. 84/97-Cus. dt. 11.11.97 as amended by Notfn. Nos. 85/99, 119/99, 75/01, 107/01 and 24/08, 22/14, 44/17].

In exercise of the powers conferred by sub-section (1) of section 25 of the Customs Act, 1962 (52 of 1962), read with sub-section (4) of section 68 of the Finance (No.2) Act, 1996 (33 of 1996), the Central Government, being satisfied that it is necessary in the public interest so to do, hereby exempts all the goods imported into India for execution of **projects financed by the United Nations or an international organisation** and approved by the Government of India, from the **whole of the duty of customs** leviable thereon under First Schedule to the customs Tariff Act, 1975 (51 of 1975), and the whole of the **special duty of customs** leviable under section 68 of the Finance (No.2) Act 1996 (33 of 1996):

Provided that the importer, at the time of clearance of the goods, produces before the Assistant Commissioner of Customs or Deputy commissioner of Customs, as the case may be, having jurisdiction,-

(i) in case the said goods are -

(a) **imported by an international organisation** listed in the Annexure appended to this notification and intended to be **used in a project** that has been **approved by the Government of India and financed (whether by a loan or a grant) by such an organisation**, a certificate from such organisation that the said **goods are required for the execution of the said project** and that the said project has duly been approved by the Government of India; or

(b) **imported for use in a project** that has been **approved by the Government of India** and **financed** (whether by a loan or a grant) **by an international organisation listed in the said Annexure**, a certificate from an officer not below the rank of **Deputy Secretary** to the Government of India, in the **Ministry of Finance** (Department of Economic Affairs) that the said **goods are required for the execution of the said project** and that the said **project** has duly been **approved by the Government of India;**

(ii) in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the **World Bank, the Asian Development Bank or any international organisation**, other than those listed in the Annexure and the said project has been **approved by the Government of India**, a certificate from the **executive head of the Project** Implementing Authority and countersigned by an officer not below the rank of a **Joint Secretary** to the Government of India, **in the concerned Line Ministry** in the Government of India, that the said goods are required for the execution of the said project and that the said project has duly been approved by the Government of India, and

(iii) in case the said goods are intended to be used in a project financed (whether by a loan or a grant) by the World Bank, the Asian Development Bank or any international organisation other than those listed in the Annexure and the said project has been approved by the Government of India for implementation by the Government of a State or a Union Territory, a certificate from the **executive head of the Project Implementing Authority and countersigned by the Principal Secretary or the Secretary (Finance)**, as the case may be, in the concerned State Government or the Union Territory, that the said goods are required for the execution of the said project, and that the said project has duly been **approved by the Government of India for implementation by the concerned State Government.**

2. Where the goods are imported prior to the 1st March, 2008, the importer may-

(a) transfer the goods to a new project subject to the condition that the importer produces before

the Assistant Commissioner of Customs or Deputy Commissioner of Customs, as the case may be, having jurisdiction over the port of import, a certificate from the officer concerned of the Central Government, State Government or Union territory Administration, as the case may be, that the goods are no longer required for the project and a declaration from the United Nations, the World Bank, the Asian Development Bank or any other international organization listed in the Annexure to the said notification that the said goods are required for the said new project which has duly been approved by the Government of India; or

(b) re-export the goods when the goods are no longer required for the existing project subject to the condition that the identity of the goods is established and no export incentive is claimed against such re-export; or

(c) pay the duty of customs which would have been payable but for the exemption contained herein on the depreciated value of the goods subject to the condition that the importer produces before the Assistant Commissioner of Customs or Deputy Commissioner of Customs, as the case may be, having jurisdiction over the port of import, a certificate from the officer concerned of the Central Government, State Government or Union territory Administration, as the case may be, that the goods are no longer required for the project. The depreciated value of the goods shall be equal to the original value of the goods at the time of import reduced by the percentage points calculated by straight line method as specified below for each quarter of a year or part thereof from the date of clearance of the goods, namely:-

(i) for each quarter in the first year at the rate of 4 per cent;
(ii) for each quarter in the second year at the rate of 3 per cent;
(iii) for each quarter in the third year at the rate of 2.5 per cent; and
(iv) for each quarter in the fourth year and subsequent years at the rate of 2 per cent, subject to the maximum of 70%.

Explanation 1 - For the purposes of this notification,-

(a) *"international organisation"* means an international organisation to which the Central Government has declared, in pursuance of section 3 of the United Nations (Privileges and Immunities) Act, 1947 (46 of 1947), that the provisions of the Schedule to the said act shall apply;

(b) *"Line Ministry"* means a Ministry in the Government of India, which has been so nominated with respect to a project, by the Government of India, in the Ministry of Finance (Department of Economic Affairs).

Explanation 2 - For the removal of doubts, it is herebyclarified that the benefit under this notification, in the case of goods supplied to the projects financed by the United Nations or an international organisation, is available when the goods brought into the project are not withdrawn by the supplier or contractor and the expression " goods are required for the execution of the project" shall be construed accordingly.

** Corrigendum vide F.No.605/187/2001-DBK dt.22.10.01.*

ANNEXURE

1. United Nations Development Programme,
2. United Nations International Childrens' Fund,
3. Food and Agricultural Organisation,
4. International Labour Organisation,
5. World Health Organisation
6. United Nations Population Fund.
7. United Nations World Food Programme
8. United Nations Industrial Development Organisation

FINANCIAL PART (PDF FILE)
To be signed and uploaded with BOQ (MS Excel File) as FINANCIAL PART of the Tender by the Tenderer.

Letter of Tender – Financial Part

INSTRUCTIONS TO TENDERERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

The Tenderer must prepare this Letter of Tender on stationery with its letterhead clearly showing the Tenderer's complete name and business address.

Note: All italicized text is to help Tenderers in preparing this form.

Date of this Tender submission: [*insert date (as day, month and year) of Tender submission*]

Tender No.: HORC/HRIDC/C-5/2023

To:

Chief Project Manager/ South,
Haryana Rail Infrastructure Development Corporation Limited (HRIDC),
Plot no.143, 5th floor,
Railtel Tower, Sector-44
Gurugram – 122003
Tel: +91 9729410447

We, the undersigned, hereby submit the second part of our Tender, the Tender Price and Price Schedule. This accompanies the Letter of Tender – Technical Part.

In submitting our Tender, we declare that:

(a) **Tender Validity Period**: Our Tender shall be valid for the period specified in TDS 18.1 (as amended, if applicable) after the date fixed for the Tender submission deadline specified in TDS 22.1 (as amended, if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(b) ****Tender Price:** The total price of our Tender including Provisional Sum is: [*insert the total price of the Tender in words and figures in INR*];

(c) **Commissions, Gratuities, Fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Tendering process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]*

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

Name of the Tenderer: [*insert complete name of the Tenderer*]

Name of the person duly authorized to sign the Tender on behalf of the Tenderer: *[*insert complete name of person duly authorized to sign the Tender*]

Title of the person signing the Tender: [*insert complete title of the person signing the Tender*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*Person signing the Tender shall have the power of attorney given by the Tenderer. The power of attorney shall be attached with the Letter of Tender.

** The total price of Tender including Provisional Sums quoted in this Letter of Tender-Financial Part shall be same as given in Worksheet BOQ5 (Price Schedule –Summary Sheet) of MS-Excel File which includes cost of Schedule 'A' plus Schedule 'B' plus Schedule 'C' plus Schedule 'D' and plus Provisional Sum. However, in case of discrepancy between the total price of Tender including provisional sums quoted in this Letter of Tender-Financial Part and the Excel sheet, the total amount as per the Excel Sheet arrived at after arithmetical correction as per ITT 36 shall prevail.

Appendix A to Financial Part: Schedule of Adjustment Data

1. Price adjustment

1.1 The amounts payable to the Contractor for Works shall be adjusted in accordance with the provisions of this Clause 1.0, Sub-Clause 13.7 of GCC and Sub-Clause 13.7, Specific Provision, Part B, Section IX-PCC.

1.2 The Contract Price shall be adjusted for increase or decrease in rates and prices of labour, materials, fuel and lubricants, equipment, Machinery, Plant and other Materials or inputs in accordance with the principles, procedures and formulae specified below:

a) Base month for the purpose of Price Adjustment shall be the month in which the Tender is opened for Civil Works and General Electrical Services Works. The 1st Quarter will start from Base month;

b) For Schedule-'A', Price adjustment shall be applied on completion of the specified stage of the respective item of work.

c) Adjustment for each item of work/stage shall be made separately;

d) The following expressions and meanings are assigned to the value of the work done for Civil works:

EW = Value of work done for the completion of a stage under the Cost Centre 'CE' of Price Schedule 'A' ;

BR = Value of work done for the completion of a stage under the Cost Centre 'CB' of Price Schedule 'A';

STN = Value of work done for the completion of a stage under Cost Centre CS of Price Schedule 'A';

VIA = Value of work done for the completion of a stage under Cost Centre CV of Price Schedule 'A';

CW = Value of work done under Price Schedule 'B';

The following expressions and meanings are assigned to the Cost Centre of Price Schedule 'A':

Cost Centre	Description of Cost Centre
1	**2**
CE	Earthwork and blanketing
CB	Bridges
CS	Station
CV	Viaduct

e) Price adjustment for change in costs of civil works shall be paid in accordance with the following formula:

i) VEW= 0.85 EW x [PLB x (LBi – LBo)/LBo + PF x (Fi –Fo)/Fo + PMACH x (MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

ii) VBR = 0.85 BR x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x (SRi – SRo)/SRo + PF x (Fi – Fo)/Fo + PMACH x (MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

iii) VSTN = 0.85 STN x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x (SRi – SRo)/SRo + PF x (Fi – Fo)/Fo + PMACH x ((MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

iv) VVIA = 0.85 VIA x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x(SRi – SRo)/SRo + PSS x(SSi – SSo)/SSo+ PF x (Fi – Fo)/Fo + PMACH x ((MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

v) VCW = 0.85 CW x [PLB x (LBi – LBo)/LBo + PC x (Ci – Co)/Co + PSR x (SRi – SRo)/SRo+ PSS x(SSi – SSo)/SSo + PF x (Fi – Fo)/Fo + PMACH x (MACHi – MACHo)/MACHo + POTH x (OTHi - OTHo)/OTHo];

Where,

vi) VEW = Increase or decrease in the cost under the Cost Centre 'CE' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

vii) VBR = Increase or decrease in the cost of Cost Centre 'CB' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

viii) VSTN = Increase or decrease in the cost of Cost Centre 'CS' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

ix) VVIA = Increase or decrease in the cost of Cost Centre 'CV' of Price Schedule 'A' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

x) VCW = Increase or decrease in the cost of work done under Price Schedule 'B' during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (f);

PC, PF, PLB, PMACH, POTH, *PSR and PSS* are the percentages of cement, fuel and lubricants, labour, Plant Machinery and tools, other materials, *Reinforcement steel/ steel components (including strands and steel cables) and Structural Steel*, respectively for the relevant item as specified in sub-paragraph (f);

xi) Co = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for sub-group Cement, Lime & Plaster for the Base Month;

Ci = The WPI for sub-group Cement, Lime & Plaster for the average price index of the 3 months of the quarter under consideration;

xii) Fo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for group Fuel & Power for the Base Month;

Fi = The WPI for group Fuel & Power for the average price index of the 3 months of the quarter under consideration

xiii) LBo = The consumer price index for industrial workers – All India, published by Labour Bureau, Ministry of Labour, Government of India, (hereinafter called "CPI") for the Base Month;

LBi = The CPI for industrial workers – All India for the average price index of the 3 months of the quarter under consideration;

xiv) MACHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for category- k "Manufacturing of Machinery for Mining, quarrying and construction' under (R) Manufacturing of Machinery and Equipment for the Base Month;

MACHi = The WPI for category- k "Manufacturing of Machinery for Mining, quarrying and construction' under (R) Manufacturing of Machinery and Equipment for the average price index of the 3 months of the quarter under consideration;

xv) OTHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for all commodities for the Base Month;

OTHi = The WPI for all commodities for the average price index of the 3 months of the quarter under consideration;

xvi) SRo = Average Rate of RINL for Rebar 8 mm (coil) as published for Ludhiana Branch on their website for the Base Month;

SRi = Average rate of RINL for Rebar 8 mm (coil) as published for Ludhiana Branch on their website for the 3 months of the quarter under consideration;

If only one rate is published for the 3 months of the quarter under consideration, the published rate for that quarter shall be considered for the quarter under consideration.

If no rate is published by RINL for Rebar 8mm (coil) for the 3 months of the quarter under consideration, the value of Si and So will be taken as under:

"SRo": Wholesale Price Index for 'MS Bright Bars' individual commodity of group item (d) Mild Steel- Long products under (N) MANUFACTURE OF BASIC METALS, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry Department of Industrial Policy & Promotion (DIIP) for the Base Month;

"SRi": Average Wholesale Price Index for 'MS Bright Bars' individual commodity of group item (d) Mild Steel- Long products under (N) MANUFACTURE OF BASIC METAL, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry Department of Industrial Policy & Promotion (DIIP) for the 3 months of the quarter under consideration;

xvii) "*SSo": Whole Sale Price Index for group item (e) Mild Steel- Flat products under (N) MANUFACTURE OF BASIC METAL, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry, Department for Promotion of Industry and Internal Trade (DPIIT) for the Base Month;*

"SSi": Whole Sale Price Index for group item (e) Mild Steel- Flat products under (N) MANUFACTURE OF BASIC METALS, published by Office of Economic Adviser, Government of India, Ministry of Commerce & Industry, Department for Promotion of Industry and Internal Trade (DPIIT) for the 3 months of the quarter under consideration;

f) The following percentages shall govern the price adjustment of the Contract Price for cost of civil works:

Component	EW (Cost Centre CE of Price Schedule 'A')	BR (Cost Centre CB of Price Schedule 'A')	STN (Cost Centre CS of Price Schedule 'A')	CV (Cost Centre CV of Price Schedule 'A')	CW (Price Schedule 'B')
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Cement (PC)	-	20%	15%	20%	20%
Fuel and lubricants (PF)	30%	20%	15%	*15%*	*15%*
Labour (PLB)	20%	10%	25%	10%	10%

Component	EW (Cost Centre CE of Price Schedule 'A')	BR (Cost Centre CB of Price Schedule 'A')	STN (Cost Centre CS of Price Schedule 'A')	CV (Cost Centre CV of Price Schedule 'A')	CW (Price Schedule 'B')
Machinery and Plants (PMACH)	40%	15%	05%	*10%*	*10%*
Other Materials (POTH)	10%	10%	20%	10%	10%
Reinforcement* Steel *(PSR)	-	25%	20%	*17%*	*15%*
Structural Steel (PSS)	-	-	-	*18%*	*20%*
Total	100%	100%	100%	100%	100%

g) The following expressions and meanings are assigned to the value of the work done for Various General Electrical Services works:

i) **ELEGWK** = Value of work done for General Electrical Services under Price Schedule 'C';

h) Price adjustment for changes in cost for various General Electrical Services works shall be paid in accordance with the following formula:

i) **VELEGWK** = 0.85 ELEGWK x [PLB x (LBi – LBo)/LBo + POTH x (OTHi – OTHo)/OTHo]

Where: -

VELEGWK = Increase or decrease in the cost of work done under Price Schedule 'C' of '**General Electrical Services works'** with complete accessories during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (i);

PLB and POTH are the percentages of Labor and, All Other Commodities respectively for the relevant item as specified in sub-paragraph (i);

LBo = The consumer price index for industrial workers – All India, published by Labour Bureau, Ministry of Labour, Government of India, (hereinafter called "CPI") for the Base month;

LBi = The CPI for industrial workers – All India for the average price index of the 3 months of the quarter under consideration

OTHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for "All commodities" for the Base month;

OTHi = The WPI for all commodities for the average price index of the 3 months of the quarter under consideration;

i) The following percentages shall govern the price adjustment of the Contract Price for Various General Electrical Services works:

Component	**General Electrical Services Works**
Labour (PLB)	20%
All other commodities (POTH)	80 %
Total	100.00%

j) The following expressions and meanings are assigned to the value of the work done for Signalling & Telecommunication (S&T) Works:

i) **STWK** = Value of work done for Signalling & Telecommunication (S&T) Works under Price Schedule 'D';

k) Price adjustment for changes in cost for Signalling & Telecommunication (S&T) Works shall be paid in accordance with the following formula:

i) **VSTWK** = 0.85 STWK x [PLB x (LBi – LBo)/LBo + POTH x (OTHi – OTHo)/OTHo]

Where: -

VSTWK = Increase or decrease in the cost of work done under Price Schedule 'D' of '**Signalling & Telecommunication (S&T) Works '** with complete accessories during the period under consideration due to changes in the rates for relevant components as specified in sub-paragraph (i);

PLB and POTH are the percentages of Labor and, All Other Commodities respectively for the relevant item as specified in sub-paragraph (i);

LBo = The consumer price index for industrial workers – All India, published by Labour Bureau, Ministry of Labour, Government of India, (hereinafter called "CPI") for the Base month;

LBi = The CPI for industrial workers – All India for the average price index of the 3 months of the quarter under consideration

OTHo = The wholesale price index as published by the Ministry of Commerce and Industry, Government of India (hereinafter called "WPI") for "All commodities" for the Base month;

OTHi = The WPI for all commodities for the average price index of the 3 months of the quarter under consideration;

l) The following percentages shall govern the price adjustment of the Contract Price for Signalling & Telecommunication (S&T) Works:

Component	**Signalling & Telecommunication (S&T) Works**
Labour (PLB)	20%
All other commodities (POTH)	80 %
Total	100.00%

Table A. Foreign Currency (FC)

Not applicable as Tenderers are required to quote rates and prices only in INR.

Table B. Summary of Payment Currencies

For ……. [insert name of Works]

Name of Payment Currency	A Amount of Currency	B Rate of Exchange (local currency per unit of foreign)	C Local Currency Equivalent C = A x B	D Percentage of Net Tender Price (NTP) 100xC / NTP
For Schedule 'A'				
Local currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				
Schedule 'B' Local Currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				
Schedule 'C' Local Currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				

Schedule 'D' Local Currency (INR)		**1.00**		
Foreign Currency # 1				
Foreign Currency # 2				
Foreign Currency # 3				
Net Tender Price				**100.00**
Provisional Sums Expressed in Local Currency (INR)	100,000,000.00	**1.00**	100,000,000.00	**Not Applicable**
TOTAL TENDER PRICE (including provisional sum)				

Note: *The Tenderer is required to propose and submit the schedules given in tables above as part of the Tender. The rates of exchange shall be the reference rate twenty-eight (28) days prior to the deadline for submission of Tenders published by the Reserve Bank of India (RBI) on its website https://www.rbi.org.in . In case the exchange rate of particular currency on given date is not available on RBI web site, it will be as per the web site https://www.fbil.org.in of Financial Benchmark India Private Limited (FBIL).*

Appendix B to Financial Part: Price Schedules

1 Preamble

1.1.*The* Price Schedules shall be read in conjunction with the Instructions to Tenderers, the General Conditions, the Particular Conditions and the Employer's Requirements General, Functional, Design (Civil & BLT), Construction (Civil & BLT), Outline Design Specifications (ODS)-Civil & BLT, Outline Construction Specifications (OCS)-Civil & BLT, General Electrical Services, Signalling & Telecommunication (S&T) Works, Tender Drawings and Documents, Appendices and the Addenda/Corrigenda (if any). *The price quoted by the Contractor for Price Schedules Schedule 'A', Schedule 'B', Schedule 'C' and Schedule 'D' shall include cost of the Works as per Part 2-Employer's Requirements (General, Functional, Design- Civil & BLT, Construction - Civil & BLT, Outline Design specifications (ODS) - Civil & BLT, Outline Construction Specifications (OCS) - Civil & BLT, General Electrical Services, Signalling & Telecom (S&T) Works, Tender Drawings and Documents, Appendices and the Addenda/Corrigenda (if any).*

1.2.**Schedule 'A'** comprises *cost* of work*s* to be executed under lump sum contract as detailed in Part 2- Employers' Requirements of Tender Document. *Design of all permanent work included in the Scope of Works of Schedule 'A' and Schedule 'B' shall be included in Schedule 'A'.* The Tenderer has to quote a single lump sum amount against Schedule 'A'. Payment to the Contractor will be made in accordance with payment stages/Milestones defined for each Cost Centre detailed in Clause 5.0 below unless otherwise specified in the Contract..

1.3.**Schedule 'B'** comprises of BoQ items for "Retaining Wall, Bridges & other civil works". Schedule 'B' **is** subdivided into fourteen parts i.e. Sub-Schedules B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13 and B14. Cost of design and drawings of all the temporary works, temporary road diversion is deemed to be included in the rates quoted for the relevant item of Schedule 'B' unless otherwise specified in the Contract. The Tenderer has to quote the percentage Excess (+) or Less (-) over the total Estimated amount of each Sub-Schedule of Schedule 'B' (which is shown as "Estimated Rate" against each Sub-Schedule of Schedule 'B' in BOQ2 of MS excel file on eProcurement portal). The payment against this Schedule 'B' will be made on the basis of quantities executed, measured and certified. Under this Schedule, the Contractor is required to carry out all works of retaining walls, bridges and other civil works, which are not covered in Schedule 'A', as per site requirements and as per the direction of the Engineer.

1.4.**Schedule 'C'** comprises of BoQ Items for "General Electrical Services works". The Tenderer has to quote the percentage Excess (+) or Less (-) over the total Estimated amount of Schedule 'C' (which is shown as "Estimated Rate" against Schedule 'C' in BOQ3 of MS excel file on eProcurement portal). The quoted rate includes the cost of design and drawings of relevant systems and items as specified in the Contract Documents. The payment against this Schedule will be made on the basis of quantities executed, measured and certified by the Engineer. Under this Schedule, the Contractor is required to carry out all works of General Electrical Services works, which are

not covered in Schedule 'A' or Schedule 'B', as per site requirements and as per the direction of the Engineer.

1.5. **Schedule 'D'** comprises BoQ Items for "Signalling & Telecommunication (S&T) Works". The Tenderer has to quote the percentage Excess (+) or Less (-) over the total Estimated amount of Schedule 'D' (which is shown as "Estimated Rate" against Schedule 'D' in BOQ4 of MS excel file on eProcurement portal). The quoted rate includes the cost of design and drawings of relevant systems and items as specified in the Contract Documents. The payment against this Schedule will be made on the basis of quantities executed, measured and certified. Under this Schedule, the Contractor is required to carry out all works of shifting of Signalling & Telecommunication (S&T) Gears at DFCCIL New Prithla Station for connection to HORC Prithla Station, which are not covered in Schedule 'A' or Schedule 'B' or Schedule 'C' as per site requirements and as per the direction of the Engineer.

1.6. The Schedules may not generally give a full description of the works to be performed and the plant or equipment to be supplied under each item. Tenderers shall be deemed to have read the Employer's Requirements and the other sections of the Tender Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling the rates and prices.

1.7. The price quoted in the Price Schedules for Schedule 'A', Schedule 'B' Schedule 'C' and Schedule 'D' are for complete and finished items of the work in all respects. The Price quoted in the Price Schedules shall, except otherwise specifically provided, shall include all design, include all necessary survey work, plants , tools, machinery, Contractor's equipment, labour, compliance of labour laws, supervision, materials, transportation, handling, loading & unloading, storage, sampling, testing, fuel, oil, consumables, electric power, water, all leads & lifts, dewatering, all temporary works including temporary accesses, staging, form works and false works, stacking, provision and maintenance of all temporary works area, construction of temporary store and buildings, fencing, barricading, lighting, drainage arrangements, erection & maintenance of inspection facilities above and below ground such as brick, concrete and steel etc., reinstatement, remedy of any defects during the Defects Notification Period, safety measures for workmen and road users, preparation of design and drawings pertaining to permanent and temporary works, & temporary diversion works, temporary road widening, traffic diversion works, mobilisation and demobilisation, establishment and overhead charges, labour camps, insurance cost for labour and works, contractor's profit, all taxes including Goods and Service Tax (GST), insurance, royalties, duties, cess, octroi, other levies and other charges together with all general risks, liabilities and obligations set out or implied in the Contract.

1.8. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the Price Schedules, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Work.

1.9. To the extent acceptable to the Employer for the purpose of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Engineer may reasonably require, the Contractor may provide the Engineer with a breakdown of any composite or lump sum items included in the Schedules.

1.10. The Provisional Sums included and so designated in the Price Schedules shall be expended in whole or in part at the direction and discretion of the Engineer. The Provisional Sum shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21. No prior instruction of the Engineer shall be required with respect to the work of the DAAB in accordance with Sub-Clause 13.4 of Part B-Specific Provisions - Particular Conditions of Contract. The Contractor shall submit the DAAB members' invoices and satisfactory evidence of having paid 100% of such invoices as part of the substantiation of those statements submitted under Sub-Clause 14.3. in accordance with Sub-Clauses 13.4 of the General Conditions.

1.11. The prices shall be quoted against Schedule 'A', Schedule 'B', Schedule 'C' and Schedule 'D' in the Price Schedule (Excel Workbook) uploaded on the eProcurement portal.

1.12. The prices quoted shall be comprehensive and must include for complying in all respects with the Price Schedules, Instruction to Tenderers, the General Conditions, the Particular Conditions, Employer's Requirements, Specifications and Drawings and for all matters and things necessary for the proper construction, completion, and making good of any defect in part or of the whole of the Works.

1.13. No claims for additional payment shall be allowed for any error or misunderstanding by the Contractor of the work involved.

1.14. The rates quoted by the Tenderer are for design and construction of the Works as per approved Alignment Plan & L-Section, approved GADs of bridges and approved drawings of other structures as per Scope of the Works.

2 Variations in Price Schedule 'A', Schedule 'B' Schedule 'C' and Schedule 'D'

2.1 Variations in Price Schedules shall be dealt in accordance with Sub Clause 13.3.1 of Part B-Specific Provisions, Section IX- Particular Conditions of Contract.

2.2 The through Chainages mentioned in the Scope of the Works/Tender Drawings can undergo some minor corrections, without any impact on the overall length/Scope of the Works.

3 Measurement and Payment

3.1 The measurement shall be made as per Price Schedules i.e. Schedule 'A'. Schedule 'B' Schedule 'C' and Schedule 'D' and other relevant provisions of the Contract such as Employer's Requirements and the Drawings.

3.2 If during execution of the Contract, it is decided by the Employer/Engineer that one or more

items of Work/Milestone of a Cost Centre in a particular Price Schedule is not required to be executed, the proportionate amount against that particular Item of Work/Milestones shall not be paid. *No claim by the Contractor on this account shall be payable by the Employer.* The Engineer's decision in this regard shall be final.

3.3 The Payment shall be made as per Clause 14 [Contract Price and Payment] of the General Conditions and Particular Conditions.

3.4 The Employer shall make interim payments to the Contractor in accordance with the provisions of Sub-Clause 14.6 [Issue of Interim Payment Certificates] of the General Conditions and Particular Conditions, as certified by the Engineer on the basis of the progress achieved for the items of works/stages/Milestones of the works.

3.5 The Contractor shall base its claim for interim payment in accordance with Sub-Clause 14.3 [Application for Interim Payment] of the General Conditions and Particular Conditions for each stage for various items of work on the basis of actual progress of work executed (i.e. Milestones achieved) till the end of the month for which the payment is claimed in relation to the Contractor's total executed quantity, supported with documents and updated programme in accordance with the Employer's Requirements.

3.6 The Employer may carry out necessary tests, either directly or through an independent agency, of the Works done by the Contractor for which payment has been accepted and certified by the Engineer. The payment shall depend upon the outcome of such tests.

3.7 Format for the Contractor's application for payment shall be agreed between the Engineer and the Contractor.

3.8 All necessary supplementary details to support progress claims, including all certified Request for Inspection in hard bound copy, shall be included with application for payment. Sketches, drawings, approvals, calculations, test reports etc. shall accompany an application for payment to be substantiated and certified by the Engineer and submitted to the Employer.

3.9 Even if no work is executed during the month, or the Contractor does not choose to issue an application for payment, a 'NIL' application shall be submitted.

3.10 For the purposes of payment, the Contractor shall submit to the Engineer a detailed Price Schedule indicating a further breakdown for each stage of payment contained in the Price Schedules within forty-two (42) days after the receipt of the Letter of Acceptance. Such cost breakdowns shall be subject to approval of the Engineer who shall review and evaluate with comments and/or issue approval within twenty-eight (28) days of receipt of same. The Contractor shall resubmit the cost breakdown structure corresponding to the Engineer's comments for review, if required.

3.11 The Engineer is not obliged to issue an Interim Payment Certificate until such breakdown structure of payment schedule has been submitted and accepted by the Engineer.

4 Methodology for Claiming Payment

4.1 The Contractor shall prepare his monthly application for payment in the agreed format in two hard copies and one soft copy. This shall be accompanied by supplementary details in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates] of the General Conditions. All hard copies shall bear the original signatures of the Contractor's Representative and be submitted to the Engineer.

4.2 If these are found in order, in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] of the General Conditions, then the Engineer shall forward two certified copies of the application along with certified supplementary details to the Employer, with his recommendation for payment; otherwise, all documents shall be returned to the Contractor for rectification and resubmission.

5 Price Schedule

5.1 Schedule "A'- Breakup of Lump Sum cost of Works under various Sub-Heads shall be as follows:

Sub-Head	Description	Percentage of the quoted lump sum cost of Schedule 'A'	No. of Cost Centre	Total Cost of Sub-Head
1	2	3	4	5
C	Civil works	100%	5	C= 1xLS*

*LS = Total lump sum accepted cost of the Works for Schedule 'A'

5.2 Apportionment of Contract Price for payments under various Cost Centre for Sub-Head 'C'- Civil Works

Cost Centre	Description of Cost Centre	Percentage of Cost Centre 'C'	Total Cost of Cost Centre	Total Cost of Sub-Head 'C'
1	2	3	4	5
CD	Design and As Built Drawing & Documents	1.50%	CD= 0.015x 'C'	100% of SCH 'A'
CV	Viaduct	69.00%	CV=0.69x 'C'	
CE	Earthwork and blanketing	13.20%	CE=0.132x 'C'	
CB	Bridges	12.00%	CB=0.12x 'C'	
CS	Station	4.30%	CS=0.043x 'C'	
	Total	100.00%		

Note: Value of 'C' shall be as defined in Sub-Clause 5.1 above.

The percentage figures as filled in column (3) for the apportionment of the Contract Price for completion of the Works corresponding to the various Sub-Heads and Cost Centres are fixed and payment will be released for different Cost centre as per above percentage break-up of Contract Price.

5.2.1 Stages of Payment i.e. Milestones of Cost Centre 'CD'- Design and As Built Drawing & Documents

Cost Centre			'CD'- Design and As Built Drawing & Documents	
Weightage of Cost Centre 'CD', (X)-			1.5%	
Sub Cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
CD1- Design	**CD1.1**	**Preliminary design**	Preliminary Design	4.00%
	CD1.2	**Formation**	Definitive design & Good for Construction Drawings (GFC)	4.00%
	CD1.3	**Minor Bridges**		
	CD1.3.1		Preparation & approval of GADs	6.00%
	CD1.3.2		Definitive Design	5.00%
	CD1.3.3		Good For Construction (GFC) Drawings	6.00%
	CD1.4	**Major Bridges**		
	CD1.4.1		Preparation & approval of GADs	5.00%
	CD1.4.2		Definitive Design of OWGs & Composite Girder of Bridge No.17, 28, 45 & 68 with BLT/Ballasted track including GFC	2.00%
	CD1.4.3		Definitive Design including RSI (except OWGs & Composite Girder of Bridge No.17, 28, 45 & 68)	5.00%
	CD1.4.4		Good For Construction (GFC) Drawings (except OWGs & Composite Girder of Bridge No.17, 28, 45 & 68)	5.00%
	CD1.5	**Retaining Walls**		
	CD1.5.1		Definitive Design	2.00%

Cost Centre			'CD'- Design and As Built Drawing & Documents	
Weightage of Cost Centre 'CD', (X)-			1.5%	
Sub Cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
	CD1.5.2		Good For Construction (GFC) Drawings	3.00%
	CD1.6	**Stations**		
	CD1.6.1		Preparation & approval of Architectural Drawings	2.00%
	CD1.6.2		Definitive Design	2.00%
	CD1.6.3		Combined Services Drawings & MEP Drawings	2.00%
	CD1.6.4		Good For Construction (GFC) Drawings	2.00%
	CD1.7	**Viaduct**		
	CD1.7.1		Preparation & approval of GADs	4.00%
	CD1.7.2		Definitive Design including RSI	10.00%
	CD1.7.3		Good For Construction (GFC) Drawings	6.00%
	CD.1.8	**BLT**	On completion of design of BLT (except BLT on Bridge No.17, 28, 45 & 68) including GFC	6.00%
CD2- As Built Drawing & Documents	**CD 2.1**	As Built Drawings	Submission of As Built Drawings	14.00%
	CD 2.2	As Built Documents	Submission of As Built Documents	5.00%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CD 1.3.2 will be equal to LS*X*Y= LSx0.015x0.05.

2. Adjustment to Contract Price pursuant to GCC 13.7 shall **NOT** be applicable to the payments of Works executed under this Cost Centre.
3. All minor bridges shall have equal weightage. Payment of each stage/Milestones shall be made on pro rata basis on completion of a stage for a bridge.
4. All major bridges shall have equal weightage. Payment of each stage/Milestones shall be made on pro rata basis on completion of a stage for a bridge.
5. No payment shall be made against the Sub-Cost Centre CD 1.4.1, if design & drawing of superstructure of Br. Nos. 17, 28, 45, 68 is not required and standard RDSO spans for DFC loading are adopted with the approval of the Engineer.
6. All stations shall have equal weightage. Payment of each stage/Milestones shall be made on pro rata basis on completion of a stage for a station.
7. Payment will be made on Completion of each Milestones as per weightage given in this Cost Centre
8. The cost of Milestones include cost of design of the formation, Bridges, retaining wall & other Structures included in Schedule 'A' and Schedule 'B' as mentioned in Section VII-2:Functional, Employer's Requirements.

5.2.2 Stages of Payment i.e. Milestones of Cost Centre 'CV'- Viaduct

Cost Centre			CV- Viaduct	
Weightage of Cost Centre 'CV', (X)			69.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
CV 1 (From Ch. 20942.473 to Ch. 24843.548)	**CV.1.1**	**Foundation**	On completion of the foundation work including pile caps/ well caps and foundations for wing and return walls, and testing.	36.00%
	CV.1.2	**Substructure**	On Completion of Abutment/Piers including Abutment/Pier Cap without bearings.	
	CV.1.2.1		Pier/Abutment	6.00%
	CV.1.2.2		Pier/Abutment cap	3.00%
	CV.1.3	**Superstructure**		
	CV.1.3.1		On completion of steel girder including launching in position.	26.00%
	CV 1.3.2		On completion of deck slab including wearing course, expansion joint etc. complete.	14.00%
	CV.1.3.3		On fixing of bearings in position true to line & level and placement of superstructure on bearings including grouting of holding down bolts complete. *This item shall also include load testing of required numbers of spans as per Employer's Requirements.*	4.00%

Cost Centre			**CV- Viaduct**	
Weightage of Cost Centre 'CV', (X)			**69.00%**	
Sub-cost Centre	**Item of Work**		**Milestone**	**Weightage (Y)**
	No.	**Description**		
1	2	3	4	5
	CV.1.4	**Installation of BLT on Viaduct *including transition on approach of Abutment A-1***		
	CV.1.4.1		On supply of track fitting/fastening system complete	2.00%
	CV.1.4.2		Construction of ballastless track (On account payment will be made on proportionate basis based on actual work progress in meter divided by total length of ballastless track).	4.00%
	CV.1.4.3		On completion of all balance works as per drawings like replacement of service rails by long panel rails, welding into LWR/CWR, destressing, drainage, supply of spares etc. complete.	1.75%
	CV.1.4.4		Maintenance of ballastless track for one year after start of traffic (to be paid monthly on pro rata basis based on satisfactory performance certificate by the Engineer.)	0.25%

Cost Centre			CV- Viaduct	
Weightage of Cost Centre 'CV', (X)			69.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage (Y)
	No.	Description		
1	2	3	4	5
	CV.1.5	**Miscellaneous works**		
	CV.1.5.1		On completion of Trolley refuge, Pathway on the sides, Inspection arrangement including access ladder etc.as per approved drawings and Employer's requirement,	2.00%
	CV.1.5.2		On completion of balance works as per drawing like- Protection works including Toe wall, Pitching, inspection steps, Bridge plaque, Bridge board, stairs, Height Gauge in RUBs, and Testing on completion, if any, complete in all respect and fit for use.	1.00%
			Total	**100.00%**

Notes-

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CV 1.1 will be equal to LS*X*Y= LSx0.69x0.36.
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Head / Price Schedule.
3. Payment will be made on Completion of each Milestones as per weightage given in this schedule.
4. Stages CV.1.1 to CV.1.2 will further be subdivided into the number of piers + 1 abutments, as applicable as per approved drawing by the Engineer, and Milestones for completed work for each pier and abutment shall be made as per the requirement of the stages stated above.
5. For Steel Composite girder payment against sub cost centre CV.1.3.1 shall be released as per following schedule-

a. On receipt of material at site/workshop against submission of Bank Guarantee: 35%
b. Fabrication of girder: 20%
c. Erection/Launching: 25%
d. On completion in all respect: 20%

5.2.3 Stages of Payment i.e. Milestones of Cost Centre 'CE'- Earthwork and Blanketing

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
CE.1-Earthwork	CE.1.1	Earthwork in formation from Ch (-) 855 m to 0 m for connectivity line, double main line track, loop lines, platform area in Prithla station yard.		
	CE. 1.1.1		Earthwork in embankment / cutting including compaction.	4.56%
	CE. 1.1.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.45%
	CE. 1.1.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.1.2	Earthwork in formation from Ch 0 to 1000 for double main line track, loop lines, platform area in Prithla station yard.		
	CE. 1.2.1		Earthwork in embankment/ cutting including compaction.	7.30%
	CE.1.2.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.60%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.2.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted.	0.20%
	CE.1.3	Earthwork in formation from Ch 1000 to 2000 for double main line track		
	CE.1.3.1		Earthwork in embankment / cutting including compaction.	3.20%
	CE.1.3.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.3.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.13%
	CE.1.4	Earthwork in formation from Ch 2000 to 3000 for double main line track		
	CE.1.4.1		Earthwork in embankment / cutting including compaction.	1.90%
	CE.1.4.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.20%
	CE.1.4.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.5	Earthwork in formation from Ch 3000 to 4000		

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
		for double main line track		
	CE.1.5.1		Earthwork in embankment / cutting including compaction.	3.10%
	CE.1.5.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.25%
	CE.1.5.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.14%
	CE.1.6	Earthwork in formation from Ch 4000 to 5000 for double main line track.		
	CE.1.6.1		Earthwork in embankment / cutting including compaction.	2.70%
	CE.1.6.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.6.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.13%
	CE.1.7	Earthwork in formation from Ch 5000 to 6000 for doble main line track.		
	CE.1.7.1		Earthwork in embankment / cutting including compaction.	2.16%
	CE.1.7.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where	0.20%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
			specified) and drainage arrangement complete in all respects.	
	CE.1.7.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.8	Earthwork in formation from Ch 6000 to 7000 for double main line track.		
	CE.1.8.1		Earthwork in embankment / cutting including compaction.	2.57%
	CE.1.8.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.8.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.9	Earthwork in formation from Ch 7000 to 8000 for double main line track.		
	CE.1.9.1		Earthwork in embankment / cutting including compaction.	3.24%
	CE.1.9.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.30%
	CE.1.9.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.15%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.10	Earthwork in formation from Ch 8000 to 9000 for double main line track.		
	CE.1.10.1		Earthwork in embankment / cutting including compaction.	5.20%
	CE.1.10.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.46%
	CE.1.10.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.1.11	Earthwork in formation from Ch 9000 to 10000 for main line including platform area in Silani station yard.		
	CE.1.11.1		Earthwork in embankment / cutting including compaction.	2.65%
	CE.1.11.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.25%
	CE.1.11.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.10%
	CE.1.12	Earthwork in formation from Ch 10000 to 11000 for main line including platform area in Silani station yard.		
	CE.1.12.1		Earthwork in embankment / cutting including compaction.	4.00%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.12.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.40%
	CE.1.12.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.15%
	CE.1.13	Earthwork in formation from Ch 11000 to 12000 for main line track.		
	CE.1.13.1		Earthwork in embankment / cutting including compaction.	4.26%
	CE.1.13.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.45%
	CE.1.13.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.15%
	CE.1.14	Earthwork in formation from Ch 18000 to 19000 for main line track.		
	CE.1.14.1		Earthwork in embankment / cutting including compaction.	4.60%
	CE.1.14.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.45%
	CE.1.14.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.1.15	Earthwork in formation from Ch 19000 to 20000 for main line track.		
	CE.1.15.1		Earthwork in embankment / cutting including compaction.	8.14%
	CE.1.15.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.70%
	CE.1.15.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.1.16	Earthwork in formation from Ch 20000 to 20942.473 for main line track.		
	CE.1.16.1		Earthwork in embankment / cutting including compaction.	6.10%
	CE.1.16.2		On cutting of extra width & dressing of slopes in profile, compaction, providing vegetative cover including coir netting (where specified) and drainage arrangement complete in all respects.	0.56%
	CE.1.16.3		On completion of maintenance of slopes, drainage system & vegetative cover for a period of 12 months and after ensuring that vegetative cover is properly rooted .	0.20%
	CE.2.1	Earthwork in formation from Ch (-) 855 to 0 for connectivity line, double main line track & loop lines in Prithala station yard.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.58%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.2.2	Earthwork in formation from Ch 0 to 1000 for double main line track & loop lines in Prithala station yard. .	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	2.10%
	CE.2.3	Blanketing from Ch 1000 to 2000 for double main line track	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.31%
CE.2-Blanketing	CE.2.4	Blanketing from Ch 2000 to 3000 for double main line	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.37%
	CE.2.5	Blanketing from Ch 3000 to 4000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.38%
	CE.2.6	Blanketing from Ch 4000 to 5000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.27%
	CE.2.7	Blanketing from Ch 5000 to 6000 for doble main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.36%
	CE.2.8	Blanketing from Ch 6000 to 7000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.36%
	CE.2.9	Blanketing from Ch 7000 to 8000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.39%
	CE.2.10	Blanketing from Ch 8000 to 9000 for double main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.26%
	CE.2.11	Blanketing from Ch 9000 to 10000 for main line in Silani station yard.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.26%

Cost Centre			CE-Earthwork and Blanketing	
Weightage of Cost Centre 'CE', (X)			13.20%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CE.2.12	Blanketing from Ch 10000 to 11000 for main line in Silani station yard.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.18%
	CE.2.13	Blanketing from Ch 11000 to 12000 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	2.24%
	CE.2.14	Blanketing from Ch 18000 to 19000 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	2.49%
	CE.2.15	Blanketing from Ch 19000 to 20000 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	3.09%
	CE.2.16	Blanketing from Ch 20000 to 20942.473 for main line track.	Blanketing on subgrade/ prepared subgrade as per design profile including compaction complete in all respects.	1.06%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CE1.1.1 will be equal to LS*X*Y= LSx0.132 x 0.0456.
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Heads / Price Schedule.
3. Payment will be made on Completion of each Milestones as per weightage given in this schedule.
4. If owing to site conditions or any other reasons, locations of retaining walls are changed or new retaining walls are constructed or retaining walls are eliminated & normal bank is provided, the variation caused in quantity of earthwork in embankment on this account shall be payable/ recoverable under Item no. NS-4 of Schedule 'B9'.

5.2.4 Milestones of Cost Centre 'CB'- for Bridges

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
CB1- Minor Bridges	CB.1.1	Construction of minor bridge No. 6 & 7 between Ch (-) 855 to 0.	On completion of bridge works in all respects	4.06%
	CB.1.2	Construction of minor bridge No. 9,10 & 11 between Ch 0 to 1000.	On completion of bridge works in all respects	8.23%
	CB1.3	Construction of minor bridge No. **Nil** between ch 1000 to 2000.	On completion of bridge works in all respects	0.00%
	CB1.4	Construction of minor bridge No. 13 & 14 between ch 2000 to 3000.	On completion of bridge works in all respects	4.71%
	CB1.5	Construction of minor bridge No. 15 between ch 3000 to 4000.	On completion of bridge works in all respects	0.47%
	CB1.6	Construction of minor bridge No. 18,19 & 20 between Ch 4000 to 5000.	On completion of bridge works in all respects	5.43%
	CB1.7	Construction of minor bridge No. 21 & 22 between Ch 5000 to 6000 .	On completion of bridge works in all respects	2.25%
	CB1.8	Construction of minor bridge No. 23 & 24 between ch 6000 to 7000.	On completion of bridge works in all respects	1.96%
	CB1.9	Construction of minor bridge No. 25 & 27 between Ch 7000 to 8000.	On completion of bridge works in all respects	2.10%

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CB1.10	Construction of minor bridge No.29, 30, 31 & 32 between Ch 8000 to 9000 .	On completion of bridge works in all respects	3.63%
	CB1.11	Construction of minor bridge No. 33 & 35 between Ch 9000 to 10000.	On completion of bridge works in all respects	2.34%
	CB1.12	Construction of minor bridge No. 38, 40 & 42 between ch 10000 to 11000.	On completion of bridge works in all respects	5.40%
	CB1.13	Construction of minor bridge No. 43 & 44 between Ch 11000 to 12000 .	On completion of bridge works in all respects	3.19%
	CB1.14	Construction of minor bridge No. 64 & 65 between Ch 18000 to 19000.	On completion of bridge works in all respects	5.11%
	CB1.15	Construction of minor bridge No. 67 between Ch 19000 to 20000.	On completion of bridge works in all respects	8.04%
	CB1.16	Construction of minor bridge No. **Nil** between Ch20000 to 20940 for main line track.		0.00%
CB.2-Major Bridges	**CB.2.1**	**Foundation**	On completion of the foundation work including pile caps/ well caps and foundations for wing and return walls, and testing.	16.08%

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CB.2.2	**Substructure**	On Completion of Abutment/Piers including Abutment/Pier Cap without bearings.	
	CB.2.2.1		Pier/Abutment	4.00%
	CB.2.2.2		Pier/Abutment cap	1.00%
	CB.2.2.3		Completion of the wing walls, return walls in all respects.	2.00%
	CB.2.3	**Superstructure**		
	CB.2.3.1		On completion of superstructure including launching in position.	10.00%
	CB.2.3.2		On fixing of bearings in position true to line & level and placement of superstructure on bearings including grouting of holding down bolts complete.	2.00%
	CB.2.4	**Miscellaneous works**		
	CB.2.4.1		On completion of backfill, transition system on approaches, Trolley refuge, Pathway on the sides, Inspection arrangement including access ladder etc.as per approved drawings and Employer's Requirements.	3.00%

Cost Centre			CB- Bridges	
Weightage of Cost Centre 'CB', (X)			12.00%	
Sub-cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
	CB.2.4.2		On completion of balance works as per drawing like- Protection works including Toe wall, flooring/apron, inspection steps, Bridge plaque, Bridge board, painting of HFL, Height Gauge, approach road, drainage arrangement in RUBs, and Testing on completion, if any, complete in all respect and fit for use.	5.00%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CB 1.1 will be equal to LS*X*Y= LSx0.12x0.0406.
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Head / Price Schedule.
3. CB2.2-Major Bridges:
   (vi) For the purpose of stage payment/Milestones, cost of a bridge shall be taken in proportion to its linear length measured along the alignment to the total linear length of all major bridges.
   (vii) Payment of each stage/Milestones for a bridge will be made on completion of the relevant stage as per the weightage given in this schedule in proportion to the cost of the bridge.
4. Stages CB.2.1 to CB.2.2 will further be subdivided into the number of piers + 2 abutments, as applicable as per approved drawing by the Engineer, and Milestones for completed work for each pier and abutment shall be made as per the requirement of the stages stated above.

5. For steel Open Web Girder (OWG) and Composite girders payment against Cost centre CB.2.3.1 shall be released as per following schedule-
   (i) Receipt of material at approved location against submission of Bank Guarantees: 40%
   (ii) Fabrication of girder and transportation to site: 25%
   (iii) Erection/launching and completion of all other balance works: 35%,

   and for PSC girder/slabs payment against sub cost centre 2.3.1 shall be released as per following schedule-

   (i) On casting of PSC girder/slabs: 50%
   (ii) On first stage prestressing: 20%
   (iii) On completion in all respect: 30%

6. The Cost of Milestones includes cost of all temporary works and temporary diversion of roads wherever required, for all bridges included in Schedule 'A', Section VII-2:Functional, Employer's Requirements.
7. The Cost of Milestones include cost of all permanent roads diversion and regrading of roads, wherever required, for all bridges included in Schedule 'A'.

5.2.5 Stages of Payment i.e. Milestones of Cost Centre 'CS'- Stations Buildings

Cost Centre			'CS'- Stations Buildings	
Weightage of Cost Centre 'CS', (X)-			4.30%	
Sub-Cost Centre	Item of Work		Milestone	Weightage
	No.	Description		(Y)
1	2	3	4	5
CS.1-Prithla	**CS.1.1**	**Station building**	Construction of station building complete in all respects.	3.40%
	CS.1.2	**Platform & Passenger amenities**		
	CS.1.2.1		Construction of platforms including earthwork in filling above formation level and cast-in-situ platform face wall as per the Employer's requirements.	4.70%
	CS.1.2.2		Surfacing of platform, Precast coping, tactile tiles, fencing at end platform etc.	4.20%
	CS.1.2.3		PF shelters, Mini PF shelters.	1.50%
	CS.1.2.4		Passenger amenities	1.20%
	CS.1.3	**Subway**		
	CS.1.3.1		On completion of barrel of RCC box.	8.00%
	CS.1.3.2		On completion of stairs & ramp to platforms including shed.	3.50%
	CS.1.3.3		On completion of subway in all respect including flooring, wall cladding, drainage, waterproofing etc.	2.00%
	CS.1.4	**Water Supply**	Water supply works including bore well, pump house, underground & overhead water storage tanks, water supply distribution system	1.00%
	CS.1.5	**Drainage and Sewerage**	On completion of drainage and sewerage system.	2.50%
	CS.1.6	**Miscellaneous works**	On completion of misc. works such as portico, station name boards at station building and platform, platform number boards and other incidental works in railway station area.	1.00%

Cost Centre			‘CS’- Stations Buildings	
Weightage of Cost Centre ‘CS’, (X)-			**4.30%**	
Sub-Cost Centre	**Item of Work**		**Milestone**	**Weightage**
	No.	**Description**		**(Y)**
1	2	3	4	5
CS.2-Silani	**CS.2.1**	**Station building**	Construction of ticket booking office complete in all respects.	0.25%
	CS.2.2	**Platform & Passenger amenities**		
	CS.2.2.1		Construction of platforms including earthwork in filling above formation level and cast-in-situ platform face wall as per the Employer’s requirements.	3.40%
	CS.2.2.2		Surfacing of platform, Precast coping, tactile tiles, fencing at end platform etc.	3.00%
	CS.2.2.3		PF shelters, Mini PF shelters.	1.50%
	CS.2.2.4		Passenger amenities	1.00%
	CS.2.3	**Subway**		
	CS.2.3.1		On completion of barrel of RCC box.	5.75%
	CS.2.3.2		On completion of stairs & ramp to platforms including shed.	3.50%
	CS.2.3.3		On completion of subway in all respect including flooring, wall cladding, drainage, water proofing etc.	1.75%
	CS.2.4	**Water Supply**	Water supply works including bore well, pump house, underground & overhead water storage tanks, water supply distribution system.	1.00%
	CS.2.5	**Drainage and Sewerage system**	On completion of drainage and sewerage system.	1.50%

Cost Centre			‘CS’- Stations Buildings	
Weightage of Cost Centre ‘CS’, (X)-			**4.30%**	
Sub-Cost Centre	**Item of Work**		**Milestone**	**Weightage**
	No.	**Description**		**(Y)**
1	2	3	4	5
	CS.2.6	**Miscellaneous works**	On completion of misc. works such as portico, station name boards at station building and platform, platform number boards area and other incidental works in railway station area.	0.75%
CS.3-IMT Sohna	**CS.3.1**	**Station building**	Construction of station building and *S&T huts* complete in all respects.	4.20%
	CS.3.2	**Platform & Passenger amenities**		
	CS.3.2.1		Construction of platforms including earthwork in filling above formation level and cast-in-situ platform face wall as per the Employer’s requirements.	4.70%
	CS.3.2.2		Surfacing of platforms, Precast coping, tactile tiles, fencing at end platform etc.	4.40%
	CS.3.2.3		PF shelters, Mini PF shelters.	1.50%
	CS.3.2.4		Passenger amenities	1.20%
	CS.3.3	**Subway**		
	CS3*.3.1*		On completion of barrel of RCC box.	17.50%
	CS3.3.2		On completion of stairs, ramp to platforms including shed, Lift well.	3.50%
	CS3.3.3		On completion of subway in all respect including flooring, wall cladding, drainage, water proofing etc.	2.50%
	CS.3.4	**Water Supply**	On completion of water supply works including bore well, pump house, underground water storage tanks, water supply distribution system	1.00%
	CS.3.5	**Drainage and Sewerage system**	On completion of drainage and sewerage system**.**	1.50%

Cost Centre			'CS'- Stations Buildings	
Weightage of Cost Centre 'CS', (X)-			**4.30%**	
Sub-Cost Centre	**Item of Work**		**Milestone**	**Weightage**
	No.	**Description**		**(Y)**
1	2	3	4	5
	CS.3.6	**Miscellaneous works**	On completion of misc. works such as portico, station name boards at station building and platforms, platform number boards and other incidental works in railway station area.	1.60%
			Total	**100.00%**

Notes:

1. The value of each Milestones will be total lump sum accepted cost of Works for Schedule 'A' (LS) multiplied by X * Y. For example, the value of Milestone CS1.1–will be equal to LS*X*Y= LS x 0.043 x 0.034
2. Adjustment to Contract Price pursuant to GCC 13.7 shall be applicable to the payments of Works executed under this Sub Head / Price Schedule.
3. Station Building- Unit of measurement is plinth area in square meters. For the buildings having more than one storey, the total area shall be found out by adding the area of each storey. Unit cost shall be determined on pro rata basis with respect to the total area of all stations and service buildings.
   - 50% Payment shall be paid after completion of structural works i.e beam, columns & slab in case of framed structure or walls & slabs in case of other buildings and
   - 30% Payment shall be paid after completion of finishing and
   - 20% Payment on final completion of works in all respects ready for use.
4. Platform- Unit of measurement is area measured in square meter. Unit cost shall be determined on pro rata basis with respect to the total area of all platforms at the station.
5. Payment will be made on Completion of each Milestones as per weightage given in this schedule.
6. Variation in 'Station building':

   In case of variation in the plinth area of any station building on either side i.e. increase or decrease with respect to the area shown in the Tender Drawings, the total value of station as mentioned in respective Sub-Cost Centres as applicable will get modified accordingly on pro rata basis of plinth area.

6 Schedule 'B': Retaining Wall, Bridges & other Civil works

Schedule 'B' is subdivided into fourteen (14) Sub-Schedules as given below:

SCHEDULE 'B': Bridges, Retaining Wall & other Civil works					
S. No.	**Sub Schedule**	**Description**	**Item Range**	**No. of Items**	**Estimated Amount (INR)**
1.	B1	Bridge Works-Steel Super Structure - Open Web Girder (USSOR Based item)	1	1	67,70,29,509.30
2.	B2	Reinforcement (USSOR Based items)	2	1	39,25,25,087.50
3.	B3	RCC Works (NS item)	3	1	17,62,43,627.52
4.	B4	Bridge Works-Pile foundation (NS items)	4	1	10,69,13,193.00
5.	B5	Bridge Works-Steel Super Structure-Composite Girder (USSOR Based item)	5	1	7,63,87,291.44
6.	B6	Backfill Material (USSOR Based item)	6	1	7,12,94,621.42
7.	B7	Bridge Works-Precast Concrete Blocks (NS item)	7	1	4,97,20,839.72
8.	B8	Cement (USSOR Based items)	8	1	4,09,37,764.39
9.	B9	Formation Works (USSOR Based & NS items)	9 to 12	4	6,02,08,512.50
10.	B10	Bridge Works-Steel Super Structure - Miscellaneous (USSOR Based items)	13 to 14	2	10,53,31,396.00
11.	B11	Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)	15 to 52	38	*16,06,83,080.29*
12.	B12	Road and Building Works (DSR Based & NS items)	53 to 109	57	16,60,31,563.15
13.	B13	Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)	110 to 124	15	9,20,01,357.06
14.	B14	P Way Works-Ballastless Track, Rails & Special Sleepers (NS items)	125 to 130	6	8,84,27,376.10
Total Estimated Amount of Schedule 'B' (INR)					***226,37,35,219.39***

6.1 Sub-Schedule 'B1': Bridge Works- Steel Super Structure -Open Web Girder (USSOR Based item)

SUB SCHEDULE-B1: Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
1	041010	Supplying, fabrication, assembling of all types of steel girders of specified spans with structural steel conforming to Quality "B0" Grade Designation E250 conforming to IS:2062, erection / slewing / end launching of steel girders with cranes or any other approved launching methods as per site conditions (not requiring traffic block) on sub-structure including provision of trolley refuges etc., complete as per approved QAP and drawings conforming to IRS-B1-2001 and other relevant codes and specifications. Note: **1.** Detailed fabrication and erection drawings & launching methodology will be prepared by the contractor and got approved from Railway. **2.** The item includes fabrication of all types of battens, bracings, ties, stiffeners, packing, diaphragms, shop rivets / welding, T&F bolts, drifts, SAW, templates, jigs, fixtures, accessories, transporting various components from fabrication shop to site including loading & unloading, assembly of girders with drifts/bolts, field riveting /welding /HSFG Bolting, assembling of temporary support for side slewing, raising of girders to the bed block level, providing sliding arrangements and slewing the girder in position, lowering of girder on				

SUB SCHEDULE-B1: Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		bearings and bed plates with all temporary arrangements or any other method of launching complete. **3.** The bearing sets to be provided with the girders will be paid separately as per relevant item of Sub schedule B13. **4.** Payment for addition in weight for rivets / welds shall be made as per clause 45 of IRS B-1-2001. **5.** In case of composite work (welding and HSFG bolts), addition in weight shall be 1% for welding and HSFG bolts shall be paid separately under relevant item of Sub schedule B10. **6.** Painting of girders will be paid separately under relevant item of this Sub schedule B10. **7. Payment Schedule:** (i) Receipt of material at plant/workshop against submission of Bank Guarantee: 40% (ii) Fabrication of girders: 20% (iii)Erection/Launching: 20% (iv)Completion in all respects: 20%				
1a	041012	Open Web Girder Upto 45.7 m Clear Span	2,091	MT	1,61,971.98	33,86,83,410.18
1b	041013	Open Web Girder Above 45.7 m Clear Span	1,959	MT	1,72,713.68	33,83,46,099.12
Estimated value of SUB SCHEDULE 'B1': Bridge Works-Steel Super Structure -Open Web Girder (USSOR Based item)						**67,70,29,509.30**

6.2 Sub-Schedule 'B2'- Reinforcement (USSOR Based items)

SUB SCHEDULE 'B2': Reinforcement (USSOR Based items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
2	025070	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete.				
2a	025072	Thermo-Mechanically Treated bars of grade Fe-500D or more.	49,49,875	Kg	79.30	39,25,25,087.50
Estimated value of SUB SCHEDULE 'B2': Reinforcement (USSOR Based items)						**39,25,25,087.50**

6.3 Sub-Schedule 'B3': RCC Works (NS Item)

SUB SCHEDULE-'B3' RCC Works (NS item)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
3	NS-1	Supplying and laying in position M-35 RCC as per approved design mix with admixtures and manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lifts & leads, having continuous agitated mixer, pumping concrete from transit mixer to site of laying, compacting, finishing & curing, with all labour, material, tools, plants, machinery and equipment, taxes, cess etc., as a complete job ,but excluding supplying & fixing form work (centring & shuttering),in accordance with the specification and drawings. Note – (i) Cost of cement is included in the above item. (ii) Cost of Reinforcement steel is not included in the above item and will be paid separately under relevant item of Sub-Schedule B2. (iii) Cost of supplying & fixing form work (centring & shuttering) is not included in the above item (except pile cap & open foundation) and will be paid separately under relevant item of Sub-Schedule B11.				
3a	NS-1A	In Pile caps, open foundation & RCC Box/Sub way	13,304	Cum	7,732.00	10,28,66,528.00
3b	NS-1B	In Piers, abutments	1,941	Cum	7,995.23	1,55,18,741.43

SUB SCHEDULE-'B3' RCC Works (NS item)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
3c	NS-1C	Abutment cap & Pier Cap, pedestals, deck slab, Inspection platform, Trolly refugee	1,781	Cum	8,259.09	1,47,09,439.29
3d	NS-1D	Retaining walls, wing walls, return walls, drop walls, curtain walls, Wearing Coat etc. of all heights	5,515	Cum	7,823.92	4,31,48,918.80
Estimated Value of SUB SCHEDULE 'B3': RCC Works (NS item)						**17,62,43,627.52**

6.4 Sub-Schedule 'B4': Bridge Works-Pile foundation (NS items)

SUB SCHEDULE-B4: Bridge Works-Pile foundation (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
4	NS-2	Boring 1200 mm diameter piles using Hydraulic Rig in all kinds of strata including boulder studded soil, underground structure like channel, sewer manholes, old foundation or any other obstruction, irrespective of sub-soil water level in all conditions whether dry or under water, shoe and temporary casing pipe, if required, with contractor plant, machinery & equipment for pile boring, use of bentonite slurry including all operations, cleaning of bore holes, supplying and laying in-situ with tremie pipe M-35 RCC in piles as per approved design mix with admixtures and manufactured in fully automatic batching plant and transported to site of work in transit mixer for all lifts & leads, having continuous agitated mixer, pumping concrete from transit mixer to site of laying including supplying & fixing form work (centering & shuttering), compacting, finishing, curing, chipping off pile top to remove laitance concrete above cut off level, removal and disposal of surplus excavated earth/debris/muck outside ROW including all lead, lift, ascends, descends, loading, unloading handling, re-handling, crossing of stream, nallahs, railway track, level crossing etc. with all labour, material, tools, plants, machinery and equipment, taxes, cess etc. as a complete job in accordance with the Specification and the Drawings. Note – i.Cost of cement is included in the above item. ii.Cost of Reinforcement steel is not included in the above item	8,718	Rmt	12,263.50	10,69,13,193.00

SUB SCHEDULE-B4: Bridge Works-Pile foundation (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		and will be paid separately under relevant item of Sub-schedule-B2 iii. Cost of temporary casing pipe is included in the above item. However, the cost of permanent casing pipe is not included in this item and shall be paid separately under relevant item of Sub-schedule-B13, if required and approved by the Engineer.				
Estimated Value of SUB SCHEDULE 'B4': Bridge Works-Pile foundation (NS items)						**10,69,13,193.00**

6.5 Sub-Schedule 'B5': Bridge Works-Steel Super Structure - Composite

SUB SCHEDULE 'B5': Bridge Works-Steel Super Structure- Composite Girder (USSOR Based item)						
S. No.	**USSOR Item No**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
5	041020	Supplying, fabrication, assembling of all types of steel Composite girders of specified spans with structural steel conforming to Quality "B0" Grade Designation E250 conforming to IS:2062, erection / slewing / end launching of steel girders with cranes or any other approved launching methods as per site conditions on sub-structure including provision of stud bolts / shear connectors, complete as per approved QAP and drawings conforming to IRS- B1-2001 and other relevant codes and specifications. Note: 1. Detailed fabrication and erection drawings & launching methodology will be prepared by the contractor and got approved from Railway. 2. Rate includes fabrication of all types of battens, bracings, ties, stiffeners, packing, diaphragms, shop rivets / welding, T&F bolts, drifts, SAW, templates, jigs, fixtures, accessories, transporting various components from fabrication shop to site including loading & unloading, assembly of girders with drifts/bolts, field riveting /welding /HSFG Bolting, assembling of temporary support for side slewing, raising of girders to the bed block level, providing sliding				

		arrangements and slewing the girder in position, lowering of girder on bearings and bed plates with all temporary arrangements or any other method of launching complete. 3. The bearing sets to be provided with the girders will be paid separately as per relevant item of Sub schedule B13. 4. Payment for addition in weight for rivets / welds shall be made as per clause 45 of IRS B-1-2001. 5. In case of composite work (welding and HSFG bolts), addition in weight shall be 1% for welding and HSFG bolts shall be paid separately under relevant item of Sub schedule B10. 6. Painting of girders will be paid separately under relevant item of Sub schedule B10. 7. Payment Schedule: (i) Receipt of material at plant/workshop against submission of Bank Guarantee: 40% (ii) Fabrication of girders: 20% (iii) Erection/Launching: 20% (iv) Completion in all respects: 20%				
5a	041021	Composite steel girder of span length up to 36.0m	564	MT	1,35,438.46	7,63,87,291.44
Estimated Value of SUB SCHEDULE 'B5': Bridge Works-Steel Super Structure- Composite Girder (USSOR Based item)						**7,63,87,291.44**

6.6 Sub-Schedule 'B6': Backfill Material (USSOR Based item)

SUB SCHEDULE 'B6' : Backfill Material (USSOR Based item)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
6	051170	Providing and laying of filter media consisting of granular materials of GW, GP, SW groups as per IS:1498 (latest) in required profile behind boulder filling of abutments, wing walls / return walls etc. above bed level with all labour and material complete job as per drawing and technical specification of RDSO Guidelines.	32,782	Cum	2,174.81	7,12,94,621.42
Estimated Value of SUB SCHEDULE 'B6': Backfill Material (USSOR Based item)						**7,12,94,621.42**

6.7 Sub-Schedule 'B7': Bridge Works-Precast Concrete Blocks (NS item)

SUB SCHEDULE 'B7': Bridge Works-Precast Concrete Blocks (NS item)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
7	NS-3	Casting, supplying and installation of Pre-cast cement concrete blocks of size 25X25 X20cm. or of required size as directed by the Engineer for protective works at bridges & banks like pitching, toe wall, flooring, drains etc. using M20 design concrete mix with 20mm aggregate size including Contractor's shuttering, leading to bridge site from casting depot, including dressing and levelling of surface, providing gravel backing, laying & jointing blocks with cement mortar 1:3 with Contractor's labour and as directed by Engineer-in-charge (All labour and materials including cement by Contractor). Note: i) Payment for gravel backing will be paid under relevant item of Sub schedule B11. ii) 60% Payment shall be made after casting of pre-cast concrete blocks and bringing at work site. The balance 40% will be made on completion of laying and finishing. iii) Measurement is based on quantity calculation of blocks used only (no of blocks x volume of one block).	8,102	Cum	6,136.86	4,97,20,839.72
Estimated Value of SUB SCHEDULE 'B7': Bridge Works-Precast Concrete Blocks (NS item)						**4,97,20,839.72**

6.8 Sub-Schedule 'B8': Bridge Works-Steel Super Structure -Miscellaneous (USSOR Based items)

SUB SCHEDULE 'B8': Cement (USSOR Based items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
8	025060	Supply and using Cement at Worksite				
8a	025062	Ordinary Portland Cement 53 grade	295	MT	8,741.08	25,78,618.60
8b	025063	Pozzolana Portland Cement	4,921	MT	7,794.99	3,83,59,145.79
Estimated Value of SUB SCHEDULE 'B8': Cement (USSOR Based items)						**4,09,37,764.39**

6.9 Sub-Schedule 'B9': Formation Works (USSOR Based & NS items)

SUB SCHEDULE 'B9' Formation Works (USSOR Based & NS items)						
S.NO.	**USSOR/NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
9	011010	Earthwork in cutting (classified) in formation, trolley refuges, side drains, level crossing approaches, platforms, catch water drains, diversion of nallah & finishing to required dimension and slopes to obtain a neat appearance to standard profile inclusive of all labour, machine & materials and removing & leading all cut spoils either to make spoil dumps beyond 10m from cutting edge or for filling in embankment with leads within 2 km on either side of cutting edge, lifts, ascent, descent, loading, unloading, all taxes / royalty, clearance of site and all incidental charges, bailing & pumping out water, if required, etc. complete as per directions of the Engineer in-Charge. The work is to be executed as per latest / updated edition of "Guidelines for Earthwork in Railway Projects" issued by RDSO, Lucknow. Cut trees shall be property of HRIDC and to be deposited in the Employers' godown unless specified otherwise in the Special Conditions of Contract. {Note - (i) All usable earth arising from cut spoils shall be led into bank formation and Unusable spoils shall be dumped / stacked (ii) All hard rock /and boulders not fit for filling will be stacked by the Contractor and will be property of HRIDC.}				

SUB SCHEDULE 'B9' Formation Works (USSOR Based & NS items)						
S.NO.	**USSOR/NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
9a	011011	In all conditions and classifications of soil except rock	1,000	Cum	184.70	1,84,700.00
10	013050	Turfing / planting, including all lead & lift and watering as required until properly rooted with. Note - Initially payment of only 40% will be made. Balance 60% will be paid only after 3 months of maintenance period, if the turfing is properly rooted.				
10a	013053	Planting Sarkanda / sarpat or any other suitable species approved by the Engineer	250	100 sqm	7,744.21	19,36,052.50
11	NS-4	Earthwork in embankment for 32.5t axle load and as per RDSO specification No. RDSO/2020/GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation" with contractor's own earth from borrow areas including all lead, lift, ascent, descent, royalty, taxes, cess, compensation, crossing of nallahs /stream and other obstructions including mechanical compaction in layers with watering, handling, re-handling, dressing of banks to the final profile with all labour, material, tools, plant, machinery and equipment, taxes, cess etc. as a complete job in accordance with the specification and drawings. **Note:** 10% of payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory rollers as per RDSO guidelines.	1,35,000	Cum	330.24	4,45,82,400.00

SUB SCHEDULE 'B9' Formation Works (USSOR Based & NS items)						
S.NO.	**USSOR/NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
12	NS-5	Supplying and laying blanketing material produced through mechanical means using crushers and pug mill for 32.5 T axle load as per RDSO specification No. RDSO/2020/GE:004 September 2020 "Comprehensive Guidelines and Specification for Railway Formation" over the top of subgrade including all lead, lift, ascent, descent, royalty, taxes, cess, crossing of nallahs /stream and other obstructions including mechanical compaction in layers not exceeding 200 mm thick with vibratory rollers, watering, handling, re-handling and dressing of formation to the final profile with all labour, material, tools, plants, machinery and equipment, taxes, cess, etc. as a complete job in accordance with the specification and drawings. Note: 10% of payment shall be withheld till the slopes are dressed to the required profile and compacted mechanically with vibratory rollers as per RDSO guidelines.	5,500	Cum	2,455.52	1,35,05,360.00
Total Estimated Value of SUB SCHEDULE 'B9': Formation Works (USSOR Based & NS items)						**6,02,08,512.50**

6.10 Sub-Schedule 'B10': Bridge Works-Precast Concrete Blocks (NS item)

SUB SCHEDULE 'B10' Bridge Works-Steel Super Structure -Miscellaneous (USSOR Based items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
13	041030	Supplying and fixing HSFG bolts of any dia. and any length with suitable nuts including DTI washers conforming to IRS-B1-2001 for bridges and steel structures with contractors labour, tools and plants and lead and lift etc., complete.	1,87,500	Kg	306.36	5,74,42,500.00
14	041050	Metalizing of steel work of girders with sprayed aluminium after surface preparation by Sand/grit blasting, followed by one coat of etch primer (IS:5666) & one coat of Zinc Chrome primer (IS:104)and two coats of aluminium paint (IS:2339) with all labour, T&P and material as a complete job duly conforming to all relevant specifications and process given under Clause 39 of IRS-B1-2001 Note: Nominal Thickness of Aluminium coating shall be 150 microns. DFT of Zinc chrome primer shall be 25-30 microns and DFT of each coat of Aluminium paint shall be 12-14 microns.	56,320	Sqm	850.30	4,78,88,896.00
Estimated Value of SUB SCHEDULE 'B10' Bridge Works-Steel Super Structure -Miscellaneous (USSOR Based items)						**10,53,31,396.00**

6.11 Sub-Schedule 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
15	013130	Shoring with 'Z' section MS sheet piles side by side in all kinds of soil mechanically or manually as per approved drawing with contractor's own arrangement complete in all respects and removal of sheet piles after completion of the work as directed by engineer in-charge. {Note - Payment will be made as per actual driven length of pile}	400	Sqm	917.12	3,66,848.00
16	014020	Supplying and laying of drainage composite for use behind abutments, wing walls, return walls and retaining walls geo composite drain (vertical) as per RDSO Specification No.-RDSO/2018/GE: IRS-0006 Latest version with all material, labour, equipment, tools and plants, lead, lift etc. complete in all respects as per the direction of engineer-in-charge.	1,407	Sqm	755.43	10,62,890.01

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
17	022010	Earthwork in excavation by mechanical means (Hydraulic Excavator)/Manual Means for foundations and floors of the bridges, retaining walls etc. including setting out, dressing of sides, ramming of bottom, getting out the excavated material, back filling in layers with approved material and consolidation of the layers by ramming and watering etc. including all lift, disposal of surplus soil upto a lead of 300m, all types of shoring and strutting with all labour and material complete as per drawing and technical specification as directed by Engineer. Note: This item will be used for excavation work in connection with other miscellaneous works also like side drains, foundation for OHE masts and other miscellaneous structures in connection with Gauge Conversion, Doubling, New lines.				
17a	022011	All kinds of soils	47,932	Cum	238.30	1,14,22,195.60

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
18	022040	Providing and laying in position machine batched, machine mixed and machine vibrated Design Mix Cement Concrete of specified grade **(M-20** Cast in-Situ) using 20mm graded crushed stone aggregate and coarse sand of approved quality in RCC raft foundation & Pile cap including finishing, using Admixtures in approved proportions (as per IS:9103), to modify workability & other properties without impairing strength and durability complete as per specifications and direction of the Engineer in charge. Payment for cement, reinforcement and shuttering shall be paid extra. **Note**-Cement concrete in drainage and other miscellaneous works shall be paid under this item.	8,804	Cum	3,383.45	2,97,87,893.80
19	022070	Providing and fixing Weep Holes in Abutments, RCC Box, Wing walls and Return walls etc, of new bridges with 110mm dia UPVC pipe (IS :13592) Type A ISI marked with all contractor's men, material, transportation, all taxes as per specifications and as directed by Engineer-in-Charge.	5,601	Meter	259.80	14,55,139.80

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
20	022120	Conducting load testing of a single pile upto following capacity in accordance with IS:2911 (Part IV) including installation of loading platform and preparation of pile head or construction of test cap and dismantling of test cap after test etc. with all labour, material, tool & plants, equipment, machinery, etc. complete as per drawing and specification, as directed by the Engineer.				
20a	022123	Initial load test above 100 ton capacity upto 250 ton capacity pile	6	Each	97,491.59	5,84,949.54
20b	022124	Extra for every increase of 50 ton in pile capacity or part thereof over 250 ton	50	Each	9,599.01	4,79,950.50
20c	022127	Routine Load Test above 100 ton capacity upto 250 ton capacity pile	26	Each	65,525.51	17,03,663.26
21	022130	Lateral load testing of single pile in accordance with "IS Code of practice IS:2911 (Part-IV) for determining safe allowable lateral load of pile" with all labour, material, tool & plants, equipment, machinery, etc complete as per drawing and specification as directed by the Engineer				
21a	022131	Piles with lateral load capacity of upto 50 ton	5	Each	24,363.19	1,21,815.95

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
22	022140	Pulse Echo Test (PET) for integrity testing of piles with contractor's men, materials and machines. The rate includes cost of Inspection of site, preparation of pile head and any other unforeseen cost required for the test, submission of reports in triplicate as per satisfaction of the Engineer in Charge at site.	356	Each	3,476.42	12,37,605.52
23	023010	Earth work in OPEN excavation in foundation of bridges, for placing of well curbs of all shapes and designs in all kinds of soil including taking out the excavated soil, levelling, ramming of bottom of excavation and trimming of sides, returning the soil in layers, consolidation, disposal of surplus soil within a lead of 300m, including all lift, dewatering, shoring and strutting complete as per technical specification and as directed by Engineer in charge. (compaction of surplus soil when led to the bank will be paid as per relevant item separately)	1,654	Cum	263.18	4,35,299.72
24	023040	Dry/Wet Sinking of Circular Wells (Other than pneumatic method) in all types of strata except hard rock requiring ballasting, including bailing and pumping out water, removal of excavated soil with all labour and material required for sinking as per drawing and direction of the Engineer in charge, disposal of surplus soil in				

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		the adjoining bank/embankment (compaction to be paid separately under the relevant item).				
24a	023041	From initial level of cutting edge & upto 3m depth	1,145	Cum	196.29	2,24,752.05
24b	023042	Above 3m to 10m depth	2,671	Cum	296.00	7,90,616.00
24c	023043	Above 10m to 15m depth	1,908	Cum	429.42	8,19,333.36
24d	023044	Above 15m to 20m depth	1,908	Cum	507.41	9,68,138.28
24e	023045	Above 20m to 25m depth	500	Cum	923.30	4,61,650.00
24f	023046	Above 25m to 30m depth	500	Cum	1,147.29	5,73,645.00
25	023090	Providing and laying in position machine batched, machine mixed and machine vibrated Design Mix Cement Concrete of specified grade (Cast in-Situ) using 20mm graded crushed stone aggregate and coarse sand of approved quality in the following elements of well including finishing, using Admixtures in approved proportions (as per IS:9103), to modify workability & other properties without impairing strength and durability complete as per drawings and technical specifications as directed by Engineer. Payment for cement,				

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		reinforcement and shuttering shall be made extra.				
25a	023091	In well Curb	360	Cum	3,555.81	12,80,091.60
25b	023092	In Steining of wells	3,179	Cum	3,555.81	1,13,03,919.99
25c	023093	In Bottom plug for wells including arrangements for placing concrete under water with tremie or bottom opening skips.	1,526	Cum	4,006.18	61,13,430.68
25d	023095	In Intermediate/Top plug with internal shuttering	351	Cum	4,296.35	15,08,018.85
25e	023096	In Well cap and corbel, if provided	668	Cum	4,296.35	28,69,961.80
26	023100	Supplying and filling ordinary sand in between bottom plug and top plug in wells including all lead lift handling, re-handling, as a complete job. Sand should be simultaneously filled with water for three days to achieve full compaction so that further chances of shrinkage due to voids are eliminated.				
26a	023102	Using sand from other than River bed (This item is to be operated if suitable sand is not available in River Bed for filling	2,543	Cum	1,909.88	48,56,824.84
27	025020	Providing and applying two coats of coal tar or bitumen confirming to IS:3117– latest version on the top and sides of RCC box/slabs @ 1.70 kg/sqm after cleaning the surface with all labour	4,740	Sqm	184.49	8,74,482.60

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		and materials complete job as directed by the Engineer				
28	025030	Centering and shuttering including strutting, propping etc. and removal of form for :				
28a	025032	All types of bridge super-structures, e.g. slabs, I-girders, T-girders, Box girders etc. upto 5m above ground level	2,360	Sqm	933.91	22,04,027.60
28b	025033	Extra for additional height over item no. 025032 wherever required with adequate bracing, propping etc. over initial height of 5 metres for every additional height of 1 metre or part thereof	9,030	Sqm	117.66	10,62,469.80

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
29	031020	Providing and laying in position machine batched, machine mixed and machine vibrated Design Mix Cement Concrete of specified grade using 20mm graded crushed stone aggregate and coarse sand of approved quality for the Precast Prestressed (Post tensioned) concrete girder/Box (spans upto 30.5m) in contactor's casting yard, including finishing, using Admixtures in approved proportions (as per IS:9103), to modify workability & other properties without impairing strength and durability, complete as per drawings, specifications and direction of the Engineer. Payment for Shuttering, Cement, reinforcement, HTS cables, anchorage cones, stressing of cables and grouting of the ducts will be done extra. Launching of girder/slab in position is not included in this item.	71	Cum	3,055.96	2,16,973.16
29a	031021	Deduct from 0310220 for casting of Slab in place of Girder/Box	71	Cum	-95.71	*-6,795.41*
30	031040	Providing, fabricating & fixing in position to exact design profiles, prestressing H.T.S. cables of all classification made from Low Relaxation strands conforming to IS:14268– latest version in Prestressed (Post tensioned) Concrete girders/slabs etc. including supplying, cutting, making into cables with necessary spacers, colour coding, protecting with water soluble oil	4	MT	1,99,689.58	7,98,758.32

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		at all time, anchoring of cables, supplying and placing spiral corrugated type galvanized metal steel ducts sheathing made up of Cold Rolled Cold Annealed (CRCA) mild steel conforming to IS:513 of required diameter/ thickness, vent pipe, placing, bending, routing, fixing, stressing & grouting of cable ducts with cement grout, Anchorage sets in required number with provision for future prestressing if any including all lead and lift with contractor's own materials, labour, equipments etc. complete as per drawings & specifications. Rate also includes covering anchorage pads with epoxy mortar of approved quality to avoid corrosion. Cement for grouting to be paid separately. Payment shall be made in terms of weight of HTS cables as per drawing.				
31	031060	Extra for Using HDPE Sheathing in place of CRCA Sheathing	367	Meter	159.26	58,448.42
32	*031110*	*Load testing of one or more spans of bridge as selected by the Engineer as per approved load test procedure following relevant IS/ IRC / Railway codes with contractor's labour, deflection measuring instruments, loading materials, recoding and analyzing the load testing results including all lead & lift, etc. complete as required. The rates are all inclusive and will be paid after load test is*				

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		finished and girder is cleared of the kentledges/ loading material etc. The load shall be 1.25 times the stipulated design load.				
32a	*031111*	*For Span design load up to 100 MT*	*5*	*Each*	*90,478.87*	*4,52,394.35*
32b	*031112*	*Extra for every increase 1 MT or part thereof in the span design load capacity up to 800 MT*	*1000*	*MT*	*893.37*	*8,93,370.00*
33	031140	Providing and fixing in position GI Drainage Spouts of required length with Grating in RCC slab and filling bitumen along kerb as shown in drawing with contractor's pipes, bitumen, tools, equipment, lead, lifts etc. complete as per specifications and as directed by Engineer in-charge				
33a	031142	100mm dia. Drainage Spouts	186	Meter	1,270.12	2,36,242.32

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
34	041240	Surface preparation for painting of bridge plate/composite girders and other steel structures where the finishing coat shows signs of deterioration; but primer coat of paint is sufficiently in good condition and there are no signs of rusting etc. Surface shall be cleaned free from oil grease, scaling and other foreign matters without disturbing the primer coat {Rate includes cost of labour, consumables, tools & plants, scaffolding, jhoola, ladder etc.}	3,250	Sqm	26.97	87,652.50
35	041260	Painting cleaned bridge plate/composite girders including all scaffolding, shuttering and strutting along with provision of Jhoola / hanging scaffolding ladders etc. where required				
35a	041261	With one coat ready mix Zinc Chromate conforming to IS:104 with DFT of 25-30 Microns followed by one coat of Zinc Chromate red oxide conforming to IS:2074 DFT of 25 Microns.	3,250	Sqm	101.72	3,30,590.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
36	041330	Launching & fixing in specified Bridge location all types of Steel Plate girders / PSC girders / Slabs including loading/unloading and transport to the site of launching with a lead of five kilometres & lifting to any height as per site requirement, provision of approaches for leading, cleaning of bed block and minor repairs to bed block with epoxy if required, as directed by Engineer in charge with all labour, tools and plant, equipment etc., complete.				
36a	041331	PSC girders / slabs	176	MT	5,643.58	9,93,270.08
37	051010	Providing and laying boulders apron on river bed for protection against scour with stone boulders weighing not less than 35 kg each with voids filled with spalls complete as per drawing and Technical Specification.	55	Cum	1,510.18	83,059.90
38	051120	Stenciling of Girders with black / blue lettering over yellow background with ready mix paint w.r.t. details of executed inspection, greasing and painting, other details as directed by Engineer in charge.	840	Each	43.40	36,456.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
39	052220	Painting the HFL mark and Danger level mark, year of HFL on bridge abutments and piers with ready mixed paint as per standard in two coats over one coat of primer with all materials, labour, tools, scaffolding, all lead and lift etc. including writing complete.	225	Each	299.88	67,473.00
40	052230	Providing cast in situ bridge number plaques as per Railway drawing in cement concrete 1:2:4 mix using 20mm hard stone aggregate embedded in 30mm notch in Bridge parapet coping duly engraving the letter and figures and an arrow indicating the direction of flow and finishing the top exposed surface with cement mortar 1:3, painting letters and figures with two coats of black enamel paint on two coats of white background with all labour, tools, cement, paint etc. with all leads and lifts.	14	Each	846.77	11,854.78
41	052240	Providing cast in-situ plaques for bridge foundations details of size 45cmx45cmx5cm in cement concrete 1:2:4 mix using 20mm hard stone aggregate embedded in 30mm deep notch over abutment & piers, engraving the letters & figures with CM 1:3 and finished smooth including painting letters and figures with 2 coats of black enamel and plaque with white enamel with all labour, tools, cement, paint, curing etc. as a complete job.	26	Each	1,108.92	28,831.92

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
42	052250	Providing & laying non pressure NP-4 Class RCC pipe with collars, jointing with 1:2 cement and ordinary sand mortar including testing of joints, but excluding earthwork with all labour and material as a complete job. Cement for mortar will be paid separately. (Pipes of 600mm dia and above will be laid using crane/hydra).				
42a	052252	450mm dia.	100	Meter	2,756.69	2,75,669.00
43	052260	Supplying, spreading and filling coarse sand (no cohesive materials to be used) of approved quality including watering and ramming in foundation, plinth, behind the abutment, wing wall, retaining wall in layers not exceeding 150mm thick including its compaction as per direction of Engineer-incharge. The rate includes all lead, lift, ascent, descent, crossing of Railway line etc. complete with contractor's labour, materials, tools and plant.	7,958	Cum	2,020.70	1,60,80,730.60

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
44	191310	Fabrication, supplying and fixing 600mm x 450mm Bridge Board made from 16 SWG MS Sheet duly welded or rivited to back support of two 600mm long horizontal angles of size 25mm x 25mm x 3mm & two 2.5 metre long vertical support of MS Angle of size 50mm x 50mm x 5mm, welded /rivited to board. Vertical supports shall have split ends for proper fixing in ground. Vertical supports of board shall be embedded in ground in M 20 Cement Concrete blocks of size 300mm x300mm x 300mm, complete job including painting & writing of subject matter on bridge board, as directed by Engineer – In charge. {Note : Excavation & concrete work will be paid separately under Sub Schedule-B12}	14	Each	2,715.86	38,022.04
45	195030	Centring and shuttering including strutting, propping etc. and removal of form for :				
45a	195032	Abutment, pier, wing walls and return walls	6,581	Sqm	376.01	24,74,521.81
45b	195033	Abutment cap, Pier Cap, Inspection Platform & Pedestal over Pier cap, Fender wall, Diaphragm wal etc.	2,110	Sqm	364.94	7,70,023.40
45c	195034	Approach slab at formation level, Dirt wall/ ballast wall at formation level	668	Sqm	237.17	1,58,429.56

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
45d	195038	In Bottom/top slab & side walls of RCC Box , toe wall and sumps haunch filling head walls, In well Kerb & Steining or any other component	23,550	Sqm	376.01	88,55,035.50
46	NS-6	Supplying and laying of 150mm thick well graded stones aggregate/gravel as base layer over the slopes of embankment with manual dressing with water compaction including the cost of supply of all material, labour, lead, lift, tools, plants, crossing of tracks etc. complete as per approved drawings and technical specifications.	6,188	Cum	1,096.18	67,83,161.84
47	NS-7	Providing Boulder Backing behind wing wall, return wall, retaining wall with hand packed boulders & cobbles not less than 15cm in any direction & not less than 15kg (except smaller boulders required for filling voids) including all lead, lift, labour & other incidental charges as complete work in all respect. Cost of boulder/cobbles is included in this item.	4,601	Cum	1,219.73	56,11,977.73
48	NS-8	Providing and fixing of 75mm dia PVC pipe for weep holes in abutments, Wing Wall, Return Wall, Face wall, retaining wall etc. at suitable intervals as directed by the Engineer-in-charge.	1,500	Meter	232.42	3,48,630.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
49	NS-9	Manufacturing, transportation (including loading & unloading) and installation in position (including joining and grouting) M-35 **or higher grade** precast reinforced cement concrete U-shaped drain/duct with cover as per the directions of the Engineer. Precast reinforced U-shaped drain shall be factory-made, and steam cured in a controlled environment with inserts for handling/transportation. Dimensional tolerances shall be as per IS: 6408 (part 2) for PC Class 6. Notes:- 1. This item includes cost of all the materials, labour, machinery, tools & plant etc. complete required for manufacture of precast segments except Steel Reinforcement which shall be paid separately under relevant item of Sub schedule B2. 2. Excavation of soil for foundation shall be paid separately under item relevant of Sub Schedule B11. 3. Before placing of wall segments, 20 mm thick stiff 1:3 cement mortar bedding layer shall be laid over a levelling course of 50 mm thick of M20 concrete. Payment for M20 concrete shall be made under relevant item of Sub Schedule	360	Cum	26,770.42	96,37,351.20

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		B11 and for mortar under relevant item of Sub-Schedule- B12. 4. 60% of the rate shall be paid on receipt of the precast retaining wall segments at site and balance 40% will be paid on fixing the same in position in satisfactory condition.				
50	NS-10	Designing, Providing and erection of specified grade precast RCC Facia Panel of thickness 180 mm made with M-35 Grade Concrete Batching plant, Transit Mixer, Concrete Pump and Vibrator for retaining earth with all element and accessories including reinforcing element complete as per approval drawing and Section 3100 of MORT&H specification including all material labour machinery etc. (Scope of work including designing, getting approval, casting in yad, curing, storing, Transporting, lifting, placing in position, erection with all necessaries fasteners etc complete). The cost of cement & steel are included in this item & no separate payment shall be paid whatsoever. The rate also include cost for excavation, foundation, reinforcing element, fasteners, drainage layer, drain pipe, coping beam and other accessories for which nothing extra shall be paid. Mode of Payment:	2640	Sqm	6,068.85	1,60,21,764.00

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		1- Casting of RE Panel: 60% 2- Erection & fixing: 35 % 3- Final Bill: 5%				
51	NS-11	Providing Placing & Compacting to desired density approved backfill material in layers as per approved methodology including testing of reinforced fill portion in approaches between reinforced soil (RS) wall panels as per approved drawing as per Section 3103 of MORT&H Specification. The soil should be predominantly coarse grained, Not more than 10 % of particles should pass 75 micron sieve. The item shall be measured and paid for the finished volume of backfill and subgrade placed in position excluding the volume of filter media at base and behind the RS RE Wall.	8316	Cum	373.31	31,04,445.96
52	NS-12	Providing & constructing of RCC Crash Barrier of M35 at the edge of road , approaches to bridge structures and medians, constructed with specified grade of concrete using batching plant , transit mixer, concrete pump and vibrator with 450 mm long at expansion joint filled with premolded asphlat filler board, keyed to the structure on which it is built and installed as per design and dimension in the approved drawing and at location directed by the engineer, all as specified as per Section 809 of MORT&H	238	Cum	6,996.32	16,65,124.16

SUB SCHEDULE 'B11': Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						
S. No.	**USSOR Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		Specification including all material labour, scaffolding etc.				
Estimated Value of SUB SCHEDULE 'B11' Well foundation, Concrete Superstructure, RE wall & Other miscellaneous Works (USSOR Based & NS items)						***16,06,83,080.29***

6.12 Sub-Schedule 'B12': Road and Building Works (DSR Based & NS items)

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
53	2.27	Supplying and filling in plinth with sand under floors, including watering, ramming, consolidating and dressing complete	96	Cum	2,212.30	2,12,380.80
54	3.8	1:3 (1 Cement : 3 coarse sand (zone-III)) cement sand levelling mortar. Item will be used as below precast item. Note:- cost of cement is included in the item.	33	Cum	5,142.94	1,69,717.02
55	4.17	Making plinth protection 50mm thick of cement concrete 1:3:6 (1 cement : 3 coarse sand (zone-III) derived from natural sources : 6 graded stone aggregate 20 mm nominal size derived from natural sources) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including necessary excavation, levelling & dressing & finishing the top smooth.	120	Sqm	697.77	83,732.40
56	4.6	Providing and fixing at or near ground level precast cement concrete in kerbs, edgings etc. as per approved pattern and setting in position with cement mortar 1:3 (1 Cement : 3 coarse sand), including the cost of required centering, shuttering complete.				
56a	4.6.1	1:1½:3 (1 Cement: 1½ coarse sand(zone-III) derived from natural sources: 3 graded stone aggregate 20 mm nominal size derived from natural sources)	10	Cum	8,322.88	83,228.80

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
57	5.1	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level.				
57a	5.1.2	1:1.5:3 (1 cement : 1.5 coarse sand (zone-III) derived from natural sources : 3 graded stone aggregate 20 mm nominal size de rived from natural sources).	51	Cum	8,561.96	4,36,659.96
58	5.3	Reinforced cement concrete work in beams, suspended floors, roofs having slope up to 15° landings, balconies, shelves, chajjas, lintels, bands, plain window sills, staircases and spiral stair cases above plinth level up to floor five level, excluding the cost of centering, shuttering, finishing and reinforcement with 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) derived from natural sources : 3 graded stone aggregate 20 mm nominal size derived from natural sources).	48	Cum	10,972.74	5,26,691.52
59	5.9	Centering and shuttering including strutting, propping etc. and removal of form for				
59a	5.9.1	Foundations, footings, bases of columns, etc. for mass concrete	450	Sqm	315.23	1,41,853.50
59b	5.9.2	Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	300	Sqm	685.38	2,05,614.00
59c	5.9.3	Suspended floors, roofs, landings, balconies and access platform	1,200	Sqm	784.67	9,41,604.00
59d	5.9.5	Lintels, beams, plinth beams, girders, bressumers and cantilevers	690	Sqm	622.73	4,29,683.70
59e	5.9.6	Columns, Pillars, Piers, Abutments, Posts and Struts	540	Sqm	823.27	4,44,565.80

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
59f	5.9.19	Weather shade, Chajjas, corbels etc., including edges	240	Sqm	834.22	2,00,212.80
60	5.33	Providing and laying in position ready mixed or site batched design mix cement concrete for reinforced cement concrete work; using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana / Ordinary Portland /Portland Slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads; but excluding the cost of centering, shuttering, finishing and reinforcement as per direction of the engineer-in-charge; for the following grades of concrete. Notes:- Extra cement up to 10% of the minimum specified cement content in design mix shall be payable separately. In case the cement content in design mix is more than 1.10 times of the specified minimum cement content, the contractor shall have discretion to either re-design the mix or bear the cost of extra cement				
60a	5.33.1	All works upto plinth level				
60aa	5.33.1.1	Concrete of M25 grade with minimum cement content of 330 kg /cum	90	Cum	8,889.11	8,00,019.90
60b	5.33.2	All works above plinth level upto floor V level				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
60ba	5.33.2.1	Concrete of M25 grade with minimum cement content of 330 kg /cum	132	Cum	10,549.87	13,92,582.84
61	6.1	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in:				
61a	6.1.2	Cement mortar 1:6 (1 cement : 6 coarse sand)	9	Cum	6,815.67	61,341.03
62	6.4	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes in :				
62a	6.4.2	Cement mortar 1:6 (1 cement : 6 coarse sand)	201	Cum	8,484.36	17,05,356.36
63	8.31	Providing and fixing Ist quality ceramic glazed wall tiles conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete.	15	Sqm	1,088.59	16,328.85
64	9.7.7	Providing and fixing panelling or panelling and glazing in panelled or panelled and glazed shutters for doors, windows and clerestory windows (Area of opening for panel inserts excluding portion inside grooves or rebates to be measured). Panelling for				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		panelled or panelled and glazed shutters 25 mm to 40 mm thick: Float glass panes.				
64a	9.7.7.1	4 mm thick glass pane (weight not less than 10kg/sqm).	27	Sqm	1,941.95	52,432.65
65	9.21	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters.				
65a	9.21.1	35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws	41	Sqm	2,063.41	84,599.81
66	9.48	Providing and fixing M.S. grills of required pattern in frames of windows etc. with M.S. flats, square or round bars etc. including priming coat with approved steel primer all complete.				
66a	9.48.1	Fixed to steel windows by welding	300	Kg	185.28	55,584.00
67	9.83	Providing and fixing aluminium die cast body tubular type universal hydraulic door closer (having brand logo with ISI, IS : 3564, embossed on the body, door weight upto 35 kg and door width upto 700 mm), with necessary accessories and screws etc. complete.	6	Each	1,049.90	6,299.40

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
68	9.96	Providing and fixing aluminium sliding door bolts, ISI marked anodised (anodic coating not less than grade AC 10 as per IS : 1868), transparent or dyed to required colour or shade, with nuts and screws etc. complete.				
68a	9.96.1	300x16 mm	18	Each	266.51	4,797.18
69	9.97	Providing and fixing aluminium tower bolts, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete				
69a	9.97.1	300x10 mm	18	Each	120.43	2,167.74
69b	9.97.4	150x10 mm	10	Each	77.34	773.40
70	9.100	Providing and fixing aluminium handles, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete				
70a	9.100.1	125 mm	18	Each	61.47	1,106.46
71	9.101	Providing and fixing aluminium hanging floor door stopper, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour and shade, with necessary screws etc. complete				
71a	9.101.2	Twin rubber stopper	6	Each	63.72	382.32

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
72	10.13	Providing and fixing T-iron frames for doors, windows and ventilators of mild steel Tee-sections, joints mitred and welded, including fixing of necessary butt hinges and screws and applying a priming coat of approved steel primer				
72a	10.13.1	Fixing with 15x3 mm lugs 10 cm long embedded in cement concrete block 15x10x10 cm of C.C. 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	600	Kg	117.36	70,416.00
73	10.14	Providing and fixing pressed steel door frames conforming to IS: 4351, manufactured from commercial mild steel sheet of 1.60 mm thickness, including hinges, jamb, lock jamb, bead and if required angle threshold of mild steel angle of section 50x25 mm, or base ties of 1.60 mm, pressed mild steel welded or rigidly fixed together by mechanical means, including M.S. pressed butt hinges 2.5 mm thick with mortar guards, lock strike-plate and shock absorbers as specified and applying a coat of approved steel primer after pre-treatment of the surface as directed by Engineer-in-charge:				
73a	10.14.1	Profile B				
73aa	10.14.1.1	Fixing with adjustable lugs with split end tail to each jamb	180	Meter	455.01	81,901.80
74	10.17	Providing and fixing M.S. fan clamp type I or II of 16 mm dia M.S. bar, bent to shape with hooked ends in R.C.C. slabs or beams during laying, including painting the exposed portion of loop, all as per standard design complete	24	Each	189.58	4,549.92

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
75	10.25	Steel work welded in built up sections/ framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required				
75a	10.25.2	in gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	6,913	Kg	145.66	10,06,947.58
76	10.26	Providing and fixing hand rail of approved size by welding etc. to steel ladder railing, balcony railing, staircase railing and similar works, including applying priming coat of approved steel primer				
76a	10.26.1	M.S. tube	102	Kg	160.87	16,408.74
76b	10.26.3	G.I. pipes	114	Kg	184.46	21,028.44
77	10.29	Providing & fixing fly proof wire gauze to windows, clerestory windows & doors with M.S. Flat 15x3 mm and nuts & bolts complete				
77a	10.29.1	Galvanised M.S. Wire gauze with 0.63 mm dia wire and 1.4 mm aperture on both sides	120	Sqm	749.51	89,941.20
78	11.20	Chequerred precast cement concrete tiles 22 mm thick in footpath & courtyard, jointed with neat cement slurry mixed with pigment to match the shade of tiles, including rubbing and cleaning etc. complete, on 20 mm thick bed of cement mortar 1:4 (1 cement: 4 coarse sand)				
78a	11.20.1	Light shade pigment using white cement	600	Sqm	1,262.20	7,57,320.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
79	11.21	Providing and fixing 10 mm thick acid and/or alkali resistant tiles of approved make and colour using acid and/or alkali resisting mortar bedding, and joints filled with acid and/or alkali resisting cement as per IS : 4457, complete as per the direction of Engineer-in- Charge				
79a	11.21.1	In flooring on a bed of 10 mm thick mortar 1:4 (1 acid proof cement : 4 coarse sand)				
79aa	11.21.1.1	Acid and alkali resistant tile	120	Sqm	1,551.28	1,86,153.60
79b	11.21.2	In dado/skirting on 12 mm thick mortar 1:4 (1 acid proof cement : 4 coarse sand)				
79ba	11.21.2.1	Acid and alkali resistant tile	90	Sqm	1,676.42	1,50,877.80
80	11.27	Kota stone slabs 20 mm thick in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete.	600	Sqm	2,086.75	12,52,050.00
81	11.38	Providing and laying Ceramic glazed floor tiles of size 300x300 mm (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in all colours, shades, except White, Ivory, Grey, Fume Red Brown, laid on 20 mm thick bed of cement mortar 1:4 (1 Cement : 4 Coarse sand), jointing with grey cement slurry @ 3.3 kg/ sq.m including pointing the joints with white cement and matching pigments etc., complete	35	Sqm	1,133.22	39,662.70

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
82	11.41	Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3 kg/ sqm including grouting the joints with white cement and matching pigments etc., complete				
82a	11.41.2	Size of Tile 600x600 mm	411	Sqm	1,450.14	5,96,007.54
83	11.55	Providing and laying flamed finish Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge :				
83a	11.55.1	Flamed finish granite stone slab Jet Black, Cherry Red, Elite Brown, Cat Eye or equivalent.	100	Sqm	2,651.13	2,65,113.00
84	13.1	12 mm cement plaster of mix				
84a	13.1.2	1:6 (1 cement: 6 fine sand)	1,800	Sqm	288.67	5,19,606.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
85	13.2	15 mm cement plaster on the rough side of single or half brick wall of mix				
85a	13.2.2	1:6 (1 cement: 6 fine sand)	420	Sqm	331.97	1,39,427.40
86	13.16	6 mm cement plaster of mix				
86a	13.16.1	1:3 (1 cement : 3 fine sand)	360	Sqm	259.03	93,250.80
87	13.42	Distempering with 1st quality acrylic distemper (ready mixed) having VOC content less than 50 gms/litre, of approved manufacturer, of required shade and colour complete, as per manufacturer's specification.				
87a	13.42.1	Two or more coats on new work	780	Sqm	94.94	74,053.20
88	13.45	Finishing walls with textured exterior paint of required shade.				
88a	13.45.1	New work (Two or more coats applied @ 3.28 ltr/10 sqm) over and including priming coat of exterior primer applied @ 2.20kg/10 sqm.	420	Sqm	250.79	1,05,331.80
89	13.47	Finishing walls with Premium Acrylic Smooth exterior paint with Silicone additives of required shade.				
89a	13.47.1	New work (Two or more coats applied @ 1.43 ltr/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/10 sqm).	600	Sqm	166.19	99,714.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
90	13.48	Finishing with Deluxe Multi surface paint system for interiors and exteriors using Primer as per manufacturers specifications:				
90a	13.48.2	Painting wood work with Deluxe Multi Surface Paint of required shade. Two or more coat applied @ 0.90 ltr/10 sqm over an under coat of primer applied @0.75 ltr/10 sqm of approved brand and manufacture.	24	Sqm	148.33	3,559.92
90b	13.48.3	Painting Steel work with Deluxe Multi Surface Paint to give an even shade. Two or more coat applied @ 0.90 ltr/ 10 sqm over an under coat of primer applied @ 0.80 ltr/ 10 sqm of approved brand and manufacture.	30	Sqm	143.36	4,300.80
91	13.50	Applying priming coat:				
91a	13.50.1	With ready mixed pink or Grey primer of approved brand and manufacture on wood work (hard and soft wood).	54	Sqm	62.90	3,396.60
92	13.60	Wall painting with acrylic emulsion paint of approved brand and manufacture to give an even shade.				
92a	13.60.1	Two or more coats on new work	1,170	Sqm	141.11	1,65,098.70
93	13.61	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade.				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
93a	13.61.1	Two or more coats on new work.	111	Sqm	134.56	14,936.16
94	13.80	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	2,580	Sqm	126.78	3,27,092.40
95	16.54	Providing and laying Dense Graded Bituminous Macadam using crushed stone aggregates of specified grading, premixed with bituminous binder and filler, transporting the hot mix to work site by tippers, laying with paver finisher equipped with electronic sensor to the required grade, level and alignment and rolling with smooth wheeled, vibratory and tandem rollers as per specifications to achieve the desired compaction and density, complete as per specifications and directions of Engineer-in-Charge				
95a	16.54.1	50 to 100 mm average compacted thickness with bitumen of grade VG-30 @ 5% (percentage by weight of total mix) and lime filler @ 2% (percentage by weight of Aggregate) prepared in Batch Type Hot Mix Plant of 100-120 TPH capacity.	195	Cum	10,250.05	19,98,759.75
96	16.57	Providing and laying Bituminous concrete using crushed stone aggregates of specified grading, premixed with bituminous binder and filler, transporting the hot mix to work site by tippers, laying with paver finisher equipped with electronic sensor to the required grade, level and alignment and rolling with smooth wheeled, vibratory and tandem rollers to				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		achieve the desired compaction and density as per specification, complete and as per directions of Engineer-in-Charge.				
96a	16.57.1	40/50 mm compacted thickness with bitumen of grade VG-30 @ 5.5% (percentage by weight of total mix) and lime filler @ 3% (percentage by weight of Aggregate) prepared in Batch Type Hot Mix Plant of 100-120 TPH capacity.	103	Cum	11,127.77	11,46,160.31
97	16.69	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineer-in-charge).	161	Cum	8,817.20	14,19,569.20
98	16.75	Providing and laying C.C. pavement of mix M-25 with ready mixed concrete from batching plant. The ready mixed concrete shall be laid and finished with screed board vibrator , vacuum dewatering process and finally finished by floating, brooming with wire brush etc. complete as per specifications and directions of Engineer-incharge. (The panel	5,848	Cum	8,473.26	4,95,51,624.48

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		shuttering work shall be paid for separately). (Note:- Cement content considered in this item is @ 330 kg/cum. Excess/less cement used as per design mix is payable/ recoverable separately).				
99	16.78	Construction of granular sub-base by providing close graded Material conforming to specifications, mixing in a mechanical mix plant at OMC, carriage of mixed material by tippers to work site, for all leads & lifts, spreading in uniform layers of specified thickness with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per specifications and directions of Engineer-in-Charge.				
99a	16.78.2	With material conforming to Grade-II (size range 53 mm to 0.075 mm) having CBR Value-25	6,279	Cum	2,841.28	1,78,40,397.12
100	16.79	Providing, laying, spreading and compacting graded stone aggregate (size range 53 mm to 0.075 mm) to wet mix macadam (WMM) specification including premixing the material with water at OMC in for all leads & lifts, laying in uniform layers with mechanical paver finisher in sub- base / base course on well prepared surface and compacting with vibratory roller of 8 to 10 tonne capacity to achieve the desired density, complete as per specifications and directions of Engineer-in-Charge.	4,868	Cum	2,869.94	1,39,70,867.92

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
101	16.80	Construction of dry lean cement concrete sub base over a prepared sub-grade with coarse and fine aggregate conforming to IS:383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per specifications, cement content not to be less than 150 Kg/cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, for all leads & lifts, laid with a mechanical paver, compacting with 8-10 tonne vibratory roller, finishing and curing etc. complete as per direction of Engineer in- charge.	5,043	Cum	4,228.21	2,13,22,863.03
102	16.90	Providing and laying tactile tile (for vision impaired persons as per standards) of size 300x300x9.8mm having with water absorption less than 0.5% and conforming to IS:15622 of approved make in all colours and shades in for outdoor floors such as footpath, court yard, multi modals location etc., laid on 20mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) in all shapes & patterns including grouting the joints with white cement mixed with matching pigments etc. complete as per direction of Engineer-in-Charge.	1,000	Sqm	1,759.64	17,59,640.00

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
103	16.91	Providing and laying factory made chamfered edge Cement Concrete paver blocks in footpath, parks, lawns, drive ways or light traffic parking etc, of required strength, thickness & size/ shape, made by table vibratory method using PU mould, laid in required colour & pattern over 50mm thick compacted bed of sand, compacting and proper embedding/laying of inter locking paver blocks into the sand bedding layer through vibratory compaction by using plate vibrator, filling the joints with sand and cutting of paver blocks as per required size and pattern, finishing and sweeping extra sand. complete all as per direction of Engineer-in-Charge.				
103a	16.91.1	60mm thick cement concrete paver block of M-35 grade with approved colour, design & pattern.	100	Sqm	954.39	95,439.00
103b	16.91.2	80 mm thick C.C. paver block of M-30 grade with approved color design and pattern.	3,570	Sqm	1,035.11	36,95,342.70
104	19.1	Providing, laying and jointing glazed stoneware pipes class SP-1 with stiff mixture of cement mortar in the proportion of 1:1 (1 cement : 1 fine sand) including testing of joints etc. complete :				
104a	19.1.2	150 mm diameter	100	RMT	605.38	60,538.00
105	19.6	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete :				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
105a	19.6.5	450 mm dia. R.C.C. pipe	100	RMT	1,516.58	1,51,658.00
105b	19.6.7	600 mm dia. R.C.C. pipe	100	RMT	2,147.71	2,14,771.00
106	19.36	Providing and laying Non Pressure NP-4 class (Heavy duty) R.C.C. pipes including collars/spigot jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete.				
106a	19.36.5	1200 mm dia RCC pipes. (Laying by manual/mechanical means)	10	RMT	10,104.64	1,01,046.40
107	21.1	Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / panelling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, panelling and dash fasteners to be paid for separately)				
107a	21.1.1	For fixed portion				

SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						
S. No.	**DSR-2021 Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
107aa	21.1.1.1	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15).	360	Kg	444.21	1,59,915.60
107b	21.1.2	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately).				
107ba	21.1.2.1	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15).	240	Kg	544.37	1,30,648.80
108		Items included in Delhi Schedule of Rate-(Horticulture & Landscaping) 2020.		LS		10,00,000.00
109	NS-13	Earthwork in filling with contractor's own earth of approved quality from borrow areas including all lead all lead, lift, ascent, descent, royalty, taxes, cess, compensation, crossing of nallahs /stream and other obstructions including mechanical compaction in layers with watering to 95% of MDD (as per IS 2720 part 8), handling, re-handling, dressing to the final profile with all labour, material, tools, plant, machinery and equipment, taxes, cess etc. as a complete job in accordance with the specification and drawings. Note:- This item will be used for earthwork in filling for other than railway embankment work.	1,43,601	Cum	259.50	3,72,64,459.50
Estimated value of SUB SCHEDULE 'B12': Road and Building Works (DSR Based & NS items)						**16,60,31,563.15**

6.13 Sub-Schedule 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
110	022100	Providing, fabricating and installing permanent casing pipe for bored piles for all diameters with specified thickness of steel plate including all labour, materials, pumping and bailing out water wherever required, complete as per technical specifications as directed by Engineer in charge. This will include the weight of plate only and no cognizance will be given for the fittings, i.e. rivets and welding etc.	194	MT	93,323.45	1,81,04,749.30
111	023030	Supplying, Fabrication, assembly, erection & placing in position the cutting edge of well curb with structural steel including MS sheet/Plates of specified thickness for pier/abutment complete as per approved plans and as per direction of Engineering In charge including all operations like cutting, bending, straightening, drilling holes, bolting, riveting, welding, threading, jointing of steel sections including outer and inner places liners and skin plates, stiffeners, hooks, bottle nuts, bond rods etc. as per design including all ascent, descents, leads, lifts, handing, re-handling, all other obstructions whatsoever, diverting channels, pumping / bailing out of water wherever required including cost of steel such as flats, sheets, angles,	18	MT	1,01,005.73	18,18,103.14

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		steel bars etc. with all labour and material as a complete job.				
112	031090	Design, manufacturing, supplying and fixing in position elastomeric bearing true to line and level conforming to IS:3400, IS:226, BS-5400 under prestressed concrete girders/ Steel Girders, for Precast as well as cast-in-situ girders as per approved drawing. The rate shall include cost of load test of one no. bearing from Railway approved firms and all fixing materials, equipments, machineries, labour, taxes, loading, unloading, leading, lifting etc. complete. Rates include getting the drawing approved from Railway and cost of inspection during manufacturing from railway approved organization. Note : 1. The rate is for finished item complete and paid only after fixing in position below the girder.	4,42,368	Cu.Cm.	1.68	7,43,178.24

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
113	041060	Providing and fixing railing used in rows for footpath or anti-crash barrier railing with B class G.I. pipe 65/50 mm nominal dia including cost of M.S. angle and channels in vertical posts, welding / bolting, priming painting with one coat ready mix Zinc Chromate conforming to IS:104 with DFT of 25-30Microns, followed by one coat of Zinc Chrome red oxide conforming to IS:2074 with DFT of 25 Microns with all material, labour, T&P as a complete job.	9,933	Kg	107.58	10,68,592.14
114	041080	Providing and fixing various size HTS holding down bolts conforming to IS:1364 in concrete column or in other structures with proper nuts, bolts, washers/plates, grouting of holes with all material, labour, T&P as a complete job. Note: Cement used in grouting will be paid separately under relevant item.	2,000	Kg	165.20	3,30,400.00

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
115	041180	Design, supply and fixing 300MT capacity Spherical Bearing in position true to line and level consisting of set of concave and convex mating steel backing plate with a low friction sliding interface, flat sliding elements ,guides and restraining rings; with all components conforming to approved drawing and technical specifications & Bridge Code including grouting of holes for anchor bolts and underside of baseplate with approved non-shrink epoxy grout with all material, labour, T&P as a complete job. Note: Sliding surface with PTFE or UHMWPE low friction thermoplastic material and steel for backing plate of Mild steel in accordance to IS:2062 grade-B. Cast steel in accordance with IS 1030 Grade 280-520W. Stain less steel in accordance with AISI 304/316.Low friction thermo -plastic sliding PTFE material either pure polytetrafluroethalyne (PTFE) Or Ultra High Molecular weight Polythylene (UHMWPE). Austanitic steel is of stainless steel for the sliding interface shall be in accordance with AISI 316L or O2 Cr17 NI12 of IS-6911. The thickness of the stain less steel sheet shall be 3mm minimum. The stainless steel sheet shall be attached to its backing plate either by screwing/riveting or by continuous fillet weld. Hard chromium plated surface shall be entire curved surface of the convex				

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		steel plate mating with hard chromium plated concave sliding surface. The thickness of the hard chromium plating shall be at least 100 microns and the final surface roughness of the plated surface shall not exceed 3 microns. Bearing manufacturer shall give the guarantee for satisfactory performance of bearing for period specified.				
115a	041181	Spherical Fixed Bearing	26	Each	1,19,070.94	30,95,844.44
115b	041182	Spherical Free Float Bearing	26	Each	1,30,006.81	33,80,177.06
115c	041183	Spherical Slide Guide (L) Bearing	26	Each	1,30,488.44	33,92,699.44
115d	041184	Spherical Slide Guide (T) Bearing	26	Each	1,30,233.46	33,86,069.96

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
116	041390	Supplying fabricating and erecting welded and/or bolted and/or riveted steel work in built up sections, trusses and framed work, staging, racks etc. for Steel Structures other than bridge girders, using RSJ, tees, angles and channels/flats, plates, gussets, round or square bars, cleats, bolts etc., with contractors own steel including cutting, bending, straightening, drilling, riveting, hoisting, fixing, erecting, welding, bolting etc., with Providing stiffeners wherever required as per approved drawing including applying a priming coat of a approved steel primer with all contractor's materials, labour, tools & plants, lead & lift including crossing of tracks if required etc., complete as per specification and as directed by Engineer-in-charge.	85	MT	1,05,186.17	89,40,824.45
117	191260	Supplying & fixing MS chequered plates 6 to 8mm thick between guard rails on unballasted deck bridge for gang pathway, overlapping at regular intervals of 2m to 2.5m with rail screws or bolts duly drilling holes in chequered plate, as directed. [Note: Overlapping of chequered plates shall not fall in between sleepers]	5	MT	94,164.70	4,70,823.50
118	NS-14	Construction of Mild Steel pipe of 323.9 mm outer diameter in the embankment at approximately 500m interval (except in station yards) for crossing utilities in future as shown in drawings.	500	RMT	3,909.00	19,54,500.00

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
119	NS-15	Supplying, fabrication and fixing pathway on Open Web Girder bridges & Composite with hollow steel, rolled and chequred plate including welding / bolting, priming painting with one coat ready mix Zinc Chromate conforming to IS:104 with DFT of 25-30Microns, followed by one coat of Zinc Chrome red oxide conforming to IS:2074 with DFT of 25 Microns with all material, labour, T&P as a complete job as RDSO drawing No. CBS 0045 & CBS 0046.	293	MT	1,17,302.05	3,43,69,500.65
120	NS-16	Supplying and fixing M.S. Angles 100mmx 100mm x 10mm size conforming to IS:2062 in expansion joint of Composite girder bridges including provision of 10mm dia dowel bar & 12mm dia anchor bolts at 150 mm centre to centre and 250mm wide GI plate over the top of angles as per relevant RDSO standard drawing with all material, labour, T&P as a complete job.	88	Each	6,139.09	5,40,239.92

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
121	NS-17	Supplying, fabricating, transportation and fixing galvanized H-Beam sleepers as per RDSO drawing RDSO/B/1636/4/R & RDSO/B/1636/5 with latest alteration and specifications thereto complete with all fittings and fixtures including the cost of all steel sections, all fittings and fixtures ,elastomeric pad, galvanized bolts, nuts, washer, split pin, fish plates 1m and 0.6m long along with fish bolts and nuts for 60Kg running rail and 52Kg guard rail respectively, track fittings and fastenings (Zero Toe Load Fastening) for 60 kg running rail and 52 Kg guard rail as per RDSO drg -RDSO/T-8759 to RDSO/T8765. labour, lead, lift, plants and equipments including galvanized work of full steel components complete in all respects as per approved drawing and technical specifications & as per direction of Engineer on Open Web Girder (OWG) bridges. The rate is also inclusive of the cost of supply of approved quality of epoxy/adhesive and fixing of elastomeric pads with different components of steel sleepers & girder in accordance with approved drawings. The steel to be supplied by the contractor for fabrication of steel H-Beam sleepers shall conform to IS-2062-2006, Grade B0 only. The rate is also inclusive of inspection charges of components of sleepers including all fixtures & fastening, galvanization etc. from the reputed laboratory/organization. Elastomeric pad plate and	135	Each	30,640.06	41,36,408.10

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		other track fittings shall be procured from RDSO approved source. *The rate also includes supply of 10% of spare fittings as per Annexure F-8, Section VII-2:Employer's Requirements: Functional.* Note: Payment under this item shall be made in following manner; i. 75% of the rate shall be paid after fabrication, galvanization and transportation of H beam sleepers to the site and submission of material test certificate of manufacturer and inspection certificate of the agency nominated by Engineer. ii.15% of the rate shall be paid after supply of fittings to the site and submission of inspection certificate of the agency nominated by Engineer. iii. 10% of the rate will be paid after fixing H Beam sleepers to the girder in satisfactory manner. iv. In case fixing is not required, then balance payment will be released on handing over of the sleepers after making recovery @ Rs.850/- per sleeper.				

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
122	NS-18	Providing and fixing stainless steel (Grade 304) railing made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement as per approval of Engineer-in-charge, (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.).	4,144	Kg	651.22	26,98,655.68
123	NS-19	Supply, fabrication and erection of bed plate of approved sizes(as per relevant RDSO drawing No. RDSO/B-11751/4R2, B-11753/5R1, B-11754/3R2 with UpToDate corrections), in exact position over bed block on pier/abutments by giving full and even bearing, setting them on the layer of free flow non-shrinkable grouting compound, scrapping or chipping of bed block, if required, fabrication and fixing of HD bolts of suitable sizes along with nuts, washers etc., drilling holes of required size, grouting of holes by epoxy mortar after fixing HD bolts with all labour, material, T & P as a complete job.				

SUB SCHEDULE 'B13': Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						
S. No.	**USSOR/ NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
123a	NS-19A	More than 12.2m and upto 18.3m clear span	8,800	Kg	225.63	19,85,544.00
124	NS-20	Supply and fixing of Metallic Guided Bearing in position true to line and level as per RDSO drawing No. RDSO/B-11754/3R2 and IRC:83 pt. III-2018 including supply & grouting of anchor bolts with approved non-shrinking epoxy grout with all material, labour, T&P as a complete job.	32	Each	49,532.72	15,85,047.04
Estimated value of SUB SCHEDULE 'B13' Bridge Bearing & Miscellaneous Structural Steel Works (USSOR Based & NS items)						**9,20,01,357.06**

6.14 Sub-Schedule 'B14': P Way Works-Ballastless Track, Rails & Special Sleepers (NS items)

SUB SCHEDULE 'B14': P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
125	NS-21	Construction of ballast less track on straight, curved track on bridges including linking of track with 60 Kg rails in LWR including, supply and fixing of rail fittings/ fastening, Construction of derailment guard , as per design approved by the Engineer. The item include supply and leading of all material, labour and tools & plants as a complete job including welding of track in LWR, destressing, drainage arrangement as per the approved drawing complete in all respect. Nothing extra shall be paid. Note:- 1- 60 Kg, 350 R Rails shall be paid under item no NS-25 of this Sub-Schedule	1,072	Rmt	52,879.28	5,66,86,588.16
126	NS-22	Construction of Transition system of ballastless track to ballasted track on bridge approach including linking of track with 60 Kg rails in LWR including, supply and fixing of rail fittings/ fastening, Construction of derailment guard , as per design approved by the Engineer. The item include supply and leading of all material, labour and tools & plants as a complete job including welding of track in LWR, destressing, drainage arrangement as	8	Each	11,42,190.26	91,37,522.08

SUB SCHEDULE 'B14': P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
		per the approved drawing complete in all respect. Nothing extra shall be paid. Note:- 1- 60 Kg, 350 R Rails shall be paid under item no NS-25 of this Sub-Schedule				
127	NS-23	Linking of track on H- beam sleepers on Open Web Girder (OWG) bridges with 60 Kg running rail and 52 kg guard rail with track fittings/fastenings including leading of Running and guard rails from bridge approach and fixing of running rails & guard rails, bending of guard rails, notching, drilling of holes, cutting of rails etc., as directed and making track structure fit for sectional speed. Note- 1. 60Kg, 350R Rails for running rails and 52 Kg class 'IU' rails for guard rals shall be paid under item No. NS-25 & NS -26 respectively.	82	RTM	1,425.98	1,16,930.36
128	NS-24	Supplying at site of work including leading, loading, unloading and stacking of special PSC wider base sleepers for bridge approaches with provision of guard rails as per RDSO Drawing No. T-8673 to T-8680 for 60 Kg Rail.	2	Set	49,622.71	99,245.42

SUB SCHEDULE 'B14': P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						
S. No.	**NS Item No.**	**Description of Item**	**Quantity**	**Unit**	**Estimated Rate (INR)**	**Estimated Amount (INR)**
129	NS-25	Supplying, Transporting of Rail 60 kg Class 'A' ,R350 rail of 13/26 meter length as per IRS: T-12/2009 Specifications with latest amendments issued by RDSO.	2912	Rmt	7,396.29	2,15,37,996.48
130	NS-26	Supplying, Transporting of Rail 52 kg Class 'IU' as per IRS: T-12/2009 Specifications with latest amendments issued by RDSO.	164	Rmt	5,177.40	8,49,093.60
Estimated Value of SUB SCHEDULE 'B14' P Way Works- Ballastless Track, Rails & Special Sleepers (NS items)						**8,84,27,376.10**
					Total Estimated Amount of Schedule 'B'	***226,37,35,219.39***

Total Estimated Amount of Schedule 'B': INR*: 226,37,35,219.39*

7 Schedule 'C': General Electrical Services

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
1	**CONDUITS, WIRING, PLUGS, FAN AND DISTRIBUTION BOARDS**				
1.1	Point Wiring By 3x2.5 sqmm Copper Cable (With Modular Switches & Socket) in Conduits.	Nos	636	448.27	*2,85,099.72*
1.2	Supply of Material and Erection of 3x2.5 Sqmm Copper Cable in Conduits.	m	4183	93.20	*3,89,855.60*
1.3	Supply of Material and Erection of 3x6 Sqmm Copper Cable in Conduits.	m	673	141.86	*95,471.78*
1.4	Supply and Installation of 6A Modular Switch Socket.	Nos	481	254.38	*1,22,356.78*
1.5	Supply and Installation of 16A Modular Power Switch Socket.	Nos	129	281.42	*36,303.18*
1.6	Supply and Installation of 02 Module Plate GI Box.	Nos	86	109.37	*9,405.82*
1.7	Supply and Installation of 04 Module Plate GI Box.	Nos	242	151.15	*36,578.30*
1.8	Supply and Installation of 08 Module Plate GI Box.	Nos	99	260.53	*25,792.47*
1.9	Supply and Installation of 12 Module Plate GI Box.	Nos	12	280.19	*3,362.28*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
1.10	Supply, Installation, Testing and Commissioning (SITC) of 1200 mm Sweep Ceiling Fan with Fan Regulator.	Nos	181	2775.38	*5,02,343.78*
1.11	Supply, Installation, Testing and Commissioning (SITC) of 300 mm Sweep Exhaust Fan.	Nos	29	1606.70	*46,594.30*
1.12	Supply, Installation, Testing and Commissioning of Double Door, MCB TPN, 440V, 8 Module Distribution Boards (DB).	Nos	17	19614.74	*3,33,450.58*
1.13	Supply, Installation, Testing and Commissioning of Double Door, MCB SP, 12 Way Distribution Board (DB).	Nos	15	9319.16	*1,39,787.40*
1.14	Supply, Installation, Testing and Commissioning of 440V, 3-phase Change Over Distribution Board.	Nos	2	25884.66	*51,769.32*
1.15	Supply, Installation, Testing and Commissioning of MCCB 200A, 440V, 3-phase (4 Pole, 36 KA).	Nos	4	20784.60	*83,138.40*
1.16	Supply, Installation, Testing and Commissioning of Double Door, 63A, 240V, MCB SP 8 Way Distribution Board.	Nos	19	4659.58	*88,532.02*
1.17	Supply and Installation of Junction Box Size 390(H)x305(B)x170(D) mm.	Nos	10	3024.90	*30,249.00*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
1.18	Supply, Installation, Testing and Commissioning of Control and Distribution Panel for Colour Light Signalling (CLS) for 10/ 25/ 50 kVA AT supply.	Nos	3	94442.82	*2,83,328.46*
1.19	Supply and Installation of Metal Clad Plug Socket 20A, 240V, Single Phase with 32A MCB.	Nos	40	1098.64	*43,945.60*
1.20	Supply and Installation of Metal Clad Plug Socket 16A, 240V, Single Phase with 20A MCB.	Nos	4	878.91	3,515.64
1.21	Supply, installation, testing and commissioning of 32 mm dia GI Conduit.	m	80	188.02	*15,041.60*
1.22	Supply, installation, testing and commissioning of 25 mm dia GI Conduit.	m	600	146.89	*88,134.00*
1.23	Design and Drawing of conduits, wiring, panels, distribution board, as built drawings, survey, calculation etc. for Item no. 1.1 to 1.22.	LS	LS		54,281.50
2	**LT & HT CABLES AND LAYING**				
2.1	Supply of 2 Core x 10 Sqmm Copper Cable.	m	11645	194.24	*22,61,924.80*
2.2	Supply of 2 Core x 16 Sqmm Copper Cable.	m	7250	310.78	*22,53,155.00*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
2.3	Supply of 2 Core x 35 Sqmm Copper Cable.	m	2400	679.82	*16,31,568.00*
2.4	Supply of 2 Core x 70 Sqmm Copper Cable.	m	16000	1359.65	*2,17,54,400.00*
2.5	Supply of 2 Core x 95 Sqmm Copper Cable.	m	3200	1845.23	*59,04,736.00*
2.6	Supply of 4 Core x 120 Sqmm Copper Cable.	m	1800	3884.70	69,92,460.00
2.7	Supply of 4 Core x 240 Sqmm Copper Cable.	m	600	7769.40	46,61,640.00
2.8	Supply, Installation, Testing and Commissioning of LT Heat Shrinkable Straight Through Joint.	Nos	20	2581.41	51,628.20
2.9	Supply of 3 Core x 120 Sqmm 11 kV Copper Cable.	m	600	7320.32	*43,92,192.00*
2.10	Supply and Installation of End Termination Kit for 3 core, 70 Sqmm to 185 Sqmm, 11 kV Copper Cable.	Nos	24	14797.94	*3,55,150.56*
2.11	Laying of LT/ HT Cables (All Sizes) In Air/ Pipe/ Cable Tray/ Trench Etc.	m	20210	46.96	*9,49,061.60*
2.12	Excavation and Refilling of Trench of Size 500 mm Wide and depth up to 1200 mm (as per design) for cables.	m	20210	129.47	*26,16,588.70*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
2.13	Excavation and Refilling of Trench of Size 500 mm Wide and depth up to 1200 mm with brick protection (as per design) for cables.	m	2100	329.67	*6,92,307.00*
2.14	Supply and Laying of HDPE Pipe (90 mm outside dia).	m	8400	143.90	*12,08,760.00*
2.15	Supply and Laying of HDPE Pipe (90 mm outside dia) at platform along with pit and cover.	m	2400	151.09	*3,62,616.00*
2.16	Supply and Laying of HDPE Pipe (125 mm outside dia).	m	3200	466.37	*14,92,384.00*
2.17	Supply and Laying of HDPE Pipe (160 mm outside dia).	m	600	596.96	*3,58,176.00*
2.18	Supply and Laying of GI Pipe (nominal bore 125 mm).	m	1800	1694.86	*30,50,748.00*
2.19	Supply and Installation of Cable Route Marker.	Nos	210	2119.38	*4,45,069.80*
2.20	Drilling of horizontal bore below Railway track or road by pushing method for laying of HDPE/ GI pipe.	m	1610	2754.27	*44,34,374.70*
2.21	Design and Drawing of cable layout, trench layout, route markers, cable and pipe schedule, as built drawings, survey, calculation etc. for Item no. 2.1 to 2.20.	LS	LS		13,17,374.39

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
3	**LIGHTING, STREET LIGHT POLE AND HIGH MAST**				
3.1	Provision of 22 Watt LED Tube Light with fitting.	Nos	476	733.38	*3,49,088.88*
3.2	Provision of 40 Watt LED Street Light with Fitting.	Nos	100	5080.26	*5,08,026.00*
3.3	Provision of 120 Watt LED Street Light with Fitting.	Nos	44	12700.66	*5,58,829.04*
3.4	Provision of Rechargeable Batten Type 240 Watt Emergency Light.	Nos	8	3179.16	*25,433.28*
3.5	Provision of Outdoor LED Type Flood Light Luminaries (200 Watt).	Nos	60	33066.46	*19,83,987.60*
3.6	Supply, installation, testing and commissioning of 11 meter high cast iron decorative street light pole.	Nos	210	30000.00	63,00,000.00
3.7	Supply, Installation, Testing and Commissioning of (OFF Delay) Modular Digital Timers.	Nos	15	6527.92	*97,918.80*
3.8	Supply, Installation, Testing and Commissioning of 20 Meter High Mast.	Nos	5	355937.16	*17,79,685.80*
3.9	Design and Drawing of high masts, platform/ street poles, digital timer, foundation, lighting lux calculations, earthing, calculation, survey, as built drawings etc. for Item no. 3.1 to 3.8.	LS	LS		2,32,059.40

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
4	**ELECTRICAL EQUIPMENTS (PUMPS, AIR-CONDITIONERS, UPS, WATER COOLER, ETC.)**				
4.1	Supply of Submersible Pump Set of 7.5 kW.	Nos	4	69291.53	*2,77,166.12*
4.2	Supply, Installation, Testing and Commissioning of Automatic Control Panel for 7.5 kW, 440V, 3- Phase Submersible Pump.	Nos	3	20031.07	60,093.21
4.3	Installation, Testing and Commissioning of Submersible Pump Set of 7.5 kW.	Nos	3	4505.15	*13,515.45*
4.4	Supply, installation, testing and commissioning of Mono-Block Pump 1.5 kW, 240V, Complete with All Accessories.	Nos	1	15953.58	15,953.58
4.5	Supply and Installation of G.I. Pipe 50 mm nominal dia Medium Class With Flanges and Sockets.	m	300	529.17	*1,58,751.00*
4.6	Supply and Installation of G.I. Pipe Fitting Bends, Sockets, Flanges, Delivery Valve, Non-Return Valve.	Set	3	4592.40	13,777.20
4.7	Supply, Installation, Testing, Commissioning of 3 Core, 10 Sqmm Copper Flat Cable.	m	1350	165.90	*2,23,965.00*
4.8	Supply of Mono Block Pump 3.75 kW.	Nos	3	41574.92	*1,24,724.76*
4.9	Supply, Installation, Testing and Commissioning of Automatic Control Panel with DOL Starter for 3.75 kW Pump.	Nos	2	12018.64	24,037.28

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
4.10	Installation, Testing and Commissioning of 3.75 kW Mono Block Pump Set.	Nos	2	2703.09	5,406.18
4.11	Supply, Installation, Testing and Commissioning of 32A, 240V, DP MCB.	Nos	12	2123.01	*25,476.12*
4.12	Supply, Installation, Testing and Commissioning of Heavy Duty 5 Star, 1.5 Ton Split Inverter Type Air Conditioner.	Nos	4	50385.48	*2,01,541.92*
4.13	Supply, Installation, Testing and Commissioning of Heavy Duty 5 Star, 2 Ton Split Inverter Type Air Conditioner.	Nos	40	67180.64	*26,87,225.60*
4.14	Supply, Installation, Testing and Commissioning of 2 KVA, 240 Volt, AC, Pure Sine Wave Online UPS cum Inverter.	Nos	4	53940.00	2,15,760.00
4.15	Supply, Installation, Testing and Commissioning of Water Cooler (150 Litre).	Nos	7	78612.49	*5,50,287.43*
4.16	Supply, Installation, Testing and Commissioning of 5 star rated storage geyser 25 litre capacity.	Nos	4	4763.22	*19,052.88*
4.17	Design and Drawing of pumps, control panels, AC, water coolers, geyser, UPS, survey, calculation, as built drawings etc. for Item no. 4.1 to 4.16.	LS	LS		92,334.70

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
5	**SUBSTATION 11kV/ 0.44 KV, HT PANEL, LT PANEL, APFC PANEL, DG SET AND EARTHING**				
5.1	Supply, Installation, Testing and Commissioning Of 11kV/0.44kV, 1x250 kVA, Compact Substation (CSS).	Nos	2	1086256.66	21,72,513.32
5.2	Supply, Installation, Testing and Commissioning of Automatic Power Factor Correction Panel (APFC panel) with 150 kVAR shunt capacitors complete in all respects.	Nos	2	226735.74	*4,53,471.48*
5.3	Supply, Installation, Testing and Commissioning of Indoor Type 400A LT Panel.	Nos	2	210318.23	*4,20,636.46*
5.4	Supply, Installation, Testing and Commissioning of Indoor Type 160A LT Panel.	Nos	1	126190.94	1,26,190.94
5.5	Supply, Installation, Testing and Commissioning of Indoor Type 160A Essential LT Panel.	Nos	1	132500.48	1,32,500.48
5.6	Supply and Installation of 3 mm Thick Rubber Mat.	Sqm	60	11743.53	*7,04,611.80*
5.7	Supply, Installation, Testing and Commissioning of 125 kVA Capacity, Radiator Cooled Silent DG Set.	Nos	1	1240029.30	12,40,029.30

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
5.8	Supply, Installation, Testing and Commissioning of Feeder Pillar.	Nos	6	114443.66	*6,86,661.96*
5.9	Supply, Installation, Testing and Commissioning of Earth Electrode Complete with RCC chamber etc.	Nos	39	3778.11	*1,47,346.29*
5.10	Supply, Installation, Testing and Commissioning of Earth Electrode buried in ground complete.	Nos	136	3589.21	*4,88,132.56*
5.11	Supply and Installation of 40x5 mm Copper Strip on Surface or in Recess or in GI Pipe.	m	100	1700.35	*1,70,035.00*
5.12	Supply and laying of 40x6 mm GI Flat.	m	1080	137.78	*1,48,802.40*
5.13	Supply and Installation of 5 mm Dia GI Wire.	m	4500	70.13	*3,15,585.00*
5.14	Supply, installation, testing and commissioning of CO2 Panel Flooding System for length above 6000 mm.	Nos	2	309812.99	*6,19,625.98*
5.15	Supply, installation, testing and commissioning of CO2 Panel Flooding System for length up to 6000 mm.	Nos	1	259765.55	2,59,765.55
5.16	Design and Drawing of Sub-station, LT panels, APFC panel, DG set, earthing, feeder pillar, fire trace system, as-built drawings, calculations, survey etc. for Item no. 5.1 to 5.15.	LS	LS		1,61,717.79

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
6	**FIRE FIGHTING EQUIPMENTS**				
6.1	Supply and Installation of Safety Items in the Substation.	Set	3	18559.30	55,677.90
6.2	Supply and installation of Set of 04 fire buckets (10 litre) capacity with one GI stand and GI cover.	Set	5	6709.54	*33,547.70*
6.3	Supply and installation of Portable fire extinguisher Dry Chemical Powder (5 kg).	Nos	33	1263.03	*41,679.99*
6.4	Supply and installation of Carbon dioxide fire extinguishers, capacity 4.5 kg.	Nos	33	6249.38	*2,06,229.54*
7	**VIADUCT LIGHTING**				
7.1	Provision of 22 Watt LED with Bulkhead Light Fitting on Viaduct.	Nos	420	3461.19	*14,53,699.80*
7.2	Laying of 2 Core x 70 Sqmm LT Cable in Viaduct/ Tunnel/ Air Etc.	m	16000	205.93	*32,94,880.00*
7.3	Laying of 2 Core x 10 Sqmm LT Cable in Viaduct/ Tunnel/ Air Etc.	m	8000	94.24	*7,53,920.00*
7.4	Supply and Installation of Junction Box Size 250(H)x200(B)x105(D) mm.	Nos	22	2817.98	*61,995.56*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
7.5	Design and Drawing of Viaduct lighting, cabling, earthing, calculation, survey, as-built drawings etc. for Item no 7.1 to 7.4.	LS	LS		1,11,289.65
8	**MISCELLANEOUS**				
8.1	Supply, Installation, Testing and Commissioning of 25 Litre Fully Automatic with Auto Cut-Off RO water purification system.	Nos	5	17000.00	85,000.00
8.2	Supply, Installation, Testing and Commissioning of Single Sided LED Signage Board.	Sqm	300	7780.43	*23,34,129.00*
8.3	Supply, Installation, Testing and Commissioning of Double Sided LED Signage Board.	Sqm	360	9649.85	*34,73,946.00*
8.4	Dismantling of Rail Pole, Cable Pole, Overhead Line, Cable Tray complete.	Nos	12	693.72	*8,324.64*
8.5	Supply and Installation of GI Cable Duct 40x60 mm (wxh) Minimum 2 mm Thick.	m	250	105.78	*26,445.00*
8.6	Supply and Installation of Stainless Steel Wire Mesh 25mm x 25mm (of 5 mm dia wire) Welded on GI Angle.	Kg	500	66.93	*33,465.00*

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
8.7	Supply, Installation, Testing and Commissioning of GI Perforated Cable Tray of Size 150x50 mm with Thickness 1.6 mm.	m	400	636.63	*2,54,652.00*
8.8	**Spares**				
8.8.1	Digital Earth Testers	Nos	2	9991.00	19,982.00
8.8.2	Earth Leakage Detector 1000 V	Nos	2	24849.00	49,698.00
8.8.3	Digital Insulation Tester 2.5 kV	Nos	2	8559.00	17,118.00
8.8.4	Digital Insulation Tester 0 – 1000 V	Nos	2	2175.00	4,350.00
8.8.5	Digital Vernier Caliper	Nos	5	12872.00	64,360.00
8.8.6	Portable Diesel Generating set, 3 kVA, 240 V AC	Nos	1	110400.00	1,10,400.00
8.8.7	Digital micrometer	Nos	5	9957.00	49,785.00
8.8.8	Digital Multi-meter	Nos	5	1490.00	7,450.00
8.8.9	Safety Helmet	Nos	10	995.00	9,950.00
8.8.10	Tool Kit Box	Nos	3	6603.00	19,809.00
8.8.11	Portable Grinder Electrically Operated	Nos	2	8463.00	16,926.00

Schedule C: General Electrical Services					
Item No.	**Item Description**	**Unit**	**Quantity**	**Unit Rate (INR)**	**Amount (INR)**
1	**2**	**3**	**4**	**5**	**6**
8.8.12	Portable Electrical Drill	Nos	2	14914.00	29,828.00
8.9	Operation and Maintenance Manuals	LS	LS	98784.70	98,784.70
8.10	Training to Staff	LS	LS	246726.49	*2,46,726.49*
	Total amount of Schedule C				***10,77,20,424.79***

Total Estimated amount of Schedule 'C': INR *10,77,20,424.79*

8 Schedule 'D': Signalling & Telecommunication (S&T) Works

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D1	**Supply of Signalling and Telecom equipment and associated material (S. No. 1 - 12)**				
1	Supply of Relay- AC immune plug in type QNA1, DC neutral line relay, 24 V DC 8F/8B contacts, metal to carbon with plug-in arrangement etc. conforming to BRS: 931A. The interlocking code for this unit shall be "ABDGH or latest.	Nos.	4,360	15	65,400
2	Supply of 16/0.2mm, size tinned flexible single core indoor wire as per IRS:S 76/89 (latest) specification, PVC coated in different colours as per requirement and to be supplied in coils of 100 meters.	Nos.	1,041	50	52,050
3	Supply Fabrication and fixing of cable termination board of size as per Drg. No.NR/S&T/Project/13/2015 duly fitted with Bakelite sheet of size 6 mm thick. This also includes fixing of ARA terminals & fuse bases with Location box inside/outside painting, writing, cable fixing, bunching, numbering as per Indian railway standard.	Nos.	54,930	1	54,930
4	Supply of Disconnect Terminal block for four conductors with screwing cage clamp type/sliding switch disconnect as per RDSO specification. No. RDSO/ SPN/189/2004 Ver. 1.2 (latest) for conductor size upto 2.5 sq. mm for M6 terminals.	Nos	140	200	28,000
5	Supply of ARA terminal block 25 mm centre spacing for small M-6 terminal as per RDSO specifications IRS-S75/2006 (latest).	Nos	98	200	19,600
6	Supply of PVC Insulated Armoured, Unscreened, Underground Railway Signalling cable copper conductor as per specification no. IRS-S-63/2014 (latest) Size 24 Core x 1.5 Sq. mm.	Km	4,98,267	2	9,96,534

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D1	**Supply of Signalling and Telecom equipment and associated material (S. No. 1 - 12)**				
7	Supply of PVC insulated armoured, unscreened, underground railway signalling cable copper conductor as per specification no. IRS: S-63/2014 (latest) size 12 Core x 1.5 sq. mm.	Km	2,22,628	8	17,81,024
8	Supply of PVC insulated armoured, unscreened, underground railway signalling cable copper conductor as per specification no. IRS: S-63/2014 (latest) size 6 Core x 1.5 sq. mm.	Km	1,43,385	2	2,86,770
9	Supply of Power cable as per BIS specification No. IS: 694/2010 (2 x 25 sq. mm, red & black colour).	Km	1,43,038	3	4,29,114
10	Supply of 6 Quad cable. 0.9 mm jelly filled underground, screened, armoured cable as per RDSO specification No IRS TC: 30/2005 (latest) amendment.	Km	2,95,313	11	32,48,443
11	Supply of Armoured Optical Fiber Cable (OFC) (24 Fiber) Mono Mode as per Spec. No. RDSO/SPN/TC/110/2020.	Km	1,01,792	11	11,19,712
12	Supply of permanently lubricated high density polyethylene (PLB-HDPE) duct of 40 mm/ 33 as per RDSO spec. No. RDSO/SPN/TC/45/2013 Rev.2.0, complete with all accessories caps, couplers, bends etc.	Km	77,794	10	7,77,940
				Sub Total of 'D1' (INR)	**88,59,517**

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
13	Final Location Survey of cable route, Preparation of cable route plan, Track crossing plan, Location Description plan, Cable insulation chart and other outdoor diagram for way side stations. Three sets of above drawings will be submitted for approval & for execution of work to engineer (job complete work).	Nos.	48,245	1	48,245
14	Supply of Location Box /Apparatus Case single as with 'E' type lock, key ward No. 42 and handle as per RDSO drg. No. RD- SO/S-11500 or latest.	Nos.	24,550	6	1,47,300
15	Supply of Location Box /Apparatus Case steel half with with 'E' type lock, key ward No. 42 and handle as per RDSO drg. No. RD- SO/S-11507 or latest.	Nos	19,254	6	1,15,524
16	casting, concreting and curing of foundation and Installation and Erection of single location box /apparatus cases as per RDSO drg. No. NR/S&T/CON/2.7/97. All installation material as cement, sand, aggregate and anchor bolt etc. shall be supplied by the contractor.	Nos.	13,045	6	78,270
17	casting, concreting and curing of foundation and Installation and Erection of half location box /apparatus cases as per RDSO drg. No. NR/S&T/CON/2.8/97. All installation material as cement, sand, aggregate and anchor bolt etc. shall be supplied by the contractor.	Nos.	8,764	6	52,584

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
18	Fabrication and fixing of phenolic laminated sheet of grade P3, minimum 10 mm thick, in location box /apparatus cases and providing all fixtures like M6/ ARA/Disconnect terminals, fuse blocks, relays etc. on square bars. This includes fixing of PVC coated string rods at the back side for cable support with contractor's own material like iron angle, nuts, bolts etc. The iron angle for fixing shall be minimum 3 mm thick. This includes providing teak wood shelf minimum 25 mm thick for holding track circuit equipments. The work shall be done as per instructions of engineer. (Location Box/Apparatus case single involving wiring of relays).	Nos.	5,961	6	35,766
19	Fabrication and fixing of phenolic laminated sheet of grade P3, minimum 10 mm thick, in location box / apparatus cases and providing all fixtures like M6/ ARA/Disconnect terminals, fuse blocks, relays etc. on square bars. This includes fixing of PVC coated string rods at the back side for cable support with contractor's own material like iron angle, nuts, bolts etc. The iron angle for fixing shall be minimum 3 mm thick. This includes providing teak wood shelf minimum 25 mm thick for holding track circuit equipments. The work shall be done as per instructions of engineer. (Location Box/Apparatus case half).	Nos	3,322	6	19,932
20	Termination of all type of cables at either end on terminal boards providing identification, ferrules, dressing, lacing with thread. This includes testing, meggering and submitting test reports etc. and defect rectification *(*per condutor).	Nos	16	852	13,632

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
21	Dismantling and Releasing of existing Location boxes/Apparatus cases/Jn boxes including releasing of terminal boards, release, terminals, fittings installed therein complete with fittings. All dismantled material to be transported and stacked in the store of the employer.	Nos	779	12	9,348
22	Excavating and refilling of trench, in Normal Soil to the level of ground with rammed earth as per drg. No. NR/S&T/CON/1.1/97-A so as not to form a drain, 0.3 Mtrs. Wide & 1.0 m. Deep alongside the track.	M	83	10,000	8,30,000
23	Excavating and refilling of trench 0.3 Mtr./ as required Wide & 1.0 m. Deep from bottom of rail flange across the track or 0.5 Mtr. from ground level whichever is more (NR/S&T/CON /1.2/97). Earth should be rammed so as not to form a drain. This includes removal and refilling of ballast & restoration of surface under normal traffic conditions. Lesser depth of the trench is to be paid proportionately.	M	95	200	19,000
24	Supply & installation of Double walled corrugated HDPE Pipe of outer dia 120 mm (other than black in colour) in 6 m straight length with one coupler for every 6 m length conforming to RDSO/SPN/204/2011 or equivalent IS specification wherever required as per approved cable route plan. This includes brick work and other arrangements required to secure the pipe for road crossing/Platform/track crossing and for bridges & culverts etc.	M	546	200	1,09,200

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
25	Supply and installation of Half split Double wall corrugated pipe of HDPE in 2 or 3 m. length produced out of full round DWC pipes as per RDSP specn. No. RDSO/SPN/204/2011 or equivalent IS specifications. The pipe should have necessary fixing and coupling arrangements. Size 200/ 175 mm inner dia).	M	389	5,000	19,45,000
26	Supply and laying of 2nd class bricks in the trench and laying as per drg. No. NR/S&T/CON/1.1/97-A as per instructions of the Engineer's.	M	8	1,000	8,000
27	Supply & installation of earth electrodes pipe of 3 metre length and 50 mm dia. pointed on lower end by tapering for a length of 150 mm as per drg. No. NR / S&T/ Proj /16.1 /2015 and connecting with signalling gears. This includes casting and plastering of cement concrete enclosures as per drg. No. NR / S&T/ Proj /16.2 /2015.	Nos	3,751	12	45,012
28	Fabrication, supply and fixing of cable marker of 1:3:6 concrete as per No.NR/S&T/CON/1.5/97A. The marker shall be fixed at various places of cable route as per instructions of the Engineer's representative.	Nos	387	100	38,700
29	Laying of signalling/Telecom/power/ other all type of cables etc. of different sizes as per drg. No. NR/S&T/CON/1.1/97-A and testing & meggering of cable before and after laying.	M	8	26,000	2,08,000
30	"Laying of HDPE duct in the trenches, HDD/Manual Boring, RCC ducts, Pipes etc. and supply & pulling of Nylon rope through it as required.	M	10	10,000	1,00,000

Schedule 'D': Signalling & Telecom (S&T) Works					
S. No.	**Item Description**	**Unit**	**Estimated Rate (INR)**	**Quantity**	**Estimated Amount (INR)**
D2	**Signalling Installation, Testing & Commissioning (S. No. 13 -34)**				
31	"Blowing/drawing of OFC cable in the HDPE duct laid in trenches & protective works".	M	14	10,000	1,40,000
32	Supply and installation of optical fiber cable joint enclosure as per RDSO/SPN/TC/68/2014 or equivalent TEC specifications (Make: Reychem or superior) and splicing of OFC cables. This includes fabrication & installation of RCC jointing pit (1 m inner dia x 1 m deep) for OFC joint closure.	Nos.	17,622	10	1,76,220
33	Supply & installation of thermos shrinkable straight through joint suitable for making straight through/deviation joint without transformer in underground 6 quad/jelly filled cables. RDSO specification No. RDSO/SPN/TC/77/2010 (latest amendment) with all accessories.	Nos.	6,421	10	64,210
34	Supply & Installation of 1120:470 Ohms VF isolation transformers rack mounting type as per RDSO Specification IRS/TC/22/76 with latest amendment applicable on the date of opening of the tender. (Select joint type).	Nos.	1,605	10	16,050
				Sub Total of 'D2' (INR)	**42,19,993**
				Total Estimated Amount of Schedule 'D' (D1+D2) INR	***1,30,79,510.00***

Total Estimated amount of Schedule ‘D’ - INR *1,30,79,510.00*