



BID DOCUMENT FOR

Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai - Sonnagar Section of Eastern Dedicated Freight Corridor.

SONE BRIDGE CONTRACT PACKAGE

Issued on: 23.4.2013

BID DOUCUMENT No. : HQ/EN/EC/DB/Sone Bridge

PART-1 to Part-4

Employer:

**DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED
A GOVERNMENT OF INDIA ENTERPRISE**

**Under
MINISTRY OF RAILWAYS**

COUNTRY: INDIA

**INVITATION FOR BID
DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED**

Our Ref.:

Date

To

From
Managing Director,
DFCCIL
5TH Floor, Pragati Maidan Metro
Station Building Complex
New Delhi-110001.

Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai-Sonnagar Section of Eastern Dedicated Freight Corridor.

This Bidding process is open for pre-qualified bidders.

The Bid document consists of Five Parts i.e. Technical Bid in Part-1, Part-2, Part-3, & Part-4 and Financial Bid – Part-5. The contents of these Parts are as under:

TECHNICAL BID:

PART 1 – Bidding Procedures

- Section I. Instructions to Bidders
- Section II. Bid Data Sheet
- Section III. Evaluation and Qualification Criteria (Following Prequalification)
- Section IV. Bidding Forms

PART 2 – Employer’s Requirements

- Section V. Employer’s Requirements

- Volume 1: General**
- Volume 2: Functional**
- Volume 3: Design**
- Volume 4: Construction**
- Volume 5: Testing**
- Volume 6: Specification**
- Volume 7: Appendices**

PART 3 – Conditions of Contract and Contract Forms

- Section VI. General Conditions of Contract (GCC) as per FIDIC Yellow Book 1999-Edition.
- Section VII. Particular Conditions of Contract (PCC)

Section VIII. Contract Forms

PART 4 – Reference Documents

1. Site Data (As detailed in Part 4).

FINANCIAL BID:

PART – 5 - Price Schedules (To be submitted separately)

1. Preamble
2. Price Proposal Submission Sheet (BDF-10)
3. Schedule – A (Form for Lump sum cost of the Bid)
4. Schedule – B
 - (Apportionment of contract Price for Payment according to Cost Centres)
 - (Contract Price Weightages for interim Payment)

Note: *Bids duly filled in must be submitted at the place by the time and date as specified in the Bids notice. Late or delayed Bids shall not be accepted.*

Table of Contents

TECHNICAL BID:

PART 1 – Bidding Procedures	6
Section I. Instructions to Bidders.....	8
Section II. Bid Data Sheet.....	25
Section III. Evaluation and Qualification Criteria (Following Prequalification).....	28
Section IV. Bidding Forms.....	37
PART 2 – Employer’s Requirements	54
Section V. Employer’s Requirements.....	55
Volume 1: General	56
Volume 2: Functional	89
Volume 3: Design	102
Volume 4: Construction	134
Volume 5: Testing	146
Volume 6: Specification	147
Volume 7: Appendices	247
Appendix 1 Alignment of Trackways and Work Areas.....	249
Appendix 2 Project Calendar.....	253
Appendix 3 Project Programme Requirements.....	254
Appendix 4 Quality Assurance.....	267
Appendix 5 CAD and Document Standards.....	281
Appendix 6 Temporary Works.....	288
Appendix 7 Contractor’s Coordination with Others.....	301
Appendix 8 Requirements on Documents and Drawings.....	312
Appendix 9 Document Submission and Review Procedure.....	314
Appendix 10 Requirements for Design.....	318
Appendix 11 Requirements for Construction.....	328
Appendix 12 Publicity and Public Relations	344
Appendix 13 Deleted.....	345
Appendix 14 Possession Management	346
PART 3 – Conditions of Contract and Contract Forms	347
Section VI. General Conditions (GCC) As per FIDIC Yellow Book 1999.....	347
Edition	
Section VII. Particular Conditions of Contract (PCC).....	348

Section VIII . Contract Forms.....	369
PART 4 – Reference Documents.....	385
1. Site Data (detailed in Part 4).	386

FINANCIAL BID:

PART – 5 - Price Schedules (To be submitted separately).....	387
1. Preamble	
2. Price Proposal Submission Sheet BDF -10	
3. Schedule – A (Form for Lump sum cost of the Bid)	
4. Schedule – B	
• Apportionment of contract Price for Payment according to Cost Centres	
• Contract Price Weightages for interim Payment	

PART 1

Bidding Procedures

Table of Contents

Section I. Instructions to Bidders

Section II. Bid Data Sheet

Section III. Evaluation and Qualification Criteria (Following Prequalification)

Section IV. Bidding Forms

Section – I

**Instructions to Bidder
(ITB)**

Section I. Instructions to Bidders (ITB)

A. General

1. Scope of Bid
2. Source of Funds
3. Eligible Bidders
4. Eligible Materials and Equipment

B. Contents of Bidding Document

5. Sections of Bidding Document
6. Clarification of Bidding Document, Site Visit, Pre-Bid Conference
7. Amendment of Bidding Document

C. Preparation of Bids

8. Cost of Bidding
9. Language of Bid
10. Documents Comprising the Bid
11. Bid Submission Sheets and Price Schedules
12. Bid Prices
13. Currencies of Bid and Payment
14. Documents Comprising the Technical Proposal
15. Period of Validity of Bids
16. Bid Security
17. Format and Signing of Bid

D. Submission and Opening of Bids

18. Sealing and Marking of Bids
19. Deadline for Submission of Bids
20. Late Bids
21. Bid Opening

E. Evaluation and Comparison of Bids

22. Confidentiality
23. Clarification of Bids
24. Deviations, Reservations, and Omissions
25. Determination of Responsiveness
26. Nonconformities, Errors, and Omissions
27. Evaluation of Technical Bid
28. Correction of Arithmetical Errors
29. Evaluation of Financial Bids
30. Comparison of Bids
31. Employer's Right to Accept Any Bid, and to Reject Any or All Bids

F. Award of Contract

32. Notification of Award
33. Performance Security
34. Signing of Contract
35. Corrupt Practices

Section I: Instructions to Bidders

A.	General
1.	Scope of Bid
1.1	In connection with the Invitation for Bids indicated in the Bid Data Sheet (BDS), the Employer, as indicated in BDS, issues this Bidding Document for “Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai-Sonnagar Section of Eastern Dedicated Freight Corridor.” and as specified in Section V Employer’s requirements.
1.2	Throughout these Bidding Documents: <ul style="list-style-type: none"> a. the term “in writing” means communicated in written form and delivered against receipt; b. except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and c. “day” means calendar day.
1.3	Besides the information given in the Invitation for Bids, following further information are as under:- <ul style="list-style-type: none"> a. Date of commencement of works – 42 days from the date of receipt of ‘Letter of Acceptance’ or as indicated in the ‘Letter of Acceptance’. b. Period of completion – 1216 days from the date of commencement. c. Defect Liabilities Periods – Defect Notification Period for the Works shall be two years from the date of Taking Over of the Works (Sub-clause 10.1) and issue of Taking-Over Certificate by the Engineer.
2.	Source of Funds
2.1	The required funds will be arranged by the employer.
3.	Eligible Bidders
3.1	A Bidder shall be a private, public or Govt. owned legal entity or any combination of them in the form of joint venture (JV) with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture (JV). The bidder must ensure the following: <ul style="list-style-type: none"> a. In case of Single Entity: <ul style="list-style-type: none"> (i) The applicant should be an Indian firm (ii) Submit Power of Attorney authorizing the signatory of the bid to commit the bidder. b. In case of Joint Venture: <ul style="list-style-type: none"> (i) Separate identity/name shall be given to the Joint Venture Firm. (ii) Maximum number of partners in the JV shall be limited to 3 (Three). (iii) A member of JV firm shall not be permitted to participate either in individual capacity or as a member of another JV firm in the same Bid. (iv) The <i>Bid Document</i> can be purchased in the name of the Bidder/JV Firm or Lead Member of JV firm.

- (v) One of the members of the JV firm shall be its lead member who shall have majority (at least 51%) share of interest in the JV firm. The other members shall have a share of not less than 20% each in case of JV firms with upto 3 members.
- (vi) In case of JV firm with foreign member(s), the lead member has to be an Indian firm with a minimum share of 51%.
- (vii) Bidder from a country may be excluded if as a matter of law or official regulations the Government of India (GOI) prohibits commercial relations with the country.
- (viii) Joint And Several Liability - Members of the JV Firm to which the contract is awarded, shall be jointly and severally liable to the Employer (DFCCIL) for execution of the project in accordance with General and Special Conditions of Contract. The JV members shall also be liable jointly and severally for the loss, damages caused to the DFCCIL during the course of execution of the contract or due to non-execution of the contract or part thereof.
- (ix) Duration of the Joint Venture Agreement - shall be valid during the entire currency of the contract including the period of extension, if any and the defect liability (Notification) period after the work is completed.
- (x) Governing Laws - The Joint Venture Agreement shall in all respect be governed by and interpreted in accordance with Indian Laws.
- (xi) The JV shall nominate a representative (from lead partner only) who shall have the authority to conduct all business for and on behalf of JV during the bidding process and subsequent stages.
- (xii) **BID SECURITY shall be submitted by JV Firm/Lead Member of the JV firm. The BID SECURITY submitted by the Lead Member shall be deemed as BID SECURITY submitted by JV Firm.**
- (xiii) A copy of Memorandum of Understanding (MOU) executed by the JV members shall be submitted by the JV Firm along with the Bid. The complete details of the members of the JV firm, their share and responsibility in the JV firm etc. particularly with reference to financial, technical and other obligations shall be furnished in the MOU.
- (xiv) Once the Bid is submitted, the MOU shall not be modified / altered / terminated during the validity of the Bid. In case the bidder fails to observe/comply with this stipulation, the full Bid Security Deposit shall be liable to be forfeited.
- (xv) Approval for change of constitution of JV Firm shall be at the sole discretion of the Employer (DFCCIL). The constitution of the JV Firm shall not be allowed to be modified except when modification becomes inevitable due to succession / laws etc. and in any case the minimum eligibility criteria should not get vitiated. However, the Lead Member shall continue to be the Lead Member of the JV Firm. Failure to observe this requirement would render the offer invalid.
- (xvi) Similarly, after, the contract is awarded, the constitution of JV Firm shall not be allowed to be altered during the currency of contract except when modification become inevitable due to succession laws etc. and in any case the minimum eligibility criteria should not

get vitiated. Failure to observe this stipulation shall be deemed to be breach of contract with all consequential penal action as per contract conditions.

- (xvii) On award of contract to a JV Firm, a single Performance Guarantee shall be submitted by the JV Firm as per Bid conditions. All the Guarantees like Performance Guarantee, Bank Guarantee for Mobilization Advance, Machinery Advance, etc. shall be accepted only in the name of the JV Firm and no splitting of guarantees amongst the members of the JV Firm shall be permitted.
- (xviii) On issue of LOA (Letter Of Acceptance), an agreement among the members of the JV Firm (to whom the work has been awarded) shall be executed and got registered before the Registrar of the Companies under Companies Act or before the Registrar/Sub-Registrar under the Registration Act, 1908. This JV Agreement shall be submitted by the JV Firm to the DFCCIL before signing the contract agreement for the work. In case the Bidder fails to observe/comply with this stipulation, the full BID SECURITY shall be forfeited and other penal actions due shall be taken against partners of the JV and the JV.
- (xix) No member of the Joint Venture Firm shall have the right to assign or transfer the interest right or liability in the contract without the *written* consent of the other members and that of the employer (DFCCIL) in respect of the said Bid/*contract*.
- (xx) *In case* one or more of the members of the JV Firm is/are partnership firm(s), following documents shall be submitted :
 - a) Notary certified copy of the Partnership Deed
 - b) Consent *of* all the partners to enter into the Joint Venture /Agreement on a stamp paper of appropriate value (in original).
 - c) Power of Attorney (duly registered as per prevailing law) in favour of one of the partners of the partnership firm to sign the JV Agreement on behalf of the partnership firm and create liability against the firm.
- (xxi) In case one or more members is/are Proprietary Firm or HUF, the following documents shall be *enclosed* :

Affidavit on Stamp Paper of appropriate value declaring that his/her Concern is a Proprietary Concern and he/she is sole proprietor of the Concern OR he/she is in position of "KARTA" of Hindu Undivided Family (HUF) and he/she has the authority, power and consent given by other *partners* to act on behalf of HUF.
- (xxii) In case one or more members is/are limited companies, the following documents shall be submitted :
 - a) Notary certified copy of resolutions of the Directors of the Company, permitting the company to enter into JV agreement, authorizing MD or one of the Directors or Managers of the Company to sign JV Agreement, such other documents required to be signed on behalf of the Company and enter into liability against the company and/or do any other act on behalf of the company.
 - b) Copy of Memorandum and Articles of Association of the Company.

	c) Power of Attorney (duly registered as per prevailing law) by the Company authorizing the person to do/act mentioned in the para (a) above.
3.2	A firm that is under a declaration of ineligibility by the Employer in accordance with ITB 35, on the date of the deadline for bid submission or thereafter, shall be disqualified.
3.3	<p>A Bidder shall not have any conflict of interest with any other party involved with the project, either as a bidder or in any other capacity during the project formulation and developmental stage. Any Bidder (s) including all members of JV found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process, if, including but not limited to:</p> <p>(a) If they participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of this Bid; or</p> <p>(b) Where a firm, or a firm from a same economic or financial group, in addition to consulting, also has the capability to manufacture or supply goods or to construct works, that firm, or a firm from the same economic or financial group, cannot normally be a supplier of goods or works, if it provided consulting services for the contract corresponding to this Bid, unless it can be demonstrated that there is not a significant degree of common ownership, influence or control.</p>
3.4	<p>The Bidder shall be considered disqualified / in-eligible if:</p> <p>(a) The Bidder or any of its partners and/or subcontractors included in the Bid has been banned for business with Ministry of Railways along with <u>any of its attached and subordinate offices through an order issued by Ministry of Railways as per list available on Web site (http://www.indianrailways.gov.in/railwayboard)</u> of Civil Engg Directorate of Railway Board pertaining to Banning of Business, with the Banning being valid as on the last date of submission of the Bid.</p> <p>(b) The Bidder or any of its partners has suffered bankruptcy / insolvency or it is in the process of winding-up or there is a case of insolvency pending before any Court on the deadline of submission of Bid.</p>
3.5	Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.
3.6	In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified bidders.
4.	Eligible Materials and Equipment
4.1	The materials and equipment to be supplied under the Contract shall be from the approved sources as specified in Part -2 , Section V: Employer's Requirements. In addition to above, materials not covered under approved sources specified in Section V: Employer's Requirements should be procured as per the approval of Engineer.

B.	Contents of Bidding Document
5.	Sections of Bidding Document
	<p>The Bid document consists of Five Parts i.e. Technical Bid in Part-1, Part-2, Part-3, & Part-4 and Financial Bid – Part-5</p> <p>The contents of these Parts are as under: TECHNICAL BID : PART 1 – Bidding Procedures Section I. Instructions to Bidders (ITB) Section II. Bid Data Sheet (BDS) Section III. Evaluation and Qualification Criteria Section IV. Bidding Forms PART 2 – Employer’s Requirements Section V. Employer’s Requirements As per contents detailed in section – V. PART 3 – Conditions of Contract and Contract Forms Section VI. General Conditions (GCC) As per FIDIC Yellow Book 1999-Edition Section VII. Particular Conditions of Contract (PCC). Section VIII . Contract Forms PART 4 – Reference Documents As per contents detailed in Part – 4.</p> <p>FINANCIAL BID: PART – 5 : Price Schedules (To be submitted separately) 1. Preamble 2. Price Proposal Submission Sheet (BDF-10) 3. Schedule – A (Form for Lump sum cost of the Bid) 4. Schedule – B <ul style="list-style-type: none"> • Apportionment of contract Price for Payment according to Cost Centres • Contract Price Weightages for interim Payment </p> <p>The contents of all these sections listed above shall be read in conjunction with any addenda issued in accordance with ITB-7.</p>
5.1	The Invitation for Bids (IFB) issued by the Employer is not part of the Bidding Document.
5.2	A bid can be submitted only on a set of bidding documents obtained directly from the Employer or downloaded from DFCCIL’s website.
5.3	The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.
6.	Clarification of Bidding Document, Site Visit, Pre-Bid conference
6.1	A prospective Bidder requiring any clarification of the Bidding Document shall contact the Employer in writing at the Employer’s address indicated in the BDS or raise his inquiries during the pre-bid meeting in accordance with ITB 6.4 . The Employer will respond in writing to any request for clarification provided that such request is received upto 3 days prior to the

	pre-bid conference. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 7 and ITB 19.2 .
6.2	The Bidder 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 bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
6.3	The Bidder 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 Bidder, 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 himself 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.
6.4	The Bidder's designated representative is invited to attend a pre-bid conference, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions related to the subject work that may be raised at that stage.
6.5	The Bidder is requested to submit any questions/queries in writing, to reach the Employer not later than 3 days before the Pre-Bid-Meeting.
6.6	Minutes of the pre-bid meeting, including the text of the questions/queries raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document directly from the Employer. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum/ corrigendum pursuant to ITB 7 and not through the minutes of the Pre-Bid-Meeting.
6.7	Non-attendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.
7.	Amendment of Bidding Document
7.1	At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing addenda
7.2	Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 5.2 . This will also be uploaded on DFCCIL website www.dfccil.in & www.dfccil.org . All prospective Bidders are advised to see the DFCCIL website www.dfccil.in & www.dfccil.org before submitting their bid to check for any amendments/corrigendum issued in regard to this Bid.
7.3	To give prospective Bidders reasonable time to take an addendum into account in preparing their bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 19.2 .
C.	Preparation of Bids
8.	Cost of Bidding
8.1	The Bidder shall bear all costs associated with the preparation and submission of

	its Bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
9.	Language of Bid
9.1	The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in English. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant pages in English as certified by the Embassy/High Commission/ Consulate of Indian origin of the bidder or the Embassy /High Commission / Consulate of the country of origin of the bidder in India. For the purpose of interpretation and evaluation of the bid, translation certified by Embassy/High Commission/ Consulate shall prevail.
10.	Documents Comprising the Bid
10.1	The Bid shall comprise two separate envelopes submitted simultaneously, one containing the Technical Proposal and the other Financial Proposal , enclosed together in an outer single envelope.
10.2	Initially, only the Technical Proposals will be opened at the address, date and time specified in ITB Sub-Clause 21.1 . The Financial Proposals remain sealed and are held in custody by the Employer. The Technical Proposals are evaluated by the Employer. No amendments or changes to the Technical Proposals are permitted. Bids with Technical Proposals which do not conform to the specified requirements will be rejected as deficient Bids.
10.3	Financial Proposals of technically compliant Bids will be opened in public at a date and time advised by the Employer. The Financial Proposals will be evaluated and the Contract is awarded to the Bidder whose Bid has been determined to be the lowest evaluated substantially responsive Bid.
10.4	The Technical Proposal shall contain the following : (a) Technical Proposal Submission Sheet in accordance with ITB 14 ; (b) Bid Security, in accordance with ITB Clause 16 ; (c) Written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB Clause 17.2 ; (d) Relevant forms as specified for establishing eligibility criteria of the bidder in Part – I Section IV of the bid document; (e) All the information needed in the eligibility criteria as contained in Part-1 - Section III of the Bid Document . (f) any other document required in the BDS.
10.5	The Financial Proposal shall contain the following : (to be submitted separately) (a) Price Proposal Submission Sheet. (b) Price Schedule as per the format given in Part-5 Price Schedule of the Bid Document. (c) Any other document required in the BDS.
11.	Bid Submission Sheets and Price Schedules
11.1	The Bidder shall submit the Technical Proposal and the Financial Proposal using the appropriate Submission Sheets furnished in Section IV (Bidding Forms) of the Bid Document . These forms must be completed without any alterations to their format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

11.2	The Bidder shall submit, as part of the Financial Proposal a Lump-Sum cost for the entire work as per the format given in Schedule A of Part – 5 - Price Schedule of the Bid Document.
12.	Bid Prices
12.1	The bidder shall quote the lump sum cost for the entire work in BDF -10 & schedule A as contained in Part -5 of the Bidding Document. The cost should cover all the items of the work as detailed in the employer's requirement of the contract. The cost should also be inclusive of all constructional Equipment, plant, labour, supervision, materials, erection, maintenance, insurance, profit, duties, taxes, levies, royalties together with all general risks, liabilities and obligations set out or implied in the Contract under the applicable law as on the date of opening of bid.
12.2	PVC as given in clause 13.8 of Particular Conditions of Contract will be applicable on the Lump-sum cost of the bid with respect to the base date as defined in the GCC.
13.	Currencies of Bid and Payment
13.1	The bidder shall quote a lump sum cost in Indian Rupees. Payments shall be made as per billing process laid down in Part-5 – Price Schedules of Bidding Document.
14.	Documents Comprising the Technical Proposal
14.1	The bidder shall furnish all the information as detailed in Technical Proposal Section –III Evaluation and Qualification criteria of bidding document,
14.2	The Bidder shall furnish a commitment in Technical Proposal Submission Sheet (BDF -1) for deployment of equipment and personnel as stipulated in Part-1 Section - III, Evaluation and Qualification criteria.
15.	Period of Validity of Bids
15.1	Bids shall remain valid for a period of 180 days after the bid submission deadline date prescribed by the employer. A bid valid for a shorter period shall be rejected by the employer as non responsive.
15.2	In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 16 , it shall also be extended Ninety (90) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its bid.
16.	Bid Security
16.1	The Bidder shall furnish as a part of its bid, a Bid Security in favour of DFCCIL, New Delhi in original form as specified in BDS.
16.2	The bid security shall be valid for period up to Ninety (90) days beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 15.2.
16.3	Any bid not accompanied by an enforceable and compliant bid security, if one is required in accordance with ITB 16.1 , shall be rejected by the Employer as non-responsive. The bid security of unsuccessful Bidders shall be returned on award of contract.
16.4	The bid security of the successful Bidder shall be kept as security deposit for fulfillment of contractual obligation

16.5	The bid security shall be forfeited: (a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letter of Bid, except as provided in ITB 15.2 or (b) if a Bidder misrepresents or omits any material facts in order to unfairly influence the procurement process; (c) if the successful Bidder fails to: (i) Sign the Contract in accordance with ITB 34; (ii) furnish a performance security in accordance with ITB 33; (iii) accept the correction of its Bid Price pursuant to ITB 28.2;
16.6	The Bid Security of a JV shall be as per ITB 3.1b (xii).
17.	Format and Signing of Bid
17.1	The Bidder shall prepare one original of the Technical Proposal and one original of the Financial Proposal as described in ITB Clause 10 and clearly mark each “ORIGINAL - TECHNICAL PROPOSAL” and “ORIGINAL - FINANCIAL PROPOSAL”. In addition, the Bidder shall submit 2 copies of the Technical Proposal and clearly mark them “COPY NO... - TECHNICAL PROPOSAL” . In the event of any discrepancy between the original and the copies, the original shall prevail. In addition one soft copy (Read Only) of Technical proposal should also be submitted along with the Bid.
17.2	The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid, where entries and amendments have been made shall be signed or initialed by the person signing the bid.
17.3	Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.
D.	Submission and Opening of Bids
18.	Sealing and Marking of Bids
18.1	The Bidder shall enclose the original of the Technical Proposal, the original of the Financial Proposal, and two copies of the Technical Proposal, in separate sealed envelopes, duly marking the envelopes as “ORIGINAL - TECHNICAL PROPOSAL”, “ORIGINAL - FINANCIAL PROPOSAL” and “COPY NO... - TECHNICAL PROPOSAL” , as appropriate. These envelopes containing the original and the copies shall then be enclosed in one single envelope. One single envelope containing the envelopes of Technical bid, Financial bid & Bid security shall be signed and stamped by the authority who has signed the bids. Each copy shall be Serially numbered, Indexed and Hard Bound.
18.2	The inner and outer envelopes shall: (a) bear the name and address of the Bidder; (b) be addressed to the Employer in accordance with BDS; (c) bear the specific identification NCB No. HQ/EN/EC/DB/SONE BRIDGE date 23.04.2013 of this bidding process indicated in the BDS; and

	<p>(d) The outer envelope and the inner envelopes containing the Technical Proposals shall bear a warning not to open before the time and date for the opening of Technical Proposals, in accordance with ITB Sub-Clause 21.</p> <p>(e) The inner envelopes containing the Financial Proposals shall bear a warning not to open until advised by the Employer in accordance with ITB Sub-Clause 21.</p>
18.3	If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.
18.4	In case Financial Proposal in a bid is received unsealed then the bid shall be considered as non-responsive and will not be dealt with. If, financial proposal is submitted in the technical proposal then also the bid shall be considered as non-responsive and will not be dealt with.
19.	Deadline for Submission of Bids
19.1	Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.
19.2	The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 7 , in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
20.	Late Bids
20.1	The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 19 . Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.
21	Bid Opening
21.1	The Employer shall conduct the opening of Technical Proposals in the presence of Bidders' representatives who choose to attend, at the address, date and time specified in the BDS.
21.2	The financial Proposals will remain unopened and will be held in custody of the Employer until the time of opening of the Financial Proposals. The date, time, and location of the opening of Financial Proposals will be advised in writing by the Employer to all the bidders who have been determined qualified in technical evaluation.
21.3	All other envelopes holding the Technical Proposals shall be opened one at a time, and the following read out and recorded : <ul style="list-style-type: none"> (a) the name of the Bidder; (b) whether there is a modification or substitution; (c) the presence of a Bid Security, and (d) any other details as the Employer may consider appropriate.
21.4	Only Technical Proposals read out and recorded at bid opening shall be considered for evaluation. No Bid shall be rejected at the opening of Technical Proposals except for late bids, in accordance with ITB Sub-Clause 20.1 .
21.5	The Employer shall prepare a record of the opening of Technical Proposals that shall include, as a minimum: the name of the Bidder and the presence or absence of a Bid Security. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the

	record.
21.6	At the end of the evaluation of the Technical Proposals, the Employer will invite bidders who have submitted substantially responsive Technical Proposals and who have been determined as being qualified for award to attend the opening of the Financial Proposals. The date, time, and location of the opening of Financial Proposals will be advised in writing by the Employer. Bidders shall be given reasonable notice of the opening of Financial Proposals.
21.7	The Employer shall conduct the opening of Financial Proposals of all Bidders who have submitted substantially responsive Technical Proposals and who have been determined qualified as a result of technical evaluation, in the presence of Bidders` representatives who choose to attend at the address, date and time specified by the Employer. The Bidder`s representatives who are present shall be requested to sign a register evidencing their attendance.
21.8	Envelope containing Financial Proposal of technically responsive bidders shall be opened one at a time and the following read out and recorded: (a) the name of the Bidder (b) the Bid Price(s), including any discounts (c) any other details as the Employer may consider appropriate.
21.9	Only Financial Proposals, discounts, read out and recorded during the opening of Financial Proposals shall be considered for evaluation. No Bid shall be rejected at the opening of Financial Proposals.
21.10	The Employer shall prepare a record of the opening of Financial Proposals that shall include, as a minimum: the name of the Bidder, the Bid Price including any discounts. The Bidders` representatives who are present shall be requested to sign the record. The omission of a Bidder`s signature on the record shall not invalidate the contents and effect of the record.
E.	Evaluation and Comparison of Bids
22.	Confidentiality
22.1	Information relating to the examination, evaluation & comparison of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.
22.2	Any attempt by a Bidder to influence the Employer in the examination, evaluation & comparison and pre-qualification of the Bids or Contract award decisions may result in the rejection of its Bid.
22.3	Notwithstanding ITB Sub-Clause 23.2 , from the time of opening the Technical Proposals to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it should do so in writing.
23.	Clarification of Bids
23.1	To assist in the examination, evaluation & comparison of the Bids, the

	Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder 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 in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Financial Proposals, in accordance with ITB Clause 28.
23.2	If a Bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.
24.	Deviations, Reservations, and Omissions
24.1	During the evaluation of bids, the following definitions apply: <ul style="list-style-type: none"> (a) "Deviation" is a departure from the requirements specified in the Bidding Document; (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.
25.	Determination of Responsiveness
25.1	The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB 10 .
25.2	A substantially responsive bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that, <ul style="list-style-type: none"> (a) if accepted, would: <ul style="list-style-type: none"> (i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; <li style="text-align: center;">or (ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; <li style="text-align: center;">or if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.
25.3	The Employer shall examine the technical aspects of the bid submitted in accordance with ITB 14 , Technical Proposal, in particular, to confirm that all requirements of Part -1 Section III (Evaluation and Qualification criteria) have been met without any material deviation or reservation.
25.4	If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission. The employer's decision in this connection shall be final and binding.
26.	Nonconformities, Errors, and Omissions - DELETED.
27.	Evaluation of Technical Bids
27.1	The Employer shall determine to its satisfaction during the evaluation of Technical Proposals whether Bidders are qualified to perform the Contract satisfactorily.
27.2	The determination shall be based upon an examination of the documentary

	evidence of the Technical Proposal submitted by the Bidder, pursuant to ITB Clause 14 , to clarifications in accordance with ITB Clause 23 and the Evaluation and qualification criteria indicated in Part-1, Section-III , Evaluation and Qualification Criteria.
27.3	The Employer will carry out a detailed evaluation of the technical proposals in order to determine whether the technical aspects are in compliance with the Bidding Document. In order to reach such a determination, the Employer will examine and compare the technical proposals on the basis of the information supplied by the bidders, taking into account overall completeness and compliance with the Employer's Requirements and the technical merits;
27.4	An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Financial Proposal. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Financial Proposal to the Bidder.
28.	Correction of Arithmetical Errors
28.1	Provided that the bid is substantially responsive, the Employer shall correct arithmetical errors as under: If there is a discrepancy between words and figures, the amount in words shall prevail.
28.2	If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be disqualified and its bid security may be forfeited.
29.	Evaluation of Financial Bids
29.1	The Employer shall evaluate Financial Proposals of each Bid for which the Technical Proposals have been determined to be substantially responsive as per evaluation criteria given in Part – 1 Section-III, of the Bid Document
29.2	To evaluate the Financial Proposal of a bid, the Employer shall consider the following: i) Total lump sum bid price; ii) Unconditional Discounts offered if any.
29.3	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 bid evaluation.
30.	Comparison of Bids
30.1	The Employer shall compare all substantially responsive bids to determine the lowest evaluated bid, in accordance with ITB 29 .
31.	Employer's Right to Accept Any Bid, and to Reject Any or All Bids
31.1	The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be returned to the Bidders.
F.	Award of Contract
32.	Notification of Award
32.1	Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, that its bid has been accepted. The notification letter (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 and completion of the Works (hereinafter and in the Conditions of Contract and Contract Forms called “the Contract Price”) and the requirement for the Contractor to remedy any defects therein as prescribed by the Contract.
32.2	Until a formal contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract.
33.	Performance Security
33.1	Within Thirty (30) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security in accordance with the conditions of contract, using for that purpose the Performance Security Form included in Part-3, Section VIII: Contract Forms of the Bid Document or another form acceptable to the Employer.
33.2	Failure of the successful Bidder to submit the above-mentioned Performance Security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.
34.	Signing of Contract
34.1	After notification and submission of performance security, the Employer shall send the successful Bidder the Contract Agreement.
34.2	Within Thirty (30) days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.
35.	Corrupt Practices
35.1	<p>It is the Employer’s policy that Bidder, suppliers, and contractors and their subcontractors, observe the highest standard of ethics during the procurement and execution of such contracts.¹ In pursuance of this policy, the Employer</p> <p>(a) defines, for the purposes of this provision, the terms set forth below as follows:</p> <p>(i) “corrupt practice” is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party² ;</p> <p>(ii) “fraudulent practice” is 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 obligation³;</p> <p>(iii) “collusive practice” is an arrangement between two or more parties⁴ designed to achieve an improper purpose, including to influence improperly the actions of another party.</p> <p>(iv) “coercive practice” is impairing or harming, or threatening to impair or harm, directly or indirectly, any party⁵ or the</p>

¹ In this context, any action taken by a Applicant, supplier, contractor, or a sub-contractor to influence the procurement process or contract execution for undue advantage is improper.

² “another party” refers to a public official acting in relation to the procurement process or contract execution]. In this context, “public official” includes employees of other organizations taking or reviewing procurement decisions.

³ a “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

⁴ “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non competitive levels.

⁵ a “party” refers to a participant in the procurement process or contract execution.

	<p>property of the party to influence improperly the actions of a party;</p> <p>(v) "obstructive practice" is</p> <p>(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation;</p> <p style="text-align: center;">or</p> <p>(bb) acts intended to materially impede the exercise of the Employer's inspection and audit rights provided for under sub-clause 3.1 (d) below.</p> <p>(b) will reject a proposal for award if it determines that the Applicant recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question;</p> <p>(c) will sanction a firm or individual, at any time, including by publicly declaring such firm or individual ineligible, either indefinitely or for a stated period of time, Employer if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing.</p> <p>(d) will have the right to get the accounts , records and other documents relating to the bid submission and contract performance of the Applicants, suppliers, contractors and their sub-contractors audited by auditors appointed by the Employer.</p>
--	--

Section – II

Bid Data Sheet
(BDS)

Section II : Bid Data Sheet

This section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section I – Instructions to Bidders.

A. General	
ITB 1.1	The number of the Invitation for Bids is IFB No.: HQ/EN/EC/DB/SONE BRIDGE dated 23.04.2013
ITB 1.1	The Employer is: Dedicated Freight Corridor Corporation of India Limited, NEW DELHI
ITB 1.1	The name of the NCB is: “Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai-Sonnagar Section of Eastern Dedicated Freight Corridor”.
B. Contents of Bidding Document, Site Visit, Pre-bid conference	
ITB 6.1	All communication between the Employer and the Bidder shall be in writing. For the purposes of seeking clarification, the Employer's address is: Dedicated Freight Corridor Corporation of India Limited Attention : Mr.Rajendra Prasad Designation : Group General Manager/CO/ EC Address : Room # 513; 5 th Floor Pragati Maidan Metro Station Building Complex , New Delhi - 110001, India Telephone: +91 – 11 – 23454680, Facsimile number: +91-11-23454682
ITB 6.4	Pre Bid Conference: A pre-Bid conference will be held to clarify the issues related to this Bid document on the date, time and venue of the Pre Bid conference indicated below. Bidders should give their queries in writing upto 3 days prior to the pre-Bid Conference. All interested Bidders may attend the Pre-Bid Conference. DFCC response to queries will be posted on the DFCCIL's website. Non-attendance at the pre-Bid conference will not be a cause for disqualification of the Bidder. Date : 14.05.2013 (Thursday) Time: 1500 Hrs. Venue : Conference Room, Dedicated Freight Corridor Corporation of India Limited, 4 th Floor, Pragati Maidan Metro Station Building Complex, New Delhi-110001. Website of DFCC : www.dfccil.org / www.dfcc.in Site visit is not proposed to be organized by the Employer. However, the bidders are advised to visit the site before pre-bid conference.
C. Preparation of Bid	
ITB 11.2	The prices quoted by the Bidder shall be adjustable in accordance with the provisions in Sub Clause 13.8 of Particular Conditions of Contract.

ITB 15.1	The bid validity period shall be 180 (One hundred and Eighty) days.
ITB 16.1	<p>The Bidder should submit along with the bid, a bid security for Rs.5.00 crore (Rupees Five Crore only) in the following form :</p> <p>i) FDR/Demand Draft/Banker's Cheque from Nationalised/.Indian Scheduled Commercial Bank for Rs.2 crores</p> <p style="text-align: center;">and</p> <p>ii) Bank Guarantee as per format enclosed in BDF-9A from Nationalised/Indian Scheduled Commercial Bank for Rs.3 crores.</p> <p>in favour of "Dedicated Freight Corridor Corporation of India Ltd., New Delhi" in original form.</p> <p><i>The validity of FDR should not be less than 270 days.</i></p>
ITB 17.2	<p>The written confirmation of authorization to sign on behalf of the Bidder shall consist of:</p> <p>In case of Companies</p> <ul style="list-style-type: none"> • Power of Attorney authorizing the signatory of the bid to commit the bidder. <p>In case of Joint Venture</p> <ul style="list-style-type: none"> • Power of Attorney for Authorised Signatory of Joint Venture.
D. Submission and Opening of Bids :	
ITB 19.1	<p>Tender Box for submission of Bid shall remain open: From 10.00 Hrs to 17:00 Hrs on all working days from 12.6.2013 to 13.06.2013 and Upto 15:00 hrs. of 14.06.2013 at the address given below: Group General Manager/CO/ EC Room # 513; 5th Floor Pragati Maidan Metro Station Building Complex, New Delhi - 110001, India Telephone: +91-11- 23454680 Facsimile number: +91-11-23454682</p>
ITB 21.1	<p>The Technical bid opening shall take place at: Dedicated Freight Corridor Corporation of India Limited, Conference Hall; 4th Floor, DFCCIL, Pragati Maidan Metro Station Building Complex , New Delhi - 110001, India Telephone: +91-11- 23454680, Facsimile number: +91-11-23454682</p> <p><u>Technical Bid Opening:</u> Date: 14.6.2013 Time: 15:30 hrs.</p>

Section III

Evaluation and Qualification Criteria

Section III. Evaluation and Qualification Criteria

The purpose of this Section is to establish that the Bidder continues to meet the criteria used at the time of prequalification. It contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders in accordance with ITB 25, ITB 27, ITB 29 and ITB 30 Part 1, Section IV, Bidding forms of the Bid Document.

Technical Proposals

1. Evaluation

The documents required for submission and evaluation of First Stage Technical Proposal are detailed in Annexure-I of this section. In addition, the following factors shall apply in proposal evaluation.

2. Qualification

2.1 Updation of Information

The Bidder and any subcontractors shall continue to meet the criteria used at the time of prequalification and shall give an undertaking to this effect. The Bidder shall fill up Form number BDF - 2 and BDF-3 included in Section IV, Bidding Forms, Part 1 of Bidding Documents.

2.2 Personnel

The Bidder shall give an undertaking to arrange the following minimum no. of key personnel during the execution of work in addition to required semi-skilled and skilled staff :

SN	Key Position	Minimum No. of Persons	Minimum Qualifying Requirement		
			Total Work Experience (years)	In Similar Works Experience (years)	Minimum Education Qualification
1	Chief Project Manager	1	10	6	B.E. (Civil)
2.	Project Manager	3	7	5	B.E. (Civil)
3	Planning Engineer	1	07	03	B. Tech. or B.Sc. in IT (should be well conversant with Primavera-P6)

4	Chief Design Engineer*	1	10	03	B.E. (Civil) + M.E. in Structural Engg. having familiarity with Autocad
5	Contract Manager	1	05	03	B.E. Civil
6	Bridge Engineer	6	05	03	B.E. (Civil)
7	Survey & Alignment Expert	2	05	03	Diploma in Civil Engg. + Expertise in Autocad
8	Quantity Surveyor & Estimator	1	05	03	Diploma in Civil Engg.
9	Quality Control Expert	3	05	03	Diploma in Civil Engg.
10	SHE Expert	1	05	03	Engineering Graduate with Diploma/ Specialization in Safety related field.

*Can be on Sub-contractor's team.

2.3 Equipment

The Bidder shall demonstrate that it will have access to essential equipments/plants during the execution of Works. Capacity and number of machines shall be commensurate with the Works program submitted by the Bidder to enable him to finish the work in stipulated time. The Bidder shall provide ownership/renting/leasing/ arrangement details of proposed items of equipment using Form BDF-9 in Part – 1 Section IV of Bidding Document.

SN	Name of Equipments
1	Batching plants (15 - 20 cu.m capacity)
2	Transit Mixers (4.5 cum capacity)
3	Concrete Pumps of 45 & 30 cum capacity
4	35 tonne capacity of cranes
5	Air compressors with pneumatic chisel attachment for cutting hard clay
6	Tippers 10 tonne capacity
7	Pre Stressing Equipments
8	PSC Box launching equipment/arrangement
9	Dredgers
10	Pneumatic sinking equipments
11.	Excavators with 2 cum bucket capacity
12.	Graders
13.	Dozers having long blade
14.	Trucks of 14 cum capacity

15.	Rollers Pneumatic
-----	-------------------

List of Equipment /Plants is indicated and not exhaustive.

2.4 Subcontractors

Subcontractors for services identified in the prequalification document must continue to meet the minimum criteria specified therein for them. The Bidder shall demonstrate in its proposal clearly the work and value of that work to be carried out by its main subcontractors, including its proposed designer if the Design is not to be carried out in-house.

3. Financial Bid

The financial proposal will comprise the documents required as per ITB-10.5.

3.1. Evaluation

The evaluation of the financial bid shall be carried out in accordance with the provisions of ITB 29. Bidders shall submit financial Bid as per the Form – BDF-10 –Price Proposal submission sheet as given in Part – 5 of the Bidding Document.

3.2 Time Schedule for Completion of Works:

The designated period for the completion and taking over the entire Works shall be **1216 days** from the Commencement Date, as indicated with further details in Para 8.2 of GCC. Bidders shall confirm that their Technical Proposals and Financial proposal are based on this Time Schedule for Completion. No credit of any kind will be given in the evaluation of Technical Proposals and Financial proposals, to a Proposal and/ or a Bid offering to complete the Works earlier than this designated period. However, Technical Proposals and Financial Bids offering to complete the Works later than this designated period shall be rejected by the Employer.

Documents Required For Bid Submission and Evaluation of Technical Proposal

1 Type of Contract

Technical and Financial Proposals are being invited for a Lump-Sum Contract, for Design and Construction, based on the Employer's Requirements.

The detailed design of components and construction shall be done as specified in **Employers' Requirement and "General Conditions of Contract read with Particular conditions of Contract"**.

2 Documents Required for Technical Proposal

The Technical Proposal will comprise of the following documents in addition to the documents required as per Clause ITB 10:

2.1 General Submittal

S.N.	Form	Contents
1.	BDF-1	Technical proposal submission sheet.
2.	BDF-2	Applicant information Form
3.	BDF-3	Applicant's party information Form
4.	BDF-4	Draft Memorandum of understanding (MOU) for joint venture participation.
5.	BDF-5	Draft JV Agreement
6.	BDF-6	Proforma - letter of participation from each member of JV.
7.	BDF-7	Power of Attorney for authorize signatory of JV.
8.	BDF-8	Power of Attorney for lead partner of joint venture
9.	BDF-9	Contractors' Equipment
10.	BDF-9A	Form of Bid Security (Bank Guarantee)

2.2 Technical Submittal

2.2.1 Methods Statement

The Bidder shall submit methods statement which demonstrates the Bidder's understanding of the Project and comprehension of the Works involved. In these methods statement, the Bidder shall submit Method statements for:

- well foundation including Sinking methodology
- Substructure
- PSC box girders including details plan for casting, launching of girders
- Earthwork & Protection works
- Testing

in strict compliance with the Contract requirements. This shall correspond to Site organization, Contractor's equipment, construction schedule and Work Plan being submitted by the Bidder as a part of bid documents.

2.2.2 Organization and Management

The Bidder shall submit an organization chart identifying the management and reporting structure for key positions and all site teams. The Bidder shall

submit a commentary that describes the roles and responsibilities of the various key positions in the organization structure, the minimum qualifications, channel of communication, organization they come from and how this organization structure will manage the execution of the works within the scheduled period.

2.2.3 Work Plan/Bid Programme

The Bidder shall submit a Work Plan which shall indicate how the Bidder intends to organize and carry out the Works by breaking them into various activities and completing those activities by appropriate Milestones so that the whole of the work gets completed within the time of completion as mentioned in GCC para 8.2. The Work Plan shall be prepared in terms of weeks from the Date of Commencement of Works, taking D as the Commencement Date and other time schedules marked in D+ format. (Refer to Explanatory Note 1 at the end of this Section).

2.2.4 Documents for Safety and Quality Plans

The Bidder shall submit the following documents, which shall demonstrate clearly the Bidder's proposals for achieving effective and efficient Safety and Quality procedures.

- a) Outline Safety Plan
 - b) Outline Quality Plan
- (Refer to Explanatory Note 2 at the end of this Section)

2.2.5 Concept Design & Performance Parameters Compliance

The Bidder shall submit details of compliance with the Employers' Requirements as listed in Part 2 of bidding document.

Reference Paragraph 2.2.3 Work Plan of Annexure- I

Requirements of Work Plan/Bid Programme

- (1) The Bidder shall submit a Work Plan which shall indicate how the Bidder intends to organize and carry out the Works by breaking them into various activities and completing those activities by appropriate Milestones so that the whole of the work gets completed within the time of completion as mentioned in GCC para 8.2. The Work Plan shall be prepared in terms of weeks from the Date of Commencement of Works, taking D as the Commencement Date and other time schedules marked in D+ format. This may be in form of an Excel spread sheet/primavera or similar programme output.
- (2) The Work Plan shall follow the instructions given in **Part 2, Section V, “Employer’s Requirements/ Volume 7 Appendix 3, PROJECT PROGRAM REQUIREMENTS”**
- (3) The Works Plan shall take into account the Bidder’s proposed Design Submission Programme and should:
 - (a) take due account of the design co-ordination interface periods during which the Contractor shall be required to undertake and complete all aspects of design co-ordination with other consultants engaged in the review of the design of the Project such design will be compatible and coordinated with others and allowing adequate time for the Employer’s assessments and decisions.
 - (b) be consistent with the overall Work Plan and in accordance with the Employer’s Requirements;**
 - (c) make adequate allowance for periods of time for review by authorities whose approval is necessary
 - (d) include a schedule identifying, describing, cross-referencing and explaining the Design packages and submissions which the Bidder intends to submit.
- (4) The Work Plan shall contain sufficient detail to assure the Employer of the feasibility of the plan and approach proposed by the Bidder.
- (5) The Work Plan shall be accompanied by a narrative statement that shall describe Programme activities, assumptions and logic, and highlight the Bidder’s perception of the construction and completion of the work. This narrative statement shall also indicate which elements of the Works the Bidder intends to carry out off-Site with details of the proposed locations of where any such work is to be carried out, the facilities available. In particular the Bidder must state the assumptions made in respect of the interfaces with the Employer, other contractors and any requirements for information on matters which would affect his works.
- (6) All programmes shall include design, procurement periods, major material, on site, offsite, temporary construction, interface and periods for System wide,

utility and adjacent contractors, and testing alongwith other relevant information.

- (7) The proposed submission of the Work Plan and Design Submission Programme shall not, in any event, be construed as a submission under Clause 8.3 (Programme) of the General Conditions of Contract.

Reference Paragraph 2.2.4 - Documents for Safety and Quality plans of Annexure-I

OUTLINE SAFETY PLAN

The Bidder shall submit as part of his bid an Outline Safety Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient safety procedures. The Outline Safety Plan should include an outline of the safety procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring safety as required under the Employer's Requirements and Sub Clause 4.8 and 6.7 of the GCC.

The Outline Safety Plan shall be headed with a formal statement of policy in relation to safety and shall be sufficiently informative to define the Bidder's safety plans and set out in summary an adequate basis for the development of the Site Safety Plan to be submitted in accordance with Sub Clause 4.8 and 6.7 of the GCC including a testing and strategy/plan for the whole of the Works.

OUTLINE QUALITY PLAN

The Bidder shall submit as part of his bid an Outline Quality Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient Quality Assurance and Control System. The Plan should include an outline of the procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring Quality as required in terms of the Employer's Requirements. It shall also include an outline of procedures, verification and validation for all tests and materials for all the Works being done by him under this Contract.

Section IV

Bidding Forms

Section IV. Bidding Forms

Table of Forms

Form No.	Description
BDF-1	Technical Proposal Submission Sheet
BDF-2	Applicant Information form
BDF-3	Applicant's Party Information form
BDF-4	Draft Memorandum of Understanding (MOU ²) For Joint Venture Participation
BDF-5	Draft Format of Joint Venture Agreement
BDF- 6	Pro-forma Letter of Participation from each partner of Joint Venture (JV)
BDF- 7	Format for Power of Attorney for Authorised Signatory of Joint Venture (JV) Members – Power of Attorney*
BDF- 8	Format for Power of Attorney to Lead Partner of Joint Venture (JV)
BDF- 9	Contractor's Equipment
BDF-9A	Form of Bid Security (Bank Guarantee)
BDF- 10	Price Proposal Submission Sheet

² In case of existing joint venture, the certified copy of JV Agreement be furnished.

Technical Proposal Submission Sheet (TPSS)

Date:

Invitation for Bid No.:HQ/EN/EC/DB/SONE BRIDGE

To:.....

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB-7);
- (b) We confirm that our offer is fully compliant with Bid Document and Technical Preproposals submitted by us are in clause by clause compliance with Employer’s Requirement and other specifications, including Addenda thereon. We offer to execute the works in conformity with the Bidding Document.
- (c) Our bid shall be valid for a period of days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (d) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents;
- (e) If our bid is accepted, we commit to deploy key equipment and key personnel consistent with the requirements stipulated in Section- III : Evaluation and Quaqlfication criteria and Section-V : Employer’s Requirements;
- (f) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 3.3;
- (g) We understand that this bid, together with your written acceptance thereof included in your notification of award/Letter of Acceptance (LOA), shall constitute a binding contract between us, until a formal contract is prepared and executed; and
- (h) We have not made any tampering or changes in the bidding documents on which the bid is being submitted and if any tampering or changes are detected at any stage, we understand the bid will invite summery rejection and forfeiture of bid security/the contract will be liable to be terminated along with forfeiture of performance security, even if LOA has been issued.
- (i) We understand that you are not bound to accept the lowest bid or any other bid that you may receive.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

Applicant Information Form

Date: *[insert day, month, year]*

NCB Bid Document No.: HQ/EN/EC/DB/SONE BRIDGE

Page *[insert page number]* of *[insert total number]* pages

Applicant's legal name <i>[insert full legal name]</i>
In case of Joint Venture (JV), legal name of each partner: <i>[insert full legal name of each partner in JV]</i>
Applicant's Actual or Intended country of constitution: <i>[indicate country of Constitution]</i>
Applicant's actual or Intended year of constitution: <i>[indicate year of Constitution]</i>
Applicant's legal address in country of constitution: <i>[insert street/ number/ town or city/ country]</i>
Applicant's authorized representative information Name: <i>[insert full legal name]</i> Address: <i>[insert street/ number/ town or city/ country]</i> Telephone/Fax numbers: <i>[insert telephone/fax numbers, including country and city codes]</i> E-mail address: <i>[indicate e-mail address]</i>
Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation or Documents of Constitution, and documents of registration of the legal entity named above <input type="checkbox"/> In case of JV, JV agreement, in accordance with ITB 3.1b.

Applicant's Party Information Form

[The following form shall be filled in for the Applicant's parties including partner(s) of a joint venture, subcontractors and Design Consultant]

Date: *[insert day, month, year]*

NCB Bid Document No.: HQ/EN/EC/DB/SONE BRIDGE

Page *[insert page number]* of *[insert total number]* pages

JV applicant legal name: <i>[insert full legal name]</i>
Applicant's Party legal name: <i>[insert full legal name of Applicant's Party]</i>
Applicant's Party country of registration: <i>[indicate country of registration]</i>
Applicant Party's year of constitution: <i>[indicate year of constitution]</i>
Applicant Party's legal address in country of constitution: <i>[insert street/ number/ town or city/ country]</i>
Applicant Party's authorized representative information Name: <i>[insert full legal name]</i> Address: <i>[insert street/ number/ town or city/ country]</i> Telephone/Fax numbers: <i>[insert telephone/fax numbers, including country and city codes]</i> E-mail address: <i>[indicate e-mail address]</i> Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation or Documents of Constitution, and Registration Documents of the legal entity named above, in accordance with ITB 3.1 (b).

Note : Separate BDF form is required for all individual participants (members) in the JV as well as sub-contractor and Design Consultant.

**Draft Memorandum of Understanding (MOU)*
For
Joint Venture Participation
Between**

M/s having its registered office at (hereinafter referred to as) acting as the Lead Partner of the first part,

and

M/shaving its registered office at (hereinafter referred to as `.....') in the capacity of a Joint Partner of the other part.

and

M/shaving its registered office at (hereinafter referred to as `.....') in the capacity of a Joint Partner of the other part.

The expressions of and 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:

Dedicated Freight Corridor Corporation of India Limited (DFCCIL) [hereinafter referred to as “Client”] has invited bids 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 MOU.

- i) Notice for Bid, and
- ii) Bidding document
- iii) Any Addendum/Corrigendum issued by Dedicated Freight Corridor Corporation of India Limited
- iv) The bid submitted on our behalf jointly by the Lead Partner.

2. The `Parties' have studied the documents and have agreed to participate in submitting a `bid' jointly.

3. M/sshall be the lead member of the JV for all intents and purpose and shall represent the Joint Venture in its dealing with the Client. For the purpose of submission of bid proposals, the parties agree to nominate as the leader duly authorized to sign and submit all documents and subsequent clarifications, if any, to the Client. However M/s shall not submit any such proposals, clarifications or commitments before securing the written clearance of the other partner which shall be expeditiously given by M/s.....to M/s.....

4. The `Parties' have resolved that the distribution of responsibilities and their proportionate share in the Joint Venture is as under:

- (a) Lead Partner;

- (i)
- (ii)
- (iii)
- (b) Joint Venture Partner
 - (i)
 - (ii)
 - (iii)

[Similar details to be given for each partner]

5. JOINT AND SEVERAL RESPONSIBILITY

The Parties undertake that they shall be jointly and severally liable to the Client in the discharge of all the obligations and liabilities as per the contract with the Client 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 MOU 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.

7. EXECUTIVE AUTHORITY

The said Joint Venture through its authorized representative shall receive instructions, payments from the Client. 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. BID SECURITIES

Till the award of the work, JV firm/Lead Partner of JV firm shall furnish Bid Security to the Client on behalf of the joint venture which shall be legally binding on all the members of the Joint Venture.

9. BID SUBMISSION

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

10. INDEMNITY

Each party hereto 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.

11. 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.

12. 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 bid.

13. ARBITRATION

Any dispute, controversy or claim arising out of or relating to this 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 arbitration in accordance with the Indian Arbitration and Conciliation Act 1996 or any amendments thereof. The venue of the arbitration shall be Delhi.

14. VALIDITY

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

- a. The bid submitted by the Joint Venture is declared unsuccessful, or
- b. Cancellation/ shelving of the Project by the client 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 Client.

15. This MOU 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.....&M/s and a copy submitted with the proposal.

16. This MOU shall be construed under the laws of India.

17. NOTICES

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

Lead Partner	Other Partner(s)
.....
.....
(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.....
.....
(Seal)	(Seal)

Witness

1.....(Name & Address)

2..... (Name & Address)

***Notes:**

In case of existing joint venture, the certified copy of JV Agreement may be furnished.

Draft Format of Joint Venture Agreement

(To be executed on non-judicial stamp paper of appropriate value in accordance with relevant Stamp Act and to be registered with appropriate authority under Registration Act.)

The JV agreement shall be structured generally as per contents list given below:

A. CONDITIONS AND TERMS OF JV AGREEMENT

1. Definitions and Interpretation
2. Joint Venture – Include Equity of members, transferability of shareholding of equity of a partner leaving during the subsistence of the contract.
3. Proposal Submission
4. Performance – To indicate scope of responsibility of each member
5. Language and Law
6. Exclusively
7. Executive Authority
8. Documents
9. Personnel
10. Assignment and Third Parties
11. Severability
12. Member in Default
13. Duration of the Agreement
14. Liability and sharing of risks
15. Insurance
16. Sharing of Promotion and Project Costs, Profits, Losses and Remuneration
17. Financial Administration and Accounting
18. Guarantees and Bonds
19. Arbitration
20. Notices
21. Sole Agreement and Variation

B. SCHEDULES

1. Project and Agreement Particulars
2. Financial Administration Services
3. Allocation of the obligations
4. Financial Policy and Remuneration

Pro-forma Letter of Participation From Each Partner of Joint Venture (JV)

(To be executed on non-judicial stamp paper of appropriate value in accordance with relevant Stamp Act and to be registered with appropriate authority under Registration Act.)

No....

Dated

From:

.....
.....

To,

The Managing Director,
Dedicated Freight Corridor Corporation of India Limited
5th Floor, Pragati Maidan Metro Stn. Building Complex.,
New Delhi 110001.

Gentlemen,

Re: ... "[Insert name of work]....."

Ref: Your notice for Invitation for Bid (IFB) No. HQ/EN/EC/DB/Sone Bridge dated

1. We wish to confirm that our company/firm has formed a Joint Venture with(i)..... & ii)..... for the purposes associated with IFB referred to above.

(Members who are not the lead partner of the JV should add the following paragraph).*

2. 'The JV is led by ... whom we hereby authorise to act on our behalf for the purposes of submission of Bid for and authorise to incur liabilities and receive instructions for and on behalf of any and all the partners or constituents of the Joint Venture.'

OR

*(Member(s) being the lead member of the group should add the following paragraph)**

2. 'In this group we act as leader and, for the purposes of applying for Bid, represent the Joint Venture:

3. In the event of our JV being awarded the contract, we agree to be jointly with i) & ii) (names of other members of our JV) and severally liable to the Dedicated Freight Corridor Corporation of India Limited, its successors and assigns for all obligations, duties and responsibilities arising from or imposed by the contract subsequently entered into between Dedicated Freight Corridor Corporation of India Limited and our JV.

4. *I/We, further agree that entire execution of the contract shall be carried out exclusively through the lead partner.

Yours faithfully,

(Signature)

(Name of Signatory).....

(Capacity of Signatory).....

Company Seal

* Delete as applicable

Note : In case of existing joint venture, the certified copy of JV Agreement may be furnished.

BDF- 7

Format for Power of Attorney for Authorised Signatory of Joint Venture (JV) Partners

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 ofas 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 bid for the work of ...Including signing and submission of all documents and providing information/responses to Dedicated Freight Corridor Corporation of India Limited , representing us in all matters, dealing with Dedicated Freight Corridor Corporation of India Limited in all matters in connection with our bid 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 2013

(Signature of authorised Signatory)

**Signature of Lead Partner
Partner(s)**

Signature of JV

.....
**(Signature and Name in Block letters of Signatory)
Seal of Company**

Witness

Witness 1:

Name:

Address:

Occupation:

Witness 2:

Name:

Address:

Occupation:

*Notes:

- i) To be executed by all the partners jointly, in case of a Joint Venture.

Format for Power of Attorney to Lead Partner of Joint Venture (JV)

(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 *

Whereas Dedicated Freight Corridor Corporation of India Limited has invited Bids for the work of Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai - Sonnagar Section of Eastern Dedicated Freight Corridor.

Whereas, the members of the Joint Venture comprising of M/s. ..., M/s. ..., M/s., and M/s. are interested in submission of bid for the work of ...*[Insert name of work]*... in accordance with the terms and conditions contained in the bidding documents.

Whereas, it is necessary for the members of the Joint Venture to designate one of them as the Lead Partner, 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 bid for the project, as may be necessary in connection the Joint Venture's bid for the project.

NOW THIS POWER OF ATTORNEY WITNESSETH THAT:

We, M/s., hereby designate M/s., being one of the partners of the Joint Venture, as the lead partner 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 bid for the contract, including submission of bid, participating in conferences, responding to queries, submission of information/ documents and generally to represent the Joint Venture in all its dealings with the DFCCIL or any other Government Agency or any person, in connection with the Bid/contract for the said work until culmination of the process of bidding till the contract agreement if successful, is entered into with the Dedicated Freight Corridor Corporation of India 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 2013

.....
(Signature)

.....
(Name in Block letters of Executants)
Seal of Company

Witness 1:
Name:
Address:
Occupation:

Witness 2:
Name:
Address:
Occupation:

** To be executed by all the members of the JV except the lead member.*

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.

Contractor's Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key Contractor's 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 Bidder.

Item of equipment	
Equipment information	Name of manufacturer
	Capacity
Current status	Current location
	Details of current commitments
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured

Omit the following information for equipment owned by the Bidder.

<i>Owner</i>	<i>Name of owner</i>	
	<i>Address of owner</i>	
	<i>Telephone</i>	<i>Contact name and title</i>
	<i>Fax</i>	<i>Telex</i>
<i>Agreements</i>	<i>Details of rental / lease / manufacture agreements/Consent letter specific to the project</i>	

(Clause ITB-16; Section-I & II)

Form of Bid Security (Bank Guarantee)

BANK GUARANTEE

.....*Bank's Name, and Address of Issuing Branch or Office*.....

Beneficiary: *Name and Address of Employer*

Date:

Bid Security No.:

We have been informed that *name of the Bidder*. (hereinafter called "the Bidder") has submitted to you its bid dated (hereinafter called "the bid") for the execution of [insert]. . . of . . . *name of work* under Invitation for Bid No. ("the IFB").

Furthermore, we understand that, according to your conditions, bid must be supported by a bid guarantee.

At the request of the Bidder, we *name of Bank*. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of amount in figures (. *amount in words*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

- (a) has withdrawn its bid during the period of bid validity specified by the Bidder in the Form of bid;
- or
- (b) having been notified of the acceptance of its bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This guarantee will expire: (a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and performance security issued to you upon the instruction of the Bidder; and (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy your notification to the Bidder of the name of the successful Bidder; or (ii) **Ninety days (90) after the expiration of the Bidder's bid.**

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

This guarantee is subject to the Uniform Rules for Demand Guarantees, **ICC Publication No. 758.**

.....*Bank's seal and authorized signature(s)*.....

Note: *All italicized text is for use in preparing this form and shall be deleted from the final document*

Price Proposal Submission Sheet

Please refer Part-5 (Price Schedule) for this form

PART 2

Employer's Requirement

Section V. Employer's Requirement

Contents

Volume 1: General

Volume 2: Functional

Volume 3: Design

Volume 4: Construction

Volume 5: Testing

Volume 6: Specification

Volume 7: Appendices

Appendix 1 Alignment of Trackways and Work Areas

Appendix 2 Project Calendar

Appendix 3 Project Programme Requirements

Appendix 4 Quality Assurance

Appendix 5 CAD and Document Standards

Appendix 6 Temporary Works

Appendix 7 Contractor's Coordination with Others

Appendix 8 Requirements on Documents and Drawings

Appendix 9 Document Submission and Review Procedure

Appendix 10 Requirements for Design

Appendix 11 Requirements for Construction

Appendix 12 Publicity and Public Relations

Appendix 13 Deleted.

Appendix 14 Possession Management

Section V. Employer's Requirement Volume 1 – General

CONTENTS

01	Introduction
02	Definitions and Interpretations
03	Relevant Documents
04	Codes and Standards
05	Reference Drawings
06	Specifications
07	Design and Construction Phases
08	Programme Requirements
09	Document Submission and Response Procedure
10	Quality Assurance Requirements
11	Safety, Health and Environment (SHE) Requirements
12	Software Support, Management and Control
13	Contractor's Coordination with Others
14	Site Installation and Demobilization
15	Site Surveys and Investigations
16	Project Management Information System (PMIS)
17	Contractor's Project Organizations
18	Training and Skills Transfer
19	Confidentiality and Public Relations
20	Progress Report
21	Monitoring of Progress
22	Maintenance Report
23	Intellectual Property Rights and Royalties
24	Acknowledgement by the Contractor
25	Obligation on Engineer

1 Introduction

- 1.1 Dedicated Freight Corridor Corporation of India (DFCCIL) is a Special Purpose Vehicle set up under the administrative control of Ministry of Railways to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the Dedicated Freight Corridors. In the first phase, DFCCIL will be constructing two corridors – the Western DFC and Eastern DFC- spanning a total length of about 3300 route km. The Eastern Corridor, starting from Ludhiana in Punjab and pass through the states of Haryana, Uttar Pradesh, Bihar, Jharkhand and terminate at Dankuni in West Bengal.

The route alignment of Freight Corridors is mostly parallel to existing adjacent Indian Railway Track. However alignment is on detour at some locations to avoid social/environmental/wild life impact. The project entails construction of mostly double-track electrified railway lines . Bridges and embankment would be fit for 32.5 Tonne Axle load and Track structure would be designed for handling 25 Tonne axle load with train speed up to 100 Kmph. The Eastern Corridor will handle single stack containers whereas Western Corridor is planned to cater to double stack containers. Up gradation of transportation technology, increase in productivity and reduction in unit transportation costs have been taken as guiding principles for freight corridor.

- 1.2 Proposed Important Bridge falls in this section of DFC alignment between Dehri-on-sone and Sonnagar Railway stations of Railways in the districts of Rohtas & Aurangabad of Bihar state. Indicative Bridge location is enclosed in reference documents. DFCCIL intends to carry out the work of Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai-Sonnagar Section of Eastern Dedicated Freight Corridor. Bridge and its approaches are to be constructed for double line electrified track with 2 x 25 KV AC, 50 Hz, overhead catenary system, capable of operating at a maximum train speed of 100km/h. Formation and bridge structure are to be provided for 32.5 tonnes axle load. The Contractor shall undertake the design, construction, manufacture, supply, installation, testing and commissioning of the Bridge Structure including associated approaches on both sides and other misc. works and without limitation, the design, construction and removal of any Temporary Works on Design Build lump sum basis. The bridge will be constructed on D/S (downstream) side of newly constructed Railway Bridge.
- 1.3 The Employer's Requirements of the current package are divided into seven (7) sections as follows:

- (1) **General:** these apply throughout the Contract;
- (2) **Functional:** these include the specific requirements for the design, construction, performance and function of the Works including Scope of Work;
- (3) **Design:** these apply in respect of duties relating to the design of the Works;
- (4) **Construction:** these apply in respect of the requirements relating to the construction of the Works; and
- (5) **Testing:** these apply to the requirements relating to the requirements for testing pertaining to the Works under the current Package; and
- (6) **Specifications** – The specifications describe the specification, codes, relevant standards to be followed for design and construction of works.
- (7) **Appendices:** these provide further requirements to the above.

2 Definitions and Interpretations

In addition to the words and expressions defined in Conditions of Contract (in Part 3 of the Bid Documents), following words and expressions shall have the meaning assigned to them except where the context otherwise requires:

Alignment (consisting of Horizontal Alignment and Vertical Alignment):

The 'Horizontal Alignment' and the 'Vertical Alignment' for the Main Line, Connecting Lines, Loop Lines, Sidings (Yard Layout) at Stations are collectively referred to as the 'Alignment'.

'Horizontal Alignment' is the horizontal position of DFC tracks.

The 'Vertical Alignment' is the vertical position of the DFC tracks.

As-Built Documents: mean the set of drawings and documents prepared by the Contractor as one of the four major design submissions (Inception Report, Technical Design, Construction Design and As-built Documents) during Design Phase and Construction Phase.

Key Plan and Alignment Drawing: mean one of the Reference Drawings the alignment for the Main Line on bridge and its approaches within the Scope of Work, as developed by the Employer and collectively referred to as 'Alignment Drawings'. This forms the basis of final design of the bridge and its approaches and construction by the Contractor.

As-Built Drawings: mean those drawings produced and endorsed

by the Contractor as true records of construction of the Permanent Works. The As-Built Drawings are subject to confirmation and issue of a "Notice of No Objection by the Engineer".

- **Construction Phase:** means phase of the Work during which the Construction Design and Construction Technical Drawings and construction of the Permanent Works shall be undertaken by the Contractor as per the requirements of the Employer's Requirements, the Specifications and other Conditions of the Contract. It has been further detailed in Clause 7 of the Employer's Requirements - General.
- **Construction Technical Drawings/ Construction Drawings:** mean those set of drawings in respect of each element of the Permanent Works prepared by the Contractor as part of the Construction Design and to be used for construction of Permanent Works and shall be derived directly from the Technical Design and Technical Drawings for which 'Notice of No Objection' has been received from the Engineer. The Construction Technical Drawings / Construction Drawings shall be used only after issue on 'Notice of No Objection' from the Engineer and endorsement of 'Good for Construction' as per the process detailed in Employer's Requirement - Design. These have been further explained in the Employer's Requirements – Design.
- **Construction Design:** means a set of design, drawings and documents in respect of each of the element of the Permanent Works, which shall be prepared by the Contractor during Construction Phase as part of the Construction Design Package based on which the Contractor shall undertake the construction of the Permanent Works. Construction Design shall be developed directly from the Technical Design and Technical Drawings for which 'Notice of No Objection' has been received from the Engineer and submit the same to the Engineer in accordance the Employer's Requirements – Design.
- **Construction Design Package:** comprises the Construction Technical Drawings, Working Drawings and all other associated documents necessary to supplement the design covered in the Technical Design and to comply with the Contract regarding the construction of the Works such as detailed Method Statement, Safety Risk Assessment etc. The contents of the Construction Design Package are as defined in the Employer's Requirements – Design.
- **Coordinated Construction Programme:** means the most precedent programme above all sub-programmes prepared by the Contractor for execution of the Works in co-ordination with Other Contractors describing all the activities of the Works

- **Contractual Construction Programme:** means the most precedent detailed programme above all sub-programmes as developed by the Contractor covering the whole scope of the Contract and based on the Bid Programme for execution of the Works within the specified completion period.
- **Design Manual:** means the manual to be prepared and submitted by the Contractor as part of the Inception Report and as described in the Employer's Requirements - Design.
- **Design Phase:** means phase of the Work during which the detailed design of the Permanent Works and Temporary Works shall be undertaken by the Contractor as per the requirements of the Employer's Requirements, the Specifications and other Conditions of the Contract. It has been further detailed in Clause 7 of the Employer's Requirements - General.
- **Design Data:** means the data as identified to be required by the Contractor for design of the Permanent Works
- **Reference Drawings:** express the Employer's concept and/or intent bearing function purpose and structural form of the Permanent Works.
- **Inception Report:** means the set of drawings and documents prepared by the Contractor as one of the four major submissions during the Design Phase and Construction Phase as identified in the Employer's Requirements - Design.
- **Internal Authorization Process:** means one of the core quality management systems established by the Contractor as described in Appendix 4 [Quality Assurance] to the Employer's Requirements.
- **Operation and Maintenance Manuals (O&M Manuals):** mean the manual indicating the additional provisions over and above the existing Manuals of Indian Railways for Operations and Maintenance of various assets created and shall be prepared as part of the As-Built Documents. O&M Manuals are generally prepared for the Employer's operation and the Other Contractor's works.
- **Interfacing Parties:** comprises the designated contractors / consultants / service providers other than Other Contractors, who are engaged in part of the Works and relevant statutory authorities, relevant public utility agencies and adjacent contractors who are or will be working adjacent to the Site.
- **Other Contractors:** means any party or parties having a direct contract with the Employer for work on the project outside the scope of this Contract, and shall include any subcontractor of the Other Contractors.

- **Railway:** means Railway or any portion of a Railway for public carriage of passenger and goods as defined in the Indian Railway Act 1989.
- **Railway Envelope:** means the area within the Right of Way (ROW) as required for the safe operation of the railway.
- **Right of Way:** means the width / area of the land as required and / or acquired/to be required for the operations of the Railway. Right of Way for DFC be as indicated in reference documents.
- **SHE Requirements:** contain items with respect to environmental and social considerations, and safety and health considerations for all parties involved in the Contract.
- **Site:** means the area where the Permanent Works are executed in the Right of Way(see the Work Areas).
- **Specialist Subcontractor:** means any person so named in the Prequalification Application as a Specialist Subcontractor for a part of the Works which requires highly specialized inputs and the legal successors in title to such person, but not any assignee of any such person.
- **Specifications:** mean the detailed specifications developed by the Contractor considering the Employer's minimum and specific requirements as included in relevant Documents, the Employer's Requirements, requirements of the Design Criteria, relevant provisions of various Codes and Standards, various Indian Railway rules, best engineering practices etc. as applicable. The specifications so formulated after considering above aspects and consented by the Engineer and approved by the Employer as part of Technical Design Package and Construction Design Package during Design Phase shall be termed as Specifications and would constitute a part of the Employer's Requirements.
- **Technical Design:** means a set of drawings and documents, which is submitted to the Engineer in accordance with the Employer's Requirements - Design and the Specifications.
- **Technical Design Package :** Contains the "Technical Design" and its supporting documents including various reports, plans, methods and schemes, calculations, analysis, Manuals, Specifications etc. for the Permanent Works and Temporary Works submitted by the Contractor to the Engineer for his Notice of No Objection in accordance with the Employer's Requirements. The design of the Works shall be based on Design Criteria, IR Codes and Manuals, IS Codes, IRC Codes (as applicable), other International Codes (as applicable) and as referenced to in the Specifications.

- **Work Areas:** comprise the Site (see “Site”) and areas for the Temporary Works within and outside the Right of Way.
- **Works Programme:** means the programme showing the sequence and timing of investigations, design, execution, manufacture, installation and testing of the Works , or any amended or varied version thereof, as submitted by the Contractor and for which the Employer’s/Engineer has issued a Notice of No Objection.
- The word “Notice to Commence” is synonymous with “Notice to Proceed” or “Order to Commence” or “Instruction to Commence”.
- The word “Defects Notification Period” is synonymous with “Defects Liability Period”.

3 Relevant Documents

3.1 These document shall be read in conjunction with the General and Particular Conditions of Contract, the Employer’s Requirements, the Specifications and other documents forming part of the Contract.

3.2 In the event of a conflict between provisions of the above, the order of precedence shall be as under :

- (a) **Design Criteria** (as included in the Employer’s Requirements - Design)
- (b) **Specifications**

Notwithstanding the precedence specified above, the Contractor shall always seek advice from the Engineer in the event of any conflict, immediately for a final decision.

3.3 The Bid Documents also include Part 4 of Reference Documents. The Drawings provided in the Reference drawings, are indicative and for reference only. Employer bears no responsibility to its accuracy and adequacy.

4 Codes and Standards

4.1 The design and construction of the Works shall comply with the Relevant Documents, other relevant codes, standards as applicable and consented by the Engineer.

4.2 In the event of a conflict between the Design Criteria and any other standards or specifications, the Design Criteria shall prevail.

4.3 The Contractor is responsible for obtaining prior consent from the Engineer for any alternative or additional codes of practice and standards.

- 4.4 Notwithstanding the precedence specified above, the Contractor shall always seek advice from the Engineer in the event of any conflict, immediately for a final decision.

5 Reference Drawings

- 5.1 The Reference Drawings are attached in Part 4 [Reference Documents] in this Contract Package to express the Employer's concept and/or intent bearing functions, purposes and structural forms of the Permanent Works.

- 5.2 General features of these drawings are described below:

- (1) General Drawings – Key Plan and Alignment drawing showing the location of site for the bridge
- (2) Civil Works Drawings – Containing the indicative General Arrangement Drawings (GADs) for bridge, protection works etc. The General Arrangement Drawings (GADs) are a set of reference drawings which shows the Employer's concept of each Permanent Works are indicative and for reference only and shall be further developed by the Contractor as part of Technical Design and, where relevant, coordinated with Other Contractors and Interfacing Parties and are as given below.
 - i) General Arrangement Drawing of the Bridge
 - ii) General Arrangement Drawing showing Typical Abutment and Foundation
 - iii) General Arrangement Drawing showing Typical Pier and Foundation
 - iv) General Arrangement Drawing showing Typical Post Tensioned PSC Box Girder
 - v) Earthing Arrangement at PSC/RCC Bridge/viaduct.

6 Specifications

- 6.1 The Specifications shall be as defined in the Employer's Requirements.
- 6.2 The Contract shall utilize the SI system of units. Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.
- 6.3 Conversion between metric units and imperial units shall be in accordance with Indian Standards.

7 Design and Construction Phases

- (1) The Contractor shall execute the Works in two phases - the Design Phase and the Construction Phase.
- (2) The Design Phase shall start from the Commencement Date and

shall include the completion and submission of the Inception Design and the Technical Design. The requirements for the Inception Design and Technical Design are detailed in the Employer's Requirements – Design.

- (3) The Design Phase shall be considered complete upon the issue of a "Notice of No Objection" in respect of the last Technical Design Submission and completely forms the Technical Design for the whole of the Works.
- (4) The Construction Phase for the whole or a part of the Works shall commence immediately upon the issue by the Engineer of a Notice of No Objection in respect of the relevant Technical Design Submission, subject to the availability of the Site in accordance with the agreed programme for site hand over by the Employer. Such Notice may be issued by the Engineer in respect of a Technical Design Submission covering a major and distinctive part of the Works in accordance with the Design Submission Programme, which is deemed to be part of the Contractual Construction Programme as described in Appendix 3 [Project Programme Requirements] to the Employer's Requirements. However, construction shall not be commenced until the appropriate Construction Technical Drawings and other documents forming the Construction Design Package have been endorsed as "Request for Construction" through the Contractor's Internal Authorizing Process and the request is approved by an issue of "Notice of No Objection" by the Engineer in accordance with the procedures in the Employer's Requirements - Design.
- (5) The Construction Phase shall include the completion and submission of the Construction Design and the As-Built Documents. The requirements for the Construction Design and As-Built Documents are stated in the Employer's Requirements - Design.

8 Programme Requirements

- (1) The Key Dates/stages and Key Milestones are defined in sub-clause 8.2 of Particular Conditions of Contract. The various stages of constructions shall be identified by the Contractor as required in Appendix 3 [Project Programme and Requirements] to the Employer's Requirements.
- (2) The Contractor shall develop a detailed programme covering the whole scope of the Contract to be executed within the completion period as specified in the Contract and based on the Bid Program and submit the same to the Engineer for his consent within 28 days after the Commencement Date. Upon consent by the Engineer to the programme, it shall be referred to as the **Contractual Construction Programme**, and become an integral part of the

Contract. The Engineer shall seek the consent of the Employer before communicating the acceptance of the **Contractual Construction Programme** to the Contractor.

- (3) Based on the Contractual Construction Programme, the Contractor shall submit sub-divided and further detailed **Works Programmes** to the Engineer for checking and monitoring the Works.

The Works Programmes for all the Works (the bridges and their approaches on both sides) produced and submitted to the Engineer shall be strictly in compliance with the Contractual Construction Programme. Requirements for the programmes are detailed in Appendix 3 [Project Programme Requirements] to the Employer's Requirements.

- (4) In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for coordinating and completing the design and testing of the Works, including inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Other Contractors, the review procedures, determining and complying with the requirements of all government departments and all others whose consent, permission, authority or license is required prior to the execution of any Work.

9 Document Submission and Response Procedure

Within 28 days after the Commencement Date, the Contractor shall submit the Document Control Procedure to the Engineer for review, which shall comply with the detailed technical requirements as detailed in Appendix 5 [CAD and Document Standards] to the Employer's Requirements and also with the procedural requirements described in Appendix 9 [Document Submission and Review Procedure] to the Employer's Requirements.

10 Quality Assurance Requirements

The Contractor shall establish and implement the Project Quality Assurance Plan for design and construction of the Works as described in Appendix 4 [Quality Assurance] to the Employer's Requirements. This Quality management system detailed in the plan shall be applied without prejudice to, or without in any way limiting, any quality systems that the Contractor already maintains.

11 Safety, Health and Environment (SHE) Requirements

- 11.1 The SHE requirements contain items with respect to environmental and social considerations, and safety and health considerations for all parties including, people affected by the

Works, Contractor's Employees, and the party involved in the Contract. Measures to the SHE requirements shall be taken by the Contractor in accordance with the requirements of various applicable Legislations, Acts, Statutes, Regulations, Rules, Codes & Standards etc. Key requirements are detailed in [Safety, Health and Environment (SHE) Requirements] in the specifications.

- 11.2 Under the SHE requirements, the Contractor shall establish measures to carry out his design and construction process in compliance with all relevant Indian environmental and social laws, standards, codes and regulations. The Contractor shall incorporate the principles of good environmental practice and minimizing negative environmental and social impacts into the Works contained in the Contract.

The Contractor shall at all times be solely responsible for maintaining the health and safety of all his employees and safety of the general public whilst exposed to construction activities whether on or off-site. The Contractor shall at all times take all the precautions as necessary to maintain health and safety of all his employees during working hours and during hours in his employee's camp. His Employee's camp shall meet the requirements detailed in Appendix 6 [Temporary Works] to the Employer's Requirements.

12 Software Support, Management and Control

12.1 General

- (1) The Contractor shall provide full support to the Employer and the Engineer for all computer programs provided by the Contractor under the Contract. The Contractor shall provide to the Employer and Engineer one each of the software packages with the same software products as those that the Contractor intends to use for the project, inclusive but not limited to programmes for project management, design development etc. The Contractor shall utilize a shared electronic document management system with the Engineer and the Employer which shall be web / internet based.
- (2) The Contractor shall submit a software support plan at least 28 days before commencement of software installation. This plan shall require the Contractor to provide all changes, bug fixes, updates, modifications, amendments and new versions of the program as required by the Engineer.
- (3) The Contractor shall provide all tools, equipment, manuals and training necessary for the Employer / Engineer to maintain and re-configure all the software provided under the Contract.

- (4) The Contractor shall submit all new versions to the Engineer for review at least 2 weeks prior to their installation. New versions of any program shall not result in any non-conformance with the Employer's Requirements and the specifications, or degrade the operation of the system. The Contractor shall:
- ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.
 - ensure that all new versions are fully tested and commissioned once installed on the Site; and
 - deliver to the Employer/ Engineer any new version, together with the updated Operation and Maintenance Manuals.
- (5) The Engineer shall not be obliged to use any new version and that shall not relieve the Contractor of any of its obligations. Any effect upon the performance or operation of the computer controlled system that may be caused by a new version shall be brought to the Engineer's attention including updating the files to suit new version.

12.2 Security Obligations

- (1) Within 14 days of the application of any software into the Permanent Works by the Contractor, the Contractor shall submit to the Engineer for retention by the Employer two backup_ copies of the software, which shall include, without limitation
- All licenses in favour of Employer, for their use.
 - All source and executable code

12.3 Error Correction

- (1) When a fault is discovered within delivered software or documentation, the Contractor shall take necessary steps to rectify errors or faults at the earliest opportunity.

12.4 Training

- (1) The Contractor shall provide training for the Employer / Engineer's staff to enable the Employer / Engineer to make proper use of any software and its new versions.
- (2) Where the software is to be supplied by an organization other than the Contractor, the Contractor shall pass on all requirements in their entirety and without modification. The Contractor shall, however, remain responsible for the execution of the Works.

13 Contractor's Coordination with Others

The Contractor shall take in to account the interface coordination requirements of Other Contractors who will be working at site and or duly constituted authorities who will be employed or required by the Employer to execute the work within or adjacent to site in connection with or ancillary to the works. In this regard, the Employer/Engineer shall organize coordination meetings to sort out any interfacing issues amongst the interfacing Contractors. In addition to the coordination meetings to be arranged by the Employer / Engineer, the Contractor may also arrange his own coordination meetings with the Other Contractors.

The Contractor shall fully integrate and coordinate the design and construction of the Works with Other Contractors, Interfacing Parties and related bodies parties and entities including but not limited to Indian Railways, RDSO, as well as the designated contractors / consultants / service providers, other than other contractors who are engaged in part of the Works, relevant statutory authorities, relevant public utility agencies and adjacent contractors who are or may be working adjacent to the Site.

The Contractor shall be responsible for keeping Other Contractors fully informed on all matters of progress insofar as those may affect the progress of Other Contractors and for all coordination with such Other Contractors.

The Contractor shall actively seek out solutions to integration issues, and to anticipate, to plan for, and to comply with the needs of these related parties, which are properly required and consistent with the obligations under the Contract. The Contractor shall comply in this respect with the requirements of Appendix 7 [Contractor's Coordination with Others] to the Employer's Requirements. Further details regarding design co-ordination with the other related entities are given in the Employer's Requirements – Design and Employer's Requirements – Construction.

In case of the Other Contractor is not in place, the Contractor shall co-ordinate with the Engineer/Employer for the Interfacing issues.

The Engineer/ Employer shall facilitate in drawing up the Interface Management Plan amongst the interfacing contractors.

14 Site Installation and Demobilization

- 14.1 Within twenty eight days of the Commencement Date, the Contractor shall establish a temporary office at the Site duly equipped for the Contractor's Representative and his supervisory personnel. All correspondence shall continue to be addressed to the Contractor's

registered head office but shall be sent to this office at the Site and shall be deemed to have been sent to the Contractor's head office.

- 14.2 All necessary Temporary Works regarding site installation such as Temporary Facilities and Temporary Utility Services shall be provided, equipped, and maintained by the Contractor for his own use, for his sub-contractors, for the Engineer and the Employer. The detailed requirements are described in Appendix 6 [Temporary Works] to the Employer's Requirements.
- 14.3 All the Temporary Facilities and Temporary Utilities Services including but not limited to those defined in Appendix 6 [Temporary Works] to the Employer's Requirements shall be provided, equipped, and maintained in good conditions and shall not be discontinued without the consent of the Engineer but not later than the issue of Taking-Over Certificate.

15 Site Surveys and Investigations

Prior to the validation of the alignment of bridge and its approaches and reviews of the various Reference Drawings by the Contractor, the Contractor shall carry out validation of the data as provided by the Employer and any additional surveys if considered necessary by the Contractor including any other geotechnical investigations to commence his design.

Validation of the data and any additional surveys as considered necessary by the Contractor and geotechnical investigations are particularly important in this Contract which imposes on the Contractor a single point responsibility for the whole design and construction of the Works.

The Contractor shall plan and programme those validation and additional surveys if considered necessary and investigations required to commence the design of Works and develop them to the Survey Plan and Programme as detailed in Additional Survey and Setting Out, Appendix 10 [Requirements for Design] and Appendix 3 [Project Programme Requirements] to the Employer's Requirements.

The Contractor shall summarise the results of Validation of Data and Additional Survey including all the site surveys and investigations in to different reports which shall form part of the Survey Report, and shall be submitted to the Engineer for his consent. The Contractor shall continue to be solely responsible for the accuracy and entirety of all the site surveys and investigations including Traverse Survey, Topographic Survey, Centre Line Survey and Geotechnical Investigations etc. throughout the Contract. Any 'Notice of No Objection' from the Engineer does not absolve the Contractor from his responsibility for accurately designing the Alignment and setting out the Works within the available Right of Way.

15.1 General

First, the Contractor shall establish horizontal and vertical control system (x, y, z) at the Site and establish DFC Bench marks using GTS Bench Marks, and locate / confirm the ROW marks given by the Employer.

Second, the Contractor shall carry out validation of the data provided by the Employer and additional topographic, hydrological surveys, if considered necessary by him to validate the details of the Horizontal and Vertical Alignment of the bridge and its approaches in compliance with the Design Criteria (as specified in the Employer's Requirements – Design, Volume 3 of the Bid Documents) with which the Contractor shall eventually develop the Technical Design.

The Contractor shall summarize the results of validation of the data and additional surveys so far in the Survey Report and develop the Site Location Map, and the Structure Setting-Out Map and submit them to the Engineer for consent as part of the Technical Design Package.

Based on the above, the Contractor shall validate the alignment of the bridge and its approaches in compliance with the Design Criteria (as specified in Employer's Requirements – Design in Volume 3 of the Bid Documents) and within the available ROW. Upon consent by the Engineer to the same, it shall be referred to as the Final Alignment Plan and Profile Drawings of the bridges and their approaches.

Thirdly, the Contractor shall carry out physical staking of the alignment of the approaches at the Site based on the Final Alignment Plan and Profile Drawings and also verify and ensure the ROW stacking in the same interval as the horizontal staking so as to ensure the sufficiency of the available ROW.

Finally, upon the Construction Design completion by the "Good for Construction" Notice, the Contractor shall set out the Works to commence the construction with consistent accuracy and entirely throughout the design and construction stages.

15.2. Horizontal and Vertical Control System

15.2.1 DFC Bench Mark Installation at Site

A set of the DFC Bench Marks comprising a horizontal control system (x, y) and vertical control system (z) shall be established at the Site based on the GTS Bench Marks which are established and maintained by the Survey of India /Differential Global Positioning System (DGPS) . The Contractor shall ensure that horizontal and vertical position (x, y, z) of each DFC Bench Mark shall not be interfered and affected by any Permanent and Temporary Works.

- (i) All pillars shall be of thin metal fabricated in dimensions of 20cm x 20cm x h cm (height above the ground (h) shall be determined at

the Site). Exposed surface of the pillars shall be appropriately painted with enamel paint of a color as specified by the Engineer to be easily identified. A concrete base on which the steel pillar is founded shall be 1:3:6 lean concrete and enable to support the pillar stable enough. Details shall be developed by the Contractor and submit to the Engineer for review. Each pillar shall be protected by retractable fencing or other similar measures to keep the pillar from accidentally being touched, hit and moved.

- (ii) The pillars for the DFC Bench Marks shall be staked on both sides of the alignment of the approaches of the bridges in the ROW, as consented by the Engineer. The Contractor may establish temporary bench marks (x, y, z) which shall be staked and identified clearly painted in different color from the DFC Bench Marks as described hereinbefore. These temporary bench marks will be used to running a closed traverse for checking the DFC Bench Marks.
- (iii) The Contractor shall plan and programme to establish a horizontal and vertical control system at the Site by DGPS and correlate and adjust the system based on the GTS Bench Marks or with reference to the existing control points as specified by the Engineer. The Contractor shall develop the plan and program in the Survey Plan and the Survey Programme and submit to the Engineer as specified Appendices 3 [Project Programme Requirements], 8 [Requirements on Documents and Drawings] and Appendix-11 [Requirements for Construction] to the Employer's Requirements. The Survey Plan shall include, but not be limited to, details of the survey methods, error adjustment/ correction, accuracy achieved, means of accuracy maintained, and the coordination with others with respect to the consistent accuracy and entirety.
- (v) The Contractor shall summarize the Traverse Survey results with verification studies in the DFC Benchmark Establishing Report.
- (vi) Upon establishing the DFC Bench Marks completing all necessary adjustments, the final and detailed survey data of the DFC Bench Marks shall be submitted to the Engineer for consent. Upon 'Notice of No Objection' from the Engineer to the DFC Benchmark Establishing Report, the system shall be the sole horizontal and vertical control system (x, y, z) and the reference pillars provided with the coordinates (x, y, z), as described herein and shall be referred to as the DFC Bench Marks which shall be consistently applied to the project under this Contract. DFC Benchmark Establishing Report containing the Traverse Survey results shall also be included as part of the Survey Report as detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements.
- (vii) The DFC Bench Marks shall be periodically checked (at the intervals as consented by the Engineer) by running closed traverses

and closed level works. The Contractor shall submit the results to the Engineer for review. The periodical check shall include the nearest equivalent bench marks established by the Other Contractor(s) with sufficient communication with him/them. If any discrepancy which deems to be crucial is found, the Contractor shall carry out appropriate corrective measures under the instruction of the Engineer.

- (viii) The equipment to be adopted in the survey to establish the horizontal control system shall be Static DGPS System (horizontal/ vertical) and Total Stations of adequate accuracy and to establish vertical control system shall be auto levels which have sufficient accuracy to meet the requirements hereinafter. The calibration shall be checked & re-validated from time to time at a pre-determined interval or before the expiry of the calibration certificate whichever is earlier.

15.2.2 Requirements for Horizontal Control

- (1) The Contractor shall establish a horizontal control system at the Site by DGPS, providing each DFC Bench Mark with a horizontal coordinate (x, y). The horizontal coordinate (x, y) shall be checked by the existing control points, if available. The Contractor shall coordinate with the adjacent Other Contractor(s) if any to ensure that the DFC Bench Marks established by the Contractor and the equivalent bench marks established by the Other 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 in the project under this Contract.
- (2) The horizontal control system shall be developed by DGPS and by running a closed traverse on the DFC Bench Marks and the temporary bench marks along the alignment.
- (3) The Contractor shall compute angular closing error of the traverse followed by linear error. The error within the permissible limits of the traverse line shall be balanced by the Transit Method. In case the errors are beyond the permissible limits, the traverse survey shall be carried out until the resulted error is within the permissible limits.
- (4) The Contractor shall summarize the established coordinates (x, y) with necessary adjustments of all DFC Bench Marks along with raw observation data downloaded from Total Station, calculation process and descriptions of all DFC Bench Marks and submit to the Engineer for his review.

15.2.3 Requirements for Vertical Control

- (1) The Contractor shall establish a vertical control system at the Site

by DGPS, providing each DFC Bench Mark with a vertical coordinate (z). The vertical coordinate (z) shall be checked by the GTS Bench Marks of the Survey of India practically as many as possible to ensure the entire vertical control system is consistent including the equivalent system of the adjacent Other Contractor(s) if any. 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 in the project under this Contract.

- (2) The vertical control system shall be developed by DGPS or by running a closed level work on the DFC Bench Marks and the temporary bench marks 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.
- (3) Each level work shall be connected with the DFC Bench Marks which have the consistent accuracy and entirety in the system and the system of the adjacent Other Contractor(s) and properly maintained at the Site. In case, the accuracy of loop closure exceeds the permissible limits, the entire loop shall be repeated until the desired accuracy is achieved.
- (4) The Contractor shall summarize the established coordinates (z) of all DFC Bench Marks with necessary adjustments along with raw observation data, calculation sheets and descriptions of all control marks and submit to the Engineer for review.

15.3 Survey

15.3.1 Topographic Survey

- (1) The Contractor, after carrying out the validation and any additional survey, if considered necessary by him, shall ensure the accurate topography of the Site so that he could be fully satisfied to commence the design of Permanent Works. The DFC Bench Marks as established by the Contractor shall be consistently used for the surveys.
- (2) The Contractor shall confirm and locate all the Right of Way marks given by the Employer at the Site and provide them with coordinates (x, y, z) so that both Alignment of the bridge and its approaches and Right of Way are located based on the same horizontal control system.
- (3) The Contractor shall develop the documents including all reports, drawings, and maps as described in Appendix 10 [Requirements for Design] and Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements. The Contractor shall summarise the results of Validation of Data, Additional Survey and

Setting Out in the Survey Report and submittals to be developed by the Contractor shall include - DFC Bench Mark Establishing Plan; Survey Plan; DFC Bench Mark Establishing Report; Survey Report; Site Location Map; Rail track Formation Plan and Profile Drawings; Bridge Structure Setting-out Map; Final Alignment Plan and Profile Drawings of the bridge and its approaches including x, y & z co-ordinates for each of the pier, abutment of the bridge; and Cross Section Alignment Drawings for approaches to the bridge (at an interval of 20m).

- (4) During traversing the periphery areas, the Contractor shall pick up broad alignment of important roads, rivers, canals, and locations of important buildings and facilities etc. whenever considered necessary to develop the Alignment Plan and Profile Drawings and other required drawings as part of the Technical Design.

15.3.2 Horizontal Alignment Staking

- (1) The Horizontal Alignment of the bridge as validated by the Contractor and defined by the coordinates (x, y) of the centerline of the track shall define the co-ordinates of:
 - a) Each of the piers and abutments of the bridges; and
 - b) Approaches to the bridge at an interval of twenty meters along the proposed alignment
- (2) The Horizontal Alignment of the approaches on both sides of the bridge, defined by the coordinates (x, y) of the centerline of the track shall be staked at an interval of twenty (20) meters along the proposed Alignment. While staking the Horizontal Alignment of the approaches to the bridge, at Site, the Contractor shall ensure staking of the ROW as per the relevant provisions of Indian Railway Engineering Code.

The Contractor shall consistently apply the coordinates established by the Contractor on the DFC Bench Marks hereinbefore to the staking and any other surveys herein.
- (3) The proposed Rail Track Formation Level (as validated by the Contractor during validation of the alignment) shall also be marked on the stakes to indicate the height of the embankment.
- (4) Upon completing the Horizontal Alignment staking and providing all the ROW marks with coordinates (x, y, z), the Contractor shall submit the final coordinates (x, y, z) data of the Vertical Alignment in respect of each pier / abutment as well as at an interval of twenty (20) meters in case of the approaches to the bridges, the ROW coordinates (x, y, z) at an interval approximately twenty (20) meters, horizontal alignment calculation report including , IP coordinates (x, y, z) and direction and the Final Alignment Plan and Profile Drawings to the Engineer.

- (5) 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 in conjunction with the finalised Alignment Plan and Profile Drawings in the "Alignment Verification Report" as detailed in Appendix 10 [Requirements of Design] and submit to the Engineer for his consent
- (6) Upon consent of the Engineer to the report, the confirmed Alignment of the bridges and their approaches 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 maintained and remain consistent throughout the Contract period.

15.4 Setting-Out of the Bridge

- (1) The Contractor shall prepare a detailed methodology for accurate setting out of the bridge alignment including location of each of the pier and shall get the same consented by the Engineer.
- (2) The Contractor shall consistently apply the DFC Bench Marks to the setting-out. The Setting-out for the bridge structures shall be checked by executing the Internal Authorization System as described Appendix 4 [Quality Assurance] to the Employer's Requirements.

15.5 Auxiliary Works

It shall be the Contractors responsibility to provide all the auxiliary works and take precautions necessary to ensure that the survey works are accurate, accountable and secure. The Contractor shall ensure but not limited to the following:

- (1) perform all necessary calculations in a clear presentation of computations and results in order to facilitate verification by the Contractor himself and by the Engineer;
- (2) remove machinery and obstructions from the required sight-lines;
- (3) stop all machinery, drilling, blasting, driving and other work causing ground vibration and stop all smoke, dust, gas, etc., obscuring clear view or causing refraction. If it is hindering the survey work;
- (4) restrict or stop traffic of persons and vehicles near instruments or in sight-lines during instrument observations as required;
- (5) provide adequate labor, and materials as deemed necessary and suitable by the Engineer for the control and auxiliary surveys; and

- (6) carry out additional topographical surveys in cases where the existing topographical data is, in the opinion of the Engineer, insufficient for accurate measurement of the Works.

15.6 Geotechnical Investigations

- (1) Employer has carried out geotechnical investigation along the alignment of the bridge within the Scope of the Work and details of the same including the bore log data etc. are available for reference of the Contractor. The contractor shall carry out the confirmatory exploratory core boring at his own cost. The Employer shall not entertain any claim in case the contractor encounters the strata different than that indicated in the Reference Documents.
- (2) The Contractor shall carry out the exploratory core boring for the bridge and its approaches in the Scope of Work, in compliance with the following as a minimum requirement:
 - (a) In case of Bridge, the exploratory bore holes shall be made at every sub-structure location; and
 - (b) The Contractor shall carry out the exploratory core borings for locations on which the Rail Track Formation is to be constructed at least one (1) exploratory bore hole for each bridge approach alignment.

In case the Contractor considers that additional geotechnical investigation are necessary for undertaking the Detailed Design work, this shall be done by the Contractor at his own cost.

- (3) The Contractor shall also carry out Plate Load Tests, as required and at the locations as consented by the Engineer, to determine the bearing capacity of the soil.
- (4) Based on the geotechnical investigation as above, the Contractor shall submit the Geotechnical Interpretative Report on Structure Foundation and Rail track Formation to the Engineer for review.

15.7 Hydrological Survey

The Contractor shall carryout validation of the Hydrological data provided by the Employer including additional Hydrological surveys, if considered necessary, for design of various bridge components.

16 Project Management Information System (PMIS)

The Contractor shall devise and utilize a PMIS such that all documents generated by the Contractor can be transmitted to the Engineer by electronic means (and vice versa) and that all documents generated by either party are electronically captured at the point of origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer Office at site and the Employer's

site office and Headquarters Office by the Contractor. The documents shall comply with the standards as specified in Appendix 5 [CAD and Document Standards] to the Employer's Requirements.

17 Contractor's Project Organizations

- 17.1 The Contractor shall have a competent team of managers, engineers, technical staff, experts and support staff etc so as to complete the work in a satisfactory manner in compliance with the Employer's Requirements and the specifications. The designations of the various project organizations team members shall be accepted by the Engineer before adoption.
- 17.2 The Contractor shall establish an organizational and procedural scheme which ensures all the Works are carried out strictly in compliance with the Employer's Requirements and the Specifications and for the benefit of the Employer throughout the Contractor's design/build implementation as required in Employer's Requirement – Design/Construction and Appendix 4 [Quality Assurance] to the Employer's Requirements.

18 Training and Skills Transfer

The Contractor shall ensure that the Employer's personnel and all local contractors and sub-contractors engaged on the Works are given the opportunity for the necessary training and skills transfer to the extent required in the various areas of Civil Works such as Detailed Design, Foundation Works, Fabrication Works, Launching Works, safety, quality assurance, environmental protection, installation procedures, and any other job trainings that facilitate efficient execution of the Works,

19 Confidentiality and Public Relations

- 19.1 The Contractor shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out its obligations under it or to comply with applicable Laws.
- 19.2 The Contractor / Sub-contractors shall not publish, present at seminars, forums or otherwise circulate alone or in conjunction with any other person, any articles, photographs or other materials relating to the Contract, the Site, the Works, the Project or any part thereof, nor impart to the Press, or any radio or television network any information relating thereto, nor allow any representative of the media access to the Site, Contractor's Works Areas, or off-Site place of manufacture, or storage except with the permission, in writing, of the Employer. The provisions of this Sub-Clause shall not exempt the Contractor from complying with any statutory provision in regard to the taking and publication of photographs. The Contractor shall ensure that his Sub-contractors of any tier shall be bound by a like obligation and shall, if so

required by the Employer, enforce the same at his own expense.

20.0 Progress Report

20.1 General

The Contractor shall submit to the Engineer, a Monthly Progress Report (MPR). This Report shall be submitted on the last working day of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty- fifth (25th) day of the month of the submission and referred to as the 'Report Month'. It shall be submitted in a format to which the Engineer shall have given his consent, describing, but not limited to, the topics listed below.

20.2 Design Status

Status of design progress shall be reported including:

- (1) a report detailing the design progress made for 'Technical Design', 'Construction Design, and 'As Built Records', as the case may be and outstanding issues to be resolved with solutions during the reporting period; and
- (2) the progressive and detailed version of the Design Submission Programme or its sub- programme indicating actual achievement dates and forecast dates for outstanding items.

20.3 Physical Progress

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, in respect of all the items / sub-items of the milestones / cost centre in each major / important element of the Work and shall, in particular, address interface issues, problems and resolutions, representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.

The Physical Progress shall be reported including:

- (1) a listed description of all the Works performed during the month with quantified progress and the updated Works Programmes as specified in Appendix 3 [Project Programme Requirements] to the Employer's Requirements showing both scheduled and actual progress of each sub-item of the work corresponding to each milestone / cost centre pertaining to each major / important element of the Work;
- (2) the percentage of each main work activity completed as well as the projected percentage thereof to be completed to the end of the Report Month;

- (3) the total overall percentage of the works completed as well as the projected percentage thereof to be completed in respect of each cost centre, each major / important element of the Work and the project as a whole to the end of the Report Month, and with appropriate comments to explain any differences and how to regain any lost time or set-backs which may have occurred;
- (4) a list of quantities of each major items of the Work (including temporary works) performed during the month vis-a-vis the total estimated quantities to be executed and illustrations showing the exact location of the work done such as concrete lift schedule; and
- (5) a list of major Works (including Temporary Works) schedules to be started within the next two (2) months and estimated quantities thereof. If the expected starting and/or completion dates are different from those shown on the updated programme, an explanation is to be given as detailed in Appendix 3 [Project Programme Requirements] to the Employer's Requirements.

20.4 Coordination

Status and outstanding issues of coordination and interfacing activities with the Other Contractors and other entities to be reported shall include:

- (1) a summary of the coordination and interfacing activities during the Report Month and details of outstanding actions; and
- (2) a schedule of all submissions and consents/approvals outstanding as well as those obtained.

20.5 Procurement

Status of procurement of major items such as plants, equipment, materials and manufactured materials, and material for the earthwork shall be reported including:

- (1) a summary of all significant procurement activities during the Report Month, including action taken to overcome problems;
- (2) a list of major items with description detailing their manufacturer, date of letter of credit, status of manufacturing and its origin, transportation and date of arrival at site (scheduled / actual), reasons for delay, if any and quantities procured immediately and made available for the Works; and
- (3) Delays in procurement, if any, including reasons thereof and mitigation measures.

20.6 Programme Update

Programme Update for the entire project shall include but not limited to the following items:

- (1) The Monthly Programme Update which shall be prepared by

recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall include:

- (a) updated Works Programme to reflect modifications in the design and construction Programme;
 - (b) status of the every Work in progress, its graphic representation (completed and remaining) in respect of the identified Works in the Report Month as well as for all the major Works and relevant activities; and
- (2) The Programme Update shall be accompanied by an Activity Report and a Narrative Statement which shall explain the basis of the contractor's submittal regarding:
- (a) Work Programme – explaining determination of activity duration and describing the Contractor's approach for meeting Key Dates & Milestones as specified in the Contract.
 - (b) Updated Work Programme – stating in the narrative, the Works actually completed and reflecting along the Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:
 - i. Identification of causes of actual and potential delays (if any) in respect of Milestones, Key Dates and Contract Completion dates;
 - ii. Provide explanation of the Works affected due to delays and proposed corrective action / mitigation measures to achieve the Milestones, Key Dates and Contract Completion dates;
 - iii. Identification of any deviation from previous month's Critical Path;
 - iv. Clear identification of every activity with number and description for activities in progress and activities scheduled to be completed; and
 - v. Provision of time required to cater for the Design Changes and Variation order, if any.
 - (c) Programme Status presenting:
 - i. Works Programme status up to and including the current Report Month with cumulative progress to date and a forecast of remaining work.
 - ii. Programme bar-chart size A3 and a time-related logic network diagram on an A1 size, including activity listings.

20.7 Three Month Rolling Programme

- 20.7.1 The Three Months Rolling Programme shall be an expansion of the Works Programme, covering sequential periods of three months.
- 20.7.2 The Three Month Rolling Programme shall provide more detail of the Contractor's plan, organisation and execution of the work within these periods.
- 20.7.3 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.
- 20.7.4 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 A3 size 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.
- 20.7.5 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 / suppliers.
- 20.7.6 Each activity in the Three Month Rolling Programme shall be coded, or described so as to clearly indicate the corresponding activity in the Works Programme.
- 20.7.7 The Three Month Rolling Programme shall be issued on a monthly basis.

20.8 Three Month Rolling Programme Revisions and Updates

- 20.8.1 The Three Month Rolling Programme shall be extended forward each month as described 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.
- 20.8.2 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.
- 20.8.3 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.

20.9 Performance on Quality Management System

The MPR shall also include the Contractor's monitoring report on performance of the Contractor's quality management system and shall include the following as a minimum:

- (a) The submission status and review status of the quality system documents;
- (b) An up-to-date audit schedule and status;
- (c) An up-to-date nonconformity register providing the status of all nonconformity identified by the Engineer or the Contractor within the reporting period and those nonconformities not yet satisfactorily closed;
- (d) A narrative appraisal of the performance of the quality management system, including any nonconformities, shortcomings or problem areas identified and the corrective and preventative action taken or proposed; and
- (e) All the pending issues / references with the Engineer, Employer and the Contractor and the action proposed.

20.10 Financial Status

The MPR should also include the following aspects of the financial status:

- (1) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.
- (2) A spread sheet summarizing each major activity as defined in Appendix 3 [Project Programme Requirements] to the Employer's Requirements, the budget, costs incurred during the period, costs to date, costs to go;
- (3) A spread sheet indicating the status of all payments due and made;
- (4) 'S' curve for the cash flow planned as per the Contract and as actual till the date of MPR including describing the variance;
- (5) A report of the status of any outstanding claims;
- (6) The report shall in particular provide interim updated accounts of continuing claims; and
- (7) Any other information as required by the Engineer.

20.11 Other Items

The minimum following items shall be covered:

- (1) Details of local labour (in man-date by trade classification) employed during the month and including shifts and hours of works executed

and an explanation of any actual or potential problems;

- (2) a table showing actual working hours of each items of construction equipment, a list of stand-by equipment and a list of unserviceable (inoperable) equipment describing action being taken to get it back in operation;
- (3) a quantity list of the Contractor's construction materials consumed or used during the month and accumulated quantities thereof;
- (4) photographs called for in the General Conditions of the Bid Documents;
- (5) a summary of quality control tests (routine tests and check tests) performed on the materials and the products for the Permanent Works during the month including results (in values) of performance on each test and contrasted fluctuations of the properties with the specified range of their acceptability. The results of Quality Audits shall be summarized in the Contractor's monthly reports;
- (6) a general description of the weather, listing rainfall in mm, maximum and minimum temperatures, and river water levels, for each day through the month;
- (7) a statement concerning the effectiveness of the safety/security activities including a list of each accident involving the hospitalization and/or death of any person and list of any major thefts.
- (8) a list of the amount and date of each payment received and amount of any monthly invoice which has been submitted but not yet paid;
- (9) a list of claims (if any) submitted during the month, including claim amounts and extension(s) of time;
- (10) a list of letters, drawings, and documents received from or submitted to the Engineer and/or Employer during the month;
- (11) Resources Mobilisation: Status in respect of key persons and major construction material indicating the resources already available at Site and the proposed mobilization schedule for the next three months;
- (12) Status of all the Temporary Works including temporary facilities and utility services for ontractor's use;
- (13) Status of Borrow Areas arrangement including access roads;
- (14) Status of temporary facilities and utility services for the use of Engineer / Employer; and
- (15) Assistance required from the Employer/Engineer.

21 Monitoring of Progress

21.1.1 Monthly progress report

The Contractor shall submit to the Engineer **4 copies** of a Monthly Progress Report (MPR).

21.1.2 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 physical progress and current status relating to construction including co-ordination, procurement and other miscellaneous items.

21.1.3 A monthly meeting to monitor the progress of the project shall be convened by the Engineer. Contractor's Representative and Representative of all the Other Contractors / Interfacing Parties (as required) shall also attend the meeting. The meeting shall be chaired by the Employer.

21.1.4 The Engineer shall record the proceeding of the monthly meeting and shall circulate the copies of the record to all the concerned and as instructed by the Employer.

21.1.5 Management Meetings

(1) The Employer or the Engineer will require the Contractor to attend a management meeting in order to review the resource mobilisation for future work, works progress or other issues. The Engineer shall record the proceeding of the management meetings and shall supply copies of records of to all those in attendance and as instructed by the Employer.

(2) The items to be discussed at the management meetings will be set out at the first meeting with the concurrence of the Contractor, the Employer and the Engineer.

(3) The minutes of the meeting signed by the Contractor, the Employer and the Engineer shall constitute an official record of matters discussed, but shall not replace any requirement in the Contract for approvals, instructions or decisions to be submitted in writing.

(4) The Contractor shall copy all correspondence, notices and documents related to the management meetings and send them to the Employer, the Engineer and those parties as instructed by the Employer prior to the meeting.

(5) The Contractor shall, when requested with reasonable notice, attend any other meetings convened by the Employer, the Engineer to review works progress or other relevant issues.

- 21.6 A copy of all the reports, as submitted by the Contractor to the Engineer shall be submitted to the Employer by the Engineer along with his comments within 7 days of its submission by the Contractor.

22 Maintenance Report

- 22.1 The Maintenance Report shall be submitted as part of the Technical Design and shall include full details of the long term inspection and maintenance operations for each major component of the bridge and their approaches including drainage etc.

- 22.2 In addition to the various existing Codes and Manuals of Indian Railways as applicable for Operation & Maintenance of permanent Civil Works and other assets, the Contractor shall provide the additional provisions (if any) to the applicable IR Manuals required for the Operation and Maintenance of various assets created as per the Contract. It shall include but shall not be limited to those identified in Clause 15 of Employer's Requirements – Design.

The additional provisions as above shall also include inspection checklist / formats for each area and shall cover but not limited to inspection frequency, items to be inspected, criteria for acceptance, criteria for remedial works and details of the remedial works, including proposed materials and method statements, long term monitoring regime (if any).

23 Intellectual Property Rights and Royalties

- 23.1 The Contractor shall indemnify the Employer and the Engineer from and against all claims and proceedings on account of infringement (or alleged infringement) of any patent rights, registered designs, copyright, design, trademark, trade name, know-how or other intellectual property rights in respect of the Works, Contractor's Equipment, machines, work method or anything whatsoever required for the Works and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. The Contractor shall pay all traffic surcharges and other royalties, license fees, rent and other payments or compensation, if any, for getting stone, sand, gravel, soil/ earth or other materials, machine, process, systems, work methods, or Contractor's Equipment required for the Works. The Contractor shall, in the event of infringement of Intellectual Property Rights, rectify, modify or replace at his own cost the Works, equipment or materials or anything whatsoever required for the Works so that infringement no more exist or in the alternative shall procure necessary rights/license so that there is no infringement of Intellectual Property Rights.

- 23.2 The Contractor shall be promptly notified of any claim under this Sub-Clause made against the Employer. The Contractor shall, at his cost, conduct negotiations for the settlement of such claim, and any litigation or arbitration that may arise from it. The Employer or the Engineer

shall not make any admission which might be prejudicial to the Contractor, unless the Contractor has failed to take over the conduct of the negotiations, litigation or arbitration within a reasonable time after having been so requested. In the event of Contractor failing to act at Engineer's notice, the Employer, in addition to any other remedy as deemed necessary, shall be at full liberty to deduct any such amount of pending claim from any amount due to the Contractor under this Contract or any other Contract.

23.3 Subject to the provisions of relevant clause of the General Conditions:

- a) All designs, drawings, including the computer computations undertaken, software developed by the Contractor solely for the purposes of executing the Project and fulfilling the prescribed contractual requirements of this Contract shall be taken over by the Employer.
- b) Insofar as the patent, copyright or other intellectual property rights in any Plant, Design Data, plans, calculations, drawings, documents, materials, know-how and information relating to the Works shall be vested in the Contractor, the Contractor shall grant to the Employer, his successors and assignees a royalty-free, exclusive and irrevocable license with permission to sublicense to use after completion of the Work 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 (including without limitation the design, manufacture, installation, reconstruction, testing, completion, reinstatement, extension, repair and operation of the Works).
- c) If any patent, registered design or software is developed by the Contractor specifically for the Works, the title thereto shall vest in the Contractor and the Contractor shall grant to the Employer an exclusive irrevocable and royalty-free license to use, repair, copy, modify, enhance, adapt and translate in any form such Software for internal use of the Employer.
- d) If the Contractor uses proprietary software for the purpose of storing or utilizing records, the Contractor shall obtain at his own expense the grant of a license or sub-license to use such software in favour of the Employer and Engineer and shall pay such license fee or other payment as the grantor of such license may require provided that the use of such software under the license may be restricted to use relating to the design, construction, reconstruction, manufacture, completion, reinstatement, extension, repair and operation of the Works or any part thereof.
- e) The Contractor's permission referred to above shall be given, inter-alia, to enable the Employer to disclose (under conditions of

confidentiality satisfactory to the Contractor) programmes and documentation for a third party to undertake the performance of services for the Employer in respect of such programmes and documentation.

- f) If any software is developed under the Contact or used by the Contractor for the purposes of storing or utilizing records over which the Contractor or a third party holds title or other rights, the Contractor shall permit or obtain for the Employer (as the case may require) the right to use and apply that Software free of additional charge (together with any modifications, improvements and developments thereof) for the purpose of the design, manufacture, installation, reconstruction, testing, completion, reinstatement, extension, repair, modification or operation of the Works, or any part thereof, or for the purpose of any Dispute.
- g) The Employer reserves the right to use other Software on or in connection with the Works.

24 Acknowledgement by the Contractor

24.1 The Contractor shall be deemed to have satisfied himself and shall be responsible about the correctness and sufficiency of the Contractor's Proposal to cover all his risks, liabilities and obligations set out in or implied by the Contract and all matters and things necessary for the proper design, procure, execution, installation, completion, testing of the Works and remedying of defects.

24.2 The Contractor shall be responsible for ascertaining and securing the Contractor's obligations as described herein from (a) to (f) at his own cost:

- (a) Conditions bearing upon the proper transportation, disposal, handling and storage of materials (including but not limited to hazardous toxic substances and excavated materials).
- (b) Availability and costs of electricity, water and gas.
- (c) Availability and rates of employment of skilled and unskilled manpower.
- (d) The character and quantum of equipment and facilities needed preliminary to and during the design, procurement, manufacture, installation, execution, and testing of the Works and remedying of any defect.
- (e) The protection of the environment and adjacent structures which will be necessary preliminary to and during the design, procurement, manufacture, installation, execution and testing of the Works and remedying of any defect.
- (f) The location of and the authorization required for and the means

of diversion and facilities required for the purposes of the Works.

25 Obligation on Engineer

It shall be obligatory on the part of the Engineer to seek the prior approval of the Employer on the certain issues specified in relevant clause of the General Conditions and the Particular Conditions.

The Engineer's communication to the Contractor on these aspects shall also mention the specific reference of the Employer's approval. The Copy of all such communications shall also be sent by the Engineer to the Employer for his record.

Section V. Employer's Requirement Volume 2 – Functional

CONTENTS

- 01 Objective**
- 02 Contract Requirements**
- 03 Scope of Works**
- 04 Alignment of Track ways**
- 05 Clearances**
- 06 Durability and Maintenance**
- 07 Interface Requirements**
- 08 Operational Requirements**
- 09 General Responsibilities of the Contractor**
- 10 Aesthetics**
- 11 Planning Submissions**
- 12 Traffic Management**
- 13 Standards**

1 Objective

- 1.1 The purpose and function of the Contract and the Bid Documents is to execute design, construction, completion and testing of the Works by the Contractor in the manner and in time stipulated by the Contract and to achieve the standards, performance and functionality specified in the Contract.

In full recognition of this purpose, and with full acceptance of the obligations, liabilities and risks that may be involved, the Contractor shall undertake the design, construction, and testing of the bridge and its approaches including and without limitation, the design, construction and removal of all the Temporary Works and handover the completed Works to the Employer in a condition in which the Employer can immediately use the Works for the intended purpose, and/or to make them available to the Other Contractors who can commence and carry out its work without delay or disruption. In full recognition of these objectives and with full acceptance of the obligations, the Contractor shall execute the Works taking into account all liabilities and risks that may be involved.

- 1.2 The Specifications developed by the Contractor shall comply with the Employer's Requirements and the specifications as specified in relevant Clause of the Specifications
- 1.3 Design of the Works shall be developed in accordance with the Employer's Requirements and Specifications under the Contract to the Contractor's Technical Design proposals, consent of which by the Engineer is deemed to be completion of the design phase. Procedure of the design development is described in the Employer's Requirement – Design.
- 1.4 The Track, system design and its construction / commissioning shall be carried out by Other Contractors. This includes electrification of the line, signaling systems with automatic block signaling, telecommunications and implementation of train radio and a SCADA control system with the main control centre and other connected works.
- 1.5 Construction, Installation and testing shall be carried out in accordance with the Specifications and with procedures established by the Contractor through his quality management system as also developed by him meeting the requirements as detailed in Appendix 4 [Quality Assurance] to the Employer's Requirements and meeting the Safety, Health and Environment (SHE) requirements as detailed in [Safety, Health and Environment (SHE) Requirements] in the specifications and other requirements under this contract and subject to consent by the Engineer.
- 1.6 The Contractor shall be responsible for obtaining all necessary

approvals from the relevant authorities in Design and Construction of the Works.

- 1.7 In addition, the Contractor shall be responsible for rectification of the defects appearing in the Permanent Works in the manner and to the standards within the time stipulated by the Contract
- 1.8 A copy of all the correspondence including the communication as specified in Clause 25 [Obligations on Engineer] of the Employer's Requirements – General, being exchanged between the Contractor and the Engineer pertaining to the Contract shall also be endorsed to the Employer for his information, by the respective parties.

2 Contract Requirements

- 2.1 The design and performance of the Permanent Works shall comply with the specific requirements contained in the Contract.
- 2.2 The specifications included in the Bid Documents are the minimum specific requirements for certain items. The Contractor shall further develop these specifications to the detailed specifications. The specifications so formulated shall be termed as 'Specifications' after consent of the Engineer.

The Contractor shall also develop Method Statements and test procedures / works procedures / Plans and Manuals / Technical Drawings / Construction Drawings / Sketches etc. giving due consideration to the Specifications, and submit to the Engineer for his consent during the Design Phase.

- 2.3 In addition, the Contractor shall also comply with Indian Railways (IR) rules and regulations for works to be carried out within the DFC Railway Envelope.
- 2.4 The Geotechnical Investigation data (Geotechnical Profile) along the alignment of the bridge within the Scope of Work as well as other Technical Details, as available with the Employer, is included in the Bid Documents and is only for information and reference of the Contractor and the Employer does not claim accuracy / sufficiency of the same. These shall be supplemented by verifications/ additional investigations if considered necessary by the Contractor for development of his Technical Design at his own cost. No claim shall be entertained by the Employer in case the Contractor encounters the data different than that included in Reference Documents during the verification / additional investigation. The Contractor shall be responsible for the Geology and the Geotechnical parameters of the sub-surface strata along the alignment as required for his Technical Design submittals. No claim shall be entertained by the Employer in this regard.

3 Scope of Works

Design and construction of important bridge across river Sone (Approx.length 3.06km) its approaches (on both sides), protection work and other miscellaneous work for double track electrified Railway line including testing and without limitation removal of all temporary works on design, build lumpsum basis between Sonnagar (Rly. km.549) and Dehri-on-Sone (Rly. Km.554) Railway station on Mughal Sarai - Sonnagar Section of Eastern Dedicated Freight Corridor.

For the purpose of clarity and better understanding, the entire Scope of Work has been sub-divided as follows:

- a) Survey and investigation including geotechnical investigation including but not limited to setting out, benchmarking etc.,
- b) Design of Important bridge across river Sone (approximate length 3.06 Kms), its approaches (100 m on both sides) and other miscellaneous works,
- c) construction of bridge well foundation & substructure, bearings, approaches on both sides in embankment upto 100m length/cutting, drainage and other miscellaneous works etc.
- d) PSC bridge superstructure consisting of construction and launching of PSC superstructure spans including trolley refuge, wearing Coat, footpath, ballast-retainer, hand railing, expansion joint, inspection ladder and support for OHE & signaling posts, etc.
- e) Precast cover slab between two PSC girders.
- f) All testing activities and any other activity connected with the construction and completion of the bridge.
- g) The scope of work does not include
 - **any track work**
 - **any System work**

The Scope of Work is identified including but not limited to the following and is subdivided into item-wise Works to further clarify the Scope of Work.

3.1 General :

- (i) **Validation of the Data and Additional Survey:** Validation of the Data provided by the Employer including additional surveys if considered necessary by the Contractor for design of the Permanent Works and verifying the available Right of Way at Site and re-fixing the missing stakes, if any.
- (ii) **Geotechnical Investigations:** The Geotechnical Investigations required for Design of Permanent Works and as described in Employer's Requirement – General for design of Permanent Works.

- (iii) **Hydrological Survey:** Validation of the Hydrological Data provided by the Employer including additional Hydrological surveys, if considered necessary by the Contractor, for design of various bridge components.
- (iv) **Coordination with Others:** The Coordination and Interfacing with the other Contractors and the Interfacing Parties.
- (v) **Relevant Approvals / Clearances:** Obtaining all the necessary approvals / clearances to work relevant Certificates and / or Clearances from Local Authorities viz. completion Certificates, etc. as required. Associating with the Other Contractors, Testing of the bridge and their approaches under the current Package. Preparing relevant documentation for CRS inspection including carrying out changes / rectifications / modifications and making good any deficiencies in the Work, if required.

3.2 Civil Works

- (i) **Bridge Structures:** Design and construction of the structures of Important Bridge including but not limited to:
 - (a) Abutments including Well Foundation
 - (b) Piers including Well Foundation
 - (c) Bearings including bearing inspection platform for each bearing
 - (d) Superstructure / deck including wearing Coat, footpath, railing, ballast retainers, cable ducts, deck drainage system, expansion joints, inspection ladders, etc.
 - (e) Trolley/Maintenance staff refuges as required
 - (f) Supports for locating OHE Mast for traction system and signaling post as required.
 - (g) Protection works for abutment and approaches. (protection work for piers not included in the scope of work).
 - (h) Provision for outfall of the longitudinal side drains coming parallel to the tracks
 - (i) Signages as required
 - (j) Suitable fixtures / arrangement for inspection of superstructure
 - (k) Precast cover slab between two PSC girders.
 - l) Other related works as considered necessary
- (ii) **Earthwork for Railtrack Formation:** Design and construction of the Earthworks in embankment or cutting for the Railtrack Formation for double tracks as identified above for the Main Lines, including but not limited to:
 - (a) Clearing & Grubbing and Striping,

- (b) Excavation with or without Blasting,
 - (c) Embankment,
 - (d) Sub-Grade,
 - (e) Blanket Layer,
 - (f) Slope Protection & Erosion Control,
 - (g) All other related works as considered necessary.
- (iii) **Drainage systems:** Design and construction of drainage system of all along the alignment of the bridge and their approaches including all other related works as considered necessary.
 - (iv) **Earth Retaining Structures:** Design and construction of earth retaining structures along the alignment of the bridge approaches, if required, due to site constraints only.
 - (v) **Uncharted Public Utilities:** Identification of the uncharted public utilities (if required) including co-ordination with the utility owning entities.
 - (vi) **Miscellaneous Works:** Design and construction of all the other miscellaneous works including but not limited to:
 - (a) Wayside Signs and sign boards;
 - (b) Interface Management and Co-ordination with Other Contractors;
 - (c) Testing of elements of the bridges and their approaches for their structural conformity to the Design and the specifications and
 - (d) All other related works as necessary for the successful completion of the Permanent Works.

3.3 Associated Works and Temporary Works

- (i) **Providing & Laying Double Wall Corrugated HDPE Pipes for Other Contractors:** Providing & laying Double Wall Corrugated Pipes of required dia. for Other Contractors (Signalling & Telecommunication and E&M contractors) at two location in each of the approach length on both sides of the bridges as decided by them for crossing of their cables, and as specified in Clause 7.1 and 7.3 below.
- (ii) **Temporary Diversions and Restoration:** All the necessary temporary traffic diversions and traffic management, waterway diversions / diversion of the natural water flow etc. as required for execution of the Permanent and Temporary Works and ensuring smooth flow of the same during construction and restoration of the same on completion of the Works.

- (iii) **Temporary Facilities, Temporary Utilities and Equipment for Use of Employer / Engineer:** Provision of all Temporary Facilities Viz. Provisional Site Office, Engineer's Site Office, Survey Equipment and Temporary Utility Services Viz. Electricity and water supply, sanitation and sewerage, office cleaning, waste and garbage disposal etc. for the use of the Employer and the Engineer, as detailed in Appendix 6 [Temporary Works] to the Employer's Requirements.
- (iv) All the Temporary Works associated with the Permanent Works including but not limited to:
 - (a) Access roads to Site as required
 - (b) Temporary bridges, if required
 - (c) Dismantling of the portion of existing structure (wherever and to the extent required) for the purpose of constructing Permanent Work adjacent to it, with the prior consent of Engineer and approval of Employer.
 - (d) Temporary Facilities / works and Temporary Utility Services as required by the Contractor for the safe execution of the Permanent Works
 - (e) Temporary signages as necessary for safe movement of public and construction machinery
 - (f) Any other temporary work as required for execution of the Permanent works and removal of the same on completion of the Work
- (v) **HIV/AIDS Activities:** HIV-AIDS awareness programme as described in relevant Clause [Health and Safety] of the General Conditions of the Bid Documents.

4 Alignment of Track ways

- 4.1 The proposed Alignment for the bridges and their approaches as developed by the Employer is enclosed in the Drawings as part in the Reference Documents and is further detailed in Appendix 1 [Alignment of Trackways and Work Areas] to the Employer's Requirements. The Employer has acquired the adequate Right of Way (ROW). ROW has also been indicated in the Drawings for reference.
- 4.2 The drawings showing the alignment of the bridge and its approaches on both sides of the bridge as developed by the Employer are enclosed in the Reference Documents. The Contractor shall be responsible for validating the same in compliance with the Design Criteria stipulated in the Employer's Requirements – Design and other technical and geometrical obligatory requirements. While validating the alignment of bridge and its approaches, the Contractor shall ensure that:

- (a) The available Right of Way is not infringed.
- (b) The other obligatory points viz. High Flood Level of the existing bridge, is not infringed.

Prior to the validating the alignment of the bridge and its approaches, the Contractor shall carry out the validation of the data provided by the Employer including additional surveys and Geotechnical Investigations as considered necessary to satisfy himself.

- 4.3 During validation process, if the Contractor notices any conflict with respect to, design-ability and constructability, the Contractor shall immediately notify the same to the Engineer as described in Conditions of the Contract with supporting documents including data, calculations, maps and drawings etc.
- 4.4 With reference to the Alignment Drawings as described above, the Employer has carried out preliminary geotechnical investigations and river data collection including bed levels and High Flood Levels. The said data is included in the Reference Documents of Bid Documents. Based on these data, the conceptual General Arrangement Drawings (GADs) have been developed and included in the Reference Drawings for reference only. The Contractor is expected to generally adopt the spanning arrangement as per the conceptual GADs. The Contractor shall prepare GADs and submit the same to the Engineer as part of the Technical Design Submittals for consent. The Contractor shall also assist the Engineer / Employer to take the necessary approval from Indian Railways, if required.

5 Clearances

- 5.1 The Works shall not infringe the Structure Gauge as shown in the Design Criteria in the Employer's Requirements - Design.
- 5.2 The Contractor shall make all provisions and considerations for the Other Contractors to install railway operating equipment without infringement of the Structure Gauge.
- 5.3 The Contractor shall comply with the requirements of clearances (structural and electrical) to be provided in accordance with requirements of relevant authorities, Indian Railway Standards and Codes including Schedule of Dimensions. Indian Standard Codes and any other laws and regulations in force in India. For the requirement of various clearances, a reference shall be made to the Design Criteria included in the Employer's Requirements – Design.

The Right of Way (ROW) data is included to the Scope of Work above and is also indicated on the Alignment Drawings. The Contractor shall design the Works to be contained totally within the available Right of Way, respecting the relevant laws and regulations being practiced in India. Accordingly the Railtrack formation shall be contained within the available ROW only. However at certain locations if required the earth

retaining structures may also be provided.

6 Durability and Maintenance

- 6.1 The Works shall be designed and constructed such that, if maintained, in accordance with the Contractor's statements of maintainability to be contained in the Contract, they shall endure in a serviceable condition throughout their minimum design lives as described in the Design Criteria in the Employer's Requirements – Design.
- 6.2 The Works shall be designed and constructed so as to minimize the cost of maintenance whilst not compromising the safety or performance characteristics of the railway.
- 6.3 Bearings shall be replaceable with minimum disruption to rail traffic, as appropriate.
- 6.4 Movement joints shall be designed and constructed so as to be maintained and replaced with the minimum of disruption to rail traffic.

7 Interface Requirements

7.1 Traction

- (1) The Other Contractor (E&M Works Contractor) will be required to cross the track for passage of traction return connections at all the feeding post locations, in between AT locations and any other locations. Such locations shall be identified by the Other Contractor (E&M Works Contractor)/Engineer/Employer. At these locations return cable connection has to be to the mid point of impedance bonds to be installed by the Other Contractor. The impedance bond is likely to be located on both up and down tracks between the two rails of both the tracks. Accordingly the Contractor shall be required to co-ordinate and interface with the Other Contractors (E&M Works Contractor)/Engineer/Employer regarding any installations to be provided by them.
- (2) The Contractor shall provide and lay 100mm dia. Double Wall Corrugated HDPE pipes of required length under the track at two locations within each side of the bridge approaches of 100m length to facilitate the Other Contractor (E&M Works Contractor) for making the power supply available at both sides of the track. The exact locations of the same shall be decided by the Other Contractor (E&M Works Contractor)/Engineer.

7.2 Traction Earthing

2 x 25 kV AT electrified railway have heavy rail currents, which may cause enhanced rail voltage. To facilitate flow of normal as well as fault current to earth on reinforced cement concrete / pre-stressed concrete bridges and viaduct structures, a well designed earthing system shall have to be provided at the time of construction of the bridges as per

the procedures stipulated in EN 50122-1.

The Other Contractor(s) (E&M Works Contractor and Signalling & Telecommunication Works Contractor) shall be designing, providing and installing the earthing and traction return paths including traction earthing and bonding of the RCC / PSC / Steel / Composite bridges and viaducts. The Contractor shall co-ordinate with Other Contractors (E&M Works Contractor and Signalling & Telecommunication Works Contractor/Engineer) so that the earthing bars, earthing lugs are provided at the time of casting of the piers and deck girders. A typical arrangement is indicated in Part 4, Reference Documents. However this arrangement is only for the guidance and the final design shall be provided by Other Contractor (E&M Works Contractor). In case the Other Contractor (E&M Works Contractor) is not in position, the design of traction earthing and bonding of bridges shall be provided by Employer through Engineer. All the external connections shall be made by the Other Contractor (E&M Works Contractor).

7.3 Track Crossings of Cables and Space Requirements of Other Contractors

- (1) The Contractor shall be required to co-ordinate and interface with the Other Contractors (E&M Contractor, Signalling and Telecommunication Contractor) regarding any installation to be provided by them. Till such time any other contractor is in place, the co-ordination for these items shall be with Engineer/Employer.
- (2) The Contractor shall provide and lay 100mm dia. Double Wall Corrugated HDPE pipes under the track in the formation for crossing of cable at two locations within each side of the bridge approaches of 100m length at the locations as decided by E&M Contractor, Signalling & Telecommunication contractor/Engineer.

8 Operational Requirements

- 8.1 The Works shall be designed and constructed to permit the Railway to operate continuously and satisfactorily seven days per week, at a maximum design train speed of 100 km/hr where applicable.
- 8.2 The design of the works shall be such that the train operations, does not risk the safety of public and railway employees including during emergency situations.
- 8.3 In the construction of the Works, the Contractor shall, as a fundamental objective and as a priority, ensure that the public and railway employees will, throughout the operational period of the project and within the confines thereof, be provided with as safe an environment as is reasonably possible.

- 8.4 The contractor shall prepare the documents required for CRS Inspection and submit the same to the Engineer.
- 8.5 During construction the contractor shall be responsible for providing and maintaining adequate flood protection measures to ensure protection of the Works.

9 General Responsibilities of the Contractor

- (1) The Contractor shall design, execute, install, complete and test the Works, including providing Construction Documents, within the Time for Completion and shall remedy any defects as per the Contract. The Contractor shall provide all superintendence, labour, Plant, Materials, Contractor's Equipment, Temporary Works including temporary island / bunds/cofferdams / river diversion (as required) for construction of foundation and all other things, whether of a temporary or permanent nature, required in and for such design, execution, installation, completion, testing and remedying of defects.
- (2) The Contractor's responsibility shall not be in any way be diminished nor shall the Contractor's design approach be limited by the Engineer's acceptance of the Contractor's guidance or recommendations as to the engineering standards and design specifications, or by the Engineer's consent, suggestions or recommendations or any aspect of the engineering or design.
- (3) In addition to the above, the Contractor shall undertake various incidental works including but not limited to:
 - a) testing of the elements of the bridge structures and their approaches for their structural conformity to the Design and the Specifications, if required, and preventive as well as corrective actions,
 - b) traffic management around work sites,
 - c) reinstatement of the existing roads, utilities and services (to the extent disturbed by the Contractor),
 - d) obtaining relevant certificates or clearances / acceptance from local civil authorities viz. completion certificates, fire clearances etc. as required.
- (4) Before commencing design, the Contractor shall satisfy himself regarding the Employer's Requirements and the Specifications. The Contractor shall give notice to Engineer of any error, fault, discrepancies or other defects in the Employer's Requirements or such items of reference within the period specified in Sub-Clause 5.1 [General Design Obligations] of the Particular Conditions and Appendix to Bid This shall be further dealt as per sub clause 5.1 of GCC/PCC.

10 Aesthetics

The Permanent Works for important bridge shall be designed to achieve a high aesthetic character and reflecting the aesthetic character and geographic features of the location (wherever possible) subject to consent of the Engineer.

11 Planning Submissions

11.1 All the submissions if required, for obtaining Notice of No Objection in respect of planning for the Works shall be made by the Contractor, typical submission are enumerated below : :

- i) Water Supply and Sewerage – Local Municipality;
- ii) Power Supply – Power Distribution Company or Authority;
- iii) Road Traffic Control - Appropriate Local Authority;
- iv) Reconstruction of road connections, road overpasses and underpasses – Local Public Works Department or other appropriate local authority.
- v) River corrections – Appropriate State or Central River Authority
- vi) Archaeological Sites if any in proximity to the alignment – Appropriate State or Central Govt. Department;

11.2 The list as above is only an indicative and it shall be extended, as necessary by the Contractor, in compliance with the design and construction stages, structures types etc. in accordance with the applicable legislation in force in India.

11.3 The Engineer and Employer shall facilitate the Contractor in such activities, as appropriate.

12 Traffic Management

The Contractor shall carry out the Works so as to minimize disruption to road and pedestrian traffic. The Contractor shall prepare his Traffic Management Plan based on his proposed construction methodology and he shall implement the Traffic Management Plan throughout the whole period of the Contract and modify the same to the extent required during currency of the Contract in consultation with the local authorities and Engineer.

The requirements for the Traffic Management and the Traffic Management Plan are fully detailed in [Safety, Health and Environment (SHE) Requirements] in the specifications (Volume 6 of the Bid Documents) and supplemented by the Employer's Requirements - Construction and its Appendix 11 [Requirements for Construction].

13 Standards

13.1 Equipment and materials (as required within the Scope of Works) 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 by the Engineer for the Work.

- 13.2 The Contractor shall submit **three**(3) original copies (latest publications in English) to the Engineer of all the Codes, Standards and Guidelines proposed to be used for the work including those listed in the specifications of the Bid Documents. Two original copies shall be retained by the Engineer and one original copy shall be forwarded to the Employer for his use.
- 13.3 References to “standards or to materials and equipment of a particular manufacturer” in the Bid Documents shall be regarded as followed by the words “or better”.
- 13.4 The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified and compatible with the Specifications / requirements defined under the Contract and their use shall be subject to the consent of the Engineer.

Section V. Employer's Requirement Volume 3 – Design

CONTENTS

- 01 General**
- 02 Contractor's Organization during Design Phase**
- 03 Requirements during Design Phase**
- 04 Requirements during Construction Phase**
- 05 As-Built Documents**
- 06 Contractor's Coordination with Others**
- 07 Design Review Procedures**
- 08 Design Submissions**
- 09 Design Submission Programme**
- 10 Document Submission**
- 11 Calculations**
- 12 Contractor's Warranty of Design**
- 13 Document Format Requirement**
- 14 Design Criteria**
- 15 Maintenance**

1 General

- 1.1 The Employer's Requirements - Design, specifies the requirements for the preparation and submission of the design of the Works and shall be read in conjunction with the Appendix 10 [Requirements for Design], Appendix 4 [Quality Assurance], Appendix 7[Contractor's Co-ordination with Others] to the Employer's Requirements and other relevant Appendices as applicable. 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 The Contractor shall be responsible for the design of the Works and shall ensure his design is accurate and in compliance with the Employer's Requirements and the Specifications which are deemed to be part of the Contract as defined in the General Conditions and the Particular Conditions of the Bid Documents. The Contractor shall be responsible and ensure that when the Works are completed, it shall be fit for the intended purposes and as are specified in the Contract. In this context, the Contractor shall provide the Professional Indemnity Insurance as specified in Sub-Clause 18.5 [Professional Indemnity Insurance] of the Particular Conditions of the Bid Documents. This insurance shall be in the joint name of the Contractor, Designer and the Employer naming the Employer as the beneficiary.
- 1.3 The Contractor shall establish an office for his dedicated design team in the Main Site Office of the Contractor and referred to as Design Team. The Design Team shall function from this office and all meetings and discussions relating to design shall be held in this office or in the office of Engineer / Employer and / or as instructed by the Engineer. In addition to the requirements herein, the Contractor shall, whenever the Engineer so requests, provide information and participate in discussions that relate to design matters.
- The members of the Design Team shall have the experience and qualification appropriate to the type and magnitude of the design involved. Full details regarding their qualifications and experience shall be submitted to the Engineer for his consent.
- 1.4 To clarify the responsibility and the authority, the Contractor shall also establish a Construction Team independent of the Design Team. Thereby the Contractor is responsible for assuring the quality of the Works governed by quality management system specifically to the Contract and the requirements as described in Appendix 4 [Quality Assurance] to the Employer's Requirements. The integrated system thereby to assure the quality of the Works in this Contract is referred to as the Project Quality Assurance Plan.
- 1.5 The Contractor shall ensure that **the Design Team continues to be represented at Site** 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. If the Engineer asks (in writing) the Contractor to remove a person of his Design Team stating the reasons thereof, the Contractor shall ensure that the person leaves the Site within seven (7) days and shall have no further connection with the Works in the Contract. The Engineer shall also seek consent of the Employer in this regard.

- 1.6.1 There are four Design Submissions covering the Design Phase and Construction Phase:
 - (i) Inception Report
 - (ii) Technical Design
 - (iii) Construction Design
 - (iv) As-Built Documents
- 1.7 During the Design Phase (Technical Design Stage and Construction Design Stage), the Contractor shall comply with all the requirements pertaining to Safety, Health and Environment as specified in [Safety, Health and Environment (SHE) Requirements] in the specifications of the Bid Documents.
- 1.8 If there are discrepancies between documents referring to the same subject, the more stringent criteria shall be followed, unless otherwise the order of precedence described in the relevant documents is not applicable.
- 1.9 All technical solutions, schemes, structures, materials etc. shall be fully compatible with those used by the beneficiary and should not be in conflict with the applicable rules / codes/ manuals and standards as well as legislations in India.
- 1.10 The Contractor shall submit plans, programmes, reports, manuals and drawing as specified in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements for the four design stages in accordance with the provisions herein and as further detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements, to the Engineer for consent and issue of Notices of No Objection. It shall also include the additional information as required by the Engineer and / or required for co-ordination of the design of Other Contractors/Agencies.
- 1.11 The Engineer will review the submissions to be satisfied that the submittal covers the obligations and intended purpose of the design of the Works and fully complies with the Contract.
- 1.12 Details of the Inception Report, Technical Design, Construction Design and As-Built Documents are as follows-

- i) **Inception Report to include :**
- Validation of Alignment and ROW
 - Review of Structures
 - Preliminary Design of Bridge & GADs
 - Preliminary Design Manual
 - Design Warranty Format
 - Proposed Softwares to be used
 - Proposal on Borrow Areas, Quarries
 - Project Organisation Plan
 - Construction Methodology
 - Proposed Equipment.
 - Project QA Plan
 - Project SHE Plan
 - Design Submission Programme
 - Other Documents as included in Appendix 10 of Employer's Requirements
- ii) **Technical Design Package to include :**
- Technical Design / Detailed Design of all the elements & Report
 - Technical Drawings (including Alignment, - Structural Drawings)
 - Detailed Design Manual
 - Method Statements / Fabrication Schemes / Launching Schemes
 - Survey Report (including DFC Benchmark Report, Topo survey, Geotech Report, Uncharted Utilities Report)
 - Slope Stability Analysis Report,
 - Hydrologic Report
 - Interface Report
 - Testing Report
 - Temporary Works Design Report
 - Other Documents as included in Appendix 10 of Employer's Requirements
- iii) **Construction Design Package to include :**
- Construction Design supplementing the Technical Design to facilitate Constr.
 - Construction Drawings / Construction Technical Drawings
 - Working Drawings (including PSC Box, Strands drawings, temporary works drawings, re-bar drawings , fabrication & erection sequences etc.)
 - Construction Practicising Document (including updated Method Statements, SHE plan, QA Plan, Testing plan, Traffic Management plan , Safety Risk Assessment etc.)
 - Other Documents as included in Appendix 10 of Employer's Requirements
- iv) **As-Built Design Document to include:**
- As-Built Drawings
 - O&M Manuals
 - As Built Survey Data
 - As Built Record Data (including damage & settlement if any)
 - Project photographs
 - Official letters regarding the design change acceptance
 - Certificates of acceptance between the Contractor and the Engineer
 - Construction diary
 - Internal certificates of acceptance
 - Contractor's Self-checking Verification
 - Other Documents as included in Appendix 10 of Employer's Requirement

- 1.13 The designs shall be submitted within the specified dates summarized in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements as per the Design Submission Programme consented by the Engineer.
- 1.4 The design of the Works shall be carried out in accordance with the Design Criteria as specified in the Employer's Requirements - Design, Project Quality Assurance Plan as described in Employer's Requirements – General and Appendix 4 [Quality Assurance] to the Employer's Requirements.
- 1.15 All drawings and documents shall be produced and submitted in accordance with the requirements described in the Employer's Requirements.
- 1.16 Design submissions including Technical Design, Construction Design, As-Built Documents shall include a valid "Design Certificate" as specified in Appendix 4 [Quality Assurance] to the Employer's Requirements, duly signed by the Chief Design Engineer of the Contactor's Design Team and Contractor's Representative thereby demonstrating that the Contractor has carried out and fully checked the design as being compliant with the Design Criteria, all quality assurance procedures and fully compliant with the requirements of the Contract.

2 Contractor's Organization during Design Phase

2.1 Project Organization Plan

- (1) The Contractor's Personnel shall be deployed and maintained as per the General Conditions of the Bid Documents.
- (2) Within **42 days** after the Commencement Date, the Contractor shall submit the Project Organization Plan which includes complete project organization chart during the Design Phase, equipped with the functions in a manner as described in Appendix 4 [Quality Assurance] to the Employer's Requirements. The Contractor shall deploy fully qualified personnel in the Design Team with the Engineer's consent for each key personnel during the Design Phase. This plan shall be updated and resubmitted whenever there are changes to the personnel. The Plan shall show the management structure and state clearly the duties, responsibilities and authority of each key and staff member.
- (3) The Contractor shall establish the Design Team in his organization independent of the Construction Team, which shall also be maintained in the construction phase to ensure that the Contractor's design development strictly complies with the Technical Design which has received 'Notice of No Objection' from Engineer and also the Employer's Requirements and the

Specifications without being harmed by the adverse position of the Contractor against the Employer as detailed in Appendix 4 [Quality Assurance] to the Employer's Requirements.

3 Requirements during Design Phase

Before communicating the Notice of No Objection to the Contractor, the Engineer shall seek the approval of the Employer for items mentioned in sub-clause 3.1 of GCC/PCC.

3.1 Review of Indicative Design included in Reference Drawings

- (1) The span arrangement / bridge length is shown in GADs included in the Reference Drawings and Contractor shall review and may modify the same subject to para (2), (3) and (4) below. However the proposed Bridge constructed for DFC tracks shall be sized as a minimum to match the existing bridge on IR tracks on adjacent parallel section to ensure least obstruction to the flow of water and should have same span length (c/c of pier) as adjacent IR bridge.
- (2) The foundations for all piers and abutments will be well Foundations
- (3) Preferably the level of Top of deck of the proposed bridge will be same as the top level of the deck of adjacent IR bridge, unless it is required to be raised due to consideration of clearance from HFL.
- (4) The GADs/ spanning arrangement and the type of foundation for the Bridge shall require the consent of the Engineer prior to undertaking the Technical Design.

3.2 Inception Report

- (1) Within **42 days after the Commencement Date**, the Contractor shall submit the Inception Report as described herein and as further detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements to the Engineer for consent and issue of a Notice of No Objection.
- (2) The Inception Report shall be based on the Contractor's Design and shall be sufficiently developed including the main documentation needed to prepare and to develop the Technical Design and to demonstrate compliance with design requirements, including, but not limited to, survey and investigation plans, design submission plan and programme, reviews of the Employer's Documents. The Inception Report shall sufficiently define the main structures and track alignment etc.

Full details of the contents of the Inception Report are given in Appendix 10 [Requirements for Design] to the Employer's

Requirements and the submittals are summarized in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.

- (3) Design Basis Report which has summarised the various design basis necessary for development of the Technical Design shall be included as part of the Inception Report.
- (4) In addition, general construction, testing methodologies and documentation required to develop the Technical Design shall be submitted.

3.3 Technical Design

- (1) Based on the Contractor's Design and Technical proposals, and supplemented by the Inception Report as consented by the Engineer, the design of the Works shall be fully developed and detailed in the Technical Design by the Contractor. The Technical Design shall be prepared in accordance with the requirements of the Specifications and the Design Criteria included in the Employer's Requirements – Design, Codes, Standards and Manuals as applicable on Indian Railways and applicable regulations/legislation in India and existing international norms/standards wherever required. The developed and updated drawings and documents shall be submitted in the Technical Design Submission to the Engineer for consent and issue of a Notice of No Objection.
- (2) During the preparation of the Technical Design, the Contractor shall in particular:
 - (a) complete all calculations and analysis;
 - (b) delineate all main and all other significant elements;
 - (c) complete all tests and trials and all selection of materials and equipment;
 - (d) assess and take full account of the effect on the Works of the proposed methods of construction, installation, testing and temporary works;
 - (e) complete the validation of all the data provided by the Employer including all the additional surveys, investigations and testing as required to develop the Technical Design of the Works in accordance with the Contract; and
 - (f) draw up a set of the Technical Drawings as summarized in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.
- (3) Engineering studies and comparative evaluations shall be performed to ensure that the designs incorporate features to achieve optimum performance of all elements.
- (4) The Technical Design shall include the Technical Drawings, the Works Specifications, the Technical Design

Report, the Construction Method Statement and all other contents of the Technical Design Submittals as summarized in Appendix 8 [Requirements on Documents and Drawings] and detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements.

- (5) Upon issue of the "Notice of No Objection" in respect of the Technical Design Report, the Contractor shall complete the design in all respects and produce Technical Drawings.
- (6) The Temporary Works as defined in Appendix 6 [Temporary Works] to the Employer's Requirements shall also be identified as a separate activity and the design of those shall be proposed by the Contractor early enough to have sufficient discussions on engineering and procedural issues with the Engineer so as to meet the intent of the Employer's Requirements. The Contractor shall submit the agreed design of the Temporary Works as part of the Technical Design to the Engineer for consent.
- (7) The Contractor shall further sub-divide the Technical Design into Design Packages for submission and the sub-division shall be identified in the Design Submission Programme. The Design Packages are to relate to clearly identifiable parts and shall address the design requirements as described herein. The Design Packages shall facilitate the review and understanding of the Technical Design as a whole and shall be produced and submitted in an orderly, sequential and progressive manner to suit the construction sequence and the Works Programme.
- (8) The issue of separate Notices for such sub-division shall be conditional upon the Contractor having demonstrated, to the satisfaction of the Engineer, that all loadings and load combinations including temporary loadings and the effect of each structure on other structures, public utilities, etc., and the effects of Other Contracts for the whole Works has been fully accommodated in the Technical Design Package.
- (9) Upon completion of Internal Authorisation Process, as specified in Appendix 4 [Quality Assurance] to the Employer's Requirements, the Contractor shall submit the Technical Design as described herein, and as detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements, to the Engineer for consent and issue of a "Notice of No Objection".
- (10) The Contractor shall provide to the Engineer three original copies of full and latest editions of the publications / Technical Standards including the Codes and Standards and other documents that the Contractor propose to use for carrying out the Technical Designs, including other communications between Engineer and the Contractor relevant to this Contract as part of

the Inception Report. Two original copies shall be retained by Engineer and other original copy shall be forwarded to the Employer for his use. Upon completion of the Contract, these documents shall become the property of the Employer.

4 Requirements during Construction Phase

The principal requirements during the Construction Phase are the production, submission and consent of the Construction Design, the As-Built Documents and the O&M Manuals.

4.1 Construction Design

- (1) Upon the issue of a Notice of No Objection in respect of a Technical Design Package, the Contractor shall produce the respective Construction Design Package which shall include, but not limited to,
 - (a) the Technical Drawings,
 - (b) the updated Specifications including Method Statements/ work procedures/ construction sequences,
 - (c) the Working Drawings
 - (d) the Construction Practicing Documents including site sketches, bar bending schedules, bar reference drawings, fabrication and shop drawings, erection sequences,. pre-stressing arrangement, launching scheme, etc and
 - (e) Works Management Plans as detailed in Appendix 10 (Requirements for Design) to the Employer's Requirement.

They shall be endorsed by the Contractor through the Contractor's Internal Authorising Process as being in accordance with the Technical Design for which the Contractor has received the "Notice of No Objection".

- (2) The Construction Design and Construction Technical Drawings including updated Specifications (if any) / Method Statements etc. shall be derived directly from the Technical Design as consented by the Engineer including changes that may be necessary to resolve the comments of the Engineer attached to the Notice of No Objection.
- (3) The Working Drawings and the Construction Practicing Documents shall be prepared to facilitate construction to meet the required workmanship as well as technical requirements. The Works Management Plans shall be prepared to check and monitor the Works in terms of SHE requirements described in [Safety, Health and Environment (SHE) Requirements] in the Specifications of the Bid Documents and Quality Assurance requirement described in Appendix-4 [Quality Assurance] to the Employer's Requirements. The submittals are summarized in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.

- (4) All those drawings and documents are revised, upgraded, detailed and integrated in the Construction Design Package. The Contractor shall fully verify the Construction Design Package through the Internal Authorization Process along with Design Certificate as described in Appendix-4 [Quality Assurance] to the Employer's Requirements by endorsing the original paper drawings and documents.
- (5) Upon the Internal Authorization Process, as specified in Appendix-4 [Quality Assurance] to the Employer's Requirements, the Contractor shall submit the Construction Design Package as the "Request for Construction" as further detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements, to the Engineer for consent and issue of a Notice of No Objection.
- (6) Upon receipt of the "Notice of No Objection" or "Notice of No Objection With Comments", the Contractor shall endorse the original paper drawings in respect of the Working Drawings as "Good For Construction" as per the Internal Authorisation Process as defined in the Design Quality Assurance Plan as per Appendix 4 [Quality Assurance] to the Employer's Requirements. If the Engineer so requires, the said endorsed original paper drawings shall be re-submitted to the Engineer, who shall, if has no objection to the contents of the re-submission, further endorse the original paper drawings by stating that he has no objection to the proposed Working Drawings. On endorsement by the Engineer, the original drawings will forthwith be returned to the Contractor as Working Drawings to be issued to Site.
- (7) The Construction Technical Drawings and the Working Drawings shall be used for construction purposes and only those drawings and documents that have been endorsed and certified through the procedure and have received "Notice of No Objection" as above or those that the Engineer has expressly stated as not requiring his endorsement shall be issued to the Site.
- (8) The Construction of the Works shall be strictly in accordance with the Construction Design Package, for which "Notice of No Objection" has been issued by the Engineer and "Good For Construction" drawings has been issued as per the authorization process detailed as above.
- (9) The Construction Design Package may be divided into multiple submissions for different elements of the bridge and their approaches and as consented by the Engineer. In such a case,
 - (a) Construction Design and Drawings in respect of each element shall be submitted for the bridge ,
 - (b)submittals which are commonly applicable to the

subsequent submissions shall be submitted in the initial submission and each submission shall include correlated and interdependent submittals.

All the divided Construction Design Submissions shall be integrated and compiled into one package at the time when the final submission is made as the Construction Design Package.

- (10) If the Contractor identifies the need for any change to the design due to site conditions or other reason, then the Contractor shall produce a Design Change Notice or Field Change Notice in accordance with procedures described in Appendix 10 [Requirements for Design] to the Employer's Requirements.
- (11) The Contractor shall submit the Construction Design and Drawings for a particular work to the Engineer at least 3 months prior to the planned / scheduled date of commencement of that particular work.

5 As-Built Documents

- (1) The Contractor shall maintain all records necessary for the preparation of the As-Built Documents. The Contractor shall prepare and submit the As-Built Drawings and the Records which, subject to the Engineer's agreement, shall become the contents of the As-Built Documents. The Records are defined and detailed in Appendix 11 [Requirements for Construction] to the Employer's Requirements.
- (2) The As-Built Drawings shall be a full set of the latest revisions of the Construction Technical Drawings, which are updated to incorporate all Design Change Notices and Field Change Notices and as many Working Drawings as necessary to convey a full and true record of the as-built condition of the Works. The As-Built Drawings shall show all changes from the Construction Design, all construction deviations and all other features relevant to the future maintenance and management of the DFCCIL and its facilities. The As-Built Drawings shall be endorsed by the Contractor as true records of the construction of the Works.
- (3) The As-Built Records shall include the recorded photographs as being consistent to the General Conditions of Bid Documents.
- (4) The As-Built Records shall include survey results including geotechnical, all inspection records, and other documents as detailed in Appendix 10 [Requirement for Design] and Appendix 11 [Requirements for Construction] to the Employer's Requirements and shall be verified and endorsed by the Contractor through the Internal Authorization Process, as specified in Appendix 4 [Quality Assurance] to the Employer's

Requirements, as true records of the construction of the Works.

- (5) As part of the As Built Documents, the Contractor shall maintain all records necessary for the financial completion of the project. These records shall consist of as a minimum but not limited to the following:
 - (a) The implemented work according to activities, places and price
 - (b) Used Material – type, name of manufacturers along with batch number, place and price etc.
 - (c) Any other record as required by the Engineer / Employer
- (6) The Operation and Maintenance Manuals (O&M Manuals) shall be included as part of the As-Built Documents. O&M Manuals are generally prepared for the Employer's operation and the Other Contractor's works and shall include, but not limited to, the O&M Manual for Bridge Structures.
- (7) All the As Built Drawings and Records shall be submitted prior to the commencement of the testing. O&M Manuals shall be submitted within the period specified in the Employer's Requirements – Design in accordance with the Specifications and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works. The Work shall not be considered to be completed for the purposes of issue of Taking over Certificate until these documents and manuals have been submitted and accepted by the Engineer.

6 Contractor's Coordination with Others

6.1 Other Contractors

- (1) The Contractor shall fully coordinate the design of the Works with the design of the Other Contractors/Agencies/requirements and shall follow the interfacing requirements as stipulated in the General Conditions of the Bid Documents and as further detailed in Appendix 7 [Contractor's Coordination with Others] to the Employer's Requirements.
- (2) The provision includes access to the Other Contractors including but not limited to, OHE mast foundations, Signalling & Telecommunication equipment, other embedded materials, maintenance access and delivery routes for the installation and replacement of the plant, access facilities, lifting hooks and beams, and personnel access and means of escape, if appropriate.
- (3) Those Works, which are necessary for the Other Contractors/Agencies/requirements, are fully coordinated and provided

throughout the Technical Design development and the results shall be recorded and summarized in the Combined Service Drawings and the Interface Report on Other Contractors as part of the Technical Design and the Construction Design.

6.2 External Related Parties

The Contractor shall fully coordinate the design of the Works with all relevant bodies and entities, in particular government authorities, departments and regulatory bodies, public utility companies, and the consultants, and contractors of adjacent projects whether ongoing or planned, as advised by the Engineer. The Contractor shall identify all such related parties in his Interface Management Plan (IMP) and other relevant requirements detailed in Appendix 7 [Contractor's Coordination with Others] to the Employer's Requirements.

7 Design Review Procedures

7.1 General

- (1) The designs for all four Design Stages shall be submitted for review and consent to the Engineer. The form and the procedures prepared in the Contract shall not release or remove the Contractor's responsibility for the design under the Contract as indicated in the General Conditions of Bid Documents.
- (2) The issue of a Notice of No Objection will be without prejudice to the issue of any future Notices.
- (3) The Contractor shall, prior to the submission of the Technical Design, obtain all required and/or statutory approvals that relate to that submission and demonstrate that all required approvals have been obtained.
- (4) Supplemental, supporting information to the design submission under review may be requested by the Engineer. The Contractor shall supply such information within the time specified by the Engineer.
- (5) All submissions shall be accompanied by three (3) original copies of "Design Certificate" format of which is appended as "Attachment QA-1" to the Appendix - 4 [Quality Assurance] to the Employer's Requirements, as part of the Internal Authorisation Process as set out in Appendix - 4 [Quality Assurance] to the Employer's Requirements.

8 Design Submissions

- 8.1 In the case of submissions subsequent to the Technical Design, the Design Data shall be in accordance with the Employer's Requirements and the Technical Design.

- 8.2 The Contractor shall submit to the Engineer all the Designs and relevant Design Data together with the Design Certificates, on or before the respective dates for submission shown on the Design Submission Programme or the Works Programme. In the event that a resubmission of Design / Design Data is required, such resubmission shall be made as soon as practicable after the receipt of the relevant statement of objections. All submissions of Design Data shall include the copies as stipulated in the Employer's Requirements.
- 8.3 Following receipt of a submission of Design and Design Data, the Engineer shall, within the period specified in Appendix 9 [Documents Submission and Review Procedure] to the Employer's Requirements, respond as per the procedure defined in the Appendix 9 and issue "Notice of No Objection" or "Notice of No Objection with 'A' Comments" or "Notice of Objection with Comments" as the case may be. The Contractor shall comply with the requirements accordingly as specified therein.
- 8.4 The issue of a Notice of No Objection in relation to any submission of Design shall be entirely without prejudice to the review of subsequent submissions of Design or to any subsequent request for a Contractor's Variation, and shall not bind the Engineer in any manner whatsoever when deciding whether to accept or not to accept the issue.

9 Design Submission Programme

- 9.1 The Contractor shall prepare the Design Submission Programme (for Design Phase and Construction Phase) which is to set out fully the Contractor's anticipated programme for the preparation, submission by the Contractor and review of the Design Packages, the issue of Notices by the Engineer for all stages of design. The Design Submission Programme shall cover all submissions during the Design Phase and the Construction Phase.
- 9.2 The Design Submission Programme shall:
- (a) be deemed to comprise part of the Contractual Construction Programme and be in any case consistent and comply with all relevant Key Dates in the latest Contractual Construction Programme;
 - (b) identify dates and subjects by which the Engineer's response should be made;
 - (c) make adequate allowance for periods of time for review by the Engineer as specified in Appendix 9 [Document Submission and Review Procedure] to the Employer's Requirement
 - (d) clarify correlations by identifying, describing, cross-referencing and explaining the various Design Submissions including multiple submissions of the design for the different elements of the bridges and their approaches;

- (e) make adequate allowance for the design and development of the specialist works /sub-contractor works;
 - (f) indicate the interfacing design activities in respect of each of the Other Contractor / Interfacing Parties and external related parties; and
 - (g) shall meet the requirements as specified in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.
- 9.3 The Contractor shall submit the Design Submission Programme to the Engineer within forty-two (42) days after the Commencement Date, and thereafter up-dated versions thereof at intervals of not more than one (1) month throughout the Design Phase. Such updates shall be included as an exhibit in the Contractor's Monthly Progress Report.
- 9.4 The Contractor shall submit complete set of documents requested by any Indian legislation, as well as approved As Built Documents and certificates for conclusion of any legislative procedures.
- 9.5 General requirements which are applicable to the Design Submission Programme are described in Appendix 3 [Project Programme Requirements] to the Employer's Requirements.

10 Document Submission

The Contractor's Technical Proposals shall be amplified during the design stages (Inception Report, Technical Design and Construction Design). The following process of document submission shall be generally followed:

- (1) The Contractor shall submit drawings and documents, as required by the Contract, to the Engineer in accordance with the Design Submission Programme meeting the requirements as specified in Appendix 10 [Requirements of Design] and Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements. The Construction Design submittals shall be made sufficiently before the Works are to be carried out to give the Engineer reasonable time to examine the drawings or other documents and to prepare comments within the response time as specified in Appendix 9 [Documents Submission and Review Procedure] to the Employer's Requirements.
- (2) Where the consent / Notice of No Objection from the Engineer is required, the Engineer shall notify the Contractor in writing of his decision within such period as stipulated in Appendix 9 [Documents Submission and Review Procedure] to the Employer's Requirements.
- (3) If the Engineer has reasonable cause for being dissatisfied with

the submissions made by the Contractor, the Engineer shall require the Contractor in writing to make such amendments thereto as the Engineer may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended documents for Engineer's consent.

- (4) Within 7 days of notification of the Engineer's consent / "Notice of No Objection" or "Notice of No Objection with Comments", the Contractor shall provide the Engineer with the type and numbers of sets of the relevant drawings and / or documents as stipulated in the Employer's Requirements for further execution of the process.
- (5) 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.
- (6) 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 construction documents shall not amount to any waiver and shall not relieve the Contractor of his obligations under the Contract.
- (7) 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.

11 Calculations

- 11.1 Unless otherwise required by the Engineer, calculations shall be submitted together with the respective Design Package submissions.
- 11.2 A comprehensive set of calculations for the whole of the Technical Design and the Construction Design and Technical Drawings / Working Drawings (in the form acceptable to the Engineer) shall be submitted by the Contractor to the Engineer for consent as part of the relevant submittals.

- 11.3 Should the design of the Works be revised thereafter and such revision render the submitted calculations superseded, then the Contractor shall prepare and submit revised calculations at the same time the revised design is submitted.
- 11.4 The Engineer shall require the Contractor to submit and install one copy all the applicable software as used by the Contractor for the Design, duly licensed in the name of Employer, including in-house software programme / worksheets developed by the Contractor, computer input and programme logic prior to the acceptance of any computer output. The Contractor shall submit the same to the Engineer without any additional cost.
- 11.5 The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

12 Contractor's Warranty of Design

- 12.1 The Contractor warrants that the Contractor's design (in accordance with Sub-Clause 4.1 [Contractor's General Obligations] of the General Conditions and the Particular Conditions (Part 3 of the Bid Documents)) meets the Employer's Requirements and the Specifications and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the Employer's Requirements and the Specifications or any part thereof, the Contractor's design shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost.
- 12.2 The Contractor shall indemnify the Employer against any damage, expense, liability, loss or claim, which the Employer might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this Clause.
- 12.3 The Contractor further specifies and is deemed to have checked and accepted full responsibility for the Contractor's part of the design in accordance with the General Conditions and the Particular Conditions of the Bid Documents,
- (a) Notwithstanding that such design may be or have been prepared, developed or issued by the Employer which has been checked by the Contractor, any of Contractor's consultants, his sub-contractor's and/or his qualified personnel/persons or cause to be prepared, developed or issued by others.
 - (b) Notwithstanding any warranties, guaranties and/or indemnities that may be or may have been submitted by any other person.
 - (c) Notwithstanding that the same have been accepted by the Engineer.

- 12.4 The Contractor shall ensure compliance of provision of all laws of land in force and enacted from time to time and:
- (a) Ensure compliance of the regulations or bye-laws of any local body and utilities.
 - (b) The contractor will arrange necessary clearances and approvals before the work is taken up. Nothing extra will be paid by Employer on this account.
 - (c) Ignorance of rules, regulations and bye-laws shall not constitute a basis for any claim at any stage of work.
- 12.5 **The Design Warranty** shall be submitted by the Contractor as part of the Inception Report and shall be as per the format included in the Bid Documents.

13 Document Format Requirement

Detailed requirements regarding the number of copies of drawings and documents and their standards required for submissions, the acceptable file formats and content formats are given in Appendix 5 [CAD and Document Standards] to the Employer's Requirements. After receipt of "Notice of No Objection" from the Engineer, the Contractor shall submit three (3) copies of the Design and / or Drawings for the use of the Engineer.

14 Design Criteria

14.1 General

The design of the Works shall comply with the relevant Indian Railway standards, Codes, Specifications, manuals and guidelines as published by Indian Railways / RDSO, Indian Standards, Indian Road Congress (IRC) codes and specifications and other International codes as specified in the Specifications of the Bid Documents and as applicable, and with the consent of the Engineer. The precedence of the various codal provisions shall be as specified in of the Specifications of the Bid Documents and the Employer's Requirements.

The Design Criteria shall be read in conjunction with the, Specifications as described in the Bid Documents, General and Particular Conditions of Contract in Bid Documents and other documents forming part of the Contract.

The project entails construction of double-track electrified railway Bridge capable of handling DFC loading. The bridge, formation and other structures shall be designed to allow movement of trains with DFC loading operating at maximum train speed of up to 100 Km/hr.

All levels shall be quoted in meters correct to three decimal places and shall be with respect to Mean Sea Level Datum India.

14.2 Design Principles

The proposed Alignment for the bridge and its approaches as developed by the Employer is given in the Alignment Drawings included in the Reference Documents. Accordingly the required Right of Way (ROW) has been identified and acquired by the Employer.

The Contractor shall carry out the detailed design as per the Design Criteria specified herein below as part of his Technical Design during Design Phase

14.3 Design Life

The design life of a structure is that period for which it is designed to fulfill its intended function. The assumption of a design life for a structure or component does not necessarily mean that the structure will no longer be fit for its purpose at the end of that period.

Requirements for durability, including choice of materials and detailed requirements to achieve good durability, are given in the relevant paragraphs herein.

Contractor is expected to submit a report demonstrating the approach in design, construction and selection of material so as to achieve the Design Life as specified or as agreed upon. The bridge shall be designed for the service life as given in Clause 15.1.3 of Concrete Bridge Code for Bridges in "Rest of India".

The Contractor is deemed to have guaranteed to the Employer that the Contractor is responsible for any significant failure and or substantial reduction in performance or quality of the Works in accordance with the Employer's Requirements and as specified in the Particular Conditions of Contract of the Bid Documents. This guarantee shall not restrict the Contractor's obligation under the Law of India. All the design parameters shall be adopted meeting the above requirements.

14.4 Design Requirements

14.4.1 The Contractor is responsible for design and construction of the Civil Works, and also responsible for coordinating and cooperating with the Other Contractors so that the design and installation of all components of the railway bridge and the approach embankments are compatible as a whole.

14.4.2 The design and installation of all railway operating equipment, including but not limited to track work, signals and signaling cables, signaling equipment, the traction power electrification equipment, electrical cables, electrical and mechanical equipment, telecommunication links, etc. that are required for the railway will be undertaken by the Other Contractors. Accordingly necessary space shall be earmarked and provided by the Contractor for laying of the cables and equipment on

both sides of the bridges and their approaches along the DFC Alignment by the Other Contractors.

- 14.4.3 The Contractor shall design the Works taking into account of the works to be done by the Other Contractors and handover the site where the Other Contractor execute his works as planned and programmed during the design phase.
- 14.4.4 The extent and details of such provisions are to be determined by the Contractor(s) making due enquiries, during the design coordination period, from the Other Contractors engaged (or from the Engineer in case of absence of the Other Contractor(s)) to provide railway operating equipment as stated above.
- 14.4.5 The Contractor shall be responsible for coordinating his design and construction with the Other Contractors and with the Engineer / Employer and for ensuring that the design incorporates such fixings as are required in order to avoid any necessity for the Other Contractors or the Employer to drill, weld, burn or cut any part of the structure when carrying out installations.

14.5 Maximum Moving Dimensions (MMD) and Structure Gauges

- 14.5.1 For Maximum Moving Dimensions, provisions shall be as per “Standard Schedule of Dimensions for Eastern Dedicated Freight Corridor of Indian Railways – January 2013”. The Contractor shall ensure that the proposed size and location of the Permanent Works and Other Contractor’s works are outside the Structure Gauge through the procedure as described in Appendix 7 [Contractor’s Coordination with Others] to the Employer’s Requirements.

14.6 Railway Alignments

14.6.1 General

- (1) The proposed alignment for the bridge and its approaches as developed by the Employer, is given in the Reference Documents.
- (2) The Contractor shall carry out the detailed design of the bridge and its approaches as per the Design Criteria specified herein below as part of his Technical Design during Design Phase.

14.6.2 Levels

All levels shall be quoted in meters correct to three decimal places and shall be with respect to Mean Sea Level Datum India. Preferrably the level of Top of deck of the proposed bridge will be same as the top level of the deck of adjacent IR bridge, unless it is required to be raised due to consideration of clearance from HFL.

14.6.3 Distance between Track Centres

The distance between the track centres of the two DFC Main Line tracks shall be minimum 6.0m

14.7 Earthwork Design

14.7.1 Geometric and Cross –Sectional Features:

- (1) The width of formation (measured at the top of the blanket) on straight alignment shall be as follows:
 - a) Double lines : 14.10 m
- (2) Bidders shall follow RDSO “Guidelines and Specifications for design of formation of heavy axle load GE:14 - Nov. 2009”. However the aspects given below shall also be satisfied.
- (3) Following aspects of work shall require additional attention while designing the formation:-
 - Pressure on Formation and sub-soil: The maximum pressure on formation at bottom of ballast, typical values as good design practice, should not exceed 0.3 MN/sqm or 3.0 kg/sqcm, and the pressure on sub-soil should not generally exceed 0.1 MN/sqm or 1.0 kg/sqcm. Indicative load distribution bulb through the layers, due to wheel load, is represented in RDSO “Guidelines and Specifications for design of formation of heavy axle load- Nov. 2009”.
 - Formation has to be provided with layers well designed to be safe against shear failure and accumulated/plastic deformation under repetitive axle loads.
 - Sub-grade/sub-soil shall be designed and checked to ensure not to allow any shear failure and/or large deformation without shear failure.
 - Additional width of formation on the outside of curves.
 - Minimum track center distance between double line shall be 6.0 m.
 - In case the contractor follows the RDSO design for formation then a uniform total thickness of formation layers of 1.75 m should be provided including blanket, prepared sub-grade & top layer of embankment fill etc. (Refer foot note on page 33 of 75 and page 34 of 75 of RDSO “Guidelines and Specifications for design of formation of heavy axle load-Nov. 2009” (2.0 m has been changed to 1.75m). In case the difference between formation level and ground level is less than required, the existing ground will have to be excavated to provide the formation layers of requisite thickness and specifications as mentioned in the said specifications. In case the existing ground soil at a particular level satisfies the specifications of formation layers at that level, then the existing ground shall not be cut to provide total thickness.

- Minimum height of embankment shall generally be 1.0 m except at obligatory points like level crossings, junction yards, bridge approaches etc.
 - The bottom width of cuts (including side drains).
 - Cross slope on the finished surface of the formation (Top blanket).
 - Cross slope on the finished surface of prepared sub-grade /embankment fill/cut on which the blanket is to be placed.
 - Required amount of formation cross slopes on curves.
 - Tolerances for top level of formation to be included.
 - Geometrical requirements (except for the formation width as specified in clause 2.3.2 (1) shall be as per RDSO :GE-0014 “Guidelines and Specifications for design of formation of heavy axle load.
 - In GE-0014, specifications of Nov. 2009, in the diagrams on page 35 of 75 and page 36 of 75, minimum layer of 1.0 m of embankment fill above HFL have been indicated. These provisions are not mandatory. For exceptional locations prone to flooding, the Engineer may call for the stability analysis of the banks.
- (4) Formation levels shown on the Reference Documents furnished as part of bidding documents shall be reviewed, verified and corrected by contractor on the basis of his own surveys and in compliance to the provisions of Indian Railways Manuals and specifications.
- (5) Signalling and Telecom cables of DFCC which will be laid by the system contractor and which therefore does not form part of scope of this work will be laid at suitable distance after the toe of the bank. The drawings to be prepared by the contractor as mentioned in item (4) above shall take into account this aspect. However facility for crossing of embankment shall be provided as per clause 7 of Employer’s Requirement Vol. 2 Functional.

14.7.3 Drainage

- (1) Top of the formation should be finished to cross slope of 1 in 30 from centre of formation to both sides.

14.7.4 Planning for All Weather Service Road Along the Alignment

Design and construction of All Weather Service Road along the approaches of the bridges is not in the Scope of Work for this Package, and shall be taken up by the Employer in future. However while designing the approach embankment for the bridges, the Contractor shall ensure that adequate space is left for providing the All Weather Service Road at a later stage all along the approach embankment within the Right of Way.. Planning of the Service Road shall be done generally for a carriageway width of 3.5m with a 1.2m

shoulder on the inside (DFC side) and 1.5m shoulder on outside (total 6.2m width) but in any case not less than a total width of 3.5m at the locations having restricted Right of Way.

14.8 Bridges

14.8.1 The basis for the design of structure, foundation, sub-structure, superstructure, protection works shall be based on relevant IRS Code.

14.8.2 Design Criteria for Bridge

The design criteria for the railway bridge shall be as under:

- (a) The bridge shall be designed with ballasted deck. Minimum width between face to face of the ballast retainer for each track shall be 4.5m.
- (b) Design shall be suitable for DFC Loading (32.5 tonne axle load) with PSC sleepers. Load condition includes the live load, earth pressure and longitudinal forces due to braking and traction considering the wind load, seismic forces, LWR forces, etc. as per relevant codes.
- (c) All bridge shall have simply supported spans.
- (d) Railway bridges shall be designed as per the Design Criteria specified herein, IRS Bridge Rules and IRS Code of Practice for Plain, Reinforced & Prestressed Concrete for General Bridge Construction (Concrete Bridge Code)', IRS Code of Practice for Design of Sub-structure and Foundations of Bridges, IRS Bridge Manual with latest correction slips and other relevant Codes as applicable.
- (e) The Well foundations shall be designed as per IRS Manual on the Design & Construction of Well and Pile Foundation. Contractor shall take into consideration all necessary aspects to be included in the design to ensure safety of the adjacent railway bridge on UP stream side.
- (f) Footpath/ walkway width shall be provided on one side of Up track and on one side of Down track. Its width shall not be less than 900mm.
- (i) Hand railing for the footpath and maintenance staff platform on bridges shall be in structural steel duly hot dip galvanized. Railing height shall not be less than 750mm for the footpath and 900mm for the maintenance staff platform / refuge. The design shall be such that it can be easily maintained and replaced, if required.
- (j) Fe 500 grade steel conforming to IS 1786: 2008 shall be used as reinforcement. Use of protective coatings for steel and

corresponding increase in lap lengths shall be decided based on exposure condition as applicable.

- (k) Length of laps shall be as per the Specifications and IRS Concrete Bridge Code.
- (l) Backfill material shall be as per IRS Bridge Sub-structure and Foundation Code.
- (m) All RCC surfaces, coming in contact with earth, shall be painted with Bitumen or Coal Tar of approved quality @ 1.464 kg/m².
- (n) Clear cover to main reinforcement shall be as per the Specifications and IRS Concrete Bridge Code.
- (o) Depth and size of foundation, return walls, levels of upstream and downstream shall be decided based on site conditions/applicable provisions.
- (p) Tolerances shall be followed as specified in the Specifications and as per the IRS Concrete Bridge Code.
- (q) The Contractor shall provide the earthing bars and earthing lugs as per the design provided by the Other Contractors/Employer/Engineer. A typical arrangement for the same shall be as indicated in reference drawing. The Contractor shall co-ordinate with Other Contractors/Engineers/Employer for the same.

14.8.3 The data like Bridge Length, High Flood Level, Total Waterway and indicative Span Configuration etc. in respect of the proposed bridge for DFC and the existing IR bridges are shown in the indicative General Arrangement Drawings for the Bridge as included in Reference Drawings. While designing the bridge, it is obligatory that the High Flood Level for the bridge for DFC tracks should not be less than that of the corresponding IR bridge.

14.8.4 Adequate arrangement shall be made on the bridge for passage and protection of all the cables including that of Signalling & Telecommunication cables as required.

14.8.5 Bridge shall be designed and provided among others with the followings

- (a) Safety, Maintenance Staff Refuge / Platform
- (b) Supports for locating OHE mast and signaling mast
- (c) Signages
- (d) Inspection steps at approaches / ladders to the bearing area.
- (e) Drainage arrangement at deck
- (f) Wearing Coat at bridge deck
- (g) Bridge bearings
- (h) Jacking arrangements for spans

- (i) Earthquake restraints
- (j) Expansion joints

14.9 Loading for Bridges

14.9.1 General

The design loading accommodating DFC loading (32.5 T axle load) shall be applied to the design of the Civil Works.

Railway bridges shall be designed as per the Design Criteria specified herein, IRS Bridge Rules and IRS Code of Practice for Plain, Reinforced & Prestressed Concrete for General Bridge Construction (Concrete Bridge Code)', IRS Code of Practice for Design of Sub-structure and Foundations of Bridges, IRS Bridge Manual with latest correction slips and other relevant Codes as applicable.

The design loading accommodating DFC loading is further described below for the structure designs of the Civil Works under the Contract.

14.9.2 Superimposed Dead Load

The Contractor shall propose the superimposed dead load to be applied in this Contract to the Engineer for review. The Contractor shall coordinate with the Other Contractors/ Engineer/Employer in the early stage of the design phase and confirm the superimposed dead load with respect to the works to be carried out by the Other Contractors.

If other Contractors are not in position, it may not be possible for the Contractor to coordinate with Other Contractors in early stage of Design Phase for confirming the superimposed dead load. In such eventualities, the Contractor shall liaison with the Engineer for superimposed dead loads or any other design coordination issue.

The superimposed dead load to be applied to the structures shall include, but not necessarily limited to:

- (1) Running rails (68 Kg) including guard rails (60 Kg)
- (2) PSC Sleeper including rail fastenings (for 32.5 T loading)
- (3) Inspection platform
- (4) Concrete trough/Box girder (with cables inside)
- (5) Parapet and railing
- (6) Overhead Equipment (OHE)
- (7) Wearing Coat
- (8) Ballast
- (9) Walkways
- (10) Transformers (if any),
- (11) Signalling and Telecommunication cables and signaling and telecom track side equipment, if any, including but not limited to signal post, track circuit equipment etc.
- (12) Light water pipe and other services (the weight to be considered @ 300kg/RM for design purpose)

14.9.3 Loads

(1) Application of the loads shall be strictly complied with the IRS Bridge Rules and other bridge design Codes as applicable. However, the force due to continuation of CWR/LWR and forces and effects due to earthquake shall be as below :

(i) **LWR/CWR Forces due to continuation of LWR/CWR**

Forces due to continuation of LWR/CWR shall be as per provisions of UIC 774-3R Oct., 2001 edition with latest modification (if any) with provision of values for track resistance as specified therein subject to the provision that a track resistance of 60KN/m in loaded conditions shall be taken.

(ii) **Seismic Forces**

Seismic design of bridge shall be carried out as per "IIT/Kanpur – RDSO guidelines on Sismic design of Railway bridges" with latest seismic map, etc.

(2) **Load Combinations**

The worst combinations possible of dead load with live load, impact effect and forces due to curvature and eccentricity of track. Longitudinal and racking forces due to live load are deemed to be included in live load wherever applicable. For design of Foundations and sub-structure and the load combinations shall be as per clause 5.13 of IRS-Foundation and Sub-structure Code, for other elements of the bridge, relevant code of practice shall be used.

(3) **Idealization of Structure**

The IRS codes provide a simplified approach to design and analysis of the bridge, amenable to hand calculations. For the computer calculations, the structures may be idealized as plain frame/ space frame with loadings in vertical and horizontal directions where applicable.

(4) **Soil Structure Interaction Modeling and Analysis Procedure:**

Where the soil structure interaction is to be considered, the soil shall be idealized as a classical Winkler foundation - beam on springs. The soil passive resistance is considered to be offered by linear elastic springs. Spring constants for the bottom raft are calculated based on modulus of sub grade reaction of the soil strata. After performing the analysis, the forces in the springs shall be compared with the allowable bearing pressure.

14.9.4 Differential Settlements

Consideration of the forces resulting from differential settlement shall be made where the nature of the chosen foundation system and the ground conditions indicate that such a condition may arise. The effects of differential settlement between adjacent structures shall be assessed in accordance with the following:-

Differential settlement between adjacent structures shall be evaluated and due allowance incorporated into the size of the structures and detailing of joints to ensure that the Structure Gauge is not infringed within the design life.

14.9.5 Safety Against Deformation and Differential Settlements

The foundation should deform within acceptable limit of total and differential settlements. These acceptable limits depend on the type of structures and substrata involved and should be decided judiciously. The settlement shall not normally exceed 25mm after the end of the construction period for bridges with simply supported spans.

In case of structures sensitive to differential settlement, the tolerable settlement limit has to be fixed based on the conditions in each case.

14.10 Bridge Bearings and Movement Joints

This work shall consist of design supply and fixing in position of bearings for bridge in accordance with details shown on drawings and to the requirements of the Specifications of the Bid Documents, codes and standards quoted therein and as directed by Engineer.

Bearing plates, assemblies and other expansion or fixed devices shall be constructed in accordance with details shown on drawings.

When bearing assemblies or plates are shown on drawings to be placed (not embedded) directly on concrete, the concrete bearing area shall be constructed slightly above grade and shall be finished by grinding.

It shall be ensured that the bearings are set truly level and in exact position as indicated on drawings so as to have full and even bearing on the seats. This shall be checked with spirit level in both directions. Thin epoxy mortar pads (not exceeding 5 mm) may be made to meet with this requirement.

It shall be ensured that the bottoms of girders to be received on the bearings are plane at the location of these bearings and care shall be taken that the bearings are not displaced while placing the girders.

Bridge bearing shall be spherical bearings.

(1) Bearings

All bearings shall be replaceable without major disruption to railway operating or to any activity underneath the bridge. Bearings shall be placed on bearing pedestals designed in accordance with applicable Codes. Appropriate jacking points on the pier / abutment cap as well as on the girders shall also be provided. For railway bridges to be suitable for carrying Continuous Welded Rails, normally it is essential that the spans are provided with fixed bearings (not permitting longitudinally / transverse movement but allowing only rotation) on one end and free bearing (permitting longitudinal movement as well as rotation) on other end.

The "Spherical Bearings" are best suited for railway bridges allowing for rotation both in transverse and longitudinal direction and shall be provided as per the Specifications, detailed in the Specifications of Bid Documents.

Bearing inspection platforms shall be provided along with access ladder from bridge deck to ensure the safe access to monitor the bearing inspections for all Important Bridges.

(2) Movement Joints

Movement joints and other necessary measures to control shrinkage and thermal effects shall be incorporated in the structural design so that the performance of architectural finishes or of any services are not adversely affected during normal working conditions. Movement joints shall be designed to be easily maintained and replaceable.

14.11 Wayside Signs

The Contractor shall design and install the Wayside Signs in accordance with the requirements as specified in relevant IRS Codes and Manuals. The list of the Wayside Signs indicated herein below are not exhaustive and the Contractor shall provide all the Wayside Signs as per the IRS Codes and Manuals as applicable. Details of these signs shall be developed and submitted to the Engineer as part of the Technical Design for consent. The Contractor shall take into account the visibility of the signs (in particular by the locomotive drivers); their stability (support post and foundations); durability and maintenance aspects. Design of reflective-type signs, incorporating clear numerals, located on non-corrosive supports, with parallel and perpendicular to the track shall be developed in accordance with the requirements of relevant IRS Codes and Manuals.

- (1) **Bridge Number Plaque:** Bridge number plaques for the bridge number which shall be embossed onto a metal plate or similar shall be attached diagonally on the top surface of the both abutments as indicated in the para 203-7 of IR Bridge Manual.

- (2) **Inscription Plaques on Bridges** : Inscription plaques showing nature and depth of foundations shall be provided on each pier and abutment as per Indian Railway Bridge Manual.
- (3) **Flood Gauges** : Flood gauges with marking of danger level and HFL to be painted on each of the abutment and pier as per IRS Manuals.
- (4) **Bridge Boards**
- (5) **Project Sign Boards**
- (6) **Any other board as per the requirement of relevant IR codes/manuals.**

14.12 Other Design Considerations

14.12.1 Hydrological Design Considerations and Design of Protection Works

(1) Discharge Estimation and Water Way Calculation

Estimation of design discharge is required for proper design, construction, and maintenance of bridge water ways, foundations, approaches and training works. Parameters like Vertical clearances also depend on the design discharge. .

(2) Bridge Protection Works

Bridge protection works are required to protect the bridge structure and its approaches from damage due to flood waters

Protection work for the approach embankment shall be fully provided with stone boulder pitching for a minimum length of 100m behind abutment as per specifications and drawings.

(3) Scour Depth Calculations

For hydraulic design, most important parameters are discharge, HFL and Scour. Depth of the scour shall be calculated as per relevant Codes.

- (4) The discharge shall be taken as 39643 cumecs and maximum silt factor shall be taken as 1.5, however the discharge and silt factor shall be validated by the contractor and if the discharge calculated by the contractor is more than 39643 cumecs, the higher value shall be taken for design, and if the silt factor calculated by the contractor is less than 1.5 lesser value shall be taken for design as per best Engineering practice.

14.12.2 Clarification of Design Assumptions

- (1) Stresses in partially completed structures shall be analyzed for appropriate critical conditions at various stages of the

construction. Any restriction on the construction operations resulting from design assumptions shall be clearly specified on the drawings and specifications.

- (2) Well foundations shall be designed as per IRS Manual on the Design and Construction of Well and Pile Foundation (1985), IRS Sub-structure code and the other criteria as specified in the specifications of Bid Documents/relevant codes.
- (3) If any other clarification is required with respect to various design assumptions, the Contractor shall propose the same with reference to the provisions of various Codes, Standards and Manuals as applicable and seek the consent of the Engineer before undertaking the Technical Design.

14.12.3 Deck Drainage

A complete drainage system for the entire deck shall be provided to ensure that the drainage water is disposed off quickly from the deck to safe location. For bridges level in longitudinal profile, minimum cross slopes in deck shall be kept as per applicable provisions.

14.12.4 Vertical Clearance and Free Board in Bridges shall be as per IRS substructure code.

14.12.5 Retaining Structures

Earth retaining structure if required at any location where the sufficient space within the ROW is not available, shall be proposed by the Contractor and shall be subject to consent of the Engineer and approval of the Employer.

Design shall be done as per the Design Criteria specified herein and IRS Bridge Rules, IRS Code of Practice for Plain, Reinforced & Prestressed Concrete for General Bridge Construction (Concrete Bridge Code), IRS Code of Practice for Design of Sub-structure and Foundations of Bridges, IRS Bridge Manual with latest correction slips and other relevant Codes as applicable.

14.12.6 OHE Mast

While designing the Bridge, necessary provisions for the OHE mast shall be made and requirements for OHE shall be co-ordinated with the Other Contractors/ Engineer/Employer.

14.12.7 Design of well foundation

1 Depth of Well Foundation

The depth of the well foundation shall be determined as per IRS-substructure Code and other relevant codes.

2 Well Shapes and Dimensions

The wells may be circular, double D shape in plan depending on the depth, plan area of the pier/abutment, type of strata through which it is to be sunk etc. The thickness of well wall is i.e. steining should be such that the sinking effort required without excessive kentledge matches the self-weight of the well and rectification of any tilts and shifts during sinking operation can be achieved. The inside diameter/opening of dredge hole should be adequate to lower suitable machinery for dredging below the cutting edge. The steining thickness should be adequate to withstand the loads and forces during service and during sinking operation. The minimum steining thickness shall be 1 m. The overall size of the well should be adequate to transmit the loads from super structure; substructure; live loads and all occasional loads to the base without exceeding safe bearing pressure and. there should be adequate stability against sliding, overturning etc.

3 Allowable Bearing Pressure

The allowable bearing pressure shall be determined as per IRS-Manual on the design and construction of well and pile foundations (1985).

15 Maintenance

15.1 Maintenance Support Plan

15.1.1 The Contractor shall provide a maintenance support plan that shall include such items as:

- a) procedures for maintaining bridge structures including routine inspection, periodical inspection and test running;
- b) technical manuals;
- c) procedures for removal and replacement of components;
- d) manpower plan required for maintenance.

15.1.2 On completion of the Works the Contractor shall deliver to the Engineer copies of all manufacturing drawings (for bearings), schedules and software for all components, as well the As-Built Drawings as specified in Appendix 5 [CAD and Documents Standards].

15.2 Operation and Maintenance (O&M) Manuals

15.2.1. In addition to the various existing Codes and Manuals applicable to Indian Railways for operation and maintenance of bridges, the Contractor shall produce additional Manuals covering the additional provisions (if any) over and above the various existing Codes and Manuals of Indian Railways in respect of the following for Operation and Maintenance of various assets created under the Contract.

15.2.2. With reference to the requirements as above:

- (1) The Contractor shall produce manuals for the bridges for its efficient operations and maintenance. These shall include, but may not necessarily be limited to, the following:
 - (a) Manual for Maintenance of Bridges
 - (b) Manual for maintenance of rail track formation and Protection Works and Drainage System
- (2) Operation & Maintenance manual shall also contain the following:
 - (a) Technical description of each component of the bridge written to ensure that the Employers staff fully understands the scope and facilities provided.
 - (b) Name, addresses, telephone, e-mail and fax numbers of the manufacturer of every component of the bridge.
 - (c) Manufacturer's service manual for each component of the bridge, installed specifically for the project, including detailed drawings, illustrations and preventative maintenance program.
 - (d) Procedures for fault finding, where applicable, data or recommended maintenance procedures, maintenance intervals.
 - (e) All test results conducted on the relevant components of the bridge whether at the manufacturer's place or at site.
 - (f) Manufacturer's list of recommended spare parts for items subject to wear and deterioration, giving expected running period and indicating specifically those items, which may involve extended deliveries.
- (3) Operating/User Manuals and a summary (suitable for use at technician level) of the O&M Manuals shall be prepared in both English and Hindi languages unless otherwise instructed by the Engineer.
- (4) The Contractor shall submit all the Manuals for review by the engineer atleast 6 months before the targeted date of Taking Over for the Engineer's consent.
- (5) The Contractor shall provide 6 controlled copies of all Manuals for the use of the Engineer.
- (6) O&M Manuals and drawings as submitted by the Contractor shall be updated by him during the Defects Notification Period, if required, and shall be re-submitted to the Engineer for review without any extra cost to the Employer.

Section V. Employer's Requirement Volume 4 – Construction

CONTENTS

01	Contractor's Responsibilities
02	Contractor's Organization during Construction Phase
03	Construction Works
04	Checking of the Contractor's Temporary Works Design
05	The Site and the Work Areas
06	Safety, Health and Environment (SHE) Requirements
07	Safety Requirements for electrical works
08	Legislation and Codes of Practice
09	Damage and Interference
10	Care of Works
11	Handling of Public Utilities and Interferences
12	Use of Roads
13	Security
14	Site Establishments
15	Testing of Works
16	Provisions for Other Contractors
17	Restoration of Work Areas Disturbed by Construction

1 Contractor's Responsibilities

- 1.1** The Contractor shall take full responsibility for adequacy, stability, safety and security in respect of all the:
- (a) Works including the Permanent Works and Temporary Works;
 - (b) Site Operations;
 - (c) Methods of construction, fabrication, erection, transportation, installation including testing;
 - (d) Plants (if any); and
 - (e) Contractor's Equipment irrespective of any consent by the Engineer.
- 1.2** The Contractor shall, whenever required by the Engineer, submit to the Engineer details of the arrangements and methods which the Contractor proposes to adopt for execution of the Works for his consent. No alteration to these arrangements and methods shall be made without the consent of the Engineer.
- 1.3** Before starting the Work at Site, it shall be essential on part of the Contractor to ensure that there are no charted and uncharted utilities infringing the Permanent Works particularly the cables carrying the working circuits within the Right of Way (ROW). Diversion of all the uncharted utilities shall be handled as specified in Appendix 11 [Requirements for Construction] to the Employer's Requirements.

2 Contractor's Organization during Construction Phase

2.1 Project Organization Plan

- (1) The Contractor's Personnel shall be deployed maintained as described in the General Conditions of the Bid Documents. The Contractor's Superintendence shall also be properly deployed and maintained to carry out the construction activities as described in the General Conditions of the Bid Documents.
- (2) The Contractor shall submit an updated Project Organization Plan which includes complete project organization chart during the Construction Phase adding functions and personnel necessary to perform the Works during the Construction Phase in accordance with Conditions of Contract. This plan shall be updated and resubmitted whenever there are changes to the staff and / or the organizational structure. The plan shall show the management structure and state clearly the duties, responsibilities and authority of key staff member.
- (3) Full details regarding qualification and experience in respect of all the key staff shall be submitted to the Engineer for his consent. If the

Engineer asks (in writing) the Contractor to remove a person of his work force stating the reasons, the Contractor shall ensure that the person leaves the Work Area within seven days and shall have no further connection with the Works in the Contract. The Engineer shall also seek prior consent of the Employer in this regard.

- (4) During the Construction Phase, the Contractor shall maintain the Design Team in his organization independent of the Construction Team to deal with his design development including the Variation and changes to his design as shall be performed through the Design Changes and Variation Procedure as described in Appendix 10 [Requirements for Design] to the Employer's Requirements and as described in the General Conditions and the Particular Conditions of the Bid Documents.

2.2 Requirements During Construction Phase

- (1) The principal requirements relating to the Contractor's Documents during the Construction Phase are the submissions by the Contractor of the followings:
 - (a) Working Drawings and Documents,
 - (b) the technical submissions as required under the Contract,
 - (c) the compilation of the multiple design submissions for the different elements of the bridge and their approaches and submission of the final design with related documentation and the submission of the As-Built Drawings / Document.
- (2) Working Drawings and Documents shall be prepared as required under the Contract.
- (3) The Contractor shall endorse the Working Drawings and Documents as being in accordance with the Technical Drawings which have received "Notice of No Objection" or "Notice of No Objection with Comments" from the Engineer after the comments duly resolved.
- (4) The Contractor shall endorse the submissions required under the contract that "all effects of the designs 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".
- (5) The Contractor shall submit the Construction Design and Drawings as specified in Clause 4 of the Employer's Requirement - Design.
- (6) The Contractor shall maintain all records necessary for the preparation of the As-Built Drawings and Documents.
- (7) 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 and Final Documents.

- (8) All such drawings and documents 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.
- (9) The Contractor shall maintain all records necessary for the physical and financial completion of the Work. These records shall consist of as a minimum:
 - (a) The implemented work according to activities, places and price; and
 - (b) Used materials – type, name of manufacturer along with batch No., place & price etc.;
- (10) Prior to the commencement of construction operations, the Contractor shall obtain all necessary clearances from the concerned Authorities.

3 Construction Works

- 3.1 Prior to start of the construction operations, the Contractor shall submit all relevant technical details including but not limited to the following for review and evaluating the proposed construction methods and quality control procedures.
 - (a) Geological Investigation Report and evaluation of sub-surface conditions for Permanent Works for bridge foundations and bridge approaches along the alignment.
 - (b) Geological Investigation Report for borrow areas
 - (c) Material test report for steel and bearings etc. for bridge construction
 - (d) Material test report for cement, pre stressing, reinforcing steel, water, sand, aggregate etc. for concrete works
 - (e) Material test report for embankment fill, prepared subgrades and blanket material
 - (f) Slopes stability calculations
 - (g) Details of construction equipments.
 - (h) Construction quality control plan
- 3.2 Contractor shall be responsible for reviewing and validating the information provided, taking all necessary measures and precautions of satisfactory completions of the Works meeting the performance requirements in the stipulated time including but not limited to carrying

out all the investigations as required, changes in the design, ground treatment or improvement, modification of construction methods etc. required due to site conditions. He shall also be responsible for all the temporary works, dewatering and drainage arrangements.

3.3 Storage /Fabrication Yard for Structural Steel for Bridge Construction

The Contractor shall plan, design and construct his casting Yard / fabrication yard / shop assembly yard as consented by the Engineer and at the location acceptable to the Engineer. All the facilities provided therein shall be subject to consent of the Engineer.

In respect of pre stressing steel structural material brought by the Contractor to the storage / fabrication yard for incorporation into the Permanent Works, the Contractor shall store such steel material in the proper storage yard and carry out casting / fabrication / shop assembly of such steel material in the proper casting yard /fabrication yard. Such storage / fabrication yard shall be kept clean and properly drained, as to prevent loss, damage and deterioration, and to ensure the preservation of its quality and fitness for the Works.

3.4 Availability of Embankment Fill Material

The Contractor shall procure the materials suitable for sub-grade and embankment fill after carrying out the necessary tests required as per the Specifications and confirming their suitability.

4 Checking of the Contractor's Temporary Works Design

4.1 The Contractor shall, prior to commencing the construction of the Temporary Works as detailed in Appendix 6 [Temporary Works] to the Employer's Requirements, fully check the design and go through the Internal Authorization Process as described in Appendix 4 [Quality Assurance] to the Employer's Requirements and submit design to the Engineer for consent as part of the Technical Design. Through those process and procedures, the Contractor shall ensure that his Temporary Works have been properly and safely designed and checked the effect of the Temporary Works on the Permanent Works.

4.2 In addition to the above the Contractor shall also submit a Design Certificate to the Engineer, duly signed by Chief Design Engineer of the Contractor's Design Team and Contractor's Representative as part of Contractor's Internal Authorisation process (as specified in Appendix 4 [Quality Assurance] to the Employer's Requirements certifying that the Temporary Works have been properly and safely designed and checked including the effect of the Temporary Works on the Permanent Works and has found this to be satisfactory.

5 The Site and the Work Areas

5.1 The Work Areas, Site including timings, sequence and conditions

relating to the Contractor's Possession of the Site during the Construction Phase, his access to the Site prior to the Site possession, and his acquisition of the Work Areas outside Right of Way are detailed in Appendix 1 [Alignment of Trackways and Work Areas] and Appendix 11 [Requirements for Construction] to the Employer's Requirements.

6 Safety, Health and Environment (SHE) Requirements

- 6.1 The Contractor shall comply with all the requirements as specified in [Safety, Health and Environment (SHE) Requirements] in the Specifications.
- 6.2 The Contractor shall prepare and submit to the Engineer for review his proposed SHE plan including Site Safety Plan and Programme within the period as specified in [Safety, Health and Environment (SHE) Requirements] in the Specifications. It shall, as a minimum, meet the requirements as specified in [Safety, Health and Environment (SHE) Requirements] in the Specifications. The Contractor's SHE Policy, SHE Plan and Site Safety Plan shall be got approved from the Engineer and other concerned authorities before start of the Work at Site.
- 6.3 The Contractor's Site Safety Plan shall cover the following aspects:
 - (a) Statement of Contractor's Safety Policy
 - (b) Senior management responsibility for safety
 - (c) Appointment, duties and responsibilities of Site safety staff
 - (d) Policy for identifying Hazards
 - (e) Safety training
 - (f) Safety equipment
 - (g) Safety of the Contractor's construction and office equipment
 - (h) Safety of the workmen and staff at site
 - (i) Safety procedures for sub-contractors
 - (j) Disciplinary procedures
 - (k) Accident reporting
 - (l) First aid and emergencies
 - (m) Safety promotion and awareness
 - (n) Site security
 - (o) Labour safety
- 6.4 The Contractor's Site Safety Plan shall also incorporate the requirement of Safety while having interface with the running tracks of Indian Railways (if applicable) and shall comply with:
 - (a) Indian Railway's rules and regulations for track, signalling and operations possessions,
 - (b) operating a system of permit to work for all works which may affect the operations of the existing railway, and
 - (c) requirements of safety aspects for working near the running tracks of Indian Railways.

- 6.5 Engineer reserves the right to order (in writing) the immediate removal and replacement of any of the Contractor's equipment or temporary works which in his opinion is unsatisfactory or not required for the Work for its purpose and / or is in unsafe condition.
- 6.6 Contractor shall be fully responsible for safety of the Works and shall treat safety measures as a priority in all his activities throughout the execution of the Works.
- 6.7 Contractor shall have full regard for the safety of all his personnel, sub-contractor's personnel, the public and all the personnel directly or indirectly associated with the Works on or in the vicinity of the Site and the Work Areas (including without limitation to the persons to whom access to the Site has been allowed by the Contractor), to comply with all relevant safety regulations, including provision of safety gear, and insofar as the Contractor is in occupation or otherwise is using areas of the Site and the Work Areas, to keep the Site and the Work Areas (so far as the same are not completed and occupied by the Employer) in an orderly state appropriate to the avoidance of injury to all persons and shall keep the Engineer/ Employer indemnified against all the injuries to such persons.
- 6.8 Contractor shall provide and maintain all lights, guards, fences and warning signs and watchmen when and where necessary or required by the Engineer or by laws or by any relevant authority for the protection of the Works and for the safety and convenience of the public and all persons on or in the vicinity of the Site and the Work Areas.
- 6.9 When the Work would otherwise be carried out in darkness, the Contractor shall ensure that all parts of the Site and the Work Areas where the Work is being carried out are so lighted as to ensure the safety of all the persons on or the vicinity of the Sites, the Work Areas and of such Work to the satisfaction of the Engineer.
- 6.10 Contractor shall be required to take note of all the necessary provisions in the Employer's Safety, Health and Environment requirements as specified in [Safety, Health and Environment (SHE) Requirements] in the Specifications and the Contract Price shall be deemed to be inclusive of all the necessary costs to meet the standards and requirements as prescribed therein. In case the Contractors fails to meet the above requirements, the Employer shall provide the necessary arrangements and recover its costs from any bills due to the Contractor.

7 Safety Requirements for electrical works

- (i) The Indian Electricity Rules 1956, as amended up to date, shall be followed. The detailed instructions on safety procedures given in I.S.S. and Indian Electricity Rules, respective State Electricity Authorities' regulation with up to date amendment shall be applicable.

- (ii) The LT/HT distribution diagrams of sub stations shall be prominently displayed. The substation premises, main switch rooms and D.B. enclosure shall be kept clean whenever works are carried either inside or outside.
- (iii) No inflammable materials shall be stored in places other than the rooms specially constructed for this purpose in accordance with the provisions of Indian Explosives Act.
- (iv) Rubber insulating mats of suitable size and thickness shall be provided in front of the main switch boards of sub-station or any other control equipments of medium voltage and above.
- (v) Protective and safety equipment such as rubber gauntlets or gloves, earthing rods, linemen's belt, portable artificial respiration apparatus, safety goggles etc., shall be provided as per the requirement of the Work.
- (vi) Necessary number of caution boards such as "Man working on line, Don't switch on" shall be readily available in the vicinity of electrical installation.
- (vii) Standard first aid boxes containing materials as prescribed by the John's Ambulance Brigade or Indian Red Cross shall be made available.
- (viii) Charts displaying methods of giving artificial respiration to a recipient of electrical shock (one in English and another one in the regional language) shall be prominently displayed at appropriate places.
- (ix) No work shall be undertaken on live installations, or on installation, which could be energized unless one another person is present to immediately isolate the electric supply in case of any accident and to render first aid, if necessary.
- (x) No work on live L.T. bus bar or pedestal switch board in the sub stations shall be handled by a person below the rank of a Licensed Wireman and such a work shall preferably be done in the presence of a qualified engineer.
- (xi) When working on or near live installations, suitable insulated tool shall be used, and special care shall be taken to see that those tools accidentally do not drop on live terminals causing shock or dead short.
- (xii) The electrical switch controls in distribution boards shall be clearly marked to indicate the areas being controlled by them.
- (xiii) Before starting any work on the existing installation, it shall be ensured that the electric supply to that portion is cut off. Precautions, like displaying "Men at Work" caution boards on the

controlling switches, removing fuse carrier from these switches shall be taken against accidental operation. Caution boards shall be kept with the person working on the installation,

- (xiv) All electrical panels & switchgear shall conform to relevant IEC standard.
- (xv) All external enclosures shall have degree of protection not less than IP-54.
- (xvi) Cable routes of all the newly laid cables by the Contractor shall be identified with electronic or concrete markers.

8 Legislation and Codes of Practice

- 8.1 The Contractor shall comply with all the safety and industrial health legislation including without limitation to the Rules and Regulations of National Safety Council of India. The Contractor shall keep at each site office sufficient copies of Safety and Industrial Health Regulations and related documents.
- 8.2 All regulations and documents as referred above shall be translated into languages which are understood by the operators engaged by the Contractor or sub-contractor and such translations shall be displayed or kept alongside those in Hindi, English and Regional language.

9 Damage and Interference

- 9.1 Works shall be carried out in such a manner that there shall be no damage to or interference with:
 - (a) water courses or drainage systems;
 - (b) public utilities;
 - (c) structures (including foundations), roads, including street fixtures, or other properties; and
 - (d) public or private vehicular or pedestrian access,
 - (e) monuments, graves or burial grounds other than to the extent that is necessary for them to be removed or diverted to permit the execution of the Works.
- 9.2 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 consent of the Engineer to such removal or diversion has been obtained.
- 9.3 Assets / items of the Employer, Other Contractors and any other entities which are damaged due to Contractor's operations / negligence

during construction or are interfered with or removed to enable the Works to be carried out shall be replaced / reinstated by the Contractor at his own cost to the same condition as existed before the Work started and to the satisfaction of the Engineer and the concerned entity.

In case of damage to the existing cables, the Contractor shall have suitable arrangement of joining the cable under technical supervision of relevant authority. In addition to this, the Contractor shall also be responsible for any claim or legal action as a result of the damage and shall indemnify the Engineer, Employer, Other Contractors and any other entities in this regard.

9.4 In case of obstructions due to interference, the Contractor shall comply with the requirements described in Appendix 11 [Requirements for Construction] to the Employer's Requirements. Followings are the major required items as detailed therein:

- (a) Uncharted Public utilities
- (b) Alternative Access
- (c) Protection of Trees
- (d) Removal of trees, graves and other obstructions
- (e) Protection of adjacent structures

10 Care of Works

Care of Works, including protection of Works from weather and protection of finished Works shall be as specified in Appendix 11 [Requirement for Construction] to the Employer's Requirements.

11 Handling of Public Utilities and Interferences

11.1 The existing public utilities (if any) identified within the Right of Way shall, in principle, be relocated and/or diverted by the relevant public utility agencies at their risk and responsibility prior to the Contractor's possession of the Site except for those utilities which are included in the Scope of Work of this Package . The costs of relocation and/or diversion of such utilities as having been done prior to the Contractor's possession of the Site shall be paid by the Employer to the relevant public utility agencies separately.

11.2 Alternative access which may be needed for all public or private premises when interference with the existing access occurs to enable the Works to be carried out shall be arranged by the Contractor as described in Appendix 11 [Requirements for Construction] to the Employer's Requirements.

11.3 Trees, graves and other obstructions which may remain at the Site or the Work Areas shall be appropriately removed as described in Appendix 11

[Requirements for Construction] to the Employer's Requirements.

- 11.4 Identification of uncharted public utilities within ROW shall be undertaken by the Contractor in such a manner so that there is no damage to the utilities.

12 Use of Roads

The Contractor shall comply with the requirements as described in the General Conditions of the Bid Documents, Appendix 11 [Requirements for Construction] to the Employer's Requirements and [Safety, Health and Environment (SHE) Requirements] in the Specifications of the Bid Documents.

13 Security

The Contractor shall comply with the requirements described in the General Conditions of the Bid Documents) and Appendix 11 [Requirements for Construction] to the Employer's Requirements.

14 Site Establishments

- 14.1 The Contractor shall provide and maintain the Temporary Facilities and Temporary Utility Services, which comprise part of the Temporary Works for use of the Employer and Engineer as specified in Appendix 6 [Temporary Works] to the Employer's Requirements.

- 14.2 The Contractor shall provide and maintain all Temporary Works as required by him and as specified but not limited to those detailed in Appendix 6 [Temporary Works] to the Employer's Requirements, for execution of the Works.

14.3 Latrines and wash places:

Contractor shall provide latrines and wash places for the use of his personnel and all persons who will be on the site as per the requirements as specified in [Safety, Health and Environment (SHE) Requirements] in the Specifications of the Bid Documents and in accordance with the local laws and regulations.

15 Testing of Works

- 15.1 The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. Daily on-site testing shall be coordinated with the Engineer. A programme of proposed tests shall be provided on a weekly basis, at least one week in advance of such events.

- 15.2 Notification of required Factory testing shall be made in writing to the Engineer, including full details of test requirement, at least 15 days in an advance of the test.

- 15.3 The Contractor shall comply with all requirements described in the Employer's Requirements - Manufacturing, Installation, Testing

and Appendix 4 [Quality Assurance], Appendix 3 [Project Programme Requirements] and Appendix 11 [Requirements for Construction] to the Employer's Requirements.

16 Provisions for Other Contractors/Agencies

16.1 The Contractor shall construct the Works in full coordination with the Other Contractors/Agencies (as applicable) and shall comply with the requirements described in Appendix 7 [Contractor's Coordination with Others] to the Employer's Requirements.

16.2 Provision of Masts for OHE

For the mast installation to be done by the Other Contractor on the bridge, the Contractor shall prepare necessary provision as part of the Permanent Work. The Contractor shall ensure that this provision as and the masts to be installed by the Other Contractor do not infringe the Structure Gauge as specified in the Design Criteria. Prior to design of the provision, the Contractor shall take all necessary steps to ensure that the provision of the mast installation is coordinated and integrated with the works to be done by the Other Contractor(s) as described in Appendix 7 [Contractor's Coordination with Others] to the Employer's Requirements. In case system contractor is not in place, this will be co-ordinated with engineer/Employer.

17 Restoration of Work Areas Disturbed by Construction

Unless otherwise directed by the Engineer, any areas disturbed by the construction activity, either inside or outside the 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, adjacent roads, properties and landscaping, water bodies. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

Section V. Employer's Requirement Volume 5 – Testing

CONTENTS

1. Testing

The testing shall be done as per provisions of Employers Requirements and provisions of Concrete Bridge Code and other relevant codes as required.

Section V. Employer's Requirement Volume 6 – Specification

CONTENTS

- 01 General**
- 02 Standards**
- 03 Geotechnical Investigation**
- 04 Earthworks**
- 05 Materials for Structures**
- 06 Well Foundation**
- 07 Concrete Work**
- 08 Structural Steel Works**
- 09 Miscellaneous Works**
- 10 Safety, Health and Environmental (SHE) Requirements**

1 General

These specifications for certain items contained herein are based on the provisions of various Codes and Employer's Requirements for the Works required to be undertaken by the Contractor under this Contract and for better understanding of the Contractor. However for details, the respective Codes shall be referred to. The order of precedence for various Codes has been specified in Clause 2.2 of these specifications.

The Contractor shall further develop these specifications and the specifications for the other items (not covered in this document) to the detailed specifications giving due considerations to the Employer's Requirements, requirements of Design Criteria (as included in the Employer's Requirements – Design relevant provisions of various Codes and Standards, various Indian Railway Rules (as identified therein), best engineering practices etc. as applicable and shall submit the same to the Engineer for his consent and approval of the Employer as part of the Technical Design Package and the Construction Design Package during the Design Phase. The specifications so formulated finally after considering the above aspects, shall be termed as 'Specifications' and would constitute a part of the Employer's Requirements.

The Contractor shall also develop Method Statements and Test Procedures / Work Procedures / Plans and Manuals / Technical Drawings / Construction Drawings / Sketches etc. for all the items of Work, based on Specifications, applicable Codes & Standards, best Engineering practices etc. and shall submit to the Engineer for his consent.

2 Standards

2.1 Introduction

The Materials and workmanship specification as follows has been based on Indian Standards and International Standards as scheduled below. Apart from the basic data, specifications etc. all items of works shall be governed by the Codes & Specifications as detailed hereunder and as revised / corrected / amended up to 28 days before the due date of submission of the Bid Proposal.

The Contractor shall be responsible for detailing in his specification of the standards on which his materials and workmanship shall 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 Engineer for the International Standards which are not specifically included herein below and the Contractor intends to apply the same for the detailing of his specification, additionally.

The Contractor is required to review in the first instance the relevant IRS / Indian Standards and other Standards / Codes as mentioned. The specifications will be primarily based on the said standards to the extent that they are applicable. However in case the Contractor intends to use any other International Standards, he should indicate the same in his

proposal for consideration of the Engineer. Usage of the same shall be subject to approval of the Engineer.

2.2 Relevant Standards

Apart from the basic data, Specifications and specific requirements listed in the Employer's Requirement, all items of works shall be governed by the latest versions of the following Codes, Specifications as revised/corrected/amended (with latest correction slip) up to the time as specified above. In case of any contradiction in various codal provisions, the order of precedence shall be as follows:

- a) Specific provisions in the Employer's Requirements
- b) IRS Codal provisions
- c) IRC Codal Provisions
- d) IS Codal Provisions
- e) Provisions in other International Codes

However, in case of road related structures, IRC Codal provisions will 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, immediately for a final decision.

In case contractor proposes any different code/order he shall give technical reasons in detail and shall be subject to written consent of the employers.

Relevant standards are scheduled as below:

2.2.1 Indian Railway Standard Codes and Specifications (IRS)

- (1) Indian Railway Bridges Rules, specifying the loads for Design of Superstructure and Substructure of Bridges (with up to date correction slip) and Chapter – VII for the rule for the opening of Railway adopted in 1941 – Revised – August 1982
- (2) Loading Standards as given in Design Criteria (in the Employer's Requirements – Design of the Bid Documents)
- (3) Indian Railway Schedule of Dimensions for Broad Gauge
- (4) Standard Schedule of Dimensions for Eastern Dedicated Freight Corridor for Indian Railways.
- (5) Indian Railway Code for Practice of Plain/Reinforced and Pre-stressed concrete for general/bridge construction (Concrete Bridge Code- 1997) with correction slips up-to-date
- (6) Indian Railway – Engineering Code
- (7) RDSO' Letter No.RDSO/CBS/Bearing dated 22-06-2011 – Guidelines for design of Spherical and Cylindrical bearings
- (8) Indian Railway Bridge Manual 1998 with correction slip up-to-date

- (9) Indian Railways Permanent Way Manual
- (10) Indian Railways Works Manual
- (11) IRS Standard Code of Practice for design of Sub-structure & Foundation
- (12) IRS: Manual on the design and construction of well and pile foundation
- (13) Guidelines for Earthwork in Railway Projects: Guideline No. GE: G-1, July, 2003.
- (14) Guidelines on Erosion Control and drainage of Railway Formation - Guideline No. GE: G-4
- (15) Report No. RDSO/2007/GE: 0011: Guidelines for blanket layer provision on track formation with emphasis on heavy axle load train operation
- (16) RDSO Specification No. GE: IRS-2 (Final): Specification for mechanically produced blanketing material for railway formation including guidelines for laying
- (17) Guidelines and Specifications for Design of Formation for Heavy Axle Load – Report No. RDSO / 2007 / GE : 14
- (18) Report No. GE: R-50: Transitional System on approaches of bridges issued by RDSO.
- (19) IIT/Kanpur- RDSO guidelines on Seismic Design of Railway Bridges.

2.2.2 Indian Road Congress (IRC) Codes and Specifications

- (1) 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
- (2) 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
- (3) IRC-87: Design and erection of false work for road bridges
- (4) Specifications for Road and Bridge Works issued by Ministry of Road Transport & Highways. (MORTH)
- (5) SP 6, 7, 16, 21, 22, 23, 24, 34, 36, 52, 60, 70.

2.2.3 Indian Standard Specifications

- (1) IS: 875 (all 5 parts) – Design loads (other than earthquakes) for

buildings and structures.

- (2) IS: 456 Plain and reinforced concrete
- (3) IS: 269 Indian Standard Specifications for Ordinary & Low Heat Portland Cement
- (4) IS: 8112 43 Grade OPC
- (5) IS: 383 Coarse and fine aggregate from natural sources for concrete
- (6) IS: 2386 (all 8 parts) – Tests for aggregates for concrete
- (7) IS: 3025 (all 49 parts) – Methods of sampling and test for water and waste water
- (8) IS: 3085 Method of test for permeability of cement mortar and concrete
- (9) IS: 1199 Indian Standard Specifications for Method of Sampling and analysis of concrete
- (10) IS: 7320 Concrete slump test apparatus
- (11) IS: 5515 Compaction factor apparatus
- (12) IS: 1791 Batch type concrete mixers
- (13) IS: 4634 Methods of testing performance of batch type concrete mixers
- (14) IS: 2722 Indian Standard Specifications for Portable Swing Weight batches for concrete (Single and Double Bucket type)
- (15) IS: 6925 Methods of test for determination of water soluble chlorides in concrete admixtures
- (16) IS: 9103 Admixtures for concrete
- (17) IS: 516 Method of test for strength of concrete
- (18) IS: 4031 (all 15 parts) – Physical tests for hydraulic cement
- (19) IS: 5513 Vicat apparatus
- (20) IS: 10080 Vibration machine for casting standard cement mortar cubes
- (21) IS: 10262 Concrete mix design
- (22) IS: 4926 Indian Standard Specifications for Ready Mixed Concrete
- (23) IS: 1892 Subsurface investigations
- (24) IS: 2720 (all 41 parts) – method of tests for soil
- (25) IS: 2132 Thin walled tube sampling of soils
- (26) IS: 2131 Standard penetration test for soils
- (27) IS: 1893-2002 Criteria for Earthquake Resistance Design of Structures
- (28) IS: 4326 Earthquake Resistance Design and Construction of Building – Code of Practice
- (29) IS: 13920 Ductile detailing of reinforced concrete structures subjected to seismic forces
- (30) IS: 875 (Part 3) – 1987 – Code of Practice for Design Loads (Other than Earthquakes) for Buildings and Structures – Wind Loads (Second Revision)

- (31) IS: 1786-1985-High Strength Deformed Steel Bars & Wires for Concrete Reinforcement (Third Revision)
- (32) IS: 432 (Part-I & Part-II) – 1982 – Mild Steel, Medium Tensile Steel Bars and Hard Drawn
- (33) IS: 280 Mild steel wire for general purposes
- (34) IS: 2502 Code of practice for bending and fixing of Bars for concrete reinforcement
- (35) IS: 1343 Prestressed concrete
- (36) IS: 14268 Prestressing Strands
- (37) IS: 4082 Recommendations of stacking and storage of construction materials at site
- (38) IS: 800 General construction in steel
- (39) IS: 2062 (2006) -- Hot Rolled Low Medium and High Tensile Structural Steel
- (40) IS: 1261 – 1959 – Seam Welding in Mild Steel (Reaffirmed 1998)
- (41) IS: 1367 – Technical Supply conditions for Threaded steel fasteners
- (42) IS: 816 - Metal arc welding for general construction in mild steel
- (43) IS: 8629 (Parts I to III) – 1977 – Protection of Iron and Steel Structures from Atmospheric Corrosion (Reaffirmed 2002)
- (44) IS: 3757 – 1985 – High Strength Bolts
- (45) IS: 6623 – 1985 - High Strength Nuts.
- (46) IS: 6911 – Stainless Steel
- (47) IS: 1363 (all 3 parts) – Hexagon head bolts, screws and nuts of product grade C
- (48) IS: 6639 Hexagonal bolts for steel structures.
- (49) IS: 102 Ready mixed paints, brushing, red lead, non-settling priming
- (50) IS: 123 Ready mixed paints, brushing, finishing, semi-gloss, for general purposes to Indian Colours etc.
- (51) IS: 104 Ready mixed paint, brushing, zinc chrome, priming
- (52) IS: 2074 Ready mixed paint, air drying, red oxide-zinc chrome
- (53) IS: 34 White lead for paints
- (54) IS: 2339 Aluminum paints for general purposes, in dual container
- (55) IS: 2751 Code of Practice for Welding of Mild Steel Bars used for reinforced concrete construction
- (56) IS: 3400 (all 22 parts) – Methods of tests for vulcanized rubbers
- (57) SP 70: 2001 Handbook on construction safety practices.
- (58) IS: 3764 Safety code for excavation work
- (59) IS: 4081 Safety code for blasting and related drilling operations
- (60) IS: 7293 Safety code for working with construction machinery
- (61) IS: 7205-1974-Safety Code for erection of Structural Steel Work (Fifth Reprint July, 2001)

- (62) SP 22 (S&T): 1992 Explanatory Hand Book on codes for Earth Quake Engineering
- (63) IS: 3696:1987 (Part – I & Part-II) Safety code for scaffolds and Ladders
- (64) IS: 3016:1965 Code of practice for Fire precaution in welding and cutting operations
- (65) IS: 14881:2001 Method for Blast Vibration Monitoring – Guidelines
- (66) IS: 1852 Rolling and cutting tolerances for hot rolled steel products
- (67) IS: 817 Training and testing of metal arc welders
- (68) IS: 1270 Metric steel tape measure
- (69) IS: 1200 (all relevant parts) – Method of measurement of building and civil Engineering works
- (70) IS: 786 Conversion factors and conversion tables
- (71) IS: 8500-1991 Structural steel – Micro alloyed (Medium and high strength qualities – specification (first Revision)
- (72) IS: 9595-1996 Metal Arc welding of Carbon and Carbon Manganese Steels – Recommendations (First Revision)
- (73) IS: 1148-1982 Specification for hot rolled rivet bars (upto 40mm dia) for structural purposes (third revisions)
- (74) IS: 1149-1982 High tensile steel rivet bars for structural purposes (third revision)
- (75) IS: 1030 Grade 280-520W - Cast Steel
- (76) IS: 75 Linseed oil, raw and refined
- (77) IS: 77 Linseed oil, boiled for paints
- (78) IS: 487 Brush, paint and varnish (92) IS: 1915 Steel bridge code
- (79) IS: 6586 Metal spraying for protection of iron steel
- (80) IS: 5666 Etch primer
- (81) IS: 887 Animal tallow
- (82) IS: 816 Metal arc welding for general construction in mild steel
- (83) IS: 1785 Part 1 High Tensile Steel Wire
- (84) IS: 1498-1970 Classification and identification of soils for general engineering purposes
- (85) IS: 1725-1982 Specification for soil based blocks used in general building construction
- (86) IS: 1888-1982 Method of Load Test on Soils
- (87) IS: 1904-1986 Code of practice for design and construction of foundations in soils: General Requirements
- (88) IS: 2809-1972 Glossary of Terms and Symbols Relating to Soil Engineering
- (89) IS: 2810-1979 Glossary of terms relating to soil dynamics

2.2.4 Other International Codes

- (1) EN 1992 – 1:2004 (Eurocode 2 – Design of Concrete Structures, Part – 1 – General Rules and Rules for Buildings)
- (2) EN 1337-7 (March 2004) – Structural bearings – Part 7 : Spherical and Cylindrical PTFE bearings

2.2.5 UIC Codes

- (1) UIC 774 – 3R –Track Bridge interaction Recommendation for calculation (for Forces due to LWR)

- (2) UIC 772R: Bearings of rail bridges
- (3) UIC 774-3R: Track/Bridge interaction

2.2.6 BS Codes

- (1) BS-3784: Grade "A" Specifications for Polytetrafluoroethylene
- (2) BS-5350: Standard Method of test of adhesives, Part C9, Floating roller peel test
- (3) BS-5400: Part – 1 General Statement
- (4) BS-5400: Part – 2 Specifications for loads
- (5) BS-5400: Part 6 Steel, Concrete and Composite Bridges- Specifications for Materials and Workmanship-Steel
- (6) BS-5400: Part- 9 Bridge Bearings

The above list is indicative and only for the guidance of the Contractor.

The list given above is by no means exhaustive. All IS, IRC and IRS Codes pertaining to the work shall be applicable.

Where the drawings and specifications described a portion of the work in only general terms and not in complete detail, it shall be understood that only the best general practice is to prevail, materials and workmanship of the best quality are to be employed and the instructions of the Engineer are to be complied with.

3 Geotechnical Investigation

3.1 Objective

Main objectives of soil survey and exploration work are:

- (1) to determine soil type with a view to identify their suitability for earthwork in formation and to design the foundation for other structures.
- (2) to avoid known troublesome spots, unstable hill sides, swampy areas, soft rock areas, peat lands, etc.
- (3) to determine method of handling and compaction of subgrade.
- (4) to identify suitable alignment for embankment and cutting from stability, safety, economy in construction and maintenance considerations.
- (5) to identify suitable borrow area for desired quality and quantity of subgrade and blanket material.
- (6) to determine depth of various strata of soil and bed rock level.
- (7) to determine ground water table position and its seasonal variation and general hydrology of the area such as flood plains, river streams, etc.
- (8) to determine behaviour of existing track or road structure nature and causes of geo-technical problems in them, if any.

3.2 Scope

This section specifies the requirements for geotechnical investigations, studies, analyses, and preparation of Geotechnical Interpretative Reports and the Technical Design Submittals as specified in Appendix – 10 [Requirements for Design] to the Employer's Requirement.

For the reference purpose of the Contractor, the indicative Geotechnical Investigation data is provided in the Reference Documents. These shall be further supplemented by the Geotechnical Investigation requirements as specified in the Employer's Requirements – General and by additional investigations as considered necessary by the Contractor for development of his Technical Design.,

The Contractor shall be responsible for determining for his Technical Design Submittals, the Geology and the Geotechnical parameters of the sub-surface strata along the alignment.

3.3 Design Considerations

In his design the Contractor shall take adequate measures to minimise the amount of local differential settlement of the embankment and structures.

3.4 Site Investigations

3.4.1 General

Regional engineering geology aspects for the area of the alignments are generally documented by the Geological Survey of India.

The effects of the design seismic event on the stability of structures, slopes and on the potential for liquefaction of soils shall be taken into account for the Technical Design.

3.4.2 Investigation Requirements

Available information shall be supplemented with project-specific geotechnical investigations. The intent and objectives of the geotechnical investigation shall be to collect all pertinent and reliable data and information required to produce a safe and economic Technical Design meeting all the requirements of the Bid.

For the purpose, the geotechnical investigation may include the following.

- (1) Compiling and reviewing pertinent existing geological data.
- (2) Compiling and reviewing the indicative geotechnical data as included in the Reference Documents.
- (3) Compiling and reviewing existing foundation, structure, substructure and related data.
- (4) Performing a detailed field reconnaissance.
- (5) Performing geotechnical investigations that include, but are not limited to drilling, soil sampling, rock coring, groundwater sampling,

in-situ field installations and testing, trial pits, geophysical surveys, slope protection strippings, and other existing structures.

- (6) Performing laboratory testing of soil, rock, and groundwater samples collected from the geotechnical investigations - (including chemical testing to identify potentially corrosive conditions).
- (7) As a minimum, the geotechnical investigation programme shall consider the locations and lateral and vertical extent of:
 - (i) Bridge location.
 - (ii) Earthworks (soil and rock excavations, embankment fills, areas requiring ground improvement, borrow pits and areas, disposal areas, etc.)
 - (iii) Existing adjacent structures that may be influenced by the construction
 - (iv) Significant engineering geology features that may influence the construction (i.e., principal faults, shear zones, persistent jointing, landslips)

Geotechnical investigations, as part of a comprehensive geotechnical investigation programme, shall be conducted according to IS: 1892.

Detailed investigations shall be done along the alignment and particularly at locations where important structures viz. high bank, deep cuttings, Important bridge etc. are to be located and where weak sub-soil, swampy ground, marshy land exist. Undisturbed soil samples with the help of deep auger sampler or Split spoon samplers shall be collected for conducting detailed tests viz. shear strength tests & consolidation test to design safe and economical structure and predict settlements.

The depths of investigation borings shall be consistent with the nature and extent of the construction.

All aspects of the geotechnical investigation shall be conducted under the direction of qualified geotechnical personnel. Detailed plans, specifications and standard forms, proposed staffing and reporting formats and indicating the types, locations, and proposed depths of investigations relative to the construction shall form part of the Geotechnical Investigation Plan and Geotechnical Investigation Programme shall be submitted for approval of the Engineer prior to undertaking the construction.

3.4.3 Investigation Approach

- (1) Exploratory Drill holes / Confirmatory Exploratory Drilling:

Exploratory drilling in soil and rock, disturbed and undisturbed soil sampling, and rock coring shall be performed according to procedures outlined in IS 1892. Full-time monitoring by qualified geotechnical personnel shall be required not only to direct the drilling, sampling and coring, but also to prepare field drill hole records.

The Contractor shall carry out the Exploratory Core Boring for all bridge structures such as the Important Bridges, as well as for all the stretches on which the Embankment is to be constructed in

compliance with the frequency not less than as specified in Clause 15.6 of Employer's Requirements – General.

All those exploratory bore holes shall be penetrated into the uniform bearing strata more than five (5) meters, where the bearing strata is defined by the N values of thirty (30) or more for sandy soil and of twenty (20) or more for clayey soil.

(2) Other Geotechnical Investigation Methods

Other geotechnical investigation methods commonly employed include, but are not limited to the following:

- (i) Field testing: Standard Penetration, cone penetration, vane shear, pressure meter, permeability/water absorption, impression packer/discontinuity survey, acoustic borehole imaging, in-situ density, N-Schmidt hammer, plate load testing.
- (ii) Field instrumentation: piezometers, inclinometers.
- (iii) Trial pits with/without block sampling.
- (iv) Inspection pits.
- (v) Geocore probes.
- (vi) Hand auger borings.
- (vii) Coring through rock or other manmade features.
- (viii) Slope protection stripping.
- (ix) Pumping tests.
- (x) Groundwater sampling.

(3) Groundwater

Piezometers shall be installed during geotechnical investigations to measure current and seasonal fluctuations in groundwater levels including fluctuations during dewatering for foundation construction. The geotechnical investigation programme shall incorporate the details of a groundwater observation plan, including locations and details of piezometer installations and frequency and duration of observations. It should also include chemical analysis of ground water. Full-scale groundwater pumping tests shall be conducted to develop design parameters for construction dewatering schemes, where ever required.

Groundwater information shall be interpreted, and recommendations for design groundwater levels, including differential levels that may develop across the structures shall be provided.

3.5 Laboratory / Field Testing

3.5.1 General

The laboratory testing programme shall be developed considering not only

the particular site conditions and project requirements, but also the applicable design standards, codes, regulations, and related publications as identified in Clause 2 [Standards] of these Specifications.

Prior to undertaking the construction work, detailed plans / proposals for the laboratory testing programme shall be prepared including specifications and standard forms, proposed staffing and reporting formats and the types and numbers of tests proposed etc. and submitted to the Engineer for his approval.

- 3.5.2** Besides classification tests, soil samples should be tested for shear strength and consolidation properties. In case of very soft clays, vane shear test should be conducted for each boring site. Free swell index test should also be carried out in case of expansive soil and organic contents of soil should be determined if soil is suspected to be having large organic contents.
- 3.5.3** Bore logs are prepared based on laboratory test results of disturbed samples obtained by auguring or split spoon sampler. Particle size distribution, soil classification and index properties of the soils are determined from laboratory tests.
- 3.5.4** In case of soft clays and sensitive clays, in-situ vane shear tests should be conducted to determine its shear strength and depth of underlying compressible clay layer. Undisturbed samples should also be collected to know actual moisture content, natural dry density and shear and consolidation parameters of the soil.
- 3.5.5** The bed rock when encountered during boring / drilling shall be tested and investigated to suitable depth as defined under para 6.4 “Sub-surface investigation – Well foundations”. The tests shall be conducted in laboratory for minimum following parameters but not limited to these as under:
 - a) Quantitative description of discontinuities in rock mass and the rock quality
 - b) Unconfined compressive strength of rock
 - c) Elastic modulus, Poisson’s ratio and dynamic modulus of rock

4 Earthworks

4.1 General

This section deals with the Selection of Materials for Earthwork, Execution of Earthwork in excavation and formation, Quality Control of the Earth work, Maintenance of Records and Quality Assurance. In principle the earth work shall be carried out as per the provisions of “Guidelines and Specifications for Design of Formation for Heavy Axle Load, Report No. RDSO / 2007 / GE: 0014 – November 2009) and “Guidelines for Earthwork in Railway Projects, Guideline No. GE: G-1 – July 2003 (with latest amendments)” issued by RDSO/ Lucknow except

for specific provisions made herein in Employer's Requirement.

4.2 Earthworks Definitions and Classifications

4.2.1 Definitions and Classifications

The following definitions of earthworks materials shall apply to this and other clauses of these Specifications in which reference is made to the defined materials.

- (1) **Top Soil:** Shall mean the top layer of soil including turf
- (2) **Soil:** This shall comprise topsoil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick, spade and/or shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having dimension in any one direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category.
- (3) **Suitable Material:** Shall comprise all that which is acceptable in accordance with the Contract for use in the Works.
- (4) **Unsuitable Material:** Shall mean other than suitable material
- (5) **Rock:** Shall comprise material found in ledges or masses in its original position.
 - (i) Soft Rock / Ordinary Rock (not requiring blasting)
 - (ii) Hard Rock (requiring blasting) -
 - (iii) Hard Rock (blasting prohibited) - Hard rock requiring blasting but where blasting is prohibited for any reason and excavation has to be carried out by chiseling, wedging or any other agreed method.
- (6) **Waste:** Waste shall be unsuitable material. Waste if not required by the Engineer / Employer shall be the property of the Contractor. The Contractor shall dispose waste at the areas outside the Site on his own expenses. However, if any low lying area is available in DFC/Indian Railway land, this can be disposed off there with permission of Employer. Disposal of the waste shall be in such a manner so as not to obstruct the existing roads, natural course / flow of the water in the adjoining river / drains / water courses, streams etc and shall be subject to the consent of the local bodies / approval of the Engineer.
- (7) **Cess:** Portion at top of formation level, extends from toe of ballast to edge of the formation.
- (8) **Ballast:** Crushed stones with desired specifications placed directly below the sleepers.
- (9) **Blanket:** Blanket is a layer of specified coarse, granular material of designed thickness provided over full width of formation between subgrade and ballast.

- (10) **Sub-grade:** It is the upper part of embankment/cutting provided above subsoil by borrowed soil of suitable quality upto bottom of blanket/ballast.
- (11) **Prepared Subgrade:** The upper part of the subgrade is formed into prepared subgrade layer, which normally has a crossfall.
- (12) **Sub-soil:** Soil of natural ground below subgrade.

4.2.2 Contractor's Equipment

The Contractor shall employ only those equipment which is suited to the soils to be handled. He shall be responsible for maintaining the nature of suitable material so that when it is placed and compacted it remains suitable in accordance with the Contract.

4.2.3 Removal of Suitable Material

No excavated suitable material other than surplus to the requirement of the Contract shall be removed from the Site except on the direction or with the permission of the Engineer. Should the Contractor be permitted to remove suitable material from the Site to suit his operational procedure, then he shall make good at his own expense any consequent deficit of filling arising there from.

4.2.4 Pollution Control

The Contractor shall submit to the Engineer, for his review, measures to be undertaken by the Contractor to prevent water pollution of the environment and erosion of earthworks.

4.3 Survey and Establishment of Working Benchmarks and Alignment References

4.3.1 The Contractor will make necessary arrangements for:

- (1) Validation of the data provided by the Employer and additional survey if considered necessary for design of the Alignment;
- (2) Setting Out Survey for setting out of the centerline of the Alignment; and
- (3) taking cross sections as necessary (and as consented by the Engineer). along the entire Alignment of bridge & its approaches and other structures and facilities included within the Scope of work.

The Contractor will be entirely responsible for accurate setting out of the works and safe guarding all survey monuments, bench marks, beacons, etc.

4.3.2 The Contractor shall establish working bench marks tied with the reference bench marks (GTS Benchmarks). The working bench marks / levels shall be got approved from the Engineer. Lines and levels of formation, side slopes, drainage works, bridge and other facilities shall be carefully set out and frequently checked to ensure that correct gradients and cross sections are obtained.

4.3.3 Centre line of the alignment and full construction width should be demarcated with reference pegs about 900 mm away from proposed toe of

the bank. Care should be taken not to disturb the pegs during construction. Pegs should be painted for identification.

- 4.3.4** The Contractor shall, in connection with the staking out of the centre line, survey the terrain along the Right of Way of the alignment and shall submit to the Engineer for his approval, a profile along the centerline and cross sections at the intervals required by the Engineer.

4.4 Soil Investigation

- 4.4.1** Soil Investigation shall be done as specified in Clause 3 [Geotechnical Investigation] of these Specifications.

- 4.4.2** Sources of blanket material, subgrade, embankment fill of specified quality and its availability around project site shall be located. The source identification should also cover various logistics involved in its utilization.

4.5 Borrow Areas

- 4.5.1** Contractor should arrange the land for Borrow Area required for carrying out the work in such a manner that borrow pits (to be excavated with in the borrow areas) are sufficiently away from the toe of the embankments to prevent slope/base failures due to lateral escapement of soil. The minimum distance to be provided between borrow pits and toe of the bank will be decided in consultation with the Engineer, in each case, on its merits. Existing borrow pits, close to toe of the embankment may be filled or its depth should be taken into account in analyzing the slope stability of the bank. The borrow areas / pits shall not be within the DFCC / IR land. The borrow pits shall be at least at a distance equal to height of the embankment from the Right of Way.

- 4.5.2** Exploratory boring with hand / auger samplers and soil sampling should be undertaken from the proposed borrow areas as specified in Clause 3 [Geotechnical Investigation] of these Specifications and tested as required therein.

4.6 Clearing and Grubbing and Stripping

4.6.1 General

(1) Scope

This work shall consist of all clearing and grubbing necessary for the performance of the work covered by the Contract in accordance with these Specifications.

- (i) The clearing and grubbing shall consist of cutting, removing, disposing and clearing the designated areas of all the obstructions like trees having girth 300mm or less, bushes, shrubs, roots, grass, weeds, snags, vegetation, loose and deleterious / organic material, pavement materials & signages / markers (if any), top organic soil not exceeding 150 mm in thickness, rubbish and objectionable material etc., which in the opinion of the Engineer are unsuitable for incorporation in the works and shall include grubbing stumps and roots and disposing of all material resulting from the clearing and / or

grubbing from the Right of Way containing embankment, drains, structures etc. and such other areas as may be specified by the Engineer.

- (ii) All the charted structures / utilities existing within the Right of Way for the Permanent Works (shall be demolished and removed by the Employer. Demolition & removal of uncharted utilities / structures, if any, within the Right of Way for the Permanent Works shall be the responsibility of the Contractor.
- (iii) Contractor shall also be responsible for demolition, removal and disposal of structures / foundations and utilities / facilities beyond the Right of Way that according to him is obtrude into or encroach upon or obstruct the work, with the prior consent of Engineer.
- (iv) Benching of the grounds having steep slopes or the slopes of the existing railway embankments where they are required to be widened.
- (v) All the incidentals removed from the project shall be stacked in neat piles so they may be collected by relevant authorities or become the property of the Employer.

(2) Preservation of property

- (i) Existing Railways and its related installations, highways and its related installations, facilities, adjacent property, utilities, services, and trees and plants designated for preservation shall be protected from injury or damage which could result from Contractor's operations.
- (ii) In order to reduce the risk of erosion, no topsoil shall be removed from the areas outside the limits of earthworks. Any topsoil outside these limits, which is inadvertently removed during clearing and grubbing operations or otherwise, shall be replaced immediately by the Contractor and at his own expenses.
 - (iii) Outside the limits of the construction works, all the trees and plants. shall be left undisturbed, for ecological purposes. These trees and plants shall be protected from injury or damage resulting from the Contractor's operations during the Contract Period.

4.6.2 Execution

(1) General

- (i) Clearing and grubbing shall be performed on the areas of full formation width at ground level plus additional extra width of 1m on both sides and should be cleared of all the obstructions viz. vegetation, trees (having girth 300mm or less), bushes, fences (if any), etc. and thereafter it should be dressed and leveled. Depressions if any should be filled with suitable soil & duly compacted.

(2) Clearing and Grubbing

- (i) Clearing and Grubbing shall consist of the removal and disposal of everything above ground level including overhanging branches except those things the Engineer directs are to be left undisturbed. The material to be cleared shall include but not necessarily be limited to trees (having girth 300mm or less), stumps, logs, brush, undergrowth, grass crops, loose vegetable matter, etc.
- (ii) All trees (having girth 300mm or less), stumps etc. falling within the excavation and fill lines shall be cut to such depth below ground level that in no case these fall within 500mm of the subgrade. Also all vegetation such as roots, undergrowth, grass and other deleterious matter unsuitable for incorporation in the embankment / subgrade shall be removed between fill lines to the satisfaction of Engineer. On areas beyond these limits, trees and stumps required to be removed as directed by the Engineer shall be cut down to 1m below ground level so that these do not present an unsightly appearance.

(3) Stripping

- (i) Stripping shall be carried out on the area of the embankment foundations, drains, structures and such other areas as specified in the drawings and approved by the Engineer. Stripping shall consist of the removal and disposal of topsoil, stumps, and roots to a depth of at least 150 mm below ground level.
- (ii) Material thus removed may be used as topsoil for slope protection if it, in the opinion of the Engineer, is suitable for this.
- (iii) Materials more than 150 mm below original ground level within embankment areas which are removed accidentally during the operation of the clearing and grubbing shall be replaced by acceptable fill materials which shall be compacted to the density prescribed for layers at the depths concerned below subgrade.
- (iv) All unsuitable materials and material not used as top soil, shall be wasted, and shall be disposed off.
- (v) Where existing Railway embankments is to be widened, all vegetation and topsoil shall similarly be completely removed from shoulders, slopes and ground under the widening before the operations of actual widening can be commenced.
- (vi) Where excavations are made, roots, stumps and the like shall be completely removed and placed outside the excavation area concerned before the excavation works proper can be commenced.
- (vii) At all remaining areas inside the Right-of-Way, the works of clearing and grubbing and stripping shall, unless otherwise instructed by the Engineer, include the leveling of obsolete

dikes (if present), terraces and ditches, the neat and complete removal of all remnants from structures and buildings (if any), roots, stumps, untidy vegetation, rubbish, garbage and the like, to such an extent that these matters will not, in the opinion of the Engineer, obstruct future maintenance by machines in the right-of-way area or access to the works.

- (viii) Ditches, streams and ponds in the embankment areas shall be properly cleared, drained and dried out prior to being filled in.
- (4) Benching: When the bank is constructed on ground having steep slope then the ground surface should be suitably benched so that new material of bank gets well bonded with the existing ground surface. The height of benching shall be 300mm and the slope of the benching shall be 4:1.
- (5) Holes / pots left after removal of vegetation, trees, roots, and stumps shall be backfilled with acceptable materials and compacted to the density prescribed for layers at the depths concerned below subgrade, and this backfilling shall be considered incidental to the works of clearing and grubbing and stripping and will not be paid for separately.
- (6) Finish - The entire Right-of-Way area shall be left with an orderly and neat appearance.
- (7) During clearing and grubbing and stripping, the Contractor shall take adequate precautions against soil erosion, water pollution, etc. as per the acceptable procedures and meeting all the requirements of Clause 10 [Safety, Health and Environment requirement] in the Specifications.

4.7 Excavation and Backfill for Structures

4.7.1 General

(1) Scope

This work shall consist of the excavation for structures and subsequent backfilling. Works may include:

- (i) Excavation of foundations for Bridge, Retaining Walls, Headwalls, Cutoff Walls and other similar structures.
- (ii) Sheet piling, shoring, bracing for supporting the excavation.
- (iii) Constructing including re-constructing (if required) and removing all the temporary works including cofferdams, guide bunds and sheet piling (wherever required).
- (iv) Protection measures during floods.
- (v) Pumping, dewatering and bailing.
- (vi) Backfilling around completed structures.
- (vii) Disposal of unsuitable & surplus excavated material.

The work done shall meet the requirements as specified on the Drawings.

4.7.2 Materials

(1) Excavation Material shall include excavation for foundations in all types of soil, rock or soft rock as classified and described in Clause 4.2 [Earthwork Definitions and Classifications] of these Specifications.

(2) Backfill material

(i) General

Backfill around completed structures shall be the consented and compatible material. It shall be obtained from the structure excavation if such material is consented by the Engineer as suitable. Any additional material, if needed, shall be obtained from excavation or approved borrow areas unless otherwise directed by the Engineer without any extra cost. The material used for backfill shall not be an organic soil or highly plastic clay.

(ii) Back Fill on Bridge approaches, behind Abutments and Wing Walls:

Behind the abutment and wing walls, boulder filling and backfill material should be provided as per relevant specifications.

Boulder filling shall consist of well hand packed boulders & cobbles with smaller size towards the backfill material.

4.7.3 Execution

(1) Clearing

Prior to starting excavation operations in any area, all necessary clearing and grubbing shall be performed.

(2) Excavation

(i) The Contractor shall notify the Engineer sufficiently in advance of the beginning of any excavation so that cross section elevations and measurement may be taken of the undisturbed ground. The natural ground adjacent to the existing structure shall not be disturbed without consent of the Engineer.

(ii) Trenches and foundation pits for structures and structure footings shall be excavated to the lines, grades and elevations shown on the Drawings.

(iii) The sides of pits and trenches shall be adequately supported at all times with shoring, strutting, planking etc. Alternatively, except where the Contract expressly requires otherwise, they may be suitably battered to such slopes as consented by the Engineer. Propping, wherever required, shall be undertaken when any foundation or stressed zone from adjoining structure

is within a line of 1 vertical to 2 horizontal from the bottom of the excavation.

- (iv) Boulders, logs and other objectionable materials encountered in excavation shall be removed.
- (v) Rock and other hard foundation material shall be cleared of all loose material and cut to a firm surface, either level or stepped, as specified or shown on the Drawings or as directed by the Engineer. All seams and crevices shall be cleared out and grouted with Portland cement grout at the time the footing is placed. All loose and disintegrated rock and thin strata shall be removed. All the annular space around footing shall be filled with M15 grade concrete up to the top of rock.
- (vi) After each excavation is completed the Contractor shall notify the Engineer to that effect and no footing, bedding material plugging of well, well sinking shall be done until the Engineer has consented the depth of excavation and the character of the foundation material.
- (vii) In the excavation for foundations, the Contractor shall take particular care during construction to avoid deterioration of the ground due to weather or the use of Contractor's equipment. Particular care shall be taken while the excavation approaches the final levels to avoid over excavation and not to disturb the natural ground.
- (viii) If required, before any concrete for a foundation is placed, the bottom of all excavations, where blinding layers shall be cast, shall be re-compacted to achieve a smooth and level surface.
- (ix) Unless otherwise specified, the excavations for foundations in soil shall be carried out at least 100mm below the proposed bottom level of the structural concrete towards the provision for lean concrete. This lean concrete shall be of M-15 grade.
- (x) The bottom of excavations shall be trimmed to the required levels. In the event of excavation having been made deeper than shown on the drawings or as ordered by the Engineer, the extra depth shall be made up with M15 grade concrete in case of foundation resting on soil and with foundation grade concrete for foundation in rock at the cost of Contractor and shall be considered incidental work.
- (xi) All excavation surfaces and surfaces of backfill material against which concrete is to be placed shall be smooth and firm and true to line and level.
- (xii) The Contractor shall allow for sufficient time between the excavation and execution of the foundations for the Engineer to carry out supplementary soils investigations and subsequent tests, if required.

(3) Dewatering and Protection

- (i) Open foundations shall be laid dry. Where water is met with in excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, depression of water level by wellpoint system, cofferdams and other necessary works to keep the foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion or sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to consent of the Engineer. Consent of the Engineer shall, however, not relieve the Contractor of the responsibility for the adequacy of dewatering and protection arrangements and for the quality and safety of the works.
- (ii) Where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed and be made as watertight as is necessary for facilitating construction to be carried out inside them. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction and inspection and to permit installation of pumping equipments, etc., inside the enclosed area.
- (iii) If it is determined beforehand that the foundations cannot be laid dry or the situation is found that the percolation is too heavy for keeping the foundation dry, the foundation concrete shall be laid under water by tremie pipe only with the prior consent of the Engineer. In case of flowing water or artesian springs, the flow shall be stopped or reduced as far as possible at the time of placing the concrete.
- (iv) Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.
- (v) At the discretion of the Contractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area.
- (vi) The Contractor shall take all precautions in diverting channels and in discharging drained water as not to cause damage to works, crops or any other property.
- (vii) Pumping or bailing to dewater a sealed cofferdam shall not be started until at least 36 hours after final set of sealing concrete.

(4) Disposal of excavated material

- (i) All excavated material so far as suitable, shall be utilized as backfill. The waste material or any excess material derived from excavations if not required by Engineer shall be the property of the Contractor.
- (ii) Excavated material suitable for use as backfill may be deposited by the Contractor in storage piles at points of convenient for re-handling of the material during the backfilling operation.

(5) Cofferdam

- (i) The term "cofferdam" denotes any temporary or removable structure, constructed to hold the surrounding earth, water, or both, out of the excavation, whether such structure is constructed of earth, timber, steel, concrete or any combination of these. The term includes earth dikes; and timber cribs, sheet piling, removable steel shells and all bracing; and it shall be understood to include excavation enclosed by pumping wells and well points.
- (ii) The Contractor shall submit drawings showing his proposed scheme and method of cofferdam construction to the Engineer for his consent. Consent of the drawings by the Engineer will not in any way relieve the Contractor of the responsibility for the adequacy of the design for strength and stability or for the safety of the people working therein.
- (iii) The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction and removal of any required forms and the inspection of the interior and to permit pumping outside the forms.
- (iv) Unless otherwise permitted, no excavation shall be made outside of cofferdams or sheet piling and the natural stream bed adjacent to the structure shall not be disturbed without consent from the Engineer. If any excavation or dredging is made at the site of the structure before cofferdams are in place, the Contractor shall, after the foundation is in place, backfill all such excavation to the original ground surface or stream bed with material satisfactory to the Engineer.
- (v) Material deposited within the stream area from foundations or other excavations or from the filling or cofferdams shall be removed and the stream area freed from obstruction.
- (vi) Cofferdam which tilt or move laterally during construction shall be corrected as necessary at the expense of the Contractor. Cofferdams shall be removed after the completion of the sub-structure. The removal shall be effected in such a manner as not to disturb or mar the finished work. The Engineer may order the Contractor to leave any part or the whole of the cofferdam in place, if required.

- (vii) Cofferdams shall be constructed so as to protect newly cast concrete from sudden rising of the water and to prevent damage to the foundation by erosion.

(6) Backfilling

- (i) All spaces excavated under these Specifications and not occupied by the permanent structure shall be backfilled. Backfilled material shall be approved and free from large lumps, wood and other extraneous material.
- (ii) After completion of foundation footings and abutments and wing walls and construction below the elevation of the final grades and prior to backfilling, all forms, temporary shoring, timber etc. shall be removed and excavation cleaned of all trash, debris and perishable materials. Backfilling shall begin only with the approval of the Engineer.
- (iii) The Contractor shall not backfill around structures until the structural elements have attained adequate strength consented by the Engineer.
- (iv) Backfill shall not be dropped directly upon or against any structure or facility where there is danger of displacement or damage.
- (v) Backfill shall be placed in horizontal layers not to exceed 200 mm in thickness. Each layer shall be compacted with proper moisture content and with such equipment as may be required to obtain a density equal to or greater than 95% of maximum dry density as determined by IS: 2720. Trucks or heavy equipment for depositing or compacting backfill shall not be used within 1.5 m of building walls, piers, or other facilities which may be damaged by their weight or operation. The methods of compaction shall be subject to the approval of the Engineer. Pushing of earth for backfilling shall not be adopted under any circumstances.
- (vi) Backfill adjacent to pipes shall be hand placed, free of stones, concrete, etc. compacted uniformly on both sides of the pipe and where practicable, to a depth of 300 mm over the top of pipes. While tamping around pipe, care shall be taken to avoid unequal pressures.
- (vii) Clods or hard lumps of soil to be used as backfill shall be broken to 75 mm or lesser size before placing as backfill.
- (viii) In placing backfill and embankment the material shall be placed insofar as possible to approximately the same height on both sides of the structure. If conditions require backfilling appreciably higher on one side, the additional material on the higher side shall not be placed until consent is given by the Engineer nor until the Engineer is satisfied that the structure has enough strength to withstand any pressure created.
- (ix) Backfill for embankment shall not be placed behind the walls of

bridges or box culverts until the top slab is placed for the required time and not less than three days. Backfill and embankment behind abutments held at the top by superstructure shall be carried up simultaneously behind opposite abutments and side walls.

- (x) No backfilling shall be placed against any structure until consent shall have been given by the Engineer. Jetting of fill or other hydraulic methods involving, or likely to involve, liquid or semi-liquid pressure shall be prohibited.
- (xi) Special care shall be taken to prevent any unduly high pressures against the structures.
- (xii) The placing of embankment / backfill and the benching of slopes (wherever required) shall continue till the backfilling is reached at the designed level.
- (xiii) Adequate provision shall be made for boulder filling behind abutments wing walls.

(7) Placement of Back-fill on Bridge Approaches and similar locations

- (i) Backfills on bridge approaches shall be placed in accordance to RDSO's Report no. GE: R-50. The Contractor shall design the Transition System to satisfy the DFC Loading Standards and shall get it approved from the Engineer.

4.7.4 Tolerance & Acceptance Criteria

- (1) Excavation level : No point of the surface of lean concrete in case of foundation on soil or the surface of hard rock in case of the foundation of hard rock, shall be higher than the founding level shown in the drawings or as ordered by the Engineer.
- (2) Backfilling: On completion of structures, the earth surrounding them shall be accurately finished to line and grade as shown on the drawings. Finished surface shall be free of irregularities and depressions and shall be within 50mm of the specified level.

4.8 Embankment

4.8.1 General

(1) **Scope**

This work shall consist of the construction of embankment by furnishing, placing, compacting and shaping suitable material of acceptable quality obtained from consented sources in accordance with these Specifications, and to the lines, levels, grades, dimensions, and cross-sections shown on the Drawings and as required by the Engineer.

(2) **Railway Formation**

- (i) Before taking up of actual execution of work, detailed drawings

- need to be prepared for the entire length of the project to give alignment, formation levels, formation width at ground level, cross sections of catch water drains and side drains, cross section and levels of sub-grade, blanket levels etc. To facilitate smooth execution at site.
- (ii) The design and construction procedures should be such that it should be able to sustain the track geometry under anticipated traffic densities and axle loads during service under most adverse conditions of weather and maintenance of track structure, which are likely to be encountered.
- (3) Geometrical Requirements for the Soil Formations should generally meet the following requirements:
- (i) Cross fall slope to be at least 1:30 from centre of the track towards both sides and from center of the embankment towards cess / drain side (both side) in double lines. Cross slopes shall be provided at top of blanket, at top of prepared subgrade, at top of embankment fill and at berm
 - (ii) Finished soil surface to be in level in longitudinal direction (≤ 20 mm on a longitudinal base of 4m), must not show hollow pits, road vehicle traffic ruts

4.8.2 Embankment Fill Materials

- (1) Embankment Fill shall be constructed of materials as per “Guidelines and specifications for design of formation of Heavy Axle Load , (Report No.RDSO/2007/GE:14”) and as per clause 14.7 – Design criteria of Employers requirements.

(2) Selection of Blanket Material

- (i) Proper survey of area close to Embankment site, at different locations needs to be carried out to identify suitable sources for blanket material required. Aim of such source identification survey is to use naturally available material, which is cheap and conforms to the specifications laid down.
- (ii) If, naturally available materials do not meet the desired specifications, blanket material can be produced by mechanical process from crushing or blending method or combination of these two methods. However detailed methodology of blending to be adopted to produce large quantity of blanket material with consistent quality, shall have to be laid down. Trials (theoretical and laboratory) for blending to judge the final product shall have to be carried out & shall be subject to consent of the Engineer. Naturally available sand, quarry dust or crusher run, if available, can be used as prepared subgrade also.
- (iii) Quarry dust or material specifically manufactured through crushers using boulders, rocks, etc. as raw material, conforming to the blanket material specification may also be used as

blanketing material.

- (iv) In any case, before planning for use of any material for formation of blanket/sub-grade, Engineer's specific approval is to be taken for the use of that particular material and also for the location from where such material will be quarried / sourced.

4.8.3 Ground Improvement

Where required, for guidance on Ground Improvement Techniques, Annexure-1 of "Guidelines and Specifications for Design of Formation for Heavy Axle Load (Report No. RDSO / 2007 / GE: 14)" will be followed.

4.8.4 Design of Side Slope of Embankment

- (1) Usually side slope gradient of 2H:1V for the Embankment and 1H:1V for Formation in Cut should be sufficient, however the same shall be designed by the Contractor based on the slope stability analysis to be carried by the Contractor.
- (2) Slope stability analysis should be carried out to design stable slopes for the embankment and has to be carried out in detail for any height.
- (3) In cutting slope, softening of soil occurs with the passage of time, and therefore, long term stability is the most critical, and should be taken into consideration while designing the cuttings.
- (4) Detailed slope stability analysis should be carried out as per procedure laid down in 'Annexure-III' of "Guidelines for Earthwork in Railway Projects, Guideline No. GE: G-1". This procedure would be applicable for most of the cases. However, in certain situations, further detailed analysis may be required due to the site conditions and shall be carried out by an expert consultant.

4.8.5 Execution

(1) Field Trials

- (i) Field trial for compaction on a test section shall be conducted on fill material to assess the optimum thickness of layer and optimum number of passes for the type of roller planned to be used to arrive at desired density. Procedure for field compaction trials as given in Annexure – IV of 'Guidelines for Earthwork in Railway Projects - July 2003, Report No. GE: G-1" issued by RDSO may be referred for guidance.
- (ii) If the soil has less than required moisture content, necessary amount of water shall be added to it either in borrow pits or after the soil has been spread loosely on the embankment. Addition of water may be done through flooding or irrigating the borrow areas or sprinkling the water on the embankment through a truck mounted water tank sprinkling system. Use of hose pipe for water need to be avoided.
- (iii) If the soil is too wet, it shall be allowed to dry till the moisture content reaches to acceptable level required for the compaction.

- (iv) Placement moisture content of soil should be decided based on the field trial and site conditions. The objective should be to compact at OMC to achieve uniform compaction with specified density in most efficient manner.

(2) Preparation of foundation for embankment

- (i) Prior to placing any embankment upon any area, all clearing and grubbing operations shall be completed in accordance with Clause 4.6: Clearing and Grubbing of these Specifications.
- (ii) Natural ground / sub-soil Strata shall be prepared to receive the placement of first layer of the Embankment.
- (iii) In case where the embankments are to be constructed on ground having slopes or along the existing embankments of Indian Railways requiring widening,
 - a) All vegetation shall be uprooted and taken away from the site of work.
 - b) Starting from toe, the benching on the slopes at every 300mm height shall be provided on slope surface so as to provide proper amalgamation between the old and new earthwork.
 - c) Material which has been loosened shall be re-compacted simultaneously with the first level of embankment material placed. It should be ensured that there is no humus material left on the benched slope.
 - d) Care shall be taken to avoid entry of rain water in to the formation from this weak junction which otherwise would result in development of weak formation, slope failure & unevenness settlement.
- (iv) In case of the Embankment in swamps or water the Contractor shall excavate or displace swamp ground / water and backfill with suitable material. Backfill will be in accordance with the same provisions as for embankment unless otherwise directed by the Engineer.
- (v) If unsuitable materials occur in some areas under the embankment or in existing embankments, such materials shall be removed to levels as consented by the Engineer, the bottom of the excavation shall be compacted, as described above, and the areas backfilled and compacted layer by layer with suitable material.
- (vi) All compaction shall conform to the requirements as specified in the subsequent paras herein below of these Specifications.

(3) Placing embankment

Embankment shall be placed in accordance with the following requirements:

(i) **General**

Except as otherwise required by the Engineer, all embankments shall be constructed in layers approximately parallel to the finished grade of the railway track. During construction of embankment, a smooth grade having an adequate crown or super-elevation shall be maintained to provide drainage. Embankment shall be constructed to the required grade, and completed embankment shall correspond to the shape of the typical sections shown on the Drawings.

(ii) **Earth Embankment**

Earth embankment shall be defined as those principally of material other than rock, and shall be constructed of consented material from designated or other consented sources. Earth embankment shall be constructed in successive layers, for the full width of the cross-section and in such lengths as are suited to the compaction and watering methods used.

(iii) **Adjacent to Culverts and Bridges**

Embankment adjacent to culverts and bridges which cannot be compacted by use of equipment used in compacting, the adjoining section of embankment shall be compacted in the manner prescribed as per relevant provision of Employers Requirement . Embankment placed round spill through type abutments shall be compacted in such a manner so as to maintain approximately the same elevation on each side of the abutment and each layer of material shall be mixed, wetted and compacted as specified herein.

(iv) **Preparation of Subgrade**

- a) The surface of the finished subgrade shall be neat and workmanlike and shall have the required form, super elevation, levels, grades, and cross-section. The surface shall be constructed to the specified accuracy to permit the construction of subsequent layers of material to the thickness, surface tolerance, and compaction as specified.
- b) As far as is practicable and when directed by the Engineer, the Contractor shall construct the Embankment fills as early in the Contract period as possible to allow for consolidation of the embankment during the remainder of the Contract period.
- c) Clods or hard lumps of soil of borrow area shall be broken before placing on embankment
- d) Suitable thickness of soil of each layer is necessary to achieve uniform compaction. Layer thickness depends upon type of soil involved and type of roller, its weight and contact pressure of its drums. Normally, 200 mm to 300 mm layer thickness is optimum in the field for achieving homogenous compaction. However for determination of

optimum number of passes for a particular type of roller and optimum thickness of layer at a predetermined moisture content, a field trial for compaction is necessary as per IS: 10379 – 1982 and Heavy Compaction Test as per IS; 2720. However as a good practice, thickness of layer should be generally kept as 300mm for fill material and 250mm for blanket material in loose state before compaction.

- e) Where streams or ditches are to be diverted, or abandoned, their beds should be filled up to a level as consented by the Engineer. Within the limits of earthwork, such fill shall be placed and compacted to the requirements as specified in this Section. Filling shall be performed well ahead of the construction of the embankments, and all other works involved such as pumping, damming, etc. Embankment fill placed against the sides of pipe culverts shall be placed in such manner as to maintain the same elevation on both sides of the culvert.
- f) The Engineer may request the installation of settlement plates, piezometers, lateral movement stakes, inclinometers or other settlement control devices if required by the Engineer for monitoring purpose.
- g) In case of rainfall during construction of formation, care should be taken that rain cuts are not allowed to develop wide and deep. The such rain cuts should be attended to / repaired as a regular measure.
- h) All settlement occurring in embankment construction shall be corrected by the Contractor by providing additional layers of embankment or selected material. The Contractor shall be fully responsible for the stability and integrity of the embankment during the Contract and Maintenance periods.
- i) If a soil failure either occurs or becomes imminent during the construction of the embankment, the Engineer shall have the authority to suspend all embankment construction in the affected area until corrective measures can be determined and implemented. Any delay in the embankment construction schedule and any other effects caused by implementation of the above clause shall not constitute grounds on the part of the Contractor for a claim for extension of the Contract and/or financial compensation.

(4) Use of Mixed Types of Soils

- (i) Different types of fill materials, if used, should be deposited in such a way that parts of the site receive roughly equal amount of a given material in roughly the same sequence to get approximate homogeneous character of sub-grade.

(5) Compaction of embankment

- (i) Embankments shall be constructed in layers of uniform

thickness as specified. The spreading of material in layers of desired thickness over the entire width of embankment should be done by mechanical means and finished by a motor grader. The motor grader blade shall have hydraulic control suitable for initial adjustment and maintain the same so as to achieve the slope and grade.

- (ii) Each layer sloping out as per specifications and compacting it mechanically using vibratory rollers.
- (iii) Thickness of the layer is decided based on field compaction trials.
- (iv) If natural moisture content (NMC) of the soil is less than the OMC, calculated amount of water based on the difference between OMC and NMC and quantity of earthwork being done at a time, should be added with sprinkler attached to water tanker and mixed with soil by motor grader or by other means for obtaining uniform moisture content. When soil is too wet, it is required to be dried by aeration to reduce the moisture content near to OMC.
- (v) The rate of progress should be uniform so that the work is compacted to the final level almost at the same time.
- (vi) Each layer should be compacted with recommended type of roller upto required level of Compaction, commencing from the sides, before putting up next upper layer.
- (vii) Each layer of the embankment fill shall be compacted to a dry density equal to at least 97% of the maximum dry density of the material.
- (viii) Each layer of the prepared subgrade fill shall be compacted to a dry density equal to at least 98 % of the maximum dry density of the material.
- (ix) Each layer of the Blanket Material fill shall be compacted to a dry density equal to at least 100 % of the maximum dry density of the material.
- (x) Each layer of material shall be compacted uniformly by use of adequate and appropriate compaction equipment as consented by the Employer after field trials for compaction. The compaction shall be done in a longitudinal direction along the embankment.
- (xi) At the end of the working day, fill material should not be left uncompacted. Care should be taken during rolling to provide suitable slope on top of the bank to facilitate quick shedding of water and avoid ponding on formation.
- (xii) Care shall be taken that the rain cuts are not allowed to be developed wide and deep, otherwise these locations will remain weak spots. Contractor should attend / repair such rain cuts as a regular measure.
- (xiii) At locations where the water table is high and the fill soil is fine-

grained, it may be desirable to provide a granular layer of about 300 mm thickness at the base, above subsoil across the full width of formation.

- (xiv) The Contractor shall protect the prepared subgrade from both his own and public traffic. Once the top surface of the formation has been finished to proper slope and level, movement of material vehicles for transportation should be avoided on the surface, as this will cause development of unevenness & ruts on the surface which shall accumulate water and weaken the formation. The Contractor shall maintain the subgrade by watering and rolling as frequently as necessary to preserve the subgrade in a completely satisfactory condition as specified above.
- (xv) Embankments shall be maintained to the grade and cross-section shown on the Drawings throughout the contract period.
- (xvi) Attention is drawn to the fact that the general compaction requirements shall at any level apply to the full width of the embankment. Slopes to be covered with topsoil and grassing shall have a firm surface before topsoil is placed.
- (xvii) At places where embankment materials are not conducive to plant growth, top soil obtained from site clearance as well as top layer of borrow area, which is rich in organic content and suitable for plant growth, may be stored for covering slopes of embankment & cutting after construction or other disturbed areas where re-vegetation is required.

(6) Preparation of subgrade surface

The subgrade shall be shaped to correct line and level and the Contractor shall at all times ensure that the subgrade is well drained and protected against damage from public as well as construction traffic.

4.8.7 Slope Protection / Erosion Control

Suitable and cost effective slope protection / erosion control system (Vegetation based) considering soil matrix, topography and hydrological conditions to protect the side slopes of Embankment / Formation in Cutting should be provided with the consent of Engineer. System shall consist of supplying & laying a layer of fertile top soil having capability to support vegetation on the exposed slopes. Vegetation may be done in accordance with any of methods as described in "Guidelines on Erosion Control and drainage of Railway Formation (Guideline No. GE: G-4)" as issued by RDSO.

4.8.8 Drainage Arrangement

Suitable drainage arrangement shall be provided for Embankment / Formation in Cutting, Berms and particularly the drainage between DFC embankment and existing Railway Embankment. Purpose of the drainage system is to collect water before it reaches the problem areas, diverting the surface water away from formation / slope and reduce infiltration of water. In case of formation in cutting and the DFC alignment near existing

Railway Embankment (if any), suitable side drains, catch water drains may have to be provided.

When height of the bank is such that the blanket layers goes below normal ground level, side drains may be required along the track at suitable distance so that the track alignment does not become the channel for flow of ground surface water. In case of cuttings, properly designed side drains of required water carrying capacity are to be provided. As Blanket Layer is to be placed like fill / embankment, top of side drains has to remain below the bottom of the blanket material.

In case of high Embankments with Berm, the suitably designed drain by the side of the berm should be provided running parallel to the embankment and leading to the sloping drains which are to be provided at suitable intervals along the slopes of the embankment. Sloping drains should lead to the natural ground sufficiently away from toe of the embankment.

In case of double line construction, central drain between tracks should be avoided.

If height of the cutting is less (say up to 4m) only side drains on both sides of the track are to be provided. In case of deep cuttings, catch water drains of adequate water carrying capacity are also provided.

All the drains in general should lead to the nearest culvert or natural low ground longitudinally or natural outlets existing near by where the water can be sufficiently discharged with appropriately designed outfall arrangements duly consented by the Engineer. Reference may be made to "Guidelines on Erosion Control and drainage of Railway Formation (Guideline No. GE: G-4)" as issued by RDSO in this regard.

4.8.9 Quality Assurance

- (1) To achieve effective performance of the permanent works, adequate quality control / checks at all stages of construction viz. selection of construction materials, adoption of method, use of suitable machinery for construction and during execution of work shall be carried out.
- (2) Quality Check on Earthwork : Quality of execution of formation earthwork shall be controlled through exercise of checks on the borrow material, blanket material, sub-grade material compaction process, drainage system, longitudinal & cross sectional profiles of the embankment.

(i) Tests for Selection of Soil:

- a) For selection of soil to be used as embankment fill, CBR test shall be conducted on material. CBR is conducted on ground soil, embankment fill, prepared sub-grade & blanket material to ensure the minimum specified CBR value of these material to be used in construction. This test is carried out on soil sample in laboratory as per procedure given in IS: 2720 (Part 16) – 1987 and in field as per IS: 2720 (part 31) – 1969.

- b) Other tests to be conducted are soil classification / sieve analysis, OMC, NMC NDD etc as per IS: 2720.
- c) Heavy Proctor Test is required to be conducted to determine the Maximum Dry Density of soil as per IS: 2720 (Part 8).
- d) In case of slope stability analysis, triaxial test will also be done to find the effective shear parameters.

Any other test as considered necessary / as required by the Engineer.

(ii) Tests for Blanket / Prepared Sub-grade Material

- a) The source of blanket material shall be identified based on the tests & studies conducted for conforming the material to the required specifications viz. Particle Size Distribution, % fine, Los Angeles Abrasion, Cu, Cc, CBR, Filter criteria, γ_{max} , γ_{min} or OMC & MDD etc.

(iii) Tests on Compacted Layer: Quality assurance tests are required to be conducted on part completion stages of formation, prior to clearing for further earthwork / blanketing work etc.

- a) In-situ density is measured in the field by Sand Replacement method as per IS: 2720 (Part 28) or Core Cutter Method as per IS: 2720 (Part 29) to calculate the degree of compaction. This shall be determined in laboratory as per BIS Procedure with specified frequency of earth work quantity.

- b) Method of Sampling : For each layer, a minimum of one sample at a predetermined interval along centre line of the alignment would be taken in a staggered pattern so as to attain a minimum frequency of tests as specified herein below. For subsequent layer, the stagger should be such that the point of sampling does not fall vertically on the earlier sampling points of the layer immediately below. In case of bank widening / for the embankment adjoining the existing embankment, the sampling shall be done at an interval of minimum 200 meters on the widened side of the embankment.

(3) Frequency of Quality Assurance Tests

Frequency of tests shall be as per RDSO/IRS/IS codes/specifications.

(4) Setting up of GE lab at Construction Site

- (i) A well equipped Geotechnical Field laboratory shall be setup by the Contractor at the pre-determined locations as consented by the Engineer.
- (ii) The field labs should be manned by trained staff capable of carrying out required investigation, soil testing & quality control.
- (iii) Aspects to be looked after by field GE lab are as under:

- a) To ensure that the quality of supplied soil and blanket material conforms to the accepted limits of gradation, classification, plasticity etc.
- b) To evaluate method of compaction by conducting tests in connection with field trials
- c) To exercise moisture and density control as the earthwork proceeds in layers rolled with the suitable equipment
- (iv) Depending upon the requirement, field lab shall be equipped with the equipment to facilitate the following minimum tests:
 - a) Gradation Analysis : Sieve and Hydrometer
 - b) Atterberg's Limits : Liquid Limit & Plastic Limit
 - c) Optimum Moisture Content (OMC), maximum Dry density (MDD) and Relative Density
 - d) Placement moisture content and in-situ Density

4.8.10 Tolerances and Acceptance Criteria

- (1) Soil Formation should meet the following requirements:
 - (i) The cross fall slope to be at least 1:30
 - (ii) The finished top levels of soil formation should be within ± 30 mm
 - (iii) The finished top of blanket layer shall be permitted to have variation from design level by + 25mm
- (2) **For Compacted earth and Blanket Layer:**
 - (i) Formation width should not be less than the specified width.
 - (ii) Side Slopes should in no case be steeper than specified/ designed side slopes. Provision of Berm Width should not be less than the specified/ designed width.

4.9 Safety Aspects

The Contractor shall observe all aspects of safety as laid down in Employers Requirements – Construction. The work being in flowing river, utmost care has to be taken for safety of temporary, permanent work and of equipment and personnel being employed on the work.

5 Material for Structures

5.1 General

Materials to be used in the work shall conform to the specifications mentioned on the drawings, the requirements laid down in this section and specifications for relevant items of work covered under these Specifications.

If any material, not covered in these Specifications, is required to be used in the work, it shall conform to relevant IRS/IRC/ Indian Standards, if there are any, or to the requirements consented by the Engineer.

5.2 Sources of Material

Approval of all sources of material for the Work shall be obtained from the Engineer before their use on the Project.

The Contractor shall notify the Engineer of his proposed sources of materials prior to delivery. If it is found after trial that proposed or previously approved sources of supply do not produce uniform and satisfactory products, or if the product from any other source proves unacceptable at any time, the Contractor shall furnish acceptable material from the other acceptable sources at his own expense.

5.3 Bricks

Burnt clay bricks shall conform to the requirements of relevant IS specifications.

5.4 Stones

Stones shall be of the type specified and consented by Engineer. It shall be hard, sound, free from cracks, decay and weathering and shall be from an approved quarry. Stone with round surface shall not be used.

5.5 Cast Iron

Cast iron shall conform to relevant IS standards.

5.6 Cement

5.6.1 Cement to be used in the works shall be any of the following types and with the prior consent of the Engineer :

- (1) Ordinary Portland Cement, 33 Grade, conforming to IS: 269.
- (2) Rapid Hardening Portland Cement, conforming to IS: 8041.
- (3) Ordinary Portland Cement, 43 Grade, conforming to IS: 8112.
- (4) Ordinary Portland Cement, 53 Grade, conforming to IS: 12269.
- (5) Sulphate Resistant Portland Cement, conforming to IS: 12330.

5.6.2 Cement conforming to IS:269 shall be used only after ensuring that the minimum required design strength can be achieved without exceeding the maximum permissible cement content as per relevant specifications.

5.6.3 Cement conforming to IS:8112 and IS:12269 may be used provided the minimum cement content mentioned elsewhere from durability considerations is not reduced.

5.6.4 Cement conforming to IS:12330 shall be used when sodium sulphate and magnesium sulphate are present in large enough concentration to be aggressive to concrete. It shall not be used under such conditions where concrete is exposed to risk of excessive chlorides and sulphates attack both. The recommended threshold values as per IS: 456 are sulphate concentration in excess of 0.2 per cent in soil substrata or 300 ppm (0.03per cent) in ground water. Tests to confirm actual values of sulphate concentration are essential when the structure is located near the sea coast, chemical factories, agricultural land using chemical fertilizers and

sites where there are effluent discharges or where soluble sulphate bearing ground water level is high. Cement conforming to IS: 12330 shall be carefully selected from strength considerations to ensure that the minimum required design strength can be achieved without exceeding the maximum permissible cement content.

5.6.5 Cement conforming to IS:8041 shall be used only for precast concrete products with prior consent of the Engineer.

5.6.6 Ordinary Portland Cement, not less than 53 Grade, conforming to IS:12269 shall be used for pre-stressed concrete works.

5.6.7 Use of Fly Ash as shall not be permitted.

5.7 Coarse Aggregates

5.7.1 For plain and reinforced cement concrete (PCC and RCC) or pre-stressed concrete (PSC) works, coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone, crushed gravel etc.. They shall not consist of pieces of disintegrated stones, soft, flaky, elongated particles, salt, alkali, vegetable matter or other deleterious materials beyond the tolerance limits specified in the relevant IS Codes. Coarse aggregate having positive alkali-silica reaction shall not be used. All coarse aggregates shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386, Parts I to VIII.

5.7.2 Marine aggregates shall not be used.

5.7.3 The Contractor shall submit for the consent of the Engineer, the entire information indicated in Appendix A of IS: 383.

5.7.4 Maximum nominal size of coarse aggregate for various structural components in PCC, RCC or PSC, shall conform to relevant IRS/IS specifications.

5.8 Sand / Fine Aggregates

5.8.1 For masonry work, sand shall conform to the requirements of IS: 2116.

5.8.2 For plain and reinforced cement concrete (PCC and RCC) or pre-stressed concrete (PSC) works, fine aggregate shall consist of clean, hard, strong and durable pieces of crushed stone, crushed gravel, or a suitable combination of natural sand, crushed stone or gravel. They shall not contain dust, lumps, soft or flaky, materials, mica or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the embedded steel. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregates shall conform to IS:383 and tests for conformity shall be carried out as per IS: 2386, (Parts I to VIII). The Contractor shall submit to the Engineer the entire information indicated in Appendix A of IS: 383 for his consent. The fineness modulus of fine aggregate shall neither be less than 2.0 nor greater than 3.5.

5.8.3 Creek /Marine sand shall not be used in permanent works.

5.9 Steel

5.9.1 Cast Steel

The use of cast steel shall be limited to bearings and other similar parts. Steel for castings shall conform to relevant Grade of IS specifications as per design requirement in relevant bearing code.

5.9.2 Steel for Pre-stressing

The pre-stressing steel shall conform to relevant provision of IR Concrete Bridge Code.

All pre-stressing steel shall be free from splits, harmful scratches, surface flaws, rough, jagged and imperfect edges and other defects likely to impair its use in pre-stressed concrete.

The value of modulus of elasticity of steel used for design of pre-stressed concrete members shall preferably be determined by tests on samples of steel to be used for construction. For the purpose of this, the value given by the manufacturer of the pre-stressing steel shall be considered as fulfilling the necessary requirements.

5.9.3 Reinforcement / Untensioned Steel

For plain and reinforced cement concrete (PCC and RCC) or pre-stressed concrete (PSC) works, the reinforcement / untensioned steel, as the case may be, shall be as per provisions of relevant codes.

All Reinforcement steel (TMT Bars) and Structural steel shall be procured as per specifications mentioned in Bid documents IS-1786 and IS-2062 respectively. Independent test shall be conducted, where ever required, to ensure that material procured Conform to specifications.

These steel shall be procured only from those firms, which are established, Reliable and primary producers of steel having integrated steel plant(ISP), using iron ore as the basic raw material and having in house iron rolling facilities, followed by production of liquid steel, as per Ministry of steel's (Government of India) guidelines.

However only certain isolated sections of structural steel, not being rolled by ISPs can be procured from the authorized rerollers of ISPs or authorized licensee of BIS having traceability system and who use billets produced by ISPs with the approval of engineer.

The Contractor shall notify the name of such primary steel producers to the Engineer, from whom he intends to procure the steel, along with copy of primary steel producer certificate and BIS license. All reinforcing steel shall be free from loose small scales, rust and coats of paint, oil mud etc. Every bar shall be inspected before assembling on the work and defective, brittle or burnt bar shall be discarded. Cracked ends of bars shall be discarded.

5.9.4 Structural Steel

- (1) Structural steel shall before fabrication comply with the requirement of the relevant Indian Standards.
- (2) Structural Steel for Railway Bridges shall also conform to the special requirements as specified below:
 - (i) IS: 2062, Quality "A" Grade Designation E250 (Fe 410W) as rolled semi-killed or killed shall be used for foot-over bridges and other structures subjected to non-critical loading.
 - (ii) IS: 2062, Quality "B" Grade Designation E250 (Fe 410W) fully killed and normalized / controlled cooled, where service temperature does not fall below 0°C, shall be used for welded / riveted girders subjected to Railway loading. Plates less than 12mm thick need not be normalized / controlled-cooled.
 - (iii) IS: 2062-2006 Grade designation E 410 (Fe 540) or E 450 (Fe 570) Quality D (both copper bearing quality) according to the welded or riveted work specifically for High Tensile Steel.
 - (iv) For superior and enhanced corrosion resistance for sections, plates and bars for welded, riveted or bolted construction, the material shall comply with the requirement of IRS: M-42, Gr. I or Gr. II for riveted / bolted or welded work respectively.
 - (v) Steel, which is to be cold pressed, shall comply with the requirements of IS: 2002.
 - (vi) Steel for bolts shall conform to property class 4.6 or 6.6 as specified in IS: 1367 accordingly, as the structural steel specification is for mild steel or high tensile steel.
 - (vii) Steel for drifts shall be in accordance with IS: 1875 for forged quality steel or IS: 7283 for hot rolled bars.
 - (viii) Steel for rivets shall comply with the requirement of IS: 1148 for hot rolled rivet bars for general structural purposes and IS: 1149 for high tensile steel rivet bars for high strength structural purposes. For high strength low alloy structural steel rivet bars with enhanced corrosion resistance for use in bridges, steel shall comply with the requirement of IRS: M-43.
 - (ix) The dimensions of all rolled sections must agree with the drawings or as consented by the Engineer.
 - (x) The rolling and cutting tolerances shall be in accordance with IS: 1852 or as consented by the Engineer. If closer tolerances are desired they shall be shown in the drawing.
 - (xi) Use of steel of any quality other than those mentioned above would require the prior approval of the Engineer.

5.10 Water

- (1) Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is considered satisfactory for mixing concrete. Quality of water shall be as per relevant IS specifications.

Sample testing shall be done as per relevant specifications

- (2) The pH value shall not be less than 6.
- (3) In case of doubt regarding development of strength, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time tests as per relevant IS specifications.

5.11 Concrete Admixtures

5.11.1 General

Admixtures are materials added to the concrete before or during mixing with a view to modify one or more of the properties of concrete in the plastic or hardened state.

Concrete admixtures are proprietary items of manufacture and shall be obtained only from established manufacturers duly approved by the Engineer having proven track record, quality assurance and full fledged laboratory facilities for the manufacture and testing of concrete.

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 the 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 as to their compatibility.
- (vii) There would be no increase in risk of corrosion of the reinforcement or other embedments as a result of using the admixture.
- (viii) Retardation achieved in initial setting time.

5.11.2 Physical and Chemical Requirements

All admixtures shall conform to the requirements of relevant IRS/IS specifications. In addition, the following conditions shall be satisfied:

- (i) "Plasticisers" and "Super-Plasticisers" shall meet the requirements indicated for "Water reducing Admixture".
- (ii) Except where resistance to freezing and thawing and to disruptive action of deicing salts is necessary, the air content of freshly mixed concrete in accordance with the pressure method given in IS: 1199 shall not be more than 1 per cent higher than that of the corresponding control mix.

- (iii) Calcium chloride or admixtures containing calcium chloride shall not be used in structural concrete containing reinforcement, prestressing tendons or the embedded metal.
- (iv) Admixtures containing Cl, SO₃ ions, nitrates and admixtures based on thiocyanate shall not be used.
- (v) Use of admixtures should not have adverse affect on the properties of concrete or mortar particularly with respect to strength, volume change durability and has no deleterious effect on reinforcement.
- (vii) When an expanding agent is used, the total unrestrained expansion shall preferably be between 4% to 6%. Aluminum powder as an expanding agent shall not be permitted.
- (viii) Admixute shall be used with prior approval of Engineer.

5.12 Handling & Storage of Materials

- a) All materials shall be stored as per IS: 4082.
- b) **Cement** : Cement of different specifications shall be stacked separately and quality of stored cement actually used in any member or part of the structure shall fulfill the design and construction requirement of the same. Cement shall be stored at work site in such a manner as to prevent deterioration either through moisture or intrusion of foreign matter. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirement at site and should be cleaned at least every 3 months. Cement older than 3 months should not be used.
- c) **Aggregates** : Coarse Aggregates supplied in different sizes shall be stacked in separate stockpiles and shall be mixed only after the quantity required for each size has been separately weighed or measured. The quantity of coarse aggregates, thus recombined shall be that required for a single batch of concrete.
- d) **Steel** : The storage of all reinforcing steel shall be done in such a manner as will assure that no deterioration in its quality takes place. The coil of HTS wires & strands shall be given anti-corrosive treatment such as water soluble oil coating before wrapping it in hessian cloth or other suitable packing. During transportation, it shall be ensured that no damage is done to coils while loading and unloading. Care shall be taken to avoid mechanically damaging, work hardening or heating prestressing tendons while handling.
- e) Any material, which has deteriorated or has been damaged, corroded or contaminated, shall not be used for concrete work.

The procedures to be adopted for transportation & storage of the materials shall be subject to the consent of the Engineer.

5.13 Tests and Standards of Acceptance

- a) **Cement**: A sample shall be tested for fineness, initial and final setting time and compressive strength (IS: 4031) and results approved by

Engineer before use. The methods and procedures for sampling shall be in accordance with IS: 3535. Engineer may require any other form of sampling and tests including chemical analysis (IS: 4032) in case the cement supplied is of doubtful quality

- b) **Steel** : Physical tests as per IS: 2062 and IS: 1786. Various physical tests shall be carried out as per IS: 1608, IS: 1599 and IS: 1387.
- c) All materials shall be subjected to an acceptance test prior to their use.
- d) The Contractor shall furnish test certificates from the manufacturer / supplier of materials along with each batch of material(s) delivered to site.
- e) The Contractor shall set up a field laboratory with necessary equipment for testing of all materials, finished products used in the construction.
- f) The testing of all the materials shall be carried out by the Contractor at the field laboratory or from the laboratory approved by the Engineer and if desired in the presence of the Engineer/ Engineer's representative. The Contractor shall make all the necessary arrangements and bear the entire cost of testing.
- g) Tests which cannot be carried out in the field laboratory have to be got done at the Contractor's cost at any recognised laboratory / testing establishments duly approved by the Engineer.
- h) If materials are brought from abroad, the cost of sampling/testing whether in India or abroad shall be borne by the Contractor.

6 Well Foundation

6.1 Description

The work shall consist of construction of well foundation in concrete by taking it down to final levels by open dredging of soil and other materials or by pneumatic sinking, pressure sinking technique and by plugging the bottom of well and filling the inside in accordance with details shown in drawings approved by the Engineer.

The work of well foundations shall be designed and constructed as per IRS- Sub structure and foundations code and IRS-Manual on design and construction of well and pile foundations except for specific provisions listed hereunder. The level of well plugging shall be approved by Engineer.

6.2 Submittals

The Contractor shall furnish the detailed design and drawings for all the components of well foundations for scrutiny and approval of the Engineer. The method of sinking of well, preparation of launching platform for well cutting edge, floating caissons if required including details of the equipment shall be submitted by the Contractor and got approved from the Engineer. Special mention shall be given to the floating equipment which should be adequate and suitable for maintaining the desired pace of progress of work.

6.3 Hydraulic and Hydrological Investigation

The contractor shall collect all the necessary hydraulic and hydrological data including forecast of floods. The data shall not only be used for working out the bridge parameters like waterway, minimum depth of foundation, span arrangement, launching and construction methodology but also planning out construction scheme, time schedules and requirement of resource mobilization.

6.4 Sub-Surface Investigation

6.4.1 The complete sub-surface investigation of strata in which well foundations are proposed shall be carried out in advance. The sub-surface investigations shall be carried out meeting the requirements as specified in Clause 15.6 [Geotechnical Investigations] of Employer's Requirements – General and Clause 3 [Geotechnical Investigation] of these Specifications. Borings shall be carried up to sufficient depths so as to ascertain the nature of strata around the well shaft and below the founding level. However, depth of boring shall not be less than:

- a) 1.5 times estimated length of well in soil but not less than 15 m beyond the probable depth of well.
- b) Same length as diameter of well in sound, hard rock but minimum 3 m in such rock.

6.4.2 The sub-surface investigation shall define adequately stratification of sub-strata including the nature and type of strata, its variation and extent and specific properties of the same. The investigation shall be adequate for the purpose of selection of appropriate foundation system and for estimating design capacities.

6.4.3 Pressure meter tests may be used in the case of rock, gravel or soil for direct evaluation of strength and compressibility characteristic. Though these tests are of specialised nature they are most appropriate for difficult/uncertain sub-strata especially for important projects.

6.4.4 For wells seated on rocks, it is necessary to determine the uniaxial compressive strength of the rock and its quality.

6.4.5 The investigation shall also include location of ground water table and other parameters including results of chemical tests showing sulphate and chloride content and any other deleterious chemical content in soil and/or ground water, likely to affect durability.

6.5 Materials

All materials used in the well foundations shall be as per Clause 5 [Materials for Structures] of these Specifications.

6.6 Settlement of Well Foundations

- i) Wells founded on cohesion less soils are assumed to have settled during construction phase due to their dead loads. The settlement shall be worked out due to dead load of superstructure and other superimposed loads.

- ii) The secondary consolidation settlements in foundations on cohesive soils be worked out using any acceptable method.

6.7 Well Curb

The well curb shall be in reinforced cement concrete, as shown in drawings and shall be designed as per IRS- Manual on the design and construction of well and pile foundations(1985). The specifications for plain and reinforced cement concrete, steel reinforcement and structural steel work in well curb shall be as given in respective sections of the specifications.

6.7.1 The well curb shall satisfy the following requirements:

- a) It should have a shape offering minimum resistance while the well is being sunk;
- b) Strong enough to be able to transmit super-imposed loads from the steining to the bottom plug. The curb shall invariably be of reinforced cement concrete with reinforcement as shown in drawing. The quantity of steel shall be suitably arranged so as to prevent spreading and splitting of the curb during sinking and in service.
- c) In case pneumatic sinking is indicated, the internal angle of the well curb shall be made steep enough to provide easy access for pneumatic tools.
- d) The slope of the vertical of inner faces of curb shall preferably be 30 degrees. In sandy strata it may be increased to 45 degrees. The offset on the outside of 50mm be provided to ease sinking.
- e) The minimum reinforcement excluding bond rods shall be 72 kg/m^3 .
- f) In case blasting is anticipated, unless otherwise indicated in drawing or specified by Engineer, the outer and inner faces of the curb shall be protected with suitable steel plates of thickness not less than 8 mm upto half the height of the well curb on the outside and on the inner face not less than 10 mm thick up to top of well curb, suitably reduced to 6 mm to a height of 3 meters above the top of the curb. The steel plates shall be properly anchored to the curb and steining. The curb in such a case shall be provided with additional hoop reinforcement of 10 mm diameter mild steel or deformed bars at 150 mm centres. The latter reinforcement shall also extend upto a height of three metres into well steining above the curb.
- g) The well curb shall be in RCC of grade minimum M 25 or higher grade.

6.7.3 Cutting Edge

The mild steel cutting edge made from structural angles & plates shall be strong enough and weighing not less than 60 kg/m or as specified in drawings to facilitate sinking of the well through the various types of strata expected to be encountered without suffering any damage. It shall be properly anchored to the well curb.

6.7.4 Platform for Pitching the Well Cutting Edge

For pitching the well cutting edge level solid platform is required. When the location of foundation is in the water stream, suitable island of locally available earth is to be made to be used as platform. The island has to be protected from erosion by water current by means of coffer dams using two layers sand bags, bamboo piles or wooden piles which should be strong enough to not only to preclude erosion but also the active pressure exerted by the earth fill along with other loads placed on the working island. The height of the coffer dam should be such as to have a free board of minimum 0.6m. This method of island making is suitable only when the depth of flowing or standing water is not more than 5-6m. and the flow velocity is up to 2m/sec. For greater depths or greater flow conditions either coffer dams may have to be made with temporary steel sheet piling or floating caissons may be resorted to.

The plan dimension of the island should be such that minimum 2-3 m. room is available all round, which can be increased depending on the activities to be carried out from the island. The coffer dams of any construction require maintenance and a close watch has to be maintained regarding erosion and subsidence.

6.8 Steining

6.8.1 Design of Well Steining

The well steining shall be designed as per IRS- Manual of the design and construction of well and pile foundations (1985) or as per IRC 78:2000.

The thickness of steining shall be decided on the basis of self sinking with minimum kentledge. The minimum thickness of steining shall be 1000mm. The well steining shall be of min. M-25 grade concrete. A minimum clear cover of 75mm is to be provided for reinforcement.

6.8.2 The sinking effort can be calculated by any standard method.

6.8.3 Pneumatic Sinking

The contractor shall ascertain the need for pneumatic sinking beforehand i.e. at planning and design stage itself. For pneumatic sinking, if the concrete steining is used as air chamber, the steining shall be strong enough to withstand the air pressure and the tension developed should not be allowed to exceed $\frac{3}{8}^{\text{th}}$ of the modulus of rupture. The aspects as listed in IRS- Manual on the design and construction of well and pile foundations (1985) shall be taken into account.

6.8.4 The steining of the well shall be built in one straight line from bottom to top, the work being checked carefully with the aid of straight edges of approved lengths or laser beam technique as approved by Engineer. Plumb bob or spirit level should not be used. Steining built in the first stage shall not be more than 2 metres in height and in subsequent stages it shall not exceed the diameter of the well or the depth of well sunk below

the adjoining bed level at a time. As far as possible, the stages of work shall not be kept at the location of joints in the vertical steining / bond bars. The height of steining shall be calibrated by marking at least 4 gauges distributed equally on the outer periphery of the well each in the form of a 100 mm wide white or yellow strip painted on the well, with every metre mark shown in black paint. The gauges shall start with zero at the bottom of the cutting edge. Marking of the gauges shall be done carefully with a steel tape.

After sinking of a stage is complete, all damaged portions of steining at top of the previous stage shall be properly repaired before constructing the next stage.

6.9 Sinking

6.9.1 General

The sinking may be done by open dredging the soil from below the cutting edge and allowing the well to settle lower under self weight or by adding kentledge.

The well shall as far as possible, be sunk true and vertical through all types of soil strata. The well may be sunk by jacking down method by dredging material uniformly from inside the dredge hole alternately grabbing at diametrically opposite ends or by the pressure sinking technique as approved by Engineer. Pneumatic sinking may have to be resorted to where obstacles such as tree trunks, large size boulders, etc., are met at the bottom or when there are hard strata which cannot be removed by open dredging. The necessity for pneumatic sinking shall be decided by Engineer. For sinking wells through difficult strata, there should be more emphasis on the use of mechanised devices, such as high capacity Pumps for clayey strata, Aqua Header for cutting and sinking through rocky strata under water etc., Sinking or loading of well with kentledge or applying of pressure shall commence only after the steining has been cured for at least 48 hours or as specified in approved drawings.

During construction Contractor shall take all precautions for safety of adjacent railway bridge on UP stream side.

6.9.2 Special Specification for Jack Down Method

Jack-down method for well sinking is a precise and innovative method of controlled sinking within allowable limits of tilts, shifts and rotations of well at any stage of its sinking. The principle of this method is to push down the structure into the ground by applying pressure to counter the resistance of ground due to skin friction around the periphery of caisson and below the cutting edge. Ground anchors are constructed at predetermined locations around the well and are pulled by hydraulic jacks, which are placed on the top of well, resulting in the pushing of well inside the ground. Jacks are operated individually or jointly and the load on various jacks is controlled so that structure is sunk in plumb and straight with controlled tilts, shifts and rotations.

Various Operations involved In Jack-Down Method are:

- i) Making of ground anchors
- ii) Casting of well
- iii) Installation of Jack-down equipment
- iv) Excavation from inside caisson/structure
- v) Activating jacks
- vi) Removal of Jack-down equipment

The Jack-down equipment is so designed that there is no slip between ground anchor, anchor coupler, adjustment coupler, gripper rod and jack, and there is full safety during movement of jack.

6.9.3 Dewatering of Well

Normally dewatering of well shall not be permitted as a means for sinking the well. It shall never be resorted to if there is any danger of sand-blowing under the well.

6.9.4 Water Jetting and Air

Water and Air jetting may be employed for well sinking wherever necessary. Where need for jetting is anticipated, necessary pipes should be built into the steining.

6.9.5 Use of Explosives

Explosives shall not be generally used as an aid to well sinking. However, in cases where explosives are to be used, prior approval of Engineer shall be obtained. Blasting of any sort shall only be undertaken in the presence of Engineer and not before the concrete in steining has hardened sufficiently and is more than 7 days old. For wells going through bouldery strata, requiring occasional use of explosives, as an aid to well sinking, the entire inside surface of the well curb, and steining up to a minimum desirable height above the well curb shall be protected by a 6 to 10 mm thick mild steel plate which shall be suitably stiffened.

Mild explosive charges may be used as an aid to sinking of well or for final seating in clayey or other strata with prior permission of Engineer. However, blasting of any sort shall not be done before the concrete masonry in steining has hardened sufficiently and is more than 7 days old. 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 steining of the well.

If blasting has been used for setting the well after it has reached the design foundation level, at least 24 hours shall be allowed to lapse before the bottom plug is laid.

All prevalent laws concerning handling, storing and use of explosives shall be strictly followed and the permission for using the explosives shall be obtained by the Contractor from the concerned authorities.

6.9.6 Precautions during Sinking

For safe sinking of wells, precautions as indicated below, shall be taken.

(1) Construction of Well Curb and Steining

- a) Cutting edge and the top of well curb shall be placed truly horizontal.
- b) The cutting edge shall be placed on dry bed. The methods adopted for placing of well curb shall depend on site conditions.
- c) Well steining shall be built in lifts and the first lift shall be laid after sinking the curb at least partially for stability.
- d) Steining shall be built in one straight line from bottom to top and shall always be at right angle to the plane of the curb. In no case it shall be built plumb at any intermediate stage when the well is tilted.
- e) In soft strata prone to settlement/ creep construction of the abutment wells shall be taken up after the approach embankment for a sufficient distance near the abutment has been completed.

(2) Well Sinking

- a) A sinking history record is to be maintained at site.
- b) Efforts shall be made to sink wells true to position and in plumb. Prompt action should be taken to correct tilts as sinking proceeds.
- c) Sumps made by dredging below cutting edge in well shall preferably be not more than half the internal diameter.
- d) Boring chart shall be referred to constantly during sinking for taking adequate care while piercing different types of strata by maintaining the boring chart at site and plotting the soil types, as obtained during well sinking, and comparing it with earlier bore data to take prompt decisions in advance.
- e) When wells have to be sunk close to each other and clear distance between two wells is less than the diameter of the wells, they shall normally be sunk in such a manner that the difference in levels of the sump and the cutting edge in the two wells exceed half the clear gap between them.
- f) When group of wells are near each other, special care is needed such that they do not foul in the course of sinking and also do not cause disturbance to wells already sunk. The minimum clearance between wells shall be half the external diameter of the well. Simultaneous and even dredging shall be carried out in the dredging holes of all the wells in the group and plugging of all the wells should be done together.
- g) In sinking double-D shaped wells excavation in both the dredge holes should be carried out simultaneously and equally to

facilitate even sinking.

- h) During construction, partially sunk wells shall be taken to a safe depth below the anticipated scour levels to ensure their safety during ensuing floods. Further, they shall be temporarily filled and plugged before the onset of floods so that they do not suffer any tilt or shift.
- i) Dredged material shall not be deposited unevenly around the well.
- j) All necessary precautions shall be taken against any possible damage to foundations of existing structures in the vicinity of the wells, prior to commencement of dredging from inside the well. A close watch should be maintained on such structures during sinking.

(3) Sand Blows in Wells

Dewatering shall be strictly avoided if sand blows is expected. Any equipment and men working inside the well shall be brought out of the well as soon as there is any indication of a sand blow.

Sand blowing in wells can often be minimised by keeping the level of water inside the well higher than water table and also by adding heavy kentledge.

(4) Blasting

- a) Only light charges shall be used under ordinary circumstances and they should be fired under water well below the cutting edge so that there is no chance of the curb being damaged.
- b) There shall be no equipment inside the well nor shall there be any labour in close vicinity to the well at the time of exploding charges.
- c) 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. Use of large charges, 0.7 kg or above may not be allowed except under expert direction and only with permission from 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 at 0.5 to 0.6 metre.
- d) If rock blasting is to be done for finer seating of the well, the damage caused by the flying debris should be minimised by provision of rubber mats over the blasting holes before blasting.
- e) After blasting, steining shall be examined for any crack and corrective measures shall be taken immediately.

6.9.7 Additional Precautions for Pneumatic Sinking

- a) Pneumatic sinking plant and other allied machinery shall not only be of proper design and make but shall also be worked by competent

and well trained personnel. Every part of the machinery and its fixtures shall be carefully examined before installation and use. Availability of appropriate spares, stand-by units, safety of personnel as recommended in IS: 4188 for working in compressed air must be ensured at site. Safety code for working in compressed air and other labour laws and best practices prevalent in the country, as specified to provide safe, efficient and expeditious sinking shall be followed.

- b) Inflammable materials shall not be taken into air locks and smoking shall be strictly prohibited.
- c) Whenever gases are suspected to be issuing out of dredge hole, the same shall be analysed by expert personnel and necessary precautions adopted to avoid hazard to life and equipment.
- d) Where blasting is resorted to, it shall be carefully controlled and all precautions regarding blasting shall be taken. Workers shall be allowed inside after blasting only when a competent and qualified person has examined the chamber and steining thoroughly.
- e) If it is not possible to make the well heavy enough during excavation "blowing down" may be resorted to. Men should first be withdrawn and air pressure reduced. The well would then begin to move with a small reduction in air pressure. "Blowing down" should only be adopted where the ground is such that it will not heave up inside the chamber when pressure is reduced. When the well does not move with a reduction in air pressure, kentledge should be added. Blowing down should be in small stages and the drop should not exceed 0.5 metre at any stage. To control sinking during blowing down, use of packs or packings below cutting edge may be made.
- f) Site Engineers in charge of pneumatic sinking shall familiarise themselves with particular reference to caisson diseases and working of medical air-lock.
- g) A doctor competent to deal with cases of Caisson Disease or other complications arising as a result of working under high pressure shall be stationed at construction site when pneumatic sinking is in progress.
- h) The contractor shall provide complete facilities including issue of orders or delegation of authority to the doctor to ensure strict enforcement of requirements outlined in these specifications or any codal or statutory requirement.
- i) For pneumatic sinking provision made in IS: 4138 shall be complied with. In addition to IS: 4138, safety provisions contained in the following paragraph shall also be strictly followed.
- (1) Man-Locks and Shafts Locks, reducers and shafting used in connection with caissons shall be of rivetted construction throughout. Material used in their manufacture shall not be less than 6 mm thick steel plate.

Shafts shall be subjected to a hydrostatic or air-pressure test of 5.2 kg/sq.m at which pressure they shall be tight and same stamped

on the outside shelf about 300 mm from each flange, to show the pressure to which they have been subjected.

All shafts used in pneumatic caissons shall be provided with ladders, which shall be kept clear and in good condition at all times and shall be constructed, inspected and maintained to the entire satisfaction of Engineer.

All outside caisson air locks shall be provided with a platform of not less than 1 metre width and provided with a guard rail 1 metre high.

All caissons or chambers in which fifteen or more men are employed shall have two locks, one of which shall be used as a man-lock. Man-Locks and shafts shall be under the charge of men whose duty shall be to operate the air valves in such locks.

Locks shall be so located that the lowest part of the bottom door shall be not less than 1 metre above mean high water level. The supply of fresh air to the working chamber shall at all times be sufficient to permit work to be done without danger or excessive discomfort. All air supply lines shall be provided with check valves and fines carried as near to the face as practicable.

For every man-lock, reply signals, repeating the original signals, shall be made before any cage, skip, bucket or elevator is set in motion.

A man-lock shall be used solely for compression or decompression of persons and not for the passage of plant or material and shall be maintained in a reasonably clean and sufficiently warm state. However, nothing in this clause shall prevent any person carrying with him into the man-lock any hand-tools or hand instruments used for the purpose of work.

The specifications of preceding paragraph shall not apply where it is not reasonably practicable to provide a separate man-lock for persons only but in any such case, not exempted by the specification given in succeeding paragraph, that the lock, when in actual use for compression or decompression of a person or persons, shall not be put simultaneously to any other use and shall be in a reasonably clean and sufficiently warm state.

Nothing in the two preceding paragraphs shall apply to a lock which does not afford direct or indirect access to a working chamber, in which the pressure exceeds 1.25 kg/sq.cm and in so far as a lock affords only indirect access to such a working chamber those paragraphs shall apply only whilst persons who have worked in the chamber are in the lock.

(2) **Valves**

Exhaust valves shall be provided, having risers extending to the upper part of chamber, if necessary, and shall be operated at such times as may be required and especially after blast, and men shall not be required to resume work after a blast until the gas and smoke have cleared fully.

(3) **Lighting**

All lighting in compressed air chambers shall be exclusively by electricity and two independent electric-lighting systems with independent sources of supply shall be used. The emergency source shall be arranged to become automatically operative on failure of the regularly used source. The use of worn or defective portable and pendent conductors shall be prohibited.

(4) **Safety against Fire Hazard**

Head frames shall be constructed of structural steel or open frame work fire proof timber. Head houses and other temporary surface buildings or structures within 30 metres of the shaft or caisson shall be built of fire-resisting materials.

No oil, gasoline, or other combustible material shall be stored within 30 metres of any shaft or caisson except that oils may be stored in suitable tanks in isolated fire-proof buildings, provided such buildings are not less than 15 metres from any shaft or caisson or any building directly connected thereto. Positive means shall be used to prevent leaking inflammable liquids from flowing into the areas specifically mentioned in the preceding paragraph. Where feasible, a fire hose connected to a suitable source of water shall be provided at the top of every caisson. Where fire mains are not accessible, a supply of water shall be stored in tanks near the top of each caisson, provided fire pails or suitable pumps are kept available. Alternatively approved fire extinguishers shall be substituted.

(5) **Safety Shields**

Wherever, in the execution of work in which compressed air is used, the working chamber is less than 3.7 metres in length, and when such caissons are at any time suspended or hung while work is in progress, in such a way that the bottom of the excavation is more than 2.7 metres below the deck of the working chamber, a shield shall be erected therein for the protection of workmen.

(6) **Sanitation**

Properly heated, lighted, and ventilated dressing rooms shall be provided for all employees engaged in compressed air work. Such rooms shall contain lockers and benches and be open and accessible to men during the intermission between shifts. Adequate toilet facilities/ accommodation at the ratio of not less than one for every twenty-five men employed shall be provided.

(7) **Detection of Gases**

In all cases where gas is expected, including alluvium impregnated with decayed vegetable matter, the use of Davy's Safety Lamp in a pneumatic caisson sinking shall be compulsory.

6.9.8 Tilts and Shifts

- (1) Unless otherwise specified; the tilt of any well shall not exceed 1 (horizontal) in 100 (vertical) and the shift at the well base shall not be more than $D/40$ (where D is the diameter of well but shall not exceed 150mm). Tilts and shifts shall be carefully checked and recorded regularly during sinking operations. For the purpose of measuring tilts along and perpendicular to the axis of bridge, level marks at regular intervals shall be painted on the surface of the steining of the well. Whenever any tilt is noticed, adequate preventive measures like putting eccentric kentledge, pulling, strutting, anchoring or dredging unevenly and depositing dredge material unequally, putting obstacles below cutting edge, water jetting, etc., shall be adopted before any further sinking. After correction the dredged material placed unevenly shall be cleared or spread evenly.

A pair of wells close to each other have a tendency to come closer while sinking. Timber struts may be introduced in between the steining of these wells to prevent such tilting.

Tilts occurring in a well during sinking in dipping rocky strata can be safeguarded by suitably supporting the kerb in advance.

Due to some abnormal condition, even after all corrections and precautions taken if the tilt / shift are exceeding the allowable limits, the design shall be frequently checked and ensured that founding pressure stresses in concrete are not exceeding.

- (2) **Remedial measures to be undertaken**

In case of wells if the permissible limit(s) of tilt and shift are exceeded, remedial measures approved by Engineer shall be taken by the Contractor to bring the tilt(s) and or shift(s) within these permissible limits and all expenditures involved in this shall be borne by the Contractor and nothing extra shall be paid towards such measures.

- (3) **Action on rejection of a well**

In the event of a well being rejected on account of non-compliance with extreme tilt and/ or shift as mentioned above, the Contractor shall dismantle the rejected well to the extent directed by the Engineer and remove the debris. The Contractor shall further, at his own risk and expense complete the bridge with modified span arrangement acceptable to Engineer.

6.9.9 Removal of Obstructions during Sinking

During the sinking operation certain obstructions like drift wood, isolated boulders etc. may be met with, the contractor should be well equipped with cutting chisels and other equipment for removal of the same. This may include underwater cutting equipment and employment of skilled divers with or without use of pneumatic lock.

6.10 Bedding of Wells In Rock (if applicable)

The well should be sunk into or through rocky strata so that it rests on even, level, good hard rocky base and is keyed into it. This is necessary even if the rocky strata profile is sloping steeply. It is desirable that it is keyed in at such a depth that cutting edge is embedded at least 50 cm into the rock at the lowest end of the sloping strata, or as otherwise directed by Engineer. Additionally, well shall be nominally anchored to the rocky strata by anchor rods provided in steining wall as an abundant measure of safety, irrespective of tension developing or not at base of wells at design loads. After the well is seated in good hard rock, it should be inspected, preferably in dry conditions before bottom plug is laid.

6.11 Bottom Plug

Founding of the well shall be done as per the relevant provision of IR Bridge Manual 1998.

Before bottom plugging is done, it shall be ensured, by test boring or other approved means, that soil properties of the founding strata encountered are identical to those adopted in the design and that the same or better strata extends for a sufficient depth below the founding level i.e. to not less than one and a half times the diameter or the least dimension of the well. In case soil encountered is inferior to that adopted in design the well shall be redesigned adopting soil properties actually encountered and the founding level of the well shall be revised accordingly. The level of bottom plug shall be approved by Engineer.

Each well, after being sunk to its final position and ensuring above stated condition and that the whole steining has not developed cracks for its entire length, shall be suitably plugged at its bottom.

If well cannot be dewatered and concrete is done under water, 10% extra cement shall be added and concrete be laid with tremie pipe.

Before commencing plugging, all the loose material from the bottom of the well shall be removed and the depth of bulb so formed, if more than 1/6 th diameter of the well, shall be filled up with sand and then with concrete.

Concrete for the bottom plug shall be poured by tremie pipe method. Tremie concrete shall be continued without interruption for full concreting in the bottom plug. Concrete production and placement equipment should be sufficient to enable under -water concreting within stipulated time. Necessary standby equipment should be available for emergency situation. Least disturbance shall be caused to water inside well while laying concrete in bottom plug. Concreting shall be done in one continuous operation till dredge hole is filled upto the required height and thereafter sounding shall be taken to ensure that concrete has been laid to the required depth.

In order to check rise in the level of bottom plug, soundings should be taken at the close of concreting and for 3 days thereafter once every day. Concrete as laid shall not be disturbed in any way for at least 14

days. The minimum grade of cement concrete shall be M-20.

6.12 Sand Filling

A minimum of 3 days after the bottom plug has been laid shall elapse before the well is filled with sand. Before filling with sand, the height of the bottom plug shall be verified. Filling shall be in saturated condition. Sand to be filled shall be clean and free from earth, clay clods, roots, boulders, shingles, etc.

6.13 Intermediate Plug

After filling sand up to required (scour level) height intermediate plug shall be laid over it. The minimum grade of cement concrete to be used shall be M-20.

6.14 Well Cap / Capping Slab

A reinforced cement concrete well cap shall be provided over the top of steining. The bottom of well cap shall preferably be kept as low as possible taking into account the low water level. The design of well cap or capping slab shall be done to withstand and transfer loads coming over the well to the steining. As many longitudinal bars as possible extended from the well steining shall be anchored into the well cap.

The well cap will be required to be cast after suitable false work in the well opening, which will not be retrievable. The Centre point of the pier/abutment shall be marked on the form of well cap, duly accounting for any tilts and shifts during sinking. The bottom of the well cap shall be kept above LWL(Low Water Level) as per relevant codes. . The top of well cap shall not be above top of existing bridge pile cap.

6.15 Safety Aspects

The Contractor shall observe all aspects of safety as laid down in Employers Requirements - Construction. The work being in flowing rivers, utmost care has to be taken for safety of temporary, permanent work and of equipment and personnel being employed on the work.

6.16 Record Keeping

The Contractor shall keep meticulous records of all the quality checks carried out on the materials and the finished work as required in Clause 5 [Materials for Structures] of these Specifications. Besides, daily measurement of the tilt and shift of the well during sinking operation shall be maintained as described above. All the records of strata met across while sinking operation and the cores of rock sunk through shall be maintained for scrutiny by the Engineer and also required for reworking out capacity of well foundation, if required.

7 Concrete Works

7.1 General

This section refers to the construction of concrete structures including

concrete mix design, trial mix, testing and workmanship for concreting. The work shall consist of furnishing and placing structural concrete and incidental construction in accordance with these Specifications and in conformity with the lines, grades and dimensions, as shown on the approved drawings.

7.2 Materials

All the materials shall conform to the requirements as specified in Clause 5 [Materials for Structures] of these Specifications

7.3 Grades of Concrete

7.3.1 The grades of concrete shall be designated by the characteristic strength as given in Table given below, where the characteristic strength is defined as the strength of concrete below which not more than 5 percent of the test results are expected to fall.

Grades of Concrete

Sl. No.	Grade Designation	Specified Characteristic Compressive Strength of 150mm cubes at 28 days in MPa
1	M 10	10
2	M 15	15
3	M 20	20
4	M 25	25
5	M30	30
6	M 35	35
7	M 40	40
8	M 45	45
9	M 50	50
10	M 55	55
11	M 60	60

7.3.2 Durability

The durability of concrete depends on its resistance to deterioration and the environment in which it is placed. The resistance of concrete to weathering, chemical attack, abrasion, frost and fire depends largely upon its quality and constituents materials. Susceptibility to corrosion of the steel is governed by the cover provided and the permeability of concrete. The cube crushing strength alone is not a reliable guide to the quality and durability of concrete; it must also have an adequate cement content and a low water-cement ratio. The general environment to which the concrete will be exposed during its working life is classified in three levels of severity that is moderate, severe and extreme, as described in Table given below:

Environmental Exposure Conditions of Concrete

Sl. No.	Environment	Exposure Conditions
1	Moderate	Concrete surface protected against weather or aggressive conditions. Concrete surface sheltered from severe rain or freezing whilst wet. Concrete exposed to condensation. Concrete structure continuously under water. Concrete in contact with non-aggressive soil/ground water.
2	Severe	Concrete surface exposed to severe rain, alternate wetting and drying or occasional freezing or severe condensation. Concrete exposed to aggressive sub-soil / ground water or coastal environment.
3	Extreme	Concrete surface exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet. Concrete structure surfaces exposed to abrasive action, surfaces of members in tidal zone. All other exposure conditions which are adverse to exposure conditions covered above.

Climatic conditions of the project shall be taken as Moderate.

7.3.3 The lowest grades of concrete in structures and corresponding minimum cementitious material contents and water-cement ratios shall be as per relevant provision of IRC concrete bridge code subject to minimum requirements (if any) specified in this Bid Document. :

7.3.4 Concrete used in any component or structure shall be specified by designation along with prescribed method of design of mix i.e. "Design Mix". For all items of concrete, only "Design Mix" shall be used.

7.3.5 If the Contractor so decides, the Engineer may permit the use of higher grade concrete than that specified on the drawing, in which event the higher grade concrete shall meet the specifications applicable thereto without additional compensation.

7.4 Permeability

One of the main characteristics influencing the durability of any concrete is its permeability. Therefore, tests for permeability shall be carried out for concrete bridges as recommended herein.

- a) Permeability test shall be mandatory for all RCC/PSC bridges under severe and extreme environment.
- b) Under moderate environment, permeability test shall be mandatory for all major bridges.
- c) For other bridges permeability test is desirable to the extent possible.

With Strong, dense aggregates, a suitably low permeability is achieved by having a sufficiently low water-cement ratio, by ensuring as thorough compaction of the concrete as possible and by ensuring sufficient hydration of cement through proper curing methods. Therefore, for given aggregates, the cement content should be sufficient to provide adequate workability with a low water-cement ratio so that concrete can be completely compacted by vibration. Test procedure for penetration measuring permeability has been given in Appendix-G of IRS Concrete Bridge Code-1997. **The depth of penetration of moisture shall not exceed 25mm.**

7.5 Proportioning of Concrete

7.5.1 Prior to the start of construction, the Contractor shall design the mix and submit to the Engineer for approval, the proportions of materials, including admixtures to be used. Water-reducing admixtures (including plasticisers or super-plasticisers) may be used at the Contractor's option, subject to the approval of the Engineer. Other types of admixtures shall be prohibited, unless specifically permitted by the Engineer.

7.5.2 Requirements of Consistency

The mix shall have the consistency which will allow proper placement and consolidation in the required position. Every attempt shall be made to obtain uniform consistency.

The optimum consistency for various types of structures shall be as indicated in the Table given below or as consented by the Engineer. The slump of concrete shall be checked as per IS: 516.

Optimum Consistency Requirements

Sl. No.	Type of Structure	Slump (mm)
1	Structures with exposed inclined surface requiring low slump concrete to allow proper compaction	25
2	Plain cement concrete	25
3	RCC structures with widely spaced reinforcements; e.g. solid columns, piers, abutments, footings, well steining	40-50
4	RCC structures with fair degree of congestion of reinforcement e.g. pier and abutment caps, box culverts well curb, well cap, walls with thickness greater than 300 mm	50-75
5	RCC and PSC structures with highly congested reinforcements e.g. deck slab girders, box girders, walls with thickness less than 300 mm	75-125

7.5.3 Requirements for Designed Mixes

- (1) The mix design shall be as per relevant IRS/IS Codal provisions.
- (2) Trial Mixes

The Contractor shall give notice to enable the Engineer to be present at the making of trial mixes and preliminary testing of the cubes. The Contractor shall prepare trial mixes, using samples of approved materials typical of those he proposes to use in the works, for all grades prior to commencement of concreting. The initial trial mixes shall generally be carried out in an established laboratory approved by the Engineer. In all cases complete testing of materials forming the constituents of proposed Design Mix shall have been carried out prior to making trial mixes and consented by Engineer. When the site laboratory is utilised for preparing initial mix design, the concreting plant and means of transport employed to make the trial mixes shall be similar to that proposed to be used in the works.

7.5.4 Suitability of Proposed Mix Proportions

The Contractor shall submit the following information for the approval of Engineer:

- (i) Nature and source of each material
- (ii) Quantities of each material per cubic meter of fully compacted concrete
- (iii) Either of the following:
 - a) Appropriate existing data as evidence of satisfactory previous performance for the target mean strength, current margin consistency and water/cement ratio and any other additional requirement(s) as specified.
 - b) Full details of tests on trial mixes.
- (iv) Statement giving the proposed mix proportions for nominal mix concrete.

Whenever there is a significant change in the quality of any of the ingredients for the concrete, the Engineer may order the carrying out fresh trial mixes at no extra cost. Any change in the source of material or in the mix proportions shall be subject to the prior approval of Engineer.

7.6 Admixtures

Engineer may permit use of admixtures for imparting special characteristics to the concrete or mortar on satisfactory evidence that the use of such admixtures does not adversely affect the properties of concrete or mortar particularly with respect to strength, volume change, durability and has no deleterious effect on reinforcement.

Use of admixtures such as superplasticisers for concrete may be made with the prior approval of the Engineer and should meet the requirements as specified in Section 5 [Materials for Structures] of these specifications.

Manufacturers shall recommend the use of any one of his products only after obtaining complete knowledge of all the actual constituents of concrete as well as methodologies of manufacture, transportation and compaction of concrete proposed to be used in the project.

7.7 Size of Coarse Aggregates

The size (maximum nominal) of coarse aggregates for concrete to be used in various components shall be as per relevant IRS/IS Code/specifications.

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.

7.8 Equipment

The type, numbers, capacity, their location & mobilization & demobilisation schedule of the equipment for production, transportation and compaction of concrete including the measuring devices and their accuracy, to be used for the project shall be subject to the consent of the Engineer.

7.9 Batching & Mixing

7.9.1 In proportioning concrete, the quantity of cement, aggregate and water should be determined by weigh batching. Any solid admixture that may be added, may be measured by weight, liquid and paste admixtures by volume or weight. Batching plant should conform to IS: 4925. All measuring equipment should be maintained in a clean serviceable condition, and their accuracy periodically checked, Coarse and fine aggregates shall be batched separately. The grading of the aggregates should be controlled by blending the different sizes of aggregates in right proportion. The amount of added water shall be adjusted to compensate moisture contents in aggregates.

7.9.2 Concrete shall be mixed in a batching and mixing plant. Hand mixing shall not be permitted. The plant shall be at a location consented by Engineer considering the properties of the mixes and the transportation arrangements available with the Contractor. Mixing shall be continued till materials are uniformly distributed and a uniform colour of the entire mass is obtained, and each individual particle of the coarse aggregate shows complete coating of mortar. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

7.10 Transporting, Placing and Compaction of Concrete

7.10.1. The method of transporting and placing concrete shall be approved by the Engineer. Concrete shall be transported and placed as near as practicable to its final position without re-handling, so that no contamination, segregation or loss of its constituent materials takes place. Concrete shall not be freely dropped into place from a height exceeding

1.5 meters.

7.10.2. Ready Mixed Concrete:

Ready Mixed Concrete may be used subject to prior consent of the Engineer. It shall conform to the specifications of concrete as specified in Concrete Bridge Code and IS: 4926.

7.11 Clear Cover to Reinforcement

(1) Clear cover shall not be less than the size of the bar or the maximum aggregate size plus 5mm. In case of a bundle of bars, it should be equal to or greater than the size of single bar of equivalent area plus 5 mm.

(2) From durability consideration, minimum clear cover shall be as per relevant Concrete Bridge Code/ relevant IS Code provisions.

7.12 Construction Joints

7.12.1 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 on the drawings, except with prior consent of the Engineer in case of emergencies. The joints shall be provided in a direction perpendicular to the member axis. Cold joints should be totally eliminated. The location of the construction joint, procedure for surface preparation of construction joint and sequence of concreting shall be subject to consent of the Engineer.

7.13 Concreting Under Water

7.13.1 Tremie – The concrete should be coherent. When concrete is carried out under water a temporary casing should be installed to the full depth of bore hole or 2m in to noncollapsible stratum, so that fragments of ground cannot drop from the sides of the hole in the concrete as it is placed. The temporary casing may not be required except near the top when concreting under drilling mud. The hopper and tremie should be embedded in the placed concrete through which the water can not pass. The top section of tremie shall be a hopper large enough to hold one entire batch of the mix or the entire contents of the transporting bucket if any. The tremie pipe shall be not less than 200mm in diameter and shall be large enough to allow a free flow of concrete and strong enough to withstand the external pressure of the water in which it is suspended, even if a partial vacuum develops inside the pipe. Preferably, flanged steel pipe of adequate strength for the job should be used. A separate lifting device shall be provided for each tremie pipe with its hopper at the upper end. Unless the lower end of the pipe is equipped with an approved automatic check valve, the upper end of the pipe shall be plugged before delivering the concrete to the tremie pipe through the hopper, so that when the concrete is forced down from the hopper to the pipe, it will force the plug (and alongwith it any water in the pipe) down the pipe and out of the bottom end, thus establishing a continuous stream of concrete. It will be necessary to raise the tremie pipe by 25cm to 30cm slowly in order to cause a uniform flow of the concrete, but the tremie shall not be emptied to avoid flow of water into the pipe. At all times even while changing / adding pipes

to tremie, the bottom of tremie pipe shall be atleast 600mm below the top of concrete as ascertained by sounding. This will cause the concrete to build up from below instead of flowing out over the surface, and thus avoid formation of laitance layers. If the charge in the tremie is lost while depositing, the tremie shall be raised above the concrete surface, and unless sealed by a check valve, it shall be replugged at the top end, as at the beginning, before refilling for depositing concrete.

7.13.2 In case of withdrawal of tremie out of the concrete either accidentally or to remove a choke in the tremie, the tremie may 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 should be introduced in the tremie. Fresh concrete of slump between 150 mm and 175 mm should be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing the laitance/scum. The tremie will be pushed further in steps making fresh concrete sweep away the laitance/scum in its way. When tremie is buried by about 0.60m to 1.0m, concreting may be resumed.

7.13.3 In case of concreting through tremie or such tubes which are subsequently withdrawn, the concrete shall be placed in sufficient quantity to ensure that during withdrawal of the tube a sufficient head of concrete is maintained to prevent the in-flow of soil and water or bentonite slurry.

7.14 Protection and Curing

7.14.1 Concreting operations shall not commence until adequate arrangements for concrete curing have been made by the Contractor. Curing and protection of concrete shall start immediately after compaction of the concrete to protect it from:

- a) Premature drying out particularly by solar radiation and wind
- b) High internal thermal gradients
- c) Leaching out by rain and flowing water
- d) Rapid cooling during the first few days after placing
- e) Low temperature or frost
- f) Vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement

Where members are of considerable size and length, with high cement content, accelerated curing methods may be applied, as approved by the Engineer.

7.14.2 Moist Curing

The concrete should be kept constantly wet for a minimum period of 14 (fourteen) days. Water should be applied on unformed surfaces as soon as it can be done without marring the surface and on formed surfaces immediately after the forms are stripped. The concrete shall be kept

constantly wet by ponding or covered with a layer of sacking, canvas, hessian or a similar absorbant material. When air temperature is expected to drop below 5°C during the curing period, additional covering of cotton/gunny bags, straw or other suitable blanketing material shall be provided so that concrete temperature at surface does not fall below 10°C.

7.15 Finishing

Immediately after the removal of forms, exposed bars or bolts, 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 filled with suitable epoxy mortar.

All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges.

Immediately on removal of forms, the concrete work shall be examined by the Engineer before any defects are made good.

The work that has sagged or contains honeycombing to an extent detrimental to structural safety or architectural appearance shall be rejected.

7.16 Setting out for Bridges

7.16.1 Alignment for Bridges: In order to facilitate the setting out of the work, the centre line of the bridges must be accurately established by the Contractor and shall be consented by the Engineer.

7.17 Open Foundations

7.17.1 Where the bearing surface is earth, a layer of M-15 concrete shall be provided below foundation concrete. Thickness of lean concrete shall be 100mm minimum, unless otherwise specified.

7.17.2 Before laying lean concrete layer, the earth surface shall be cleaned of all loose materials. No construction joint shall be provided in lean concrete

7.17.3 For foundation concrete work, side formwork shall be used. Form work for top of foundation shall also be provided, if top has slopes steeper than 1(vertical) to 3(horizontal). Where concrete is laid in slope without top form work, the slump of the concrete shall be carefully maintained to ensure that compaction is possible without slippage down of freshly placed concrete.

7.17.4 Foundation concrete of required dimensions and shape shall be laid continuously up to the location of construction joint shown on the drawings. Dewatering, where necessary for laying the concrete shall be carried out adopting the method duly consented by the Engineer.

7.17.5 Form work shall be removed not earlier than 24 hours after placing of concrete. Where form work has been provided for top surface, the same shall be removed as soon as concrete has hardened.

7.17.6 Before backfilling is commenced, loose sand on foundation shall be removed & disposed. Protective works where provided shall be completed before the floods so that the foundation does not undermined.

7.18 Sub-structure

7.18.1 Piers and Abutments:

- (1) In case of concrete piers, the number of horizontal construction joints shall be kept minimum. Construction joints shall be avoided in splash zones unless specifically consented by the Engineer and provided they are treated in accordance with special provisions. No vertical joint shall be provided.
- (2) In case of tall piers and abutments, use of slipform shall be preferred. The design, erection and raising of slipform shall be subject to special specifications which shall be furnished by the Contractor. The concrete shall also be subject to additional specifications as necessary. All specifications and arrangement shall be subject to consent of the Engineer.
- (3) In case of abutments likely to experience considerable movement on account of backfill of approaches and settlement of foundations, the construction of abutment shall be followed by filling up of embankment in layers to the full height to allow for the anticipated movement during construction period before casting of super-structure.
- (4) Where pier type abutments are provided without wing walls and return walls, the earth fill around the abutment shall be protected by providing properly designed stone pitching on slopes and apron at toe of the fill.
- (5) Stone pitching on the slopes of the embankment on approaches of the bridge shall be as per the Specifications contained herein.

7.18.2 Pier Cap and Abutment Cap: Surface of the cap shall have slope for draining of water. The top surface of the pedestal on which bearings are placed shall be cast horizontal.

7.18.3 Pedestal Below Bearing

The pedestal should be so proportioned that a clear offset of 150mm beyond edges of bearings is available. The pedestal should be suitably designed and minimum reinforced as mentioned below shall be provided.

The two layers of mesh reinforcement – one at 20mm from top and the other 100mm from top of the pedestal or pier cap, each consisting of 8mm bars at 100mm in both directions shall be provided directly under bearings. For other details, relevant provisions of IRC: 78 – 2000 may be referred.

7.18.4 Ballast Wall, Return Wall, Retaining Wall and Wing Wall : In case of cantilever return walls, no construction joint shall generally be permitted. Wherever feasible, the concreting in cantilever return wall / retaining wall shall be carried out in continuation of ballast wall. For gravity type return /

retaining and wing walls, no horizontal construction joint shall be provided. Vertical expansion gap of 20mm shall be provided in return wall / wing wall / retaining wall at every 10 meter interval or as consented by the Engineer.

7.18.5 Joints : Butt joints should be provided between wing walls and abutment, wing wall and return walls and for various tracks when the bridge is for more than one track to cater for differential settlement in case of poor soil.

7.18.6 Weep Holes:

- (1) Weep holes shall be provided through abutments, wing or return walls / Retaining wall and parapets. Weep holes shall be provided with 100mm dia pipe for structures in plain / reinforced concrete. Weep holes in the ballast wall shall be provided with 75mm dia pipes. Weep holes shall extend through full width of the concrete with slope 1 vertical : 20 horizontal towards draining face. Spacing of the weep holes shall generally be 1m in either direction in a staggered manner with the lowest at about 150mm above the low water level or ground level whichever is higher.
- (2) For abutment of canal crossing, culverts, weep holes may be provided only above full supply level. To drain away the water from the backfill of the abutment, wing or return walls, open jointed pipes or boulder drains may be provided at suitable levels.

7.18.7 Backfill Material:

Backfill Behind Abutment, Wing Walls, Retaining Wall and Return Walls Behind abutments, wing walls and return walls / Retaining wall, boulder filling and backfill material shall be provided as per provisions of 'Code of Practice for the Design of Sub-structures and Foundations of Bridges. Boulder filling shall consist of well hand packed boulders & cobbles to thickness not less than 600mm with smaller size towards the back. Behind the boulder filling, backfill material shall consist of granular materials of GW, GP, SW groups as per IS: 1498-1970.

7.18.8 Transition system

The transition system for ballasted deck bridge shall be laid as per RDSO guidelines GE; R-50.

7.19 Superstructure

7.19.1 Pre-stressed Concrete Construction

- (1) **PSC Box Girder:** PSC Girder shall be precast. Girders shall be cast in single pour and shall be post-tensioned. For precast construction, selection of casting yard and details of methodology and of equipment for shifting and launching of girders shall be subject to consent of the Engineer. In exceptional case cast in situ PSC girder can be permitted only with the approval of Employer. The PSC girder constituting the top flange, web and the bottom flange

shall be concreted in a single operation without any construction joint. The portions of deck slab near expansion joints shall be cast along with reinforcements and embedments for expansion joints. For this purpose, the portion of deck slab near expansion joints may be cast in a subsequent stage, if consented by the Engineer.

- (2) Box Girder: Box girders shall be simply supported. It shall be cast in single pour.
- (3) Other Requirements
 - a) During concreting, care shall be taken to ensure that sheathing is not damaged and clogged. It shall be ensured that the cable move freely inside the sheath before, during and after concreting.
 - b) HTS strands should be moved in both directions during the concreting operations. This can easily be done by light hammering the ends of the wires / strands during concreting. It is also advisable that 3 to 4 hours after concreting, the cable should be moved both ways through a distance of about 20 cms. With such movement, any leakage of the mortar which has taken place in spite of all precautions, loses bond with the cables, thus reducing the chance of blockage. This operation can also be done by fixing pre-stressing jacks at one end, pulling the entire cable and then repeating the operation by fixing the jack at the other end. Compressed air should also be pumped to clear leaked mortar. However the methodology of moving the cable during and after concreting shall be subject to consent of the Engineer.
 - c) All precast slabs / parapet blocks used in gang paths etc. are to be table vibrated.
 - d) Permeability testing shall be as per Clause 7.4 [Permeability] of these Specifications.
 - e) Additional testing (in addition to the testing as specified herein), if considered necessary by the Engineer, shall also be carried out by the Contractor at no extra cost to the Employer.

7.19.3 Drainage outlets

The drainage outlets shall be in conformity to the requirements and code of practice. The spacing of the drainage outlets shall be as per approved drawing or as directed by the Engineer. The down spouts shall be adequately fixed to the deck and shall be of rigid corrosion resistant materials not less than 100 mm dia. in the least dimension and shall be provided with suitable clean out fixtures. These outlets shall be so provided that the discharge of the rain water drained by them is not directed towards any part of the super-structure or substructure component.

7.19.4 Installation of Bearings

Care shall be taken during installation of the bearings to permit their correct functioning in accordance with the design scheme. It will be desirable that the representatives of the manufacturer be present at the time of installation of bearings at least for first few girders.

The suppliers of the bearings shall dispatch the bearings in its true shape / position from the workshop with the top & bottom plates suitably clamped. Dismantling of the bearings at site shall not be permitted under normal circumstances.

The load shall be transferred on to the bearing only when the bedding materials has developed sufficient strength.

7.20 Load Testing

7.20.1 Load Test on Individual Units

(1) General

The load tests described in this clause are intended as checks on the quality of the units and should not be used as a substitute for normal design procedures. Where members require special testing, such special testing procedures should be in accordance with the specification. Test loads are to be applied and removed incrementally. The load test shall be carried out as per relevant provision of IRS concrete Bridge code.

7.20.2 Load Test of Structures or Parts of Structures

(1) General

The tests described in this clause are intended as a check on structures other than those covered by serviceability or strength.

(2) Age at Test

The test should be carried out as soon as possible after the expiry of 28 days from the time of placing the concrete. When the test is for a reason other than the quality of the concrete in the structure being in doubt, the test may be carried out earlier provided that the concrete has already reached its specified characteristic strength. When testing prestressed concrete, allowance should be made for the effect of pre-stress at the time of testing being above its final value.

(3) Test Loads

The test loads to be applied for the limit states of deflection and local damage are the appropriate design loads, i.e. the characteristic dead and imposed loads. When the ultimate limit state is being considered, the test load should be equal to the sum of the characteristic dead load plus 1.25 times the characteristic imposed load and should be maintained for a period of 24 hours. If any of the final dead load is not in position on the structure, compensating loads should be added as necessary. During the tests, struts and

bracing strong enough to support the whole load should be placed in position leaving a gap under the members to be tested and adequate precautions should be taken to safeguard persons in the vicinity of the structure.

(4) Measurements during the Tests

Measurements of deflection and crack width should be taken immediately after the application of load and in the case of the 24 hours sustained load test at the end of the 24h-loaded period after removal of the load and after the 24h recovery period. Sufficient measurements should be taken to enable side effects to be taken into account. Temperature and weather conditions should be recorded during the test.

(5) Assessment of Results

In assessing the serviceability of a structure or part of a structure following a loading test, the possible effects of variation in temperature and humidity during the period of the test should be considered. The following recommendations should be met:

- (a) For reinforced concrete structures, the maximum width of any crack measured immediately on application of the test load for local damage should not be more than two thirds of the value for the limit state requirement as given in Clause 10.2.1 of the Code of Practice for Plain, Reinforced and Pre-stressed Concrete for General Bridge Construction (Concrete Bridge Code) of Indian Railway. For pre-stressed concrete structures, no visible cracks should occur under the test load for local damage.
- (b) For members spanning between two supports, the deflection measure immediately after application of the test load for deflections should not be more than 1/500 of the effective span.
- (c) If the maximum deflection (in millimeters) shown during the 24 hours under load is less than $40 L^2 / h$ where L is the effective span (in meters) and h is the overall depth of construction (in millimeters), it is not necessary for the recovery to be measured and Clause 7.20.2 (5) (d) and (e) below do not apply.
- (d) If within 24 hours of the removal of the test load for the ultimate limit state as calculated in Clause 7.20.2 (3) above, a reinforced concrete structure does not show a recovery of at least 75% of the maximum deflection shown during the 24h under load, the loading should be repeated. The structure should be considered to have failed to pass the test if the recovery after the second loading is not at least 75% of the maximum deflection shown during the second loading.
- (e) If within 24 hours of the removal of the test load for the ultimate limit state as calculated in Clause 7.20.2 (3) above, a pre-stressed concrete structures does not show a recovery of at least 85% of the maximum deflection shown during the 24

hours under load, the loading should be repeated. The structure should be considered to have failed to pass the test if the recovery after the second loading is not at least 85% of the maximum deflection shown during the second loading.

- (f) Mass production/ regular casting of box girders shall start after validation of design /construction methodology by conducting load test on first girder as per above provisions.
- (6) **Overall at least four box girders shall be load tested.** Mass production/ regular casting of box girders shall start after validation of design /construction methodology by conducting load test on first girder. Frequency of testing of balance girders shall be approved by the Engineer. The Engineer may ask the contractor for testing more box girders without any extra cost, if required.

7.20.3 Non-destructive Tests (NDT)

Additional non destructive tests on the hardened concrete in the structure as a whole or any finished part of the structure where necessary may be carried out to certain its integrity of strength. Details of few non-destructive techniques are given in Appendix-F of the Code of Practice for Plain, Reinforced and Pre-stressed Concrete for General Bridge Construction (Concrete Bridge Code) of Indian Railway.

7.21 Painting on Bridges

- 7.21.1** Permanent markers like Bridge number, Direction of flow, Bridge Plaques, Bridge Boards, Flood Gauges, HFL, Danger level etc. shall be provided as per Indian Railway Standards by the Contractor. Contract cost shall be deemed to have included the cost of all these items.
- 7.21.2** Flood level gauges should be provided on abutments and on piers as per relevant provisions of Indian Railway Bridge Manual. The marking should be in metres divided into ten parts commencing from the underside of the girders towards the bed. The marking and the figures should be painted in black on white background. Where necessary, piers and abutments may be plastered with cement mortar 400 mm wide for providing the gauges. The HFL mark in paint should be made by the side of the gauge.
- 7.21.3** The direction of flow should be distinctly marked on both the abutments or adjacent piers as per relevant provision of Bridge Manual.
- 7.21.4** Plaques showing particulars of foundations should be fixed over every abutment and pier in accordance with instructions contained in Indian Railways Bridge Manual - .
- 7.21.5** Name boards of the bridge should be fixed at either approach at a distance of about 15 meters from the abutment indicating the name of the river and the number and length of spans.
- 7.21.6** Plaques containing Bridge numbers and indicating direction of flow should be provided on parapet wall as detailed in Indian Railways Bridge Manual .

7.21.7 Danger level should be distinctly marked in red as per provisions of Indian Railway Bridge Manual.

7.22 Tolerances

Tolerances for the finished concrete bridge structures shall be as specified in relevant provision of IRs concrete Bridge code.

7.23 Tests and Standards of Acceptance of Concrete

7.23.1 Concrete shall conform to the surface finish and tolerance as prescribed in relevant provision of IRS/IS codes.

7.23.2 Random sampling and lot by lot of acceptance inspection shall be made for the 28 days cube strength of concrete.

7.23.3 Concrete under acceptance shall be notionally divided into lots for the purpose of sampling, before commencement of work. The delimitation of lots shall be determined by the following:

- a) No individual lot shall be more than 30 cu.m. in volume
- b) At least one cube forming an item of the sample representing the lot shall be taken from concrete of the same grade and mix proportions cast on any day
- c) Different grades of mixes of concrete shall be divided into separate lots
- d) Concrete of a lot, shall be used in the same identifiable component of the bridge

7.23.4 Sampling and Testing

Sampling and testing of concrete shall be as per relevant codes.

7.23.5 Test specimen and sample strength: Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or for any other purpose. Additional cubes may be also be required for testing cubes cured by accelerated methods as described in IS: 9013. The specimen shall be tested as described in IS: 516.

The test strength of the sample shall be the average of the strength of 3 cubes.

7.23.6 Frequency: The minimum frequency of sampling of concrete of each grade shall be in accordance with relevant provision of IRS/IS codes.

7.23.7 Acceptance Criteria

- (1) Compressive Strength : When both the following conditions are met, the concrete complies with the specified compressive strength:
 - (i) The mean strength determined from any group of four consecutive test results complies with the appropriate limits in Column A of Table given below;

- (ii) Any individual test results complies with the appropriate limits in Column B of Table given below.
- (2) Flexural strength: When both the following conditions are met, the concrete complies with the specified flexural strength:
- (i) The mean strength determined from any group of four consecutive test results exceeds the specified characteristic strength by at least 0.3 N/mm²
 - (ii) The strength determine from any test result is not less than the specified characteristic strength less 0.3 N/mm².

Characteristic Compressive Strength Compliance Requirements

Sl. No.	Specified Grade	Group of Test Results	A	B
			The mean of the group of test result exceeds the specified characteristic compressive strength by at least:	Any individual test result is not less than the characteristic compressive strength less:
1	M 20 or above	Any consecutive 4 tests	3 N/mm ²	3 N/mm ²

- (3) Quantity of Concrete Represented by Strength Test Results:
- (i) The quantity of concrete represented by a group of 4 consecutive test results shall include the batches from which the first and last samples were taken together with all intervening batches.
 - (ii) For the individual test result requirements given in Column B of Table given above or in item (ii) of para (2) above only the particular batch from which the sample was taken shall be at risk.
 - (iii) Where the mean rate of sampling is not specified the maximum quantity of concrete that four consecutive test results represent shall be limited to 60m³.
- (4) If the concrete is deemed not to comply pursuant to the Flexural Strength Criteria, the structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken.
- (5) Concrete of each grade shall be assessed separately.
- (6) Concrete is liable to be rejected if:
- (i) it is porous or honey combed;
 - (ii) its placing has been interrupted without providing a proper construction joint;
 - (iii) the reinforcement has been displaced beyond the tolerances

- specified; or
- (iv) construction tolerances have not been met.

However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the Engineer.

7.24 False Work

7.24.1 False work shall be designed to meet the requirements of the permanent structure, taking into account the actual conditions of materials, environment and site conditions. Careful attention shall be paid to the detailing of connections and function with a view to avoiding gross errors leading to significant damage or failure. All false work as designed by the Contractor shall be subject to the consent of the Engineer before starting of the work.

7.24.2 Materials: All the materials shall conform to the specified quality consistent with the intended purpose and actual site condition as applicable.

7.24.3 Falsework Plans: Falsework plans shall include the following information:

- (1) Design Assumptions – All major design values and loading conditions shall be shown on these drawings. They include assumed values of superimposed load, rate of placement, mass of moving equipment which may be operated on formwork, foundation pressures, camber diagram and other pertinent information, if applicable.
- (2) Types of materials, sizes, lengths and connection details.
- (3) Sequence of removal of forms and shores.
- (4) Anchors, form ties, shores and braces.
- (5) Field adjustment of the form during placing of concrete.
- (6) Working scaffolds and gangways.
- (7) Weep holes, vibrator holes or access doors for inspection and placing of concrete.
- (8) Construction joints, expansion joints.
- (9) Sequence of concrete placements and minimum/maximum elapsed time between adjacent placements.
- (10) Chamfer strips or grade strips for exposed corners and construction joints.
- (11) Foundation details for falsework. Special provisions such as protection from water, ice and debris at stream crossings.
- (12) Form coatings and release agents.
- (13) Means of obtaining specified concrete.
- (14) Location of box outs, pipes, ducts, conduits and miscellaneous inserts in the concrete attached to or penetrating the forms.
- (15) Location and spacing of rubber pads where shutter vibrators are used.

7.25 Form Work

7.25.1 General: Formwork shall include all temporary or permanent forms required for forming the concrete of the shape, dimensions and surface finish as shown on the drawing or as consented by the Engineer, together with all props, staging, centering, scaffolding and temporary construction required for their support. The design, erection and removal of formwork shall conform to IRC:87 "Guidelines for Design and Erection of Falsework for Road Bridges" and these specifications. All form work, staging scheme etc. as designed by the Contractor shall be subject to consent of the Engineer.

7.26 Steel Reinforcement

7.26.1 Material

All the materials for steel reinforcement shall conform to the requirements as specified in Clause 5 [Materials for Structures] of these Specifications.

7.26.2 Protective Coating

In order to offer adequate resistance against corrosion, reinforcement bars may be provided with suitable protective coating depending upon the environmental conditions as per the provisions of IRS Concrete Bridge Code.

7.26.3 Protection of Reinforcement

Uncoated reinforcing steel shall be protected from rusting or chloride contamination. Reinforcements shall be free from rust, mortar, loose mill scale, grease, oil or paint. This may be ensured either by using reinforcement fresh from factory or thoroughly cleaning all reinforcement to remove rust using any suitable method such as sand blasting, mechanical wire brushing subject to consent of the Engineer.

7.26.4 Bending of Reinforcement

Bar bending schedule shall be furnished by the Contractor subject to consent of the Engineer. Reinforcing steel shall conform to the dimensions and shape as per the bar bending schedules consented by the Engineer. Bars shall be bent cold. Bars shall not be bent or straightened in a manner that will damage the parent material or the coating. Bars shall not be heated to facilitate straightening.

Any reinforcement, which is bent, should not be rebent at the location of the original bend. Where the temperature of steel is below 5°C, special precautions may be necessary such as reducing the speed of bending or with the Engineer's approval, increasing the radius of bending. Reinforcement shall be bent and fixed in accordance with the procedures specified in IS: 2502 and shall not be straightened that will injure the material.

7.26.5 Placing of Reinforcement

- (1) All reinforcement shall be placed and maintained in the position as shown in the drawings.
- (2) Cover and spacing of steel shall be uniform and as specified in the Specifications and as shown in the drawings.
- (3) Reinforcement steel shall be adequately secured and bound together at all intersections with 1.6mm dia galvanised/annealed wire or approved reinforcement clips so that it maintains its position during casting and vibration of concrete. Free ends of the binding wires used to tie bars shall be bent into the member.
- (4) Crossing bars should not be tack welded for assembly of reinforcement unless permitted by the Engineer.
- (5) Sufficient spacers shall be provided as shall, in the opinion of the Engineer, be necessary to maintain specified concrete cover to the reinforcement and preventing displacement before and during the placement of the concrete. Spacers should be of such material and design as will be durable, will not lead to the corrosion of reinforcement and will not cause spalling of concrete cover. Spacer block made from cement, sand and small aggregates should match the mix proportion of concrete as far as is practicable with a view to being comparable in strength, durability and appearance. Use of wood, tile or porous material will not be allowed for this purpose.
- (6) Subject to the reduction in bond stress, bars may be arranged as pairs in contact or in groups of three or four bars bundled in contact. Bundled bars shall be tied together to ensure the bars remaining together. Bars larger than 32mm diameter shall not be bundled except in columns. Bars shall not be used in a member without stirrups. Bars in a bundle should terminate at different parts spaced at least 40 times the bars size apart except for bundles stopping at support.
- (7) Layers of reinforcements shall be separated by spacer bars at approximately one meter intervals. The minimum diameter of spacer bars shall be 12 mm or equal to maximum size of main reinforcement or maximum size of coarse aggregate, whichever is greater.
- (8) Reinforcement bars shall be adequately secured by chairs / ties / hangers so that it will maintain its position during casting and vibrating the concrete.
- (9) The coated reinforcing steel shall be held in place by use of plastic coated binding wires especially manufactured for the purpose.
- (10) No concreting shall be done until the reinforcement has been inspected by the Engineer.

7.26.6 Bar Splices

(1) **Lapping :**

- (i) All reinforcement shall be furnished in full length as indicated in drawings. No splicing of bars, except where shown on the drawings will be permitted without consent of the Engineer. Lengths of splice, wherever required, shall be as indicated on drawings and consented by Engineer. Lapped splices shall be staggered & located at points along the span where stresses are low.
- (ii) **Lap Length :** Lap splices shall not be used for bars larger than 32 mm. When bars are lapped, the length of the lap shall at least equal the anchorage length required to develop the stress in smaller of the two bars lapped. Length of lap provided, however shall neither be less than 25 times the smaller bar size plus 150mm in tension reinforcement nor be less than 20 times the smaller bar size plus 150mm in compression reinforcement.
- (iii) The lap length calculated in the preceding paragraph shall be increased by a factor of 1.4 if any of the following conditions apply:
 - a) the nominal cover to the lapped bars from the top of the section as intended to be cast is less than twice the bar size;
 - b) the clear distance between the lap and another pair of lapped bars is less than 150 mm ; and
 - c) a corner bar is being lapped and the nominal cover to either face is less than twice the bar size.

Where conditions (a) and (b) or conditions (a) and (c) apply the lap length shall be increased by a factor of 2.0.

- (iv) Lap splices are considered to be staggered if the centre to centre distance of the splices is not less than 1.3 times the lap length
- (v) In case of bundled bars, lapped splices of bundled bars shall be made by splicing one bar at a time, such individual splices within a bundle shall be so staggered that in any cross section there are not more than four bars in a bundle.

(2) **Welding Joints or Mechanical Connections:**

- (i) Welded joints or mechanical connections in reinforcement may be used with the approval of the Engineer but in the case of important connections, test shall be made to prove that the joints are of the full strength of bars connected. All welders and

welding operators to be employed shall have to be qualified by tests prescribed in IS: 2751 and inspection of welds shall conform to IS: 822.

- (ii) Welded joints may be permitted in cold worked bars conforming to IS:1786 provided that the carbon equivalent calculated from the chemical composition of the bar is 0.4% or less. Welding of the cold worked bars may be done in accordance with the recommendations of IS: 9417. When cold-worked bars are welded, the stress at the weld should be limited to the strength of mild steel bars without cold-working.
- (iii) Welded joints should not be located near the bends in the reinforcement. Wherever possible, joints in the parallel bars of principal tensile reinforcement should be staggered. The welded joints may preferably, be placed in regions of low stresses.
- (iv) Bars may be joined with mechanical devices e.g. by special grade steel swaged on to bars in end to end contact or by screwed couplers or using bottle nuts, if consented by the Engineer. Patented systems with approved use shall only be permitted to be used on production of test results to the satisfaction of the Engineer. The effectiveness for such joints shall invariably be proved by static and fatigue strength tests. Such joints should preferably be located at sections where the bending moment is not more than 50 percent of the moment of resistance and such joints should be so disposed that at any section not more than 50% of the bars are connected by mechanical devices, bottle nuts or couplings.

8 Structural Steel Works

8.1 General

- 8.1.1** The work shall include furnishing, fabricating, transporting, erecting and painting structural steel, rivet steel and other incidental metal construction of the kind, size and quantity in conformity with the drawings and these specifications or as desired by the Engineer.
- 8.1.2** General requirements relating to the supply of material shall conform to the specifications of IS: 1387, for the purpose of which the supplier shall be the Contractor and the purchaser shall be the Employer.
- 8.1.3** Finished rolled material shall be procured from primary manufacturers and shall be free from cracks, flaws, injurious seams, laps, blisters, ragged and imperfect edges and other defects. They shall also be free from loose mill scale, rust, pits or other defects affecting its strength and durability.
- 8.1.4** The acceptance of any material on inspection at the mill, shall not be a

bar to its subsequent rejection, if found defective.

- 8.1.5** Unless specified otherwise, high tensile steel rivet conforming to IS: 1149 shall be used for members of high tensile steel conforming to IS: 961 and shall not be used for mild steel members. Unless specified otherwise, bolted connection of structural joints using high tensile friction grip bolts shall comply with requirements of IS: 4000. Cast iron shall not be used in any portion of the bridge structure, except where it is subject to direct compression.

8.2 Materials

- 8.2.1** All the materials for Structural Steel Works shall conform to the requirements as specified in Clause 5 [Materials for Structures] of these Specifications. Special requirements are given below:

- (1) Bolts and nuts shall conform to IS: 1367
- (2) Plain washers shall be of steel. Tapered or other specially shaped washers shall be of steel, or malleable cast iron.

- 8.2.2** Materials for fasteners and welding consumables shall be as under:

- (1) **Fasteners:** Bolts, nuts, washers and rivets shall comply with the relevant IS Standards as appropriate:
- (2) **Welding consumables:** Welding consumables shall comply with the following Indian Standards as appropriate:
 - (i) IS:814 (Part 1) Covered Electrodes for Metal Arc Welding of structural steel for welding other than sheets
 - (ii) IS: 814 (Part 2) For welding sheets
 - (iii) IS: 1278 Filler rods and wires for gas welding
 - (iv) IS: 1395 Low and medium alloy Steel covered electrodes for manual Metal Arc Welding
 - (v) IS: 3613 Acceptance Tests for wire flux combinations for submerged arc welding of structural steel
 - (vi) IS: 7280 Bare wire electrodes for gas shielded arc welding of structural steel
 - (vii) IS: 6419 Welding rods and bare electrodes for gas shielded arc welding of structural steel
 - (viii) IS: 6560 Molybdenum and chromium-molybdenum low alloy steel welding rods and bare electrodes for gas shielded arc welding
- (3) **Paints:** All materials for paints and enamels shall conform to the requirements specified on the drawings or other special provisions consented by the Engineer. The type of paints which can be used shall be as follows:
 - (i) Ordinary i.e. paints based on drying oils, alkyd resin, modified

alkyd resin, phenolic varnish epoxy

- (ii) Chemical Resistant - one pack type (ready for use) and two pack type (mixed before use).
- (iii) Vinyl
- (iv) Chlorinated rubber
- (v) Bituminous Epoxy
- (vi) Polyurethane
- (vii) Zinc rich

Unless otherwise specified, paints shall conform to the relevant IS specifications.

8.3 Fabrication

8.3.1 General

- (1) All work shall be in accordance with the drawings and as per these Specifications. All members shall carry mark number and item number and, if required, serial number.
- (2) Unless specifically required, corresponding parts need not be interchangeable, but the parts shall be match marked as required.
- (3) Templates, jigs and other appliances used for ensuring the accuracy of the work shall be of mild steel; where specially required, these shall be bushed with hard steel. All measurements shall be made by means of steel tape or other device properly calibrated. Where bridge materials have been used as templates for drilling, these shall be inspected and consented by the Engineer before they are used in the finished structure.
- (4) All structural steel members and parts shall have straight edges and blunt surfaces. If necessary, they shall be straightened or flattened by pressure unless they are required to be of curvilinear forms. They shall also be free from twist. Pressure applied for straightening or flattening shall be such as would not injure the materials. Hammering shall not be permitted. Adjacent surfaces or edges shall be in close contact or at uniform distance throughout.
- (5) The Contractor shall submit his programme of work to the Engineer for his consent. This programme shall include the proposed system of identification and erection marks together with complete details of fabrication and welding procedures.
- (6) The Contractor shall prepare shop drawings and obtain consent of the Engineer before the start of work. These drawings shall distinguish between shop and field welds.

9 Miscellaneous Works

9.1 Bridge Bearings

9.1.1 Scope

This work shall consist of furnishing and fixing bearings in position in accordance with the details shown on the drawings, to the requirements of these specifications and as consented by the Engineer. Quality Assurance Plan for manufacturing and testing shall be got approved in advance from the Engineer and further manufacturing & testing shall be done as per provisions.

9.1.2 General Requirements

- (1) Bearing plates assemblies and other expansion or fixed devices shall be constructed in accordance with the details shown on the drawings and as consented by the Engineer.
- (2) The Contractor shall be solely responsible for the satisfactory supply and installation of the bearing.
- (3) The Contractor shall exercise the utmost care in setting and fixing all bearings in their correct positions and ensuring that uniformity is obtained on all bearing surfaces.
- (4) Bearings shall be handled with care and stored under cover.
- (5) It shall be ensured that the bottoms of girders to be received on the bearings are plane at the locations of these bearings and care shall be taken that the bearings are not displaced while placing the girders.

9.1.3 Bearings

- (1) Railway bridge bearings are required to transfer heavy vertical longitudinal and transverse loads from the superstructure to sub-structure and finally to the foundation. The bearings also are required to accommodate large deflections/ rotations not only due to dead loads, superimposed dead loads, live loads, dynamic augment, derailment loads, temperature loads, LWR loads, wind, Seismic loads and others as defined in IRS 'Bridge Rules' and codes listed elsewhere in this specification.
- (2) Under dead loads alone the span may be deflecting up wards (camber) and under live loads it shall be deflecting downward.
- (3) The bearings on one end of the span shall only allow rotation both in longitudinal and transverse planes but not permit any translation, however on the other end both translation and rotation shall be allowed.
- (4) The bearings should be easy to install, easy to inspect and practically maintenance free during the life of the bearing, giving a

cost-effective arrangement. They should also be designed to be quickly and easily replaced.

(5) Spherical bearings as per RDSO guidelines on “Spherical and Cylindrical bearings” shall be used.

(6) In case of any ambiguity or clarification required in the ‘Guidelines on Spherical Bearings’ issued by R.D.S.O./ Lucknow/ India, reference to following European Standards be referred to:

EN 1337 – 1:2000 Structural Bearing – Part I General Design Rule

EN 1337-2 : 2004 Structural Bearing – Part 2 : Sliding Elements

EN 1337-5: 1996 Structural Bearing – Part 5

EN 1337-7 : 2004 Structural Bearing – Part 7: Spherical and
Cylindrical PTFE bearings

EN 1337-8 Guide bearings & Restraint bearings

(7) The design of the bearings should be either carried out by the approved manufacturer of the bearing or vetted as to the correctness and **suitable for performance for specified minimum 35 years of life of the bearing**. RDSO / Lucknow is the authority for issuing the list of approved manufacturer and suppliers for Bridge bearings. Manufacturer and suppliers on the approved list of Ministry of Surface Transport, India (MOST) shall also be acceptable.

9.1.4 Design Requirement

(1) General

- (a) Loads, forces, movements and rotation to be considered in designing the bearings shall be determined by suitable analysis of the structure with idealized boundary condition under any critical combination that can coexist.
- (b) Resistance due to friction at the sliding interface of the bearing shall be ignored for idealizing the boundary conditions. However, induced force generated due to friction at sliding interface shall be considered in the design of bearings and adjacent (supported / supporting) structures.
- (c) Coexisting values of loads, forces & movement data for design of bearings shall be furnished for both Service & Ultimate Limit state condition for each type of bearings separately.
- (d) The designer of bridge superstructure shall provide the forces required to be transferred to substructure. The design of bearing should normally be done by bearing manufacturers and get it approved from his representative, get ‘No Objection’ from Engineer.

(4) Manufacturers Authorisation

Bearing manufacturer shall give the **Manufacturers Authorisation** for satisfactory performance of bearing.

9.1.5 Acceptance, Certification and Marking

Stipulations of this clause regarding the Acceptance Testing, Certification and Marking shall be strictly adhered which forming the basis of Product conformance and acceptance for the Spherical & Cylindrical Bearings.

(1) System of attestation and conformity

Following will form the basis of acceptance of the Spherical & Cylindrical Bearings:

(a) Tasks of the manufacturer:

- i) Raw Material Acceptance / Testing
- ii) Factory production control / in-process testing
- iii) In-house Test on Finished Bearing

(b) Tasks of the Engineer / inspection authority:

- i) Initial inspection of factory and of factory production control
- ii) Surveillance on process of production and conformance test on raw materials
- iii) Witness of final acceptance testing of finished product

(2) Manufacturer Internal Testing

Apart from the raw material in-process inspection to be carried out & documented for all Bearings and their components. The Bearings thus manufactured shall be subjected to in house testing by the manufacturer prior to offering for the acceptance testing. Internal testing on the finished Bearings shall include checking of surface finish, overall dimensional tolerances, load testing for rotation, coefficient of friction, and combined horizontal and vertical load test.

(3) Acceptance Test by Inspecting Authority

Bearings passing the in house test requirements are then offered to the accepting / inspection authority for Acceptance Testing. Following Acceptance tests in presence of the Inspection authority shall be performed on the components of the bearings or the bearing as a whole, as applicable.

a) Tests for conformance of raw materials & its processing

- i) In addition to the certificates of Raw materials from the supplier / manufacturer forming the initial basis of acceptance. Random sampling & testing at Independent accredited lab for the material used in the production of the Bearings like steel, sliding surface, stainless steel, Bolts etc. shall be done. The inspection / accepting authority at his discretion shall relax and not insist on conducting the above test subject to availability of the satisfactory test data for the similar test conducted on materials of bearings recently manufactured & supplied for other projects within a period of six months preceding the date of Testing.

- ii) Ultrasonic inspection of the steel components
- iii) Test on welding e.g. Dye Penetration Test
- iv) Test on hard chromium plating e.g. Ferroxy Test
- v) Hardness test for the Mating Surface
- vi) Surface finish of the stainless steel sheet
- vii) Thickness of the anti-corrosive treatment etc.

b) Acceptance Test on finished Bearings

- i) Bearings shall be randomly checked for surface finish or any other discernible superficial defects.
- ii) Bearings shall be randomly checked for overall dimensions as per the Manufacturing tolerances specified in this guideline and the relevant contract specifications.
- iii) One Bearing selected at random from the lot under acceptance shall be load tested to 1.25 times the maximum design vertical load in serviceability condition as shown in the drawings.
- iv) For movable Bearings (Free Float and Slide Guide Types), One Bearing selected at random per lot shall be tested in order to determine the co-efficient of friction at permanent and maximum Vertical Loads in serviceability condition separately, the value of friction shall not exceed 0.03 under lubricated condition.
- v) For Bearings required to resist horizontal forces (Fixed and Slide Guide Types), One Bearing selected at random from each lot shall be subjected to combined Vertical and Horizontal Load Test to 1.25 times of the respective maximum design loads and forces in serviceability condition.

(4) Observation

During the Testing, the Engineer / accepting authority shall examine the behavior of the Bearings for any signs of Deformation, Crack on the Sliding surface and / or mating surface, Separation / Lift off between the sliding interface or seizing of the Bearing Components. After the above Tests are completed, the tested bearings shall be removed from the test machine, dismantled and the components shall be examined for any signs of distress, permanent deformation in the components especially the sliding surface, warping, scoring, cracks or other permanent defects which may affect the serviceability or durability of the bearing.

The Engineer / acceptance authority apart from witnessing the above test on finished Bearings shall also inspect the documents and reports submitted by the manufacturer about the internal factory production control i. e. raw material, in-process production and internal testing of finished product carried out by the manufacturer.

(5) Inspection Certificate

The details of the tests & inspection carried out both in house and in

the presence of the Witnessing authority shall be recorded in the standard testing formats along with their observations.

(6) Certification

The Engineer/ accepting agency after getting satisfied with the Quality of the Product manufactured shall issue Certificate of conformity of the product stating the conformity with the provisions of this Specification and clearance to the Manufacturer to effect the shipment of the Bearings to the Job Site.

(7) Marking

All Bearings shall have suitable identification plates permanently affixed which shall be visible after installation, identifying the following information:

- Name of Manufacturer
- Month & Last two digits of the year in which the Bearing Manufactured (mm/yy)
- Serial Number of the Bearing
- Bearing Designation & Type
- Design Performance parameters viz. Load, Movement etc.

Besides this, the Bearing Top Surface shall also be marked with the following information to facilitate their correct installation at site:

- Centerline Marking
- Bearing Designation & Type
- Orientation Marking to facilitate correct placement on the Pedestal
- Direction of Major and Minor movement, as appropriate
- Preset Marking, if applicable

9.1.6 Packaging, transport and storage

- (1) The bearing shall be labeled by the manufacturer with the marking requirement as stated in Clause 9.1.5 (7) [Marking]. The marking shall only be applied when the prerequisites, regarding manufacturing, testing & acceptance in accordance with Clause 9.1.5 [Acceptance, Certification and Marking] are fulfilled in all respect.
- (2) Bearings being made up of several components, which are not rigidly fixed together, shall be temporarily clamped together at the place of manufacture. Such clamps shall be sufficiently strong to hold the various bearing components in their correct positions during handling & transportation. They shall be marked / painted with a clear distinguish colour from that of the Bearing paint for easy identification. The Transportation Bracket shall be easily removable after installation or designed to break once the bearing starts to function, without damaging the bearing.

- (3) All bearings that are too heavy to be handled manually shall have provision for the lifting devices.
- (4) Bearings shall be wrapped under heavy duty polythene sheets and secured on wooden pallets or inside Boxes strong enough to withstand the handling & transportation. Bearings shall then be transported to the Job site under secured & horizontal condition.
- (5) The Bearings at the Job site shall be placed horizontally above the Ground Level on wooden pallets under covered space to avoid spoilage by rain water & dust etc.

9.1.7 Aspects Related to Bearing Installation & performance

In order to ensure bearing alignment & placement in accordance with the Contract plan & specifications, a reference index marking shall be provided on the Bearings Bottom & Top Component.

The deviation in level & alignment both in plan & elevation, in installation of Bearings from the standard location, shall not exceed 3% of the Bearing shorter dimension in plan and of the Bearing Total height in elevation.

The deviation in parallelism of the Sliding surface with respect to datum shall not exceed 1% of the Length in the direction of measurement.

Installation

Bearings are to be installed with due care to ensure their correct functioning in accordance with the design of the Structure. The primary factors to be considered during the Installation of the Bearings are:

Transportation & Site Handling Aspects

- Transport Brackets are not to be relied for the Lifting of the Bearings.
- Upon receipt of the Bearings at Site, the contractor shall have a visual Examination of the Bearings to ensure that no damage or Displacement of the Bearing Components is taken place during the Transportation. Any rectification or re-assembly if required shall be done strictly in the presence of the Manufacturer's Representative.

Installation Aspects

- Bearings shall be installed truly horizontal with Top & Bottom Components of the Bearings perfectly parallel to each other, unless otherwise stated.
- For pre-cast construction, the positioning of the Bolts & Dowels embedded in the Substructure / Superstructure shall be made strictly as per the Shop Drawings.
- The Dowels / Distribution Plates shall be properly grouted with suitable grout material ensuring no voids, honeycombing underneath & above the Bearing bottom & top Plates respectively. In case of Movable Bearings, particular care shall be taken to ensure the correct Orientation of the Bearings.
- In case of Pre-cast Construction, extreme care is to be taken to avoid

impact loading onto the Bearings while launching the Girders / Superstructure. Girders shall not be rested freely over the Bearings without any Support.

- Transport Brackets shall be removed at an appropriate time after the casting of the cross diaphragm and setting of the Superstructure Concrete.
- Bearings and its components shall be checked for any dust, dirt or Cement Slurry Deposit etc. and the surrounding area shall be cleaned thoroughly once the Process of bearing Installation is finished.

9.2 Stone Pitching / Revetment on Slopes

9.2.1 Scope

The work shall consist of covering the slopes of banks with stone, boulders, cement concrete blocks over a layer of granular material called filter.

9.2.2 Pitching

The pitching shall be provided as indicated in the drawings and consented by the Engineer. The pitching of the earth slopes around both Abutments for its protection shall be carried out and the area and thickness of the pitching shall be in accordance with the Reference Drawings. The pitching shall be backed by a 75 mm thick layer of filter material. The shape of stone pitching shall be as per the approved drawings. The stones shall be sound, hard, durable and fairly regular in shape. Quarry stones shall be used for this purpose. Round boulders shall not be allowed. Stone subject to marked deterioration by water or weather shall not be accepted. The size and weight of stone shall conform to Clause 5.3.5.1 of IRC: 89. No stone, weighing less than 40 kg shall, however, be used. The sizes of spalls be a minimum of 25mm and shall be suitable to fill the voids in the pitching. Where the required sizes of boulders are not available economically, cement concrete blocks of equivalent weight shall be used. The grade of concrete shall be minimum M-15 grade.

9.2.3 Filter Media

The material for the filter media shall consist of sand, gravel, stone or coarse sand. To prevent escape of the embankment material through the voids of the stone pitching / cement concrete blocks as well as to allow free movement of water without creating any uplift head on the pitching, one or more layers of graded materials, commonly known as a filter medium, shall be provided underneath the pitching. Alternatively the Contractor may suggest any other filter media subject to the approval by the Engineer.

9.3 Boulder Aprons

9.3.1 Scope

This work shall consist of laying boulders on the bed of rivers for protection against scour for buried abutments as required.

9.3.2 Material

The stones used in Apron shall be sound, hard, durable and fairly regular in shape. Stone subject to marked deterioration by water or weather shall not be used. Quarry stones are preferable to round boulders as the later roll off easily. Angular stones fit into each other better and have good interlocking characteristics. The size of stone should conform to Clause 5.3.7.2 of IRC: 89.

Where the required sizes of boulders are not available economically, cement concrete boulders of equivalent weight shall be used. The grade of concrete shall be minimum M-15. Cement concrete blocks shall be preferred where practicable.

9.3.3 Boulder Apron

The surface on which the apron is to be laid shall be leveled and prepared for the length and width as shown on the drawings. In case the surface on which apron is to be laid is below the low water level, the ground level may be raised upto low water level by dumping earth and the apron laid thereon. The quantity of stone required in the apron shall be re-worked out by taking the toe of pitching at higher level.

9.3.4 Backfill Material

Backfill Material shall be made of a good quality free draining, granular and / or selected fill and shall be Mechanically Stabilised. suitability of the material will be subject to the approval of the Engineer.

9.4 Expansion Joints

9.4.1 Scope

This work shall consist of fabrication and placing of expansion joints as indicated on the drawing and conforming to these specifications or as directed by the Engineer.

9.4.2 General Requirements

- a) The expansion joints shall be designed by the Contractor and duly got approved by the Engineer.
- b) It shall cater for expected movement and rotation of the structure at the joints.
- c) It shall also be easy for inspection, maintenance and replacement.
- d) Expansion joints shall be robust, durable, water tight and replaceable. Site fabricated expansion joints shall be prohibited. Expansion joints shall be procured from approved manufacturers and be of proven type.
- e) Proprietary type deck joints offered by the Contractor shall comply in all respects with the manufacturer's specifications and meet the required range of movements and rotations and be fit for the purpose of ensuring satisfactory long term performance in the bridge subject to approval of the Engineer.

9.4.3 Expansion Joints for Railway Bridges

Expansion joints / gaps between the two RCC deck slabs / girders / boxes shall be properly designed by the Contractor and got approved from Engineer. In addition to the performance requirements as specified above, the following requirements shall also be considered while designing the expansion joints / gaps.

- a) To permit independent movement the RCC deck slabs /girders/boxes.
- b) To resist fall of ballast.

9.4.4 Installation of Expansion Joints

Care shall be taken during installation of the expansion joints to permit their correct functioning in accordance with the design scheme. It will be desirable that the representative of the manufacturer be present at the time of installation of expansion joints at least for the first few joints.

9.5 Wearing Coat

9.5.1 Scope

The work shall consist of laying a wearing coat layer of required thickness as indicated on the drawings. It shall not be laid monolithic with the slab.

9.5.2 Material

All materials shall conform to the requirements as specified in Clause 5 [Material for Structures] in these Specifications.

9.5.3 Construction Operations

- (1) It shall have thickness of 80mm at the centre and sloping down towards edges to the thickness of 25mm.
- (2) It shall have the grade not less than the grade of PSC box girder.
- (3) For Weather and seasonal limitations shall be as per IRC Standards.
- (4) The surface to receive the wearing coat shall be thoroughly swept and scraped clean and made free of dust and other foreign matter. It shall be conditioned to the specified levels and grade as directed by Engineer.
- (5) Construction operations such as preparation of mix, laying shall conform to respective specifications as included in these Specifications.

9.6 Maintenance Staff Platform / Trolley refuges on Bridge

The maintenance staff platforms/Trolley Refuges of required dimension shall be provided at every Pier on one side of UP track and One side of DN track.

9.7 Hand Railing for Footpath and Maintenance Staff Platform on Bridges

Structural steel hand railing shall be designed and provided along the sides of footpath and Maintenance staff Platform to provide guidance and safety to the persons using it. The hand railing shall be designed to

withstand all the loads and movements of girders as given in the IRS-Bridge Rules and other related Standard codes of practice. The following shall be minimum requirements:-

- (1) The height of hand railing for footpath shall not be less than 750mm. The height of railing for maintenance staff platform shall however be not less than 900mm.
- (2) The hand railing shall be modular construction and shall be so designed that it is easy to maintain and replace in case of deterioration/damage.
- (3) The vertical post shall be of suitable angle/channel/ H-I section. The rails shall be minimum 40 NB (M) pipes.
- (4) The clear vertical distance between two rails or rail to top of curb shall not exceed 300 mm.
- (5) The rails shall be perfectly fixed to the post and no relative movement between the two shall be feasible during the life span.
- (6) The hand railing along with the inserts and base plate, shall be hot dip galvanized as per IS 4759 – 2001 and IS 1367 – 2002.

9.8 Inspection Ladder from Bridge Deck to Pier Cap/Abutment cap and Inspection platform

For the convenience of maintenance staff to inspect and maintain the bridge bearings, a steel ladder shall be provided from the deck to each pier cap/**abutment cap**, fixed rigidly to the deck and pier. The ladder shall be provided along with a safety hoop cage 2100mm above the pier cap level. The inspection ladder along with the inserts and base plate, shall be hot dip galvanized as per IS: 4759 (2001) and IS: 1367 (2002). The standard zinc used for galvanizing shall conform to IS: 13229 (1991). Inspection ladder shall be provided from pier cap/abutment cap to inspection platform.

10 Safety, Health and Environmental (SHE) Requirements

10.1 Site Safety Plan

10.1.1 General

- (1) The Contractor shall, within sixty (60) days of the Commencement Date, prepare and submit to the Engineer for review his proposed safety plan, as part of the Contractor's Safety, Health and Environment Plan, which shall contain as a minimum items as mentioned in 10.1.2 to 10.1.13 below. .
- (2) Procedures for updating the site safety plan and associated assurance system shall be given.
- (3) The compensation for affected workers or their relatives shall be paid by the Contractor in such cases utmost expeditiously in accordance with the Workmen's Compensation Act.

10.1.2 Statement of the Contractor's Safety Policy

The Contractor shall produce

- (1) a policy statement signed by the managing director of the Contractor or other senior officer acceptable, to the Engineer or the managing directors or other senior officers of each company of the consortium, partnership or joint venture comprising the Contractor, declaring that the Contractor shall ensure that safety and industrial health are given priority consideration in all aspects of the Works by the Contractor in discharging his contractual obligations;
- (2) An understanding of and means of ensuring due compliance with the statutory regulations and standards relating to construction work in India;
- (3) The statutory and contractual obligations regarding safety, rescue and industrial health imposed on the Contractor; and the means by which the Contractor will supervise, monitor and audit his site safety assurance system to ensure due compliance with these obligations.

10.1.3 Appointment, Duties and Responsibilities of Safety Staff

- (1) The “safety staff and organisational structure”, should identify the personnel to be engaged solely for site safety assurance, the responsibilities of the participants and the subdivision of the site safety assurance tasks into elements which can be effectively controlled, technically and managerially.
- (2) Names, addresses, telephone and facsimile numbers of all participants shall be listed where known (supplements to the site safety plan will update and complete this information);
- (3) The powers vested in the safety staff, which shall be sufficient to enable them to take urgent and appropriate action to make safe the site and prevent unsafe working practices or other infringements of the safety plan or statutory regulations;

10.1.4 Policy for Identifying Hazards

- (1) The means by which the Contractor will identify hazards, assess the risks and develop procedures and method statements to minimise the risk for those risks which will occur during the works;
- (2) The Contractor shall produce a list of safety and health hazards identified for this Contract and the procedures and method statements for achieving effective and efficient minimisation of the risks associated with such hazards;

10.1.5 Safety Equipment

The means by which safety equipment, scaffolds, guard-rails, working platforms, hoists, ladders and other means of access, lifting, lighting, signing and guarding equipment shall be inspected, tested and maintained and the standards below which such items will be removed from the site and replaced shall be elaborated.

10.1.6 Contractor’s Equipment

- (1) The Contractor shall produce policy and procedures for ensuring that all his plant and equipment used on the works site is maintained in a safe condition and is operated in a safe manner;

- (2) Also regulations and procedures covering all safety and health aspects of the Works, including where appropriate but not limited to the following shall be produced by the Contractor:
- a) housekeeping
 - b) working on or near operating railways
 - c) fire prevention precautions and fire fighting equipment
 - d) hot weather working
 - e) electrical equipment
 - f) welding/cutting operations and equipment
 - g) personal protection clothing and equipment
 - h) cranes
 - i) hoists
 - j) other lifting appliances
 - k) manual lifting
 - l) power tools
 - m) hand tools and portable power driven tools
 - n) hazardous substances
 - o) working at height
 - p) structural steel erection
 - q) lighting
 - r) protection against falling objects;
 - s) working in confined places
 - t) excavation
 - u) Conveyance, Handling & Use of explosives
 - v) Scaffolding & work Platforms
 - w) Working at height
 - x) Protection against falling objects

10.1.7 Sub-Contractors

- (1) The means by which safety, rescue and industrial health matters and requirements will be communicated to sub-Contractors of all tiers and their due compliance with the site safety plan and all relevant statutory regulations is ensured by the main Contractor.

10.1.8 Disciplinary Procedures

- (1) The Contractor's disciplinary procedures with respect to dealing with safety related matters both with his own staff and that of sub-Contractors shall be given.

10.1.9 Accident Reporting

- (1) The Contractor's procedure for reporting and investigating accidents, dangerous occurrences or occupational illness;

10.1.10 Safety Promotion

- (1) The Contractor shall provide details of the frequency, coverage and intent of site safety meetings together with the rationale for attendance.

10.1.11 Site Security

- (1) The Contractor's system for the protection of authorised and unauthorised visitors to the site;
- (2) The Contractor's proposals to ensure that construction methods do not compromise the Contractor's commitment to the site safety plan or its compliance with the statutory regulations.

10.1.12 Labour Safety

- (1) The activities of Contractor shall be co-ordinated with Indian Railways so as to ensure safety of all Contractor's personnel.
- (2) Labour safety arrangements by the Contractor shall be in accordance with the applicable legislation in India.
- (3) The design and construction shall comply with the applicable legislation in India.
- (4) The Contractor shall provide the equipment needed for the labour safety during the operation of the line.

10.1.13 Site Safety Plan

The brief outline of site safety plan shall cover the following:

10.1.13.1 Safety Personnel

- (1) The Contractor shall appoint a safety officer whose duties throughout the period of the Contract shall be entirely connected with the safety and industrial health aspects of the Contractor's activities on the site.
- (2) The Contractor shall ensure that the safety officer maintains a daily site safety diary, such diary comprehensively recording all relevant matters concerning site safety, safety inspections and audits, safety related incidents and the like.
- (3) The site safety diary shall be reviewed and signed on a weekly basis by the Contractor's site representative and shall be available at all times for inspection by the Engineer.

10.1.13.2 Site Safety Inspections

- (1) The Contractor will conduct site safety inspections at a regular frequency.
- (2) The findings of the inspections shall be recorded on suitable forms which shall be kept available for inspection by the Engineer.

10.1.13.3 Safety / Accident Reporting

- (1) The Contractor shall submit regular site safety reports to the Engineer in accordance with the site safety plan.
- (2) Such reports shall be submitted as part of the Monthly Progress Report. Prior to submission, the site safety report shall be endorsed by the Project Director responsible for the Contract and the Contractor's site representative.

- (3) The Engineer shall be informed by the Contractor verbally immediately after occurrence of any accidents whether on-site or off-site in which the Contractor, its personnel or plant, or those of its sub-Contractors are directly or indirectly involved and which results in any injuries to any persons, loss / damage to plant and machinery, disruption of traffic etc. This shall be followed by a written comprehensive report within 24 hours of the accident.

10.1.13.4 Sub-Contractors

- (1) The Contractor shall provide its sub-Contractors with copies of the site safety plan and shall incorporate into all sub-contract documentation provisions to ensure the compliance with such plan at all tiers of the sub-contracting.

10.1.13.5 Safety Meetings

- (1) The Contractor shall convene regular safety meetings in accordance with the safety plan and shall ensure attendance by the safety officer and safety representatives of sub-Contractors unless otherwise agreed by the Engineer.
- (2) All safety meetings shall be notified in advance to the Engineer who may attend in person or by representative at his discretion.
- (3) The minutes of all safety meetings shall be taken and sent to the Engineer within seven (7) days of the meeting.

10.1.13.6 Safety Equipment

- (1) The Contractor shall identify the safety equipment, rescue apparatus and protective clothing which will be required for the Works.
- (2) The Contractor shall ensure that safety equipment and protective clothing as described in the safety plan is available and used on the site at all material times and those measures for the effective enforcement of proper utilisation and necessary replacement of such equipment and clothing is incorporated into the site safety plan.
- (3) The Contractor shall regularly inspect, test and maintain all safety equipment, and those found damaged, dirty, incorrectly positioned or not in working order shall be repaired or replaced immediately.

10.1.13.7 First Aid

- (1) The Contractor shall establish, maintain, staff, and fully equip a first aid base as detailed in **Employer's Requirement**.

10.1.13.8 Site Publicity

- (1) The Contractor shall ensure that safety, rescue and industrial health matters are given a high degree of publicity to all persons regularly or occasionally on the site.

10.1.13.9 Training

- (1) The Contractor shall conduct regular safety training and rescue training drills, the frequency, coverage and application of which shall be in accordance with the site safety plan, and in any case shall not be more than every six months. Engineer may monitor the content of such training programs.

10.1.13.10 Breach of Safety Regulations

- (1) Any employees of the Contractor or sub-Contractor of any tiers who commit a serious breach of the safety regulations shall be liable to summary dismissal and shall not be re-employed on the Contract or allowed on any of the sites.
- (2) The due notice of this sanction shall be prominently displayed on the site.

10.1.13.11 Safety Devices

- (1) All plant and equipment used on or around the site shall be fitted with appropriate safety devices which shall be operational at all times and shall be regularly inspected and tested.

10.1.13.12 Testing and Certification of Lifting Gear

- (1) The Contractor shall provide and maintain safe mechanical cranes, hoists and conveying facilities for the lifting **and transport of materials and shall comply with all** relevant codes of practice for safe use of cranes.
- (2) All cranes, hoists and the like shall be fitted with audible overload warning devices.
- (3) All such equipment shall be regularly maintained in accordance with manufacturers' recommendations and standards having regard to local legislation and recommendations from the appropriate statutory authority.

10.1.13.13 Fire Regulations and Safety

- (1) The Contractor shall provide and maintain all necessary temporary fire protection and fire fighting facilities on the site during the construction of the Works, and shall comply with all requirements of the local fire services department.
- (2) These facilities may include, without limitation, sprinkler systems and fire hose reels in temporary site buildings, raw water storage tanks and portable fire extinguishers suitable for the conditions on the site and potential hazards.
- (3) The Contractor shall submit details of these facilities to the Engineer for review prior to commencement of work on the site.

10.1.13.14 Interface with Indian Railway Operations

- (1) The Contractor will review the interfaces with Indian Railway's operations and prepare a specific safety plan for all works that may affect the operating railway.
- (2) The Contractor will comply with and incorporate Indian Railway's rules and regulations for track, signalling and operations possessions into his safety plan and will operate a permit to work system for all works which may affect the operations of the existing railway.
- (3) Similarly, the site safety plan shall consider with other interfacing contractors in the closed vicinity of the Employer.

10.1.13.15 Standby Equipment

- (1) The Contractor shall provide adequate stand-by equipment to ensure the safety of personnel, the Works and the public.

10.1.13.16 Co-operation

- (1) The Contractor shall provide full co-operation and assistance in all safety surveillance carried out by the Engineer or the Employer. Any breaches of the site safety plan or the statutory regulations or others disregard for the safety of any persons may be the reason for the Engineer to exercise his authority to require the Contractor's site representative's removal from the site. Besides this Engineer may impose token penalty for such lapses as considered fit.

10.2 Environmental Protection Requirements

10.2.1 Measures for the Mitigation of Environmental Impacts

This section describes mitigation measures to be taken in pre-construction construction and defect notification stages against environmental impacts. While compliance of applicable statutory laws is essential, mitigation measures as described herein are to be adopted.

10.2.2 General

- (1) The Contractor shall develop within sixty 60 days of the Commencement Date its own Environment Management Plan (EMP), as part of the Contractor's Safety Health and Environment Plan (SHE), and submit to the Engineer for approval in accordance with, relevant Government of India Legislation like Pollution Control Board, various environmental monitoring agencies of Government etc.
- (2) The Contractor's detailed technical designs for the Works and operations during construction shall conform to Indian Environmental Laws.
- (3) The current national standards established by the Indian Government for control of environmental pollutants such as air, water, noise and visual impacts/aesthetics shall be followed for compliance during pre-construction, construction and defect notification stages, .
- (4) The Contractor shall ensure that proper and adequate provisions to this end are included in all sub-contracts placed by him.
- (5) The provisions mentioned here however, shall not be applicable in the case of emergency works necessary for saving of life and property or safety of the Works which shall have prior approval of Engineer in all cases.
- (6) The Contractor shall undertake environmental monitoring as required under the contract,.
- (7) The Contractor shall prepare a plan for self-monitoring over the course of the project and submit to the Engineer for approval.
- (8) The Contractor shall ensure that audits of all the activities detailed in his EMP are carried out at monthly intervals and reported in the Monthly Reports to ensure the continuing effectiveness and compliance with the EMP.
- (9) The Contractor shall make available on request any document, which relates to his recent internal audits.
- (10) The Engineer may conduct quarterly audits of the Contractor's EMP and its effective implementation on the works site.

- (11) During the audit the Contractor shall provide a suitable number of qualified staff as directed as directed by the Engineer to assist the Engineer during the audit.
- (12) Requirements established in the EMP specification shall apply to all sites and all activities of the Contractor, including the detailed technical designs of the civil infrastructure, and shall supplement the Employer's Requirements.
- (13) In the EMP the Contractor shall appoint a suitably qualified manager responsible for the environmental as well as a support team to assist this manager. Roles and responsibilities and key communication links must be highlighted to ensure responsibility for implementing the EMP.
- (14) The Contractor shall ensure that its Environment Plan documentation includes but is not limited to the provisions covered in the SHE requirements.

10.2.3 Environmental Management Process

Environmental management is based on the potential impacts assessed for the project. Assessment of potential impacts is based on the review of secondary data substantiated by site visits – environmental monitoring, public consultation, household survey and discussion with concerned Govt. Dept. The implementation of Environmental Management Plan (EMP) requires the following:-

- a) An organizational structure
- b) Assign responsibilities
- c) Define timing of implementation
- d) Define monitoring responsibilities

10.2.4 EMP during Construction

The project activities shall be executed in a phased manner, pre-construction phase, construction phase and operation phase. The major activities to be undertaken during construction phase are described below.

The environmental issues during construction phase generally involve quality, safety and public health issues. The Contractor is required to comply with the laws with respect to environment protection, pollution control, forest conservation, safety and any other applicable laws. Environmental pollution control during the construction phase shall be the responsibility of the Contractor. EMP is an executable part of project and the activities are to be guided, controlled, monitored and managed as per the provisions provided.

10 .2.5 Land Acquisition / Diversion Plan

Acquisition of land for ROW is the responsibility of DFCCIL. The proposed alignment is not passing through any forest area.

- i. The acquisition of land and private property shall be carried out in accordance to the RAA - 2008.
- ii Where temporary land is acquired by the Contractor for setting up labour camp, work site, placing of construction related equipment, dumping of wastes, stacking of excavated earth, construction materials etc., the Contractor shall be responsible for such land acquisition/ hiring from the rightful owners following applicable procedures/ rules, compensation / rent thereof and implementation of EMP provisions for the same.

10.2.6 Avoidance of Nuisance

- a) The Contractor shall take all precautions to avoid any nuisance arising from his operations. This shall be accomplished, wherever possible by suppression of nuisance at source rather than abatement of the nuisance once generated.
- b) Following site clearing and before construction, the Contractor shall remove all trash, debris and other weeds.
- c) The Contractor shall ensure that the work place is free of trash, garbage, debris and weeds. He shall provide and ensure proper uses of refuse containers to ensure that rodents, insects and other pests are not harboured and attracted.
- d) The Contractor shall provide a dedicated team of workers at each work site who shall be solely employed to keep the site and its surroundings in a clean condition and maintain a good standard of house-keeping on the site.
- e) The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials shall only be allowed at sites designated by the Engineer.
- f) The Contractor's temporary dumping areas shall be maintained by the Contractor till the materials are re-utilized for back-filling or any other purpose as per instruction of Engineer.

10.2.7 Utility Shifting

This shall be dealt as per provision in Appendix 11 (Requirements for Constructions) and other provisions of Bid Documents.

10.2.8 Construction / Labour Camp Management

During the construction phase, proper construction camp development plan has to be formulated to control degradation of the surrounding landscape due to the location of the proposed construction camp. The Contractor must provide, construct and maintain necessary living condition and ancillary facilities which shall include:

- a) Sufficient supply of potable water must be provided at camps and working sites. If the drinking water is obtained from the intermittent public water supply, then storage tanks must be provided. All water supply storage may be sufficiently away from the toilets or drains.
- b) Adequate and clean washing and bathing facilities must be provided that also have sufficient drainage.
- c) Adequate sanitary facilities may be provided within every camp. The place must be cleaned daily and maintain strict sanitary conditions. Separate latrine must be provided for women. Adequate supply of water must also be provided.
- d) The contractor must ensure that there is proper drainage system to avoid creation of stagnant water bodies.
- e) No open fires may be allowed in camps.
- f) The sites should be secured by fencing and proper lighting.
- g) The construction contractor may ensure that all construction equipments and vehicle machinery may be stored at a separate place / yard.

- h) Fuel storage and refilling areas may be located 500 m away from the water bodies and from other cross drainage structures.
- i) All the construction workers should be provided with proper training to handle potential occupation hazards and on safety and health which include the following:-
 - Environmental awareness program
 - Medical surveillance
 - Engineering controls, work practices and protective equipment
 - Handling of raw and processed material
 - Emergency response
- j) Construction / labour camps shall be located away from forest areas, settlements, cultural heritage and historical sites and water bodies and dry river beds.
- k) It should be ensured by the construction contractor that the camp area is cleared of the debris and other wastes after the completion of construction. On completion of construction, the land should be restored back to its original form to the satisfaction of DFCCIL.

10.2.9 Mitigation Measures of Land Environment during Construction

While DFCCIL is responsible for land acquisition for clear ROW, the Contractor shall be responsible for use of the land during construction. Hence, the Contractor shall take necessary measures as enumerated in the EMP to prevent/ arrest soil erosion, contamination.

10.2.10 Borrow Area Management Plan

Borrow areas shall be identified and finalized by the Contractor in consultation with Engineer. Formal agreement between landowners and the Contractor has to be made. Suitability of borrow areas from civil Engineering as well as environmental consideration have to be ensured. Meeting the guidelines/notifications as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the Contractor.

Besides this, precautions are to be taken by the Contractor for no unauthorized borrowing. No borrow area shall be opened without permission of the Engineer. Engineer in addition to the established practices, rules and regulation shall also consider under-mentioned criteria before approving the Borrow areas.

To avoid any embankment slippage, the borrow areas shall not be dug continuously and the size and shape of borrow pits shall be decided by the Engineer. Redevelopment of the borrow areas to mitigate the impacts shall be the responsibility of the Contractor. The Contractor shall evolve site-specific redevelopment plans for each borrow area location, which shall be implemented after the approval of the Engineer.

To ensure that the spills, which might result from the transport of borrow and quarry materials do not impact the settlements, it shall be ensured that the excavation and carrying of earth shall be done in a careful manner. The

unpaved surfaces used for the haulage of borrow materials shall be maintained properly. Contractor shall ensure the following issues are covered to the satisfaction of Engineer.

- a) Water pooling to be avoided/managed so that no disease spread or mosquito breeding takes place due to water stagnation.
- b) Precautionary measures as the covering of vehicles may be taken to avoid spillage during transportation of borrow area.
- c) Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction facility is operating at the place of deposition, to minimize dust pollution.
- d) During rains appropriate measures to be taken to minimize soil erosion, silt fencing to be provided as directed by Engineer/EO.
- e) Burrow pit should have proper guard to prevent accidental falling of children or animals.

An appropriate Borrow Area Management Plan shall be formulated to control the degradation of the surrounding landscape due to the excavation work. The national standard which applies to the manual borrowing of earth is detailed in IRC-10:1961.

10.2.11 Mitigation Measures to Minimize Soil Erosion during construction

- a) Suitable protection measures consisting of bio-Engineering techniques such as plantation of grass and shrubs, may be provided to control erosion. The measures shall be applied along the slopes at high embankment where bridges shall be constructed.
- b) Borrow areas may be finalized in concern with ecological sensitivity of the area. Agriculture land may not be used as borrow areas. Priority may be given to degraded area for excavation of borrows material. Rehabilitation of borrow area may be taken under the project.
- c) Construction work may be avoided during rainy season to evade erosion and spreading of loose material.

10.2.12 Geo-technical issues

The Contractor shall submit within the EMP the expected construction impacts for all major facilities and sections of higher embankments and deeper excavations, including materials used for the building of the formation prior to construction, these impacts should include:

- a) Determination of formation material quality and placement impact;
- b) Stability factors, including seismic migration;
- c) Drainage facilities for groundwater dewatering;
- d) Effects on the local communities and transportation networks from overland truck transport of fill and excavate to and from the specific borrow and fill sites.
- e) Specific mitigation measures and maintenance-of-traffic plans to ensure minimal disruption on local traffic conditions and the environment.

10.2.13 Mitigation Measures for Ambient Air Quality

1. Pre Construction / preparatory Phase: The dust generation due to pre-construction activities shall be temporary in nature and localized and shall be effectively countered by sprinkling of water wherever required.
2. Construction Phase: Contractor shall undertake following specific measures regarding this aspect:-
 - a) Locating plant at a significant distance from nearest human settlement in the predominant down wind direction.
 - b) Vehicles delivering fine materials like soil and fine aggregates may be covered to reduce spills on existing roads.
 - c) Water shall be sprayed on earthworks, temporary haulage and diversions on a regular basis.
 - d) Pollution control systems like water sprinkling and dust extractors and cover on conveyors shall be installed for the crushers.
 - e) All vehicles, equipment and machinery used for construction shall be regularly maintained to ensure that the emission levels conform to the SPCB/CPCB norms.
 - f) Air quality monitoring shall be conducted during construction period and CPCB standard should be followed.

10.2.14 Mitigation Measures for Water Quality

10.2.14.1 Water Quality Management

Contractor shall undertake following measures to avoid contamination of water bodies:-

- a) The discharge standards promulgated under the Environmental Protection Act, 1986 shall be strictly adhered to. All wastes arising from the project shall be disposed off in a manner that are as per the provisions of the State Pollution Control Board (SPCB).
- b) Water quality shall be monitored regularly near the construction site.

10.2.15 Sensitive Receptors – Mitigation Measures

All schools, hospitals and cultural properties and heritage sites that are within 100 m distance of the project area require noise control measures.

10.2.16 Mitigation Measures for Noise during Construction Phase

- a) Machinery and vehicles shall be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum.
- b) Workers in the vicinity of high noise levels shall be provided earplugs/earmufflers helmets and shall be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8 hour shift. CPCB standard is to be observed.
- c) During construction vibratory compactors will be used with due care within the urban areas. In case of complaints from nearby residents, the Engineer shall ask the Contractor to take suitable steps of restricting the work hours even further or use an alternative roller.

10.2.17 Control requirements

Under the Contract, the Contractor shall:

- a) Perform work within the procedures outlined herein and comply with applicable codes, regulations, and standards established by the Indian Government and their agencies.
- b) Schedule and conduct operations in a manner that shall minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
- c) Submit to the Engineer a Noise Monitoring and Control Plan (NMCP), within 3 months from Commencement Date, which shall form part of the overall EMP, including full and comprehensive details of all powered mechanical equipment, which he proposes to use during daytime and night-time and of his proposed working methods and noise level reduction measures.
- d) The NMCP prepared by the Contractor shall guide the implementation of construction activity.
- e) The NMCP will be reviewed on a regular basis and updated as necessary to ensure that current construction activities are addressed.
- f) It shall appear as a regular agenda item in project coordination meetings

10.2.18 Mitigation Measures for Hydrological Condition (Rivers and Lakes)

1) Construction Phase -

- a) To avoid any unwanted accumulation of water/ water logging, provision of temporary drainage arrangement due to construction activities shall be made by Contractor.
- b) Silt fencing may be provided near water bodies.
- c) Proper drainage may be planned in the area to avoid water logging.

2) Implementation Phase -

Cross drainage structures shall be provided at appropriate locations wherever local drainage is likely to be affected.

10.2.19 Mitigation Measures for Flora and Fauna during Construction

- a) For temporary land / site hired/ acquired by the Contractor for construction labour camp, materials stacking/ storage, operating equipment etc. cutting of trees will be the responsibility of the Contractor. The Contractor shall follow all procedures as per Forest Department and / or statutory law/ guidelines including compensation.
- b) Labour camps and office site shall be located outside and away from the forest area.

10.2.20 Landscape

Landscaping plan may be formulated for restoration, leveling and landscaping of the area once construction activities are over. This can involve the following:-

- a) The stockpiles may be designed such that the slope does not exceed 1:2 (vertical to horizontal) and the height of the pile to be restricted to 2 m.
- b) Stockpiled topsoil may be used to cover the disturbed areas and cut slopes. The top soil shall be utilized for redevelopment of borrow areas, landscaping along slopes, incidental spaces etc.
- c) Incorporation of suitable and effective contractual clauses for rehabilitation and restoration of borrow areas and other temporary works and landscaping it with surrounding area immediately after its use shall be made by the Contractor with its Sub Contractor for earthworks.

10.2.21 Vibration level limit

- a) The vibration level limits adjacent to the alignment shall conform to appropriate legislation of Government of India in this regard.
- b) The scheme for monitoring the vibration level at the site shall be submitted to Engineer for his approval.

10.2.22 Public Health and Safety

The Contractor is required to comply with all the precautions required for the safety of the workmen. The Contractor must comply with all regulation regarding scaffolding, ladders, working platform, excavation, etc.

10.2.23 Waste

10.2..23.1 Control of waste generation during construction and its safe disposal is the responsibility of the Contractor.

- a) Principle of 3R's (Reduce, Reuse, Recycle) shall be followed while handling waste from the construction Site. The Contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works, which may include:-
 - i. Identification of disposal sites.
 - ii. Identification of quantities to be excavated and disposed off.
 - iii. Identification of split between waste and inert material
 - iv. Identification of amounts intended to be stored temporarily on site location of such storage.
 - v. Identification of intended transport means and route.
 - vi. Obtaining permission, wherever required, for disposal.
- b) A mechanism shall be developed to ensure that the pre-designated area is available for the segregation and temporary storage of reusable and recyclable materials. This shall be incorporated in the WMP. The WMP should be prepared and submitted to the Engineer for approval.
- c) The Contractor shall handle waste in a manner that ensures that wastes are held securely, maintained and waste storage area is cleaned regularly.
- d) The Contractor shall remove waste at regular interval and dispose at landfill sites, if available nearby, after obtaining approval/ consent of concerned authority. If such authority or landfill site is not available nearby, the wastes may be dumped at a pre-designated site within Project area in consultation with SPCB & Engineer.

- e) The Contractor shall not burn debris or vegetation or construction waste on the site but remove as per relevant Rules.
- f) The Contractor shall make arrangements to disposal off metal scrap and other wastes which can be sold to authorized dealer(s) and maintain record of such sale for inspection by the Engineer.

10.2.23.2 Hazardous Waste Management (by Contractor)

- 1) Any waste classified as hazardous under the “Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008, shall be disposed according to the concerned Rules.
- 2) Chemicals classified as hazardous chemicals under “Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 shall be stored in compliance with the said Rules.
- 3) The Contractor shall identify the nature and quantity of hazardous waste generated as a result of his activities and shall file a “Request for Authorization” to SPCB along with a map showing the location of storage area.
- 4) Outside the storage area, the Contractor shall place a display board clearly mentioning ‘Hazardous Wastes’ and quantity and nature of wastes, on date. Hazardous Waste needs to be stored in secured manner..
- 5) It shall be the responsibility of the Contractor to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The labeling and packaging is required to be easily visible and be able to withstand physical conditions and climatic factors.
- 6) The Contractor shall approach only registered & authorized Recyclers of Hazardous Waste for direct sale/ disposal of Hazardous Waste, under intimation to SPCB.

Section V. Employer's Requirement Volume 7 – Appendices

Appendix 1 Alignment of Trackways and Work Areas

Appendix 2 Project Calendar

Appendix 3 Project Programme Requirements

Appendix 4 Quality Assurance

Appendix 5 CAD and Document Standards

Appendix 6 Temporary Works

Appendix 7 Contractor's Coordination with Others

Appendix 8 Requirements on Documents and Drawings

Appendix 9 Document Submission and Review Procedure

Appendix 10 Requirements for Design

Appendix 11 Requirements for Construction

Appendix 12 Publicity and Public Relations

Appendix 13 Deleted.

Appendix 14 Possession Management

EMPLOYER'S REQUIREMENTS

APPENDIX 1

ALIGNMENT OF TRACKWAYS AND WORK AREAS

1. Alignment Drawings

- 1.1 The proposed Alignment of the bridge and approaches as developed by the Employer is enclosed in the key plan and Alignment Drawings.
- 1.2 The Alignment Drawings provides the
 - (1) Plan & Profile of the Alignment (Horizontal and Vertical Alignment) as developed by the Employer,
 - (2) Location of the bridge and its approaches along the Alignment, and
 - (3) Start & end chainage of the Package
- 1.3 The Contractor shall be responsible for validation of the alignment of bridge and approach and validation of the data provided by the Employer and additional surveys if considered necessary and investigations necessary for development of his Design with reference to the Design Criteria (as specified in the Employer's Requirements – Design) and other technical and geometrical obligatory requirements (if any).
- 1.4 During validation of the alignment of bridge and approach, data and additional surveys, the Contractor shall link the same with GTS Bench Marks (Survey of India Bench Marks). The final Alignment (horizontal and vertical) shall ensure that it caters to the design of all the Works including, but not limited to, the Railtrack formations in approaches, the Bridge Structures, etc. and is to be consistently developed without infringing the ROW, the Structure Gauge and the Clearances, as stipulated in the specifications of the Bid Documents, during the Technical Design development.

2. Site and Work Areas

2.1 Definition

- (1) The 'Site' is where the Permanent Works are to be executed within the available ROW
- (2) The Work Areas comprises of the Site and areas for the Temporary Works including the area outside the ROW (as arranged by the Contractor, if required) .

2.2 Contractor's Possession of the Site

- 2.2.1 The Employer is acquiring the land width in Right of Way (ROW) required for this Package.
- 2.2.2 The Employer shall give Right to Access to the Site to the Contractor as per the schedule specified in the Bid and provisions of the Particular Conditions of the Bid Documents and in conformity with the Contractor's

work plan duly consented by the Engineer and the Employer.

2.2.3 Conditions of Possession of the Site from the Employer shall be described as follows:

- (1) The actual land as required for the execution of Permanent Works within the ROW shall be handed over to the Contractor free from all encumbrances.
- (2) Before handing over the possession of the Site, the Employer shall:
 - a) Cut all trees within the land required for execution of Permanent Works in the ROW having girth more than 300mm (if any)
 - b) Demolish all the buildings, constructed facilities and abandoned structures (if any) existing within the land required for execution of Permanent Works in the ROW, and
 - c) Divert all the charted public utilities existing in the ROW (if any).
- (3) The Contractor shall ensure that the land, for which the Right of Access has been given by the Employer, is not encroached by unauthorized persons and is not used for any purposes not connected with the Works.
- (4) Diversion of all the uncharted public shall be handled as specified in Appendix 11 [Requirements for Construction] to the Employer's Requirements.
- (5) Although the Site within the ROW shall become a possession of the Contractor during his construction as described below, the Contractor shall be solely responsible for maintaining the same and reinstating the same within the occupancy of Temporary Works to the entire satisfaction of the Engineer / Employer at his own expenses.

2.3 Contractor's Access to the Site

2.3.1 The timings, sequence and conditions relating to the Contractor's possession of the Site are variously set out in accordance with the General Conditions of the Bid Documents and as detailed below:

- (1) The Contractor shall prepare Site utilization plan and shall elaborate a schedule for the time periods of the availability of Site areas for his contract performance.
- (2) The Contractor shall indicate the exact nature and the extent of various work elements proposed to be carried out in different stretches of the Site prior to the taking up the execution of the Permanent Works or making use of the area as working space and/or for temporary works / site facilities.
- (3) The information as above shall be submitted to the engineer for his consent and approval by the Employer.
- (4) On the basis of the consented information above, the Contractor shall submit proposals for the use and the occupation of the work area of the Site, such submissions being at least fifty six (56) days prior to the

programmed use of the specific work area of the Site. The availability of work area will only be permitted for the actual duration of the Permanent and Temporary Works within the particular work area of the Site.

- (5) Prior to the scheduled dates for returning of Site for subsequent use by Other Contractors / Interfacing Parties / Employer, the Contractor shall carry out the following activities:
 - a) Construct all Permanent Works within the Site, to the extent as defined in the Technical Design and in accordance with the requirements of the Contract;
 - b) Reinstatement the balance area to the same condition as it was taken over from the Employer, unless otherwise as consented by the Engineer and the Employer;
 - c) Form the area to the approved lines and levels and carry out such other works as shall be required by the provisions of the Contract; and
 - d) Remove all rubbish, debris and other materials to the entire satisfaction of the Engineer and the Employer.
- (6) The schedule for all the work areas as above shall include, but not limited to the following data:
 - a) Indication of the work areas of the Site;
 - b) Description and intended use of the work areas of the Site;
 - c) The start and the end date of the Works in the work areas of the Site; and
 - d) Date when the Contractor shall hand over / allow the work areas of the Site to be accessed by the Other Contractors and / or the Interfacing Party(ies).

2.3.2 The Contractor shall comply with the requirements described in Appendix 11 [Requirements for Construction] to the Employer's Requirements with regard to the Works to be executed after the possession of the Site.

2.3.3 The Contractor shall submit the Engineer a proposal for the use of the Site for the survey and investigation if required for the Technical Design and execution of the Works.

3. Contractor's Operations outside Right of Way (ROW)

3.1 The Contractor shall be solely responsible for acquiring the additional land (land in addition to the Site within ROW) required by him for his Temporary Works areas outside the ROW, at his own expenses, including maintaining and reinstating the same on completion of the Works to the entire satisfaction of the land owner and the Engineer. Activities for such Temporary Works are detailed in Appendix 6 [Temporary Works] to the Employer's Requirements.

- 3.2 The Contractor shall make necessary arrangement with land owners and relevant government authorities for any work to be undertaken outside the ROW .
- 3.3 When using and/or occupying the Work Areas on or around the existing public roads (if any), the Contractor shall take necessary procedures and mitigation measures as described in Appendix 11 [Requirements for Construction] to the Employer's Requirements and Safety, Health and Environment (SHE) Requirements in specifications .
- 3.4 The Contractor shall submit the Engineer proposals for the use and occupation of such of the Work Area. Such a submission shall be at least fifty six (56) days prior to the programmed use of the specific Works Area.
- 3.5 On completion of the Works, the land arranged by the Contractor outside the ROW shall be restored back to its original condition or to the entire satisfaction of the land owner and the Engineer.

* End of Appendix 1

*

EMPLOYER'S REQUIREMENTS

APPENDIX 2

PROJECT CALENDAR

- 1.** 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 or milestone by a particular week, this shall mean by midnight on the Sunday of that week.
- 2.** A 7-day week calendar shall be adopted for various (Works) programme schedules for scheduling purposes.
- 3.** Basic Work Unit shall be “days” for scheduling purposes.
- 4.** The presentation shall be in “Week” units for project purposes.

* End of Appendix 2 *

EMPLOYER'S REQUIREMENTS

APPENDIX 3

PROJECT PROGRAMME REQUIREMENTS

1. General

1.1 The Programme has the following two primal purposes in respective phases of the contract. .

(1) Contractual Construction Programme

The Contractor shall submit a detailed time programme to the Engineer for his consent within 28 days after the Commencement Date. While preparing this, the Contractor shall duly consider his various obligations including but not limited to the, shared Site areas with the Other Contractors, Key Dates, Milestones etc. This programme shall be supplemented and developed at the time of the Inception Report. However supplementing the same shall not relieve the Contractor of his obligation to adhere to the Time for Completion and Key Dates & Milestones as specified in the Contract. Upon consent by the Engineer to this programme, it shall be referred to as the Contractual Construction Programme, and become an integral part of the Contract.

(2) Works Programme and Supporting Reports

Base on the Contractual Construction Programme, the Contractor shall submit sub- divided and detailed programmes in respect of all the Works, along with status reports of the Works to the Engineer for checking and monitoring the Works. Each programme produced and submitted to the Engineer shall be a detailed time window of the Contractual Construction Programme.

2. Methodology

2.1 Unless otherwise instructed by the Engineer, the Programme shall be in the form of a Critical Path Method (CPM) Network showing critical path along with the Narrative Statements. The programme shall also be submitted in the form of a Time Bar-chart showing a Critical Path and S-curve (cumulative progress in percentage). The Time Bar- chart Schedule shall list all main activities and connected sub-activities

2.2 The CPM Network shall be prepared in accordance with commonly accepted practices and shall show graphically the chain of activities/sub-activities and their sequential relationship with each other from the Commencement Date to the day of issue of Taking-Over Certificate. It shall include all activities with their durations along with earliest and latest event times, free and total floats, dates of submission of the Contractor's drawings, tests of

concrete materials and trial mixing of concrete, process for procurement of the Borrow Pits, soil material tests and field trials of embankment including but not limited to the duration for construction of temporary island / cofferdam / bunds / diversion of river, foundation and sub- structure in respect of each of the pier, fabrication, launching / erection and construction of super-structure in respect of each of the span, embankment in approaches & related works, protection works etc.

- 2.3 In preparing the CPM Network and the Time Bar-chart Schedule showing a Critical Path and S-curve, the Contractor shall make due allowances for delays, holidays, local working conditions, maintenance of equipment, trial runs, and similar items. Under no circumstances shall the CPM Network or the Time Bar-chart Schedule show a completion date beyond the of issue of Taking-Over Certificate.

3. Key Dates and Milestones

The Contractor shall execute the Works within a specific time so as to executing the works smoothly for the sake of overall implementation of the Works. All the programmes shall meet the Key Dates, which corresponds to achieving the Milestone and dates defined in the Particular Conditions of the Bid Documents .

4. Bid Programme

4.1 Contract Stages :

The Contractor shall divide the Work in to various stages. Completion of these stages shall be linked with the designated Key Dates and Milestones, as indicated in the Conditions of the Contract and Appendix 10 [Requirements for Design] to the Employer's Requirements. For the purpose, the Contractor shall elaborate a comprehensive schedule for achieving of the same and shall include, but not limited to, the following:

- (a) stage Identification
- (b) the Key Dates and Milestones
- (c) the Interfacing Parties
- (d) related bodies and / or organisations and its Certification and / or approval
- (e) works to be performed and / or actions to be taken before the Key Date / Milestone
- (f) intended achievements

- 4.2 The Bid Programmes shall meet the Key Dates, each of which corresponds with achieving the Milestone defined and clearly indicate sequence in which the Bidder proposes to execute the Works. The Programme shall recognise realistic review and consent durations for both the Engineer and any external agency which may impose authority on the Works.

- 4.3 The Programme shall be totally comprehensive and detailed as much as possible covering all major activities in the Design Phase and the Construction Phase. Activities of the Works shall be supported by and correlated to information detailed by the Technical proposal concurrently submitted by the Bidder.
- 4.4 The critical path shall be clearly identified and recognised in the programme and fully described in the accompanying programme narrative. Each activity description shall succinctly convey the nature and scope of the work in each stage.

5. Contractual Construction Programme

- 5.1 The Bid Programme submitted during the bidding process shall be further developed and submitted to the Engineer **within 28 days** after the Commencement Date. Upon consent by the Engineer, it shall be referred to as the Contractual Construction Programme which shall serve as the base against which the Contract progress shall be monitored. The Contractual Construction Programme shall supersede all other programmes submitted earlier and shall be deemed to be the programme with which he will execute the Works within the specified Time for Completion.
- 5.2 The Contractual Construction Programme shall be of utmost priority programme. Other programmes in respect of structure / priority, a particular time window taken from the Contractual Construction Programme and detailed in terms of their purposes.
- 5.3 If, at any time, actual progress is too slow to complete in the Time for Completion, and/or progress has fallen (or will fall) behind the current Contractual Construction Programme, then the Engineer may instruct the Contractor to submit a revised Contractual Construction Programme and supporting report describing the revised methods and resources which the Contractor proposes to adopt in order to expedite progress and to complete the Work within the Specified Time for Completion as stipulated in the General Conditions of the Bid Documents.
- 5.4 Any changes to the Contractual Construction Programme shall be subject to the consent of the Engineer and shall not relieve the Contractor of his responsibility to complete the Work within the Time for Completion as per the Contract.

6. Works Programme

6.1 General

The Contractual Construction Programme shall be divided into sub-programmes of the Works, of manageable sizes addressing in more specific detail and/or in more specific issues and they are collectively referred to as Works Programme. The Works Programme is categorized including but not limited to the following:

- (a) Survey Programme for validation of the Data provided by the

Employer and additional survey as considered necessary by the Contractor;

- (b) Hydrological & Geotechnical Investigation Programme;
- (c) Design Submission Programme;
- (d) Construction Programme;
- (e) Coordinated Construction Programme;
- (f) Temporary Facilities and Utility Services Programme; and
- (g) Procurement Programme;

The Works Programmes may be further substantiated by supplementary programmes upon request by the Engineer such as three months Rolling Programmes addressing in more detail for an imminently forthcoming time window (weeks or months). First three months rolling programme shall be submitted as part of the Inception Report. Further supplementary programmes shall be added as required to adequately plan and monitor specific Works or sets of activities.

All the Works Programmes shall be submitted to the Engineer for consent at the timing specified in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.

6.2 Programme Requirements

The Contractor's Works Programme and all other programme in the Contract as applicable shall comply with the following requirements unless otherwise instructed by the Engineer:

- (1) All programmes e.g. design and/or construction work, including all subcontractors' work, under this Contract shall be prepared, scheduled, executed and reported using the latest version of CPM scheduling software of Primavera Project Planner.. Other equivalent software such as Sure Track, Microsoft Project etc. shall also be used subject to the consent of the Engineer and provided that the system is compatible and capable of direct file interchange with the software programme being used by the Employer. Such interchangeability shall have to be demonstrated in the Contractor's Proposal as well as before start of the Work to the entire satisfaction of the Engineer / Employer. In such a case, the Contractor shall supply to the Engineer and Employer with the Original licensed copy of the said software including manuals and training and subsequent versions thereof at no extra cost to the Employer.
- (2) All programmes shall be accompanied by a Programme Analysis Report as described thereafter;
- (3) The Contractor is responsible for determining the sequence of activities, the time estimates for the detailed design and construction activities and the means, methods, techniques and procedures to be

employed. Time schedules identified herein shall represent the Contractor's best judgment of how it will execute the Work in compliance with the Contract requirements. The Contractor shall ensure that the time schedule is current and accurate and is properly and timely monitored, updated and revised to accommodate with current project conditions and in compliance with the requirements in the Contract;

- (4) A standard Gregorian calendar shall be used for planning and execution of the Works. All programme submissions shall include details of the Contractor's allowance for public holidays and non-work periods.
- (5) CPM programmes shall reflect status using remaining duration and percent complete;
- (6) All programmes shall be fully resource loaded as appropriate or required by the Engineer covering all stages and aspects of the Contract and shall include, but not be limited to:
 - (a) major manpower for both design and installation;
 - (b) number of itemized Contractor's equipment;
 - (c) drawings and other design deliverables;
 - (d) principle quantities of components or parts;
 - (e) principle quantities of bulk materials inclusive of fill volume, blanket material, piles / wells sinking, steel, concrete, re-bar, cabling, piping, ducting, etc.; and
 - (f) sub-contractor's deliverables.
- (7) Each activity shall be coded to indicate, as a minimum, the work group or entity responsible for the activity, the area, facility or location when the Other Contractors or other entities are involved; and
- (8) All the activities including Key Dates shall be coded so as to be separately identifiable. The Contractor may be required to assign additional activity codes as required by the Engineer.

Respective Works Programme shall be identified and detailed in the categories as specified herein below.

7. Survey Programme for Validation of Data and Additional Survey

The Contractor shall prepare the efficient and detailed Survey Programme for validation of data provided by the Employer and additional survey if considered necessary by the Contractor, upon sufficient consideration towards his intended design, Technical Design development and on dispensable time giving due consideration to the reasonable time required by the Engineer for checking of the Contractor's work for validation of data and additional survey (as considered necessary) within the agreed Contractual Construction Programme.

8. Hydrological and Geotechnical Investigation Programme

The Contractor shall prepare the efficient and detailed Hydrological and Geotechnical Investigation Programme based on his intended design and construction methods, upon sufficient consideration towards the Technical Design development and dispensable time within the Contractual Construction Programme given. The Programme shall include, but not necessarily limited to, confirmatory exploratory drillings (as required by the Contractor) and additional exploratory drilling as specified in the Employer's Requirements, as required and shall give due consideration to the reasonable time required by the Engineer for checking of the investigation work. Geotechnical Interpretative Report on Structure Foundation and the Geotechnical Interpretative Report on Railtrack Formation, as detailed in Appendix 10 [Requirements for Design] to the Employer's Requirements, shall also include a submission of all the data and results of the investigation.

9. Design Submission Programme

9.1 The Contractor shall, within 42 days after the Commencement Date, submit a Design Submission Programme covering all required submissions in the Contract to the Engineer as described in Appendix 10 [Requirements for Design] to the Employer's Requirements.

9.2 The Design Submissions Programme shall include each submission for every item as indicated in relevant provisions in the Employer's Requirements and as summarized in respect of major (but not necessarily exhaustive) submissions in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.

9.3 The Design Submissions Programme shall ensure that all submissions are properly coordinated with the Contractor's overall Works Programme, particularly in respect of the following:

- (a) progress of design, manufacture, construction, installation and testing work;
- (b) coordination with the Other Contractors and statutory bodies; and
- (c) due allowance for the Engineer's review process, including the time needed for any re-submissions.

10. Construction Programmes

10.1 The Construction Programmes will in general consist of the Construction Programmes for Bridge and the Construction Programmes for Earthworks for approaches.

A Construction Programme for Earthworks for bridge approaches is a programme where the Contractor executes the Works in the most efficient manner on one discrete cycle of the sequential Works of the Railtrack Formation.

A Construction Programme for Bridge is a programme of each distinctive element of the individual bridge structures and may comprise of but not limited to the following as part of a Construction Programme:

- a) Construction of temporary islands / cofferdam / bunds / river diversions
- b) Casting of individual foundation elements including well
- c) Casting of individual pier and pier cap
- d) Setting up of the casing yard/ fabrication yard and erection yard
- e) Procurement of prestressing/ structural steel for bridges
- f) Casting of individual spans.
- g) Transportation & erection of superstructure for individual span

The Construction Programmes shall be identified by the distinctive names and / or numbers. The programmes for all the major activities in respect of each Structure as exemplified below shall be submitted to the Engineer for consent indicating all Construction Programmes for the Earthworks in filling and cutting (if any) including blanketing sub-grading in the bridge approaches to the bridge ; and

The Contractor shall separately produce Coordinated Construction Programme and Temporary Facility Programme as detailed below in the separate sub-clause.

10.2 Coordinated Construction Programme

The Coordinated Construction Programme shall be submitted by the Contractor not less than 3 months before the start of the respective construction activities for check and monitor by the Engineer.

The Coordinated Construction Programme shall include detailed activities describing all aspects of the works of Other Contractors/Agencies and Interfacing Parties to meet all Key Dates and Milestones given in the Contract and clearly linked to the other Works Programme to streamline the Works and Other Contractor's works and Interfacing Parties.

The Coordinated Construction Programme shall indicate the physical areas to which the Other Contractors/Agencies and Interfacing Parties require access, with access date, duration required and the required degree of completion of the Works prior to the access dates by the Other Contractors.

It is the Contractor's responsibility to ensure timely co-ordination with the Other Contractors to review, revise and finalize his Work Programme so as not to affect the progress of Works/ and or the works of the Other Contractors and Interfacing Parties.

The Contractor shall note that the following conditions apply to the works of the Other Contractors:

- (a) the Other Contractors and Interfacing Parties shall not have exclusive access to any part of the Site except by the specific consent of the Engineer;
- (b) the Contractor shall take note that concurrent time allocations for certain areas may be given to more than one contractor. The

Contractor shall coordinate the Work in such areas with the works of Other Contractors / Interfacing Parties and report to the Engineer for his review / consent;

- (c) the absence of a programme date or installation period for the Other Contractor and Interfacing Parties or other relevant entities in a specific area shall not prejudice the right of the Engineer to establish a reasonable programme date or installation period for that area; and
- (d) the Contractor shall comply with the Key Dates and Milestones and other successive activities specified in the Coordinated Construction Programme.

10.3 Temporary Facility Programme

The Contractor shall prepare programmes of all the major temporary facilities to be constructed and operated by the Contractor such as temporary islands / cofferdam / bunds / river diversions in respect of individual pier / abutment foundation, the Borrow Pits, aggregate crusher/ mixing and, concrete batcher plants, fabrication yard, and any other temporary facilities with relevant Temporary Services .

11. Procurement Programme for Manufactured Items

- 11.1 Within 42 days after the Commencement Date, the Contractor shall submit the initial Procurement Programme for manufactured items (bearings, expansion joints etc.) to the Engineer for consent. Afterwards the Contractor shall update the Programme not less than three (3) months prior to the first shipment of each item as an item-wise Procurement Programme to the Engineer for consent. The initial submission shall fully outline the succeeding Programme as instructed by the Engineer.

The Procurement Programme shall show the interdependencies of engineering disciplines between the Contractor and its sub-contractors and/or suppliers which provide the Contractor with major machinery, equipment and materials produced and/or assembled in their factories or any off-site manufacturing process, and shipped to the corresponding site by them.

11.2 Production and Shipment

The Contractor shall carefully incorporate the activities which are subject to long lead time and/or component parts or items manufactured from countries outside India (if any) into the Procurement Programme.

11.3 Tests for Procurement Programme

Procurement Programme shall also include testing programme. The testing programme shall include, but not limited to, the factory testing programme.

- (1) Tests Performed in Factory

The factory testing programme shall be fully detailed in the

Procurement Programme, with activities individually identifying all tests for which a certificate shall be issued, and shall include activities for preparation, submittal and consideration of the test procedures. It shall also demonstrate the logical dependencies and correlations between the other individual tests of the Works.

The factory testing programme shall include details of inspection, testing and witnessing of the Contractor's and subcontractor's procurement and manufacturing activities.

(2) Tests Performed on Site

The Contractor shall include the on-site testing programme as part of the Procurement Programme that shall fulfill all the on-site testing on the items which are produced and/or assembled in the manufacturer's and/or subcontractor's factory or any off-site manufacturing process, and shipped to the corresponding site by them.

The testing programme shall be fully detailed, with activities individually identifying all tests for which a certificate shall be issued, and shall include activities for preparation, submittal and consideration of the test procedures.

The Engineer shall carry out the tests as prescribed in the respective codes before accepting any manufactured item for use in the Permanent Works and for the Temporary Works to the extent required for safety considerations.

12. Review and Monitoring of Programme

12.1 Programme Review

- (1) The Contractor shall submit all programmes as required in the Contract to the Engineer for consent.
- (2) The Engineer shall, within 21 days of receipt of the initial submission of any programme for consent, either give a notice of no objection or provide specific details as to why a notice of no objection is not given. If the Contractor is advised that the programme is not given a notice of no objection, the Contractor shall amend the programme taking into account the Engineer's comments and/or requirements and resubmit the programme within 14 days.
- (3) In the case of further re-submittals, the resubmission shall be made within 14 days after the notice.

12.2 Works Programme Revisions

- (1) The Contractor shall immediately notify the Engineer in writing of the need for any change in the Works Programme, whether due to a change of intention or circumstances or for any other reason. Where such a proposed change affects the timely completion of the respective Works or any Stretch or Stage; the Contractor shall within 14 days of the date of notifying the Engineer submit for the Engineer's consideration his proposed revised Works Programme and

accompanying Programme Analysis Report. 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 on the Works and Other Contractors and their works.

- (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 revised Works Programme. Upon receipt of such a request the Contractor shall submit within 14 days a revised Works Programme, together with an accompanying Programme Analysis Report and narrative statement, if any, including the reasons/repercussions of such deviations and the likely delays arising out of such deviations. The Contractor's resubmission of the programme shall demonstrate the means including deployment of additional resources etc. by which the Contractor shall eliminate the deviations and make good the delays occurred or likely to occur due to the same .
- (3) Unless and until an amended version has the consent of the Engineer, the existing programme shall remain as the Works Programme for all purposes of the Contract.
- (4) Consent by the Engineer to a Works Programme shall not relieve the Contractor of any of his duties or responsibilities under the Contract, nor in the event that a Works Programme indicates that a Key Date or any intermediate targeted date and / or a Milestone has not or will not be met, and nor constitute any form of acknowledgement that the Contractor is or may be entitled to an extension of time in relation to such Key Date /intermediate target date / Milestone. In any circumstances the Contractual Construction Programme shall always prevail over other programmes and each of the other programmes shall be a detailed time window of the Contractual Construction Programme
- (5) The Contractor shall submit a Programme Analysis Report that shall, in narrative format, describe the basis and assumptions used to develop every programme. The Programme Analysis Report shall be prepared in a format having been considered without objection by the Engineer and contain as a minimum the following:
 - (a) cycle times and work sequences;
 - (b) the deployment of Contractor's Equipment and labor;
 - (c) the production rates used in determining duration;
 - (d) the shifts assumed in determining duration;
 - (e) the breakdown of labor requirements by trades;
 - (f) the schedules of quantities used in developing the programme, to the extent that such information is not provided elsewhere; and
 - (g) interfaces with the Engineer and Other Contractors / Interfacing

Parties and other constraints.

12.3 Progress Monitoring & Monthly Progress Reports

The Contractor shall monitor the progress and his Sub-Contractors' performance and against programmes to ensure its compliance with its obligations under the Contract. Monitoring of the Works shall include direct, daily monitoring of the progress of the Works and the preparation of written reports to be submitted to the Engineer. The reports shall include all necessary supporting data to apprise the Engineer of the status of the completion of the Works. The Contractor shall prepare the Monthly Progress Reports covering all aspects of the execution of the Works.

12.4 Progress Meetings and Programme Updates

- (1) The Employer will chair progress meetings every month with the Contractor. These meetings will be held at dates and times to be advised by the Engineer.
- (2) The Engineer may convene at his discretion, at any time upon reasonable notice to the Contractor, any meeting, either on or off the Site, to discuss and address any aspect of the Works or the Contract. The Contractor shall attend any such meetings convened by the Engineer.
- (3) On a monthly basis, the Contractor shall arrange for its Project Manager, Superintendent, and Scheduler to meet at the Site with the Engineer to review Contractor's Monthly Programme Update. A turnaround document as per the agreed computer software generated by the Contractor will be marked-up to show the agreed upon progress, signed by the Contractor, and a signed copy issued to the Engineer. The Monthly Programme Update shall show up-to-date and accurate progress of the Work, and shall forecast the completion date for activities in progress based on the Contractual Construction Programme. The Monthly Programme Update shall be prepared by the Contractor in co-ordination with all its principal subcontractors and suppliers and the Other Contractors if necessary.
- (4) The Monthly Programme Update shall include actual activity data for progress to date, but in the Monthly Programme Update, the Contractor shall not change the schedule logic, the activity relationships/dependencies, or planned activity durations and shall not add or delete activities. If the Contractor believes that any of these items should be changed, then a proposed revised Works Programme shall be submitted by the Contractor to the Engineer. Although activities shall not be added or deleted in the Monthly Programme Update, activities that have been recommended and approved by the Engineer shall be included in the next Monthly Programme Update.
- (5) The Contractor will be notified by the Engineer, in writing, as to acceptance, reasons for rejection, or any revisions required to

the Programme.Changes to the Programme agreed upon by the Contractor and the Engineer and consented by the Employer shall be incorporated by the Contractor into the Programme within seven (7) calendar days after such agreement. Changes on which the Contractor and the Engineer cannot agree shall be documented and shall be subject to the final decision of the Employer and which shall be binding.

- (6) Contractor shall adjust the data date (“as of date”) to be the same as the end date for the invoicing period.
- (7) The Monthly Programme Update shall show actual activity commencement and completion dates, the actual remaining duration in workdays and physical percent complete for those activities commenced and not complete. For the stored materials, the update shall show the amount of material stored, representing the total cost of the materials delivered and properly stored. The Monthly Programme Update may also show a comparison of the current status and the Work Programme for each activity in the network.
- (8) Each Monthly Programme Update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect “as built” information by indicating when activities were actually started and completed.
- (9) Monthly Programme Updates shall also contain the following information for each activity:
 - (a) Activity identification number, description and estimated original duration in workdays;
 - (b) Calculated early and late finish dates;
 - (c) Actual start and actual finish dates, and remaining duration, in calendar, for those activities started and not completed;
 - (d) Days ahead and/or behind schedule of the milestones representing the identified contracted milestones and especially to the Key Dates & Milestones and Contract Completion dates;
 - (e) Physical percent complete for each activity; and
 - (f) A float analysis of the longest path through the Programme detailing potential delays and areas for acceleration. Actual start and finish dates shall be indicated for each activity as appropriate. Completed activities will be omitted from remaining float and late start sorts.
- (10) The deliberation of all meetings shall be recorded in the jointly signed Minutes of Meeting.
- (11) Other Programme Meetings:
 - (a) The Engineer may convene routine and/or ad-hoc review meetings.
 - (b) Requirement of the meetings will be provided by the Engineer

12.5 Revised Programme

- (1) If at any time the Engineer believes that the current Works Programme or Monthly Programme Update no longer represents the actual or planned execution and progress of the Work, the Engineer may require of the Contractor, and (whether or not being required) the Contractor shall submit a revision to the current Works Programme within seven (7) days after the Engineer's instructions if it is required by him or in the Contractor's opinion.
 - a) The programme revision, shall be carried out by the Contractor by modifications made to activities and / or activities duration, modification in logic connections between activities with supporting report describing additional resource loading (e.g. labour, equipment, material etc.) and / or the revised construction method / sequence to the current Works Programme or other sub-programmes at the risk and cost of the Contractor.
 - (b) Any proposed revisions to the Works Programme and other sub-programmes shall be submitted to the Engineer for consent with the supporting reports as stated above.

* End of Appendix 3 *

EMPLOYERS' REQUIREMENTS

APPENDIX 4

QUALITY ASSURANCE

1. General :

- 1.1 The Contractor shall maintain and implement a quality management system that shall remain in effect during the execution of the Works. The Contractor's quality management system shall be tailored specifically to the Contract and the Works in accordance with ISO 9001 – Quality Management System, the latest edition of the International Standard ISO 9001, and shall submit his quality management system titled as the Project Quality Assurance Plan for Engineer's review as specified herein.
- 1.2 The Project Quality Assurance Plan documentation shall include, but shall not be limited to the following:
 - (a) Project Quality Assurance Plan (Contractor's integrated quality assurance documentation);
 - (b) Design Quality Assurance Plan;
 - (c) Site Quality Assurance Plan (including Inspection and Test Plan);
 - (d) Manufacturing Quality Assurance Plans (including Inspection and Test Plan for the manufactured items like bearings / expansion joints);
and
 - (e) On-site Inspection Plan for Resources Procurement.
- 1.3 The Contractor shall plan, perform and record all quality control activities to ensure that all Works are performed in accordance with the requirements under the Contract and are detailed in the quality plans which are required herein. Such activities shall include, without limitation, the inspections and/or test expressly or implicitly required by the Contract.
- 1.4 Quality audits will be carried out by the Engineer and surveillance audit shall be carried out by Employer to verify the Contractor's implementation and compliance with the quality management system as specified herein

2. Submission of Quality Documentation

- 2.1 Quality system documents to be submitted shall embrace all activities of the Contractor and his Sub-Contractors of any tier, including his suppliers and any design consultants for the execution of the Works.
- 2.2 Within 42 days after the Commencement Date, the Contractor shall submit the following documents for review by the Engineer:
 - (a) Contractor's Quality Assurance Philosophy;
 - (b) Project Quality Assurance Plan; and
 - (c) Design Quality Assurance Plan and any associated work

instruction and/or standard forms which the Contractor proposes to be used for the Contract.

- 2.3 The Contractor shall submit the separate Site Quality Assurance Plan for managing, controlling and recording the on-site construction / fabrication process including off-site process for individual key items of the Works. The Fabrication Quality Assurance Plan shall be submitted for review by the Engineer for his consent as part of Technical Design development as described in Employer's Requirements - Manufacturing, Installation and Testing and its Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.
- 2.4 The Contractor shall submit the separate On-site Inspection Plan for Resources Procurement for managing, monitoring and recording the on-site receipt of general construction resources including all construction materials, labour forces, and works and services delivered to the construction site. The On-site Inspection Plan for Resources Procurement shall be submitted for consent by the Engineer as part of Technical Design development as summarized in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.
- 2.5 The Contractor shall, and/or as requested by the Engineer, continuously review and update the quality system documents to meet the requirements and development of the Works throughout the duration of the Contract. For any amendment to the quality system documents, the Contractor shall prepare and submit the proposed amendment for consent of the Engineer.
- 2.6 The Plan shall clearly define the Contractor's policy, Quality Assurance Organization, Management responsibility, the requirements for Quality Assurance personnel, their qualifications, skills and training, the Contractor's Quality Audit schedule.
- 2.7 Records of certifications shall be maintained and monitored by the Quality Assurance personnel. These records shall be made available to the Engineer / Employer for inspection and review as and when required.
- 2.8 The Quality Assurance operations shall be subject to the Engineer's / Employer's verification at any time.
- 2.9 The verification will include: 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.
- 2.10 The Contractor's Quality Audit schedule shall be submitted to the Engineer for consent every three months or more frequently as required.
- 2.11 The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer / Employer to carry out on-site and off-site Quality Audit / surveillance audit to verify that the Contractor's quality assurance system which has been consented by the Engineer, is being implemented fully and properly.

3. Controlled Copy of Quality System Documentation

The Contractor shall promptly supply the Engineer with Four (4) controlled copies of his quality system documents duly consented by the Engineer. The Contractor shall maintain such controlled documents throughout the duration of the Contract.

4. Project Quality Assurance Plan

4.1 The Project Quality Assurance Plan shall establish the Contractor's management structure which functions efficiently to execute the Works in compliance with the Employer's Requirements under the Contract and shall, without limitation, define as follows:

- (1) A dedicated Quality Assurance Team;
- (2) A set of organization charts which depict in line with the Contractor's intent of the quality plans. Each organization chart shall identify the Contractor's managerial staff with reference to any member of the partnership, consortium or joint venture, and the main Sub-Contractors and indicate the reporting structure and the interface relationship between all parties involved;
- (3) Each organization chart which may be subdivided with regard to Works, site locations, phases and stages of the project to ensure complete implementation of the quality management system in every part to the Work;
- (4) The allocation of responsibilities and authorities given to managerial and technical staff with particular reference to the design and site supervision of the Works; and
- (5) Hierarchy of the quality management system documentation for managing and controlling the whole system.

4.2 The Contractor shall submit the Curriculum Vitae (CV) of each member of his Quality Assurance Team and other personnel relevant to his quality management system. Assignment of such personnel shall be subject to prior consent of the Engineer.

4.3 The Project Quality Assurance Plan shall without limitation include Quality Assurance procedures for design, construction, manufacturing, supply, installation, testing and commissioning and shall contain control processes for each stage in the Work such as design verification and validation, management of change control, non-conformance procedures, control on sub-standard practices, inspection, testing, auditing and so on.

4.4 The Project Quality Assurance Plan shall also include a full list of quality management procedures, method statements, inspection and test plans, standards and protocol and/or standard forms, which shall form the frame work of the Project Quality Assurance Plan. It shall define specific procedures to perform the quality management activities and to record the evidence of the activities performed and/or the results achieved. It shall detail the system and the procedure by which the Contractor shall

ensure that

- The Quality Assurance Plan is fully observed at all times
- Any non-compliant and sub-standard material, practice and / or work are brought back to compliance

4.5 It shall cover the requirements of the International Standard ISO 9001 in compliance with the Contract as precedence requirements, and shall, without limitation, include the basic management disciplines as follows:

- (1) Review, consent / approval and updating management of the quality system documents to ensure their continuing suitability and effectiveness;
- (2) Design control management to all Permanent Works and/or Temporary Works, including design works carried out by Sub-Contractors and sub-consultants. The procedures shall clearly define the review and verification procedures of the designs submittals and the design packages described under the Contract;
- (3) Drawing management in the Contractor's main office and site office(s), including procedures of production, consent / approval, updating, maintaining, storage and distribution;
- (4) Document management, including procedures of registration, updating, indexing, filing, maintenance, storage and distribution and monitoring and recording of the submission and re-submission to the Engineer;
- (5) Monitoring, recording and control of the quality system of his Sub-Contractors with respect to their quality of works with relevant time schedule; and
- (6) Quality control of the Works including Quality audits to be held on the Contractor and Sub-Contractors, suppliers and design consultants of any tiers.

5. Design Quality Assurance Plan

The Contractor shall prepare the Design Quality Assurance Plan separately for its design Works. The Design Quality Assurance Plan shall establish the Contractor's policy for the design works in compliance with the Employer's Requirements under the Contract and shall, without limitation, define as follows:

- (1) Organization of the Contractor's Design Team in context with the Contractor's entire organization so as that it functions appropriately in this Design-Build Lump Sum Contract;
- (2) Allocation of responsibilities and authorities to be given to the Design Team, to the individual identified design staff and the Subcontractors for particular design works. Especially the Internal Authorisation Process as detailed herein below and Employer's Requirements –

Design shall be focused on in this respect;

- (3) Hierarchy of relevant documentation (including drawings) of quality management system for managing and controlling design works, including design works of Subcontractors of any tier to avoid conflicts in the design submissions;
- (4) A list of general procedures to be applied to manage and control the quality of the design works; and
- (5) The Functional procedures which maintains the Design Team in whole Contractor's organization to carry out the design works strictly in compliance with the Employer's Requirements and for the benefit of the Employer.

6. Site Quality Plan

6.1 On-site Quality Management Provisions

The Contractor shall prepare a Site Quality Plan separately for the construction and installation of Works. The Site Quality Plan shall include the comprehensive on-site quality management in compliance with the Employer's Requirements under the Contract and shall, without limitation, define as follows:

- (1) Organization of the Contractor's staff directly responsible for the day-to-day management of the construction and installation activities to execute the Works on the site;
- (2) Allocation of responsibilities and authorities given to identified personnel or Subcontractors for particular construction and installation of the Works;
- (3) Hierarchy of relevant documentation (including drawings) of quality management system for managing and controlling construction and installation of the Works, including construction and installation works of Subcontractors of any tiers to avoid conflicts in the execution of the Works; and
- (4) A list of sequences to be applied to manage, control and record the construction and installation of the Works.

6.2 On-site inspection and test provisions

- (1) The Contractor shall note that he shall also prepare on site inspection and test plans to manage, control and record any test and inspection activities. The Inspection and Test Plans shall be established for particular activities which require inspection and/or test to meet the quality level required in the Employer's Requirements and as included in any form in the Contractor's design and the Works Specification. It shall cover the requirements of International Standards ISO 9001 and in compliance with the Contract.
- (2) The Contractor shall prepare and maintain a full list of the all

Inspection and Test Plans needed under the Contract with submission status and review status, and shall submit to the Engineer for his consent.

- (3) Each Inspection and Test Plan for the particular activity shall define, without limitation:
 - (a) Scope of activities covered by the plan;
 - (b) A sequence of the Work related to the activities in the scope;
 - (c) Personnel responsible for undertaking the inspections and/or tests and the personnel responsible for certifying the inspections and tests;
 - (d) Inspections and/or test methods, their frequency, and/or reference materials to the relevant standard of the inspections and/or the tests;
 - (e) Compliance criteria of the inspections and/or tests with clear descriptions of the quality hold point and the quality control point;
 - (f) Documents to be used for reporting the results of the inspections and/or tests with sample documents incorporated into the Plan; and
 - (g) Methods of record keeping and document storage as to the locations to be maintained / stored and procedures for those to be acknowledged./ filed.

7. On-site Inspection Plan for Resources Procurement

- 7.1 The Contractor shall establish On-site Inspection Plan for Resources Procurement for managing, monitoring and recording the on-site receipt of general construction resources including all construction materials, labour forces, and works and services delivered to the Site and the Temporary Facilities (e.g. Concrete batching & mixing plant and aggregate storage, fabrication yard and so on) in the Work Areas .
- 7.2 On site Inspection Plan for resources procurement to be prepared by the Contractor shall cover all the requirements as described in sub-para 6.2 above .

8. Design Review Procedure

8.1 Contractor's Design Team

- (1) The Contractor shall be responsible for the design of the Works and shall ensure his design is correct / accurate and in compliance with the Employer's Requirements and Specifications contained in the Contract. The Contractor shall also be responsible for the construction, installation, testing of the Works and shall ensure

that all the completed Works are within the specified tolerance limits, in line with his design and concurrently in compliance with the Employer's Requirements and Specifications in the Contract.

- (2) The Contractor shall establish his dedicated design team referred to as the Design Team in his organization **which shall be based at site or other location as approved by the Employer** to ensure that his design works are strictly in compliance with the Employer's Requirements and Specifications and for the benefit of the Employer. On the other hand, to clarify the responsibilities and the authorities, the Contractor shall also establish a Construction Team independent of the Design Team. Thereby the Contractor is responsible for assuring the quality of the Works as required in the Employer's Requirements and Specifications in the Contract.

8.2 Chief Design Engineer

- (1) The Chief Design Engineer is responsible for establishing, implementing, maintaining and recording Design Quality Assurance Plan.
- (2) The Chief Design Engineer shall be able to discharge his duties without any hindrance or constraint. Accordingly, the Chief Design Engineer and his team shall strictly adhere to – Quality Assurance System of the Contractor's company or of the Lead Member of the Consortium or JV, as consented by the Engineer so as to ensure that his decisions and activities with regard to the Quality Assurance be checked and monitored by the internationally acknowledged system. The Contractor shall identify the personnel to whom the Chief Design Engineer shall be responsible and reports to and seek the consent of the Engineer for the same. The Contractor shall also identify personnel necessary under the supervision of the Chief Design Engineer to furnish the Design Team to fully function as intended in the requirements herein and seek the consent of the Engineer. In addition, the Contractor shall make available any such resources that are necessary to ensure the effective implementation of the quality management system.
- (3) The Contractor shall submit details of the authority and responsibility of the proposed Chief Design Engineer for review and consent by the Engineer, as part of the Project Quality Assurance Plan.

8.3 Internal Authorization Process

- (1) All design submissions including Technical Design, Construction Design, As-Built Documents shall include a valid "Design Certificate" (as set out as Attachment QA-1 enclosed herewith in this Appendix), duly signed by the individual who actually does the design in case the Contractor himself is the designer or the authorized representative of the any entity engaged by the Contractor in case

the Contractor himself is not the designer, Chief Design Engineer in the Contractor's Design Team and Contractor's Representative, thereby demonstrating that :

- (a) Design of the Permanent Works complies with the Employer's Requirements and Specifications and other requirements of the Contract;
 - (b) In-house checks have been undertaken to conform the completeness, adequacy and validity of the design as per all the quality assurance procedures;
 - (c) All the required consents / approvals has been obtained; and
 - (d) Design has been performed and finalized utilizing the skills of a professionally qualified, competent and experienced designers and engineers.
- (2) The Contractor shall fully verify the respective design outputs as a set of submissions through the Internal Authorization Process by signing and attaching "Design Certificate" as the covering document. Forms, further details and other requirements of the contents of the respective Design Package are given in Appendix 10 [Requirements for Design] to the Employer's Requirements.
- (3) After receiving the "Notice of No Objection" or "Notice of No Objection with Comments" in respect of the Construction Design, all the original paper drawings in respect of Working Drawings shall be endorsed as "Good For Construction" by Chief Design Engineer before issuing it to the Site or submitting to the Engineer for his endorsement as specified in Employer's Requirements – Design.
- (4) In case the Contractor contemplates any change in the design already submitted to the Engineer for consent and / or for the design and drawings for which the Contractor has already received 'Notice Of No Objection', it shall be dealt as per the provisions of Design Review Procedure as detailed above and in Employer's Requirements – Design and 'Design Changes and Variation Procedure' as detailed in Appendix 10 [Requirements for design] to the Employer's Requirements.

9 Tests

Tests to be carried out for quality assurance purposes shall be as specified in the Specifications and as per the Quality Assurance Plan / Inspections and Test Procedures duly approved by the Engineer based on the relevant Codes. Some typical tests are as follows.

- (1) Tests for Embankment/ Blanket layer
 - (a) gradation/ particle size distribution tests;
 - (b) a maximum dry density test;
 - (c) a natural moisture contents test;
 - (d) a optimum moisture contents test;
 - (e) a field compaction test;

- (f) a coefficient of uniformity test; and
 - (g) an undrained cohesion test.
 - (h) a coefficient of curvature (Cc) test;
 - (i) the Los Angeles Abrasion test; and
- (3) Tests for Field Trial Embankment:
 - (a) a compaction test; and
 - (b) a dry density test.
- (4) Tests for Concrete:
 - (a) a chloride content test and sulphur contents test in cement;
 - (b) coarse aggregates tests;
 - (c) fine aggregates tests;
 - (d) clay contents test in aggregates;
 - (e) Prestressing/ reinforcing steel tests;
 - (f) a cube crushing strength test;
 - (g) a permeability test;
 - (h) a total chloride contents of concrete test;
 - (i) a total SO₃ contents test;
 - (j) a slump test; and
- (5) Tests for Other Construction Material:

Water viz. pH value, salt contents (chloride, sulphate), suspended matter, organic / inorganic etc
- (6) Test for PSC BOX girder - Span Load Test

The Contractor may employ other tests to further ensure the quality of the Work. In such a case, the Contractor is responsible for obtaining prior consent from the Engineer by submitting the test plans with regard to the application of the tests as part of the Project Quality Assurance Plan or its sub-plans.

10. Quality Audits

- 10.1 The Contractor shall carry out quality audits on the Works at quarterly intervals, or at such other intervals as the Engineer may require, to ensure the continuing suitability and effectiveness of the quality management system. Reports of each such audit shall be submitted promptly to the Engineer for review.
- 10.2 The Contractor shall submit for review by the Engineer details of the authority, qualifications and experience of personnel assigned to quality audit activities before carrying out quality audits.
- 10.3 The Engineer may require quality audits on the Contractor and his Subcontractors of any tier to be carried out by his representative or the Employer's staff. In such case, the Contractor shall afford to such auditors all necessary facilities and access to the activities and records to permit

this function to be performed.

- 10.4 Upon receipt of corrective action request (CAR) or similar document issued by the Engineer as a result of quality audits, the Contractor shall promptly investigate the matter and submit the proposed corrective and preventive actions within 14 days to the Engineer for review. The Contractor shall take timely corrective and preventive actions to rectify the matter and to prevent re-occurrence. Evidence to demonstrate effective implementation of corrective and preventive actions shall be submitted by the Contractor to the Engineer for review.

11. Notification of Nonconformities

- 11.1 If, prior to an issue of the Taking-Over Certificate for the Works or the relevant Section, the Contractor has used or proposes to use or repair any item of the Works which does not conform to the requirements of the Contract, the Contractor shall immediately submit for review by the Engineer of such proposal and supplying full particulars of the nonconformity and, if appropriate, of the proposed means of repair.
- 11.2 If the Engineer issues nonconformity report or similar documents to notify the Contractor of any item of the Works which does not conform to the requirements of the Contract, the Contractor shall promptly investigate the matter and, within 14 days of notification by the Engineer, submit to the Engineer for review the remedial measures and necessary actions to be taken to rectify the item and to prevent re-occurrence.
- 11.3 The Contractor shall maintain and update a nonconformity register to indicate the status of all nonconformities which are identified by the Engineer/ and or the Contractor. The Contractor shall submit the register for review upon request by the Engineer.

12. Monthly Progress Report on Quality Management System

- 12.1 The Contractor shall continuously monitor the performance of the quality management system and shall include the same in each Monthly Progress Report as required in Appendix 3 [Monthly Progress Report] to the Employer's Requirements
- 12.2 The Contractor shall provide and maintain at all stages of the Works a quality control register or registers to identify the status of inspections, sampling and testing of the work and all certificates. Such register shall be updated by the Contractor to show all activities in previous months and shall reach the Engineer's office before 7th working day of each month. Each register shall:
- (a) List the certificates received for each batch of goods and materials incorporated in the Works and compare this against the certification required by the Contractor and the Contractor's quality plans;
 - (b) List the inspection and testing activities undertaken by the Contractor on each element of the Works and compare these activities against the amount of inspection and testing required by the Contract and the Contractor's quality plans;

- (c) Show the results of each report of inspection and/or test and any required analysis of these results and compare these results against the pass/fail criteria; and
- (d) Summaries any actions proposed by the Contractor to overcome any nonconformity. The Engineer shall submit the same to the Employer along with his observations / comments before 15th working day of each month.

13. Quality Records

The Contractor shall ensure that all the quality records as objective evidence of the implementation of the quality management system are properly indexed, filed, maintained, updated and stored.

Design Certificate

[A Sample Formate, subject to Consent by the Engineer]

This Design Certificate refers to Submission No. which comprises:

[*Design Package No. / the Technical Design Submission/Technical Drawings Submission No. / Construction Design/Construction Drawings Submission no. / Technical Submission No.] in respect of :

[description of the Permanent Works / Temporary Works (as applicable) to which the submission refers]

The contents of this submission are scheduled in Part A below.

The documents scheduled in 'Part B' below, for which a "Notice of No Objection" has been issued, are of relevance to this submission.

Designer's Statement :

We hereby certify that :

- a) the design of the Permanent Works / Temporary Works (as applicable), as illustrated and described in the documents scheduled in 'Part A' below, complies with the Employer's Requirements and Specifications requirements and [see note 1 below];

OR (in case of a Technical Design Submission in respect of those elements identified by the Contractor and consented by the Engineer)

the preliminary designs, design briefs and works specifications of those elements of the Permanent Works / Temporary Works (as applicable) as illustrated and described in the documents scheduled in 'Part A' below comply with the Employer's Requirements and Specifications requirements and [see note 1 below];

OR (in case of a submission of documents that do not strictly comply with the previous documents for which "Notice of No Objection" has been received)

the design of the Permanent Works / Temporary Works (as applicable), as

illustrated and described in the documents scheduled in 'Part A' below, complies with the Employer's Requirements and Specifications requirements and [see note 1 below] except in the following respects:

- (i) (to be completed by the Contractor / Designer)
- b) an in-house check has been undertaken and completed to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in 'Part A' below;
- c) all necessary and required consents / approvals relating to the design of the Permanent Works / Temporary Works (as applicable), as illustrated and described in the documents scheduled in 'Part A' below, have been obtained and copies of such consents / approvals are annexed in 'Part C' below;

AND (in the case of a submission covering a part of the Permanent Works / Temporary Works (as applicable) only) :

- 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 'Authorised Representative'

(for Designer M/s -----)

Name

Position/ Designation

Date

Contractor's Certification :

This certifies that all design has been performed utilising the skill and care to be expected of a professionally qualified, competent and licensed 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.

Signed by 'Authorised Representative'

(for Contractor M/s -----)

Chief Design Engineer
Name:

Position / Designation:

Date:

Place :

Contractor's Representative
Name:

Position /Designation:

Date:

Place :

Note 1

The Contractor shall insert one of the following, as applicable :

- (i) the Contractor's Proposal
- (ii) the Contractor's Proposal and Technical Design Packages Nos. for which a "Notice of No Objection" has been issued.
- (iii) Technical Design Packages Nos. for which a "Notice of No Objection" has been issued if such Technical Design Packages develop and amplify the Contractor's Proposals.
- (iv) The Technical Design

Part A

Submission no. comprises the following :

- Drawings : (Title, drawing number and revision)
- Documents : (Title, reference number and revision)
- Others :

Part B

Documents for which a "Notice of No Objection" has been issued and which are of relevance to this Submission No.

Document : Submitted with

[*Technical Design Package No.
...../

Technical Design Submission
No...../

The Contractor is required to provide this information in respect of each document in of in Part B

Technical Drawings Submission No./ Technical Submission No.

...../ Date of Issue of "Notice of No Objection" (* Delete as appropriate)

Part C

[Contractor to attach copies of necessary and required consent / approvals]

* End of Appendix 4 *

EMPLOYER'S REQUIREMENTS

APPENDIX 5

CAD and DOCUMENT STANDARDS

1. Requirements on Documents

1.1 General

Within 28 days after Commencement Date, the Contractor shall submit a Document Control Procedure to the Engineer for review, which shall comply with the detailed technical requirements herein and also with the procedural requirements described in Appendix 9 [Document Submission and Review Procedure] to the Employer's Requirements.

(1) Drawing Register

The Contractor shall submit the Engineer a CAD and document management system with a drawing register procedure as part of the Document Control Procedure in electronic copy and hard copy, with which he shall submit each submission of drawings and update at an interval agreed by the Engineer.

The drawing register shall be in a format submitted in the CAD and Document Management System for review and agreed without objection by the Engineer and shall include each document reference number, version, date, title and data-file name.

(2) Records and Reports

All Reports and records shall be submitted via Project Management Information System to the Engineer and shall be in a format agreed by the Engineer as outlined below. One hard copy of all the reports and records duly signed by the Contractor shall also be submitted to the Engineer.

1.2 Cover Format (Arial)

- (a) Heading and name of client are on top, in capital, size 10.
- (b) Name of the project is in bold letter, size 24.
- (c) Content of document is in bold capital, size 18.
- (d) Documents' reference number is in bold capital, size 14
- (e) Company name: capital, size 14.
- (f) Company's logo is in size 35x40 (WxH) mm.
- (g) Address of the company is in normal letter, size 10.

1.3 Document Format (Arial)

- (1) General regulations
 - (a) Height of letter: applied size 10.
 - (b) Paper size A4 (A3 is used for table.)
 - (c) Periods, semicolons, etc. should be put right after the letter.
 - (d) The space between paragraphs and headings is 1 line.
 - (e) Main headings: are placed in number's order and the period is right after the heading, then a space, written in bold capital letters. For ex.: **1. IN BOLD CAPITAL:**
 - (f) Other headings: are placed in number's order and the period is right after the heading, then a space, written in bold normal letters. For ex.: **1. In bold normal letter:**
- (2) Note
 - (a) Notes of tables should be included in the table; in case if they are not able to be included, they should be noted clearly that they are notes for which table.
 - (b) Notes are usually in italic letters.
 - (3) Contents of the documents
 - (a) Following the Indian regulations, standards of technical process on survey, design, experiment, etc.

1.4 Document Numbering System

The Contractor shall prepare the document numbering system and describe it in the Document Control Procedure.

1.5 Units

The Contract shall utilize the SI system of units.

2. Requirements on Drawings

2.1 General

- (1) The Contractor shall adopt a title block similar for all drawings prepared under the Contract.
- (2) Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.
- (3) The current status of each design drawing shall be clearly defined by the use of a single letter code as follows:

- ID - Inception Report Drawing
- TD - Technical Design Drawing
- CD - Construction Technical Drawing
- BD - As-Built Drawing

2.2 Drawing Numbering System

- (1) The drawing number shall comprise nine (9) letters/digits plus a revision letter in the following format:

Drawing No. Revision

n / xx / xx / nnnn x

(A) (B) (C) (D) (E)

(Note: This format permits the use of a full 10 - character computer reference, combining the Drawing No. and Revision.)

- (2) (A) - A single digit (from 1 to 8) denoting the Contract Package Number of project

- (3) (B) - A two (2) letter code denoting the subjected area e.g.

EW Typical Earthwork (Cut/Embankment))

AL Alignment Layout

YL Yard Layout

IB Important Bridge

MB Major Bridge

NB Minor Bridge

OB ROB

UB RUB

PS Pedestrian Subway

LC Level Crossing

JS Junction Stations

CS Crossing Stations

SB Station Building

DP Maintenance Depots

OS Operation Control Stations

RB Residential Buildings

TW Temporary Works

BA Borrow Areas

In case of any other drawings, the drawing numbering system shall be submitted by the Contractor to the Engineer for his consent.

2.3 Drawing Size

The drawings produced by the Contractor for submission to the Engineer / Employer shall generally be to ISO A1 size unless otherwise instructed by the Engineer. They shall display the title block containing the information / details as specified here in and shall be got consented from the Engineer in advance.

3. CAD Standards

3.1 Introduction

The main objectives of the CAD standards are as follows:

- (1) To ensure that the CAD data files produced for project are coordinated and referenced in a consistent manner.
- (2) 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.
- (3) 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.
- (4) To establish procedures necessary for the management of CAD data files.
- (5) To ensure all the contractors use 'Model Space' and 'Paper Space' in the production of their CAD files'.

3.2 CAD Quality Control Checks

- (1) Random CAD Quality Control Audits will be carried out by the Engineer on all CAD media received and transmitted.
- (2) 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 CAD and drafting standards shall be checked.
- (3) In addition, the Contractor who transmit and receive CAD data from the Project shall have CAD quality control procedures in place. A typical quality control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

3.3 Revisions

- (1) All Construction Industry symbols produced as CAD Cells shall typically conform to Indian regulation.
- (2) 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.

3.4 Block Libraries, Blocks, & Block Names

- (1) All Construction Industry symbols produced as CAD Cells shall typically conform to Indian regulation.
- (2) All Blocks created shall be Primitive (i.e. NOT Complex) and shall be placed Absolute (i.e. NOT Relative).
- (3) The Contractor's specific block libraries shall be transmitted to the 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.
- (4) All Blocks of a common type, symbols or details shall initially be created within a CAD "Model Space File" specifically utilized for that purpose. These files shall be made available to the Engineer / Employer as required.
- (5) All Blocks created shall 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.

3.5 CAD Dimensioning

Automatic CAD Dimensioning shall 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.

3.6 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.

3.7 Global origin, Location and Orientation on the Alignment Drawing

- (1) Location or Plan information in "Model Space" files shall coincide with the correct location and orientation on the Project grid for each specific contract.
- (2) 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 Contractor shall establish the setting out coordinates for his respective Works, which shall then be used by the Other Contractors.

3.8 Line Thickness and Color

To facilitate the consistent plotting by the Contractor and other users, the colour codes, line shape, line thickness / pen sizes etc. for different applications of the works / work elements shall be assigned by the Contractor and submitted to the Engineer for his consent.

3.9 Master List of Documents for Consent / Approval

The Contractor shall furnish the Engineer a master list of the technical documents for Notice of No Objection / consent / approval, which he proposes to prepare and submit under the Contract, within 42 days from the Commencement Date. The master list shall include the drawing number, title and the Contractor's target date for the first submission of each document for Notice of No Objection / consent / approval.

The master list of documents to be submitted shall be subject to the Engineer's consent. The master list shall be used to monitor submission and Notice of No Objection / consent / approval of each drawing.

3.10 CAD Utilization of 2D & 3D Files

Although the project standard shall be 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 visualisation process (i.e. Architecture, Survey and Public Utilities). In these specific instances 3D CAD data shall 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.

3.11 CAD File Numbering

- (1) Contractor's CAD File Numbering shall be as described in Clause 2.2 above.
- (2) Employer's CAD File Numbering: This will follow the numbering system as specified above except that the status of the drawing shall be with the letter "E".

3.12 CAD File Naming Convention – General

CAD "Model Space" files shall be named in accordance with general drawing conventions.

4. Submission, Receipt and Transmittal of Documents and Drawings

4.1 Submission of the Documents and Drawings

Unless and otherwise instructed by the Engineer, when the Contractor submit any documents and drawings to the Engineer for his check/ review/

approval/ consent/ issue of “Notice of No Objection” as well as in respect of “Good for Construction Drawings” and “As Built Documents”, the Contractor shall prepare six (6) sets of hard copies (controlled copies) with one (1) set of CDs of submitting documents and CAD data of submitting drawings.

4.2 Data Transfer Media and Format

When data is received & transmittal between the Engineer / Employer and the Contractor, the media shall be as follows:

- (1) Data Exchange Format
 - (a) Document including tables and figures: PDF (.pdf)
 - (b) Drawings: Autocad Vr. 2011 (.dwg)
- (2) Operating System - Windows 7 or above.
- (3) Data Transfer Media : Compact Disc will be preferred.
- (4) All CDs or tapes shall be labeled on the data shield with:
 - (a) Name of Company / Contractor
 - (b) Project Title
 - (c) Drawing Filenames
- (5) The Contractor shall ensure the supplied media is free from virus.

* End of Appendix 5 *

EMPLOYER'S REQUIREMENTS

APPENDIX 6

TEMPORARY WORKS

1. Scope of Work

- 1.1 All necessary Temporary Works adequate for the realization of the Works such as Temporary Facilities and Temporary Utility Services shall be provided and maintained by the Contractor for his own use, for his sub-contractors, the Engineer and the Employer unless otherwise authorized by the Engineer.
- 1.2 The Temporary Facilities including, but not limited to, offices, warehouses, fabrication yard and material stock areas as well as the Temporary Utility Services including, but not limited to, power, lighting, water and communication shall be provided, equipped, and maintained in good conditions until the issue of Taking-Over Certificate.
- 1.3 The Contractor shall ensure that the Temporary Facilities and Services do not interfere with the Permanent Works or prevent the installation, commissioning and testing of the Permanent Works and works and services of Other Contractors. Where necessary the Contractor shall divert or relocate the temporary facilities / services in the course of the works at his own cost.
- 1.4 All the requirements and provisions as specified in "Safety, Health and Environment (SHE) Requirements" in specifications of the Bid Documents shall be complied with.
- 1.5 All the temporary works required to be taken up within the river requiring the consent of the concerned authorities shall be arranged by the Contractor at no extra cost to the Employer.

2. Submittals

2.1 Technical Design Submission

The contractor shall submit the Temporary Works Drawings and the Temporary Works Design Report which detail adequate scale, location and all arrangements of the Temporary Works to the Engineer for review within **42** days after the Commencement Date except for the items as described in para 2.1 (2), (5) and (6) herein below, submissions in respect of the same may be made by the time when the Final Technical Design Submission is made.

The Temporary Works to be carried out shall be consistent with the plan submitted by the Contractor with his technical proposal in his Bid together with any subsequent developments and / or changes subsequently agreed to by the Employer / Engineer. The Temporary

Works shall include but not limited to the following:

- (1) Employees' camp:
Detailed drawings at scale 1:500 showing the camp layout, buildings, roads, recreation areas, all public utilities, etc., and drawings at scale 1:50 showing typical building construction details with specifications.
- (2) Temporary construction works including support systems for working within the rivers, deep excavations, island / cofferdam / bunds / river diversions and the support, concrete formworks and its support, temporary bridges and staging and so on.
- (3) Access routes including temporary road works to all locations necessary to be reached in the course of construction in the Site and the Work Areas including public road diversions.
- (4) Equipment pools and mechanical workshops.
- (5) The detailed plan for operation of the Borrow Areas as detailed hereinafter including approach roads.
- (6) The Stockpile areas as detailed hereinafter including approach roads.
- (7) Concrete batching & mixing plant and crushing plants, including cement storage: Detailed design and drawings including manufacturer's drawings and foundation drawing prepared by the Contractor for concrete batching & mixing plant and crushing plants in accordance with the requirements of the pertinent provisions of the Specifications.
- (8) Fabrication yard, shop erection yard, casting yard including casting bed, lifting, curing and stacking system for pre-cast concrete elements along with the supporting design calculations and drawings.
- (9) Transporting, handling and launching system for the precast concrete elements / steel fabricated elements including design and drawings for launching truss / girder etc.
- (10) Material testing laboratories
Detailed breakdown of all equipment to be used for material testing in field and in laboratories in accordance with the requirements of the pertinent provisions of the Specifications.
- (11) Explosives magazines (if required) – their proposed locations and operation plan.
- (12) Security and safety arrangements-
All arrangements shall comply with the relevant provisions prepared in the Employer's Requirements.
- (13) Layout and drawings for offices for the Employer's and the Engineer's staff.

- (14) Project sign boards and diversion boards.
- (15) Barricades and other temporary walls and alike with pertinent design considerations & drawings containing details such as height, material, colour scheme, Logo, anchoring mechanism etc. complying the requirements specified in [Safety, Health and Environment (SHE) Requirements] in specifications

3. Temporary Facilities for the Contractor's Use

3.1 Contractor's Site Offices, Warehouses, Material Yards

- (1) The Contractor shall provide and equip, for his own and his subcontractors' use, main and secondary offices, all of which shall be constructed and furnished within 90 days after commencement date and warehouses, materials stock areas, fuel storage areas and explosives magazines, all of which shall be constructed and furnished for use within 140 days after the Commencement Date and maintained in good conditions until the issue of Taking-Over Certificate.

3.2 Land for temporary facilities for Contractor's Use:

The Contractor will be allowed to use the land within Right of Way for carrying out his Temporary Works including stock piling of construction materials but excluding the Borrow Pits and the Quarries subject to the consent by the Engineer. Any land required in excess of the land mentioned above, shall have to be arranged by the Contractor using his own resources and at his own cost under due intimation to the Engineer.

3.3 Borrow Areas and Quarry

- (1) It shall be the responsibility of the Contractor to arrange for the borrow areas (for fill material) and quarry sites (for aggregates and rock material) using his own resources and at his own cost.
- (2) All the charges whatsoever towards royalties, taxes & duties, cess, cost of temporary land etc. as applicable for arranging the borrow areas and quarry sites including for the material extracted there from shall have to be borne by the Contractor.
- (3) Before commencing operations in each of the borrow areas and quarry site, the Contractor shall submit a detailed plan of his operations and emobilization/ grading & finishing etc. in respect of the same to the Engineer for his consent along with relevant drawings. The details shall be submitted as part of Temporary Work Design Report and Temporary Works Drawings as summarized in Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements.
- (4) The quality of fill material, and aggregates etc. extracted from borrow areas and quarry sites shall meet the requirements of the Specifications and subject to consent of the Engineer.

- (5) No Borrow areas, quarry sites and installation of rock crushers will be permitted within the ROW of the Project.
- (6) On completion of the work, the Contractor shall leave the borrow area site in a safe and stable condition.
- (7) The Contractor shall indemnify the Employer against all claims in relation to the borrow areas and quarry sites during and after the Works are completed.

3.4 Stockpile Areas

- (1) The Contractor may also arrange additional stockpile areas as required by him at his own discretion and cost.
- (2) The location and size of the Stockpile Areas proposed by the Contractor shall be subject to consent of the Engineer. The Engineer's consent may be withheld for any of the following reasons:
If the Stockpile Area, or access into them, in the opinion of the Engineer:
 - (a) will have a detrimental effect on the natural and social environment;
 - (b) will disturb drainage system around the Stockpile Areas;
 - (c) would constitute a danger to the public; or
 - (d) becomes too high stockpile as decided by the Engineer.
- (3) Before commencing operations, the Contractor shall submit detail drawings of the proposed Stockpile Areas together with the proposed method of operation including stockpile heights, runoff / dust control measures, access road layout, drainage and measures to be taken for restoration etc.
- (4) On completion of stockpile operations the Contractor shall reinstate the Stockpile Area in a safe and stable condition.
- (5) The Contractor shall indemnify the Employer against all claims in relation to the Stockpile Areas during and after the Works.
- (6) All the soil excavated in the ROW shall be the property of the Employer and shall not be removed from the Site without the consent of the Engineer / Employer and shall be used for the Works to the extent feasible.
- (7) The Contractor shall arrange for proper Stockpile areas for keeping the stock of oil, fule and reinforcement bars/strands as per the guidelines for storage of these materials as approved by the Engineer.

3.5 Concrete Batching & Mixing Plant and Crushing Plants

- (1) The Contractor shall plan, install and erect all necessary concrete batching & mixing plant and crushing plants of sufficient capacity to meet the planned peak requirements during construction. The capacity of the plants shall be subject to consent by the Engineer. All control and measuring equipment shall be regularly calibrated. The Contractor shall submit the Engineer the results of the calibration regularly.

3.6 Material Testing Laboratories

- (1) The Contractor shall build and equip adequate Material Testing Laboratories on the Site and / or at the Work Areas for sampling and testing of materials for concrete, earth or any other materials as specified in the Specifications. The location of the Material Testing Laboratories shall be approved by the Engineer.
- (2) The laboratory shall be located in a building properly equipped with electricity, water, air-conditioning etc., and shall have enough room for storing the samples.
- (3) The equipment to be supplied and the methods of testing shall be in accordance with the relevant Indian Standards specified in the Specifications and / or as described in the respective Manual. 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 presented to the Engineer prior to purchase.
- (4) The equipment and apparatus shall be calibrated before the testing starts and at regular intervals as specified by the manufacturer and as directed by the Engineer. The Contractor shall submit the results of the calibration to the Engineer regularly.
- (5) The Contractor shall 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 run by Contractor's personnel fully experienced in sampling and testing of materials, and quality control.
- (6) Specialized testing which may be required and which cannot be performed in the Contractor's laboratory due to lack of time or equipment shall be assigned to an independent organization consented by the Engineer. The Contractor shall accept all results, instructions or restrictions stipulated by the Engineer based on such tests.

3.7 Communication Systems

The Communication System to be applied to the project shall be basically the Mobile Phone Base Communication System. The Contractor shall establish the Mobile Phone Base Communication System Plan solely dependent on ready-to-use mobile phones for internal and external communication

The Contractor shall ensure that his Communication System is available for communication with the Engineer and Employer within **28 days** after Commencement Date and shall maintain the same until completion of the Defect Notification Period.

3.8 Employee's Camp

- (1) The Contractor shall provide adequate camping facilities for the use of his employees / staff and those of his sub-contractors. Camping facilities shall have adequate sanitary facilities including sewage disposal system, medical service, drainage, fire control and all utility services (potable water, power etc.) and shall comply with statutory requirements.
- (2) Contractor's Employee's Camp may be located at the land available within the ROW, . If any additional area is required by the Contractor for the purpose, the same shall have to be arranged by the Contractor at his own cost.
- (3) No camp construction shall commence until the Contractor's drawings and specifications have been consented by the Engineer.
- (4) Camp facilities shall be provided to meet the requirements of the maximum anticipated work load and labor force. These facilities shall be available and fully operational within 140 days after the Commencement Date and maintained in good conditions until the issue of Taking-Over Certificate unless otherwise authorized by the Engineer.
- (5) The Contractor's Camp shall comply with the applicable laws, Codes and Standards.
- (6) The Contractor shall be responsible for keeping the camp, and the buildings within it, in good hygienic conditions. The standards and regulations presently in force in India with regard to personnel treatment, sanitary conditions, and fire and accident prevention shall be duly taken into account.

3.9 First Aid Stations

- (1) The Contractor shall comply with the applicable laws and health standards presently in force in India. His contractual obligations to this end are stipulated in the General Conditions of the Bid Documents. In the event of an epidemic breaking out, the Contractor shall carry out and comply with all orders, arrangements or regulations which may be issued by the Government or local authorities.
- (2) The Contractor shall construct, equip, and maintain the First Aid Station at adequate locations on the Site and at the every camp each.
- (3) These facilities shall be fully equipped and staffed as per the applicable regulations in force. These facilities shall be available

and fully operational within 140 days after the Commencement Date and maintained in good conditions until the issue of Taking-Over Certificate unless otherwise authorized by the Engineer.

- (4) Standing arrangements shall have to be made with the nearest general hospital for providing treatment in case of emergencies and serious cases
- (5) All the other requirements as specified in specifications of the Bid Documents shall be complied with.

3.10 The Contractor shall summarise the design of all his Temporary Facilities in the Temporary Works Design Report and Drawings as described in para 2.1 above.

4. Temporary Utility Services for the Contractor's Use

4.1 Power Supply and Illumination

- (1) The electric power supplies for the 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 at his own cost.
- (2) The Contractor may install, operate and maintain its own electrical distribution systems for the power supply for his Temporary Facilities including Site, Work Areas.
- (3) The Contractor shall also furnish, install and keep operational the diesel power generating facilities of such capacity what he considers necessary to prevent the interruption of the Works.
- (4) The Contractor shall ensure adequate illumination for all his operations at the Site and at the camp.

4.2 Water Supply

- (1) The Contractor shall design, install, operate and maintain water supply systems including pumps, piping system, valves, storage tanks etc, at the Site with respect to:
 - (a) Industrial water supply system;
For construction use meeting the quality requirements as specified in Specifications
 - (b) Potable water supply system:
For supply to all the Temporary Facilities including but not limited to Contractor's camps, offices, Site, Work Areas and other facilities for human consumption and use

In case the Contractor plans to install bore well 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.

- (2) Throughout the duration of the construction, the Contractor shall take samples from all water supplies at regular intervals and test it for its suitability for the intended use.

4.3 Sanitation and Sewerage

- (1) All Sites, offices, workshops, fabrication yards, laboratory, camp and other buildings etc. shall be provided with sanitation and sewage handling & disposal system complying with the statutory requirements and applicable laws, Codes & Standards.
- (2) If required, portable chemical toilets shall be provided and maintained by the Contractor for the use of all personnel at all work locations,.

4.4 Waste and Garbage Disposal

- (1) The Site and the Work Areas shall be kept clean and free of refuse at all times.
- (2) The Contractor shall collect waste material and garbage from Site, camp, offices, yards and workshops on a daily basis and dispose off the same in the approved area and as per the guidelines prescribed by the local authorities. No waste of any kind shall be deposited in any watercourses.

4.5 Fencing and Site Security and Safety

- (1) The Contractor shall be responsible for the security and safety of the Site. Accordingly the Contractor's offices, workshops, fabrication yards and storage compounds, campsites, all construction areas, storage areas shall be adequately fenced, gated, lighted and guarded round the clock. Fire fighting equipment shall be provided in accordance with the applicable Codes and requirements of local authorities.
- (2) The explosive magazines comply with the relevant regulations of India and shall be at the locations approved by the competent authorities. Detonators and fuse shall be stored in separate magazines away from explosives. In no case they shall be transported in the same vehicles with explosives. Explosive magazines shall be kept locked and keys accounted for at all times.
- (3) The Contractor shall be responsible for any losses occurring within the Site premises.

- 4.6** The Contractor shall install, furnish all these facilities within 140 days after the Commencement Date and maintained in good conditions until the issue of Taking-Over Certificate

4.7 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.

4.8 Final Clean-Up

- (1) Upon the Completion of Works, or when any of the plants and facilities have completed its functions, the Contractor shall dismantle and demobilize the temporary facilities and remove all refuse, debris, objectionable material, and fill, grade and dress all the areas to its original condition as it was before commencement of the Work .
- (2) No demobilization or removal of temporary facilities and equipment shall be made without prior consent of the Engineer.

5. Temporary Facilities for the Use by Employer and Engineer

5.1 Site Office

5.1.1 Requirements

The Contractor shall design, construct, equip and furnish the site offices for the Employer's and Engineer's use within **90 days** after the commencement date. The Contractor shall also maintain the site offices in good conditions and provide services including, but not limited to maintenance of the office equipment and furniture, repairing and mending, cleaning, consumable replenishment in respect of toiletries, cartridges for the plotter and colour laser writers, first aid box, batteries / battery cells, drinking water etc. Design of all the Site Offices shall be submitted to the Engineer for review prior to commencement of the construction of those facilities. Details of the Engineer's site office including provisional site offices are described in the following paragraphs.

All furniture, furnishings, fittings & fixture and equipment etc. shall be of the configuration, make and quality as consented by the Engineer.

Unless otherwise stated herein below, all the site offices including all furniture, furnishings, fittings & fixture and equipment etc. as provided by the Contractor for the use of Engineer / Employer shall be the property of the Employer after issue of Taking-over Certificate.

5.1.2 Engineer's Site Offices

- (1) The area surrounding the office shall be well drained and provided with concreted pavements, walkways and parking areas for the vehicles.
- (2) The main office buildings shall be of sound design and of the material as approved by the Engineer, complying with national building codes. The office shall be weatherproof, lined inside with plywood, and painted internally and externally. Floors shall be tiled and floor to ceiling height shall be as approved by the Engineer. Each room having an internal wall shall have at least one screened window. The office building shall have two external lockable doors with screened storm doors. Electricity supply and

receptacles shall be provided in various locations appropriate to the usage of the rooms. Rooms shall be well lighted, appropriate HVAC systems with temperature control and other necessary building services as described in the National Building Code of India.

- (3) Two Site offices one main site office and other satellite site office shall be provided for Engineer. The location of these offices will be decided with approval of Engineer.

Engineer's Site Offices shall be furnished as referred to the following parameters and the design shall be submitted to the Engineer for review.

Room No. and Designation		Min. Area (m ²)
A	Employer	
i.	Chief Project Manager Office	50
B	Engineer	
i.	Project Manager	40
ii.	Senior Engineers/ Jr. Engrs./ Inspectors/Surveyors	130
iii.	Administration Office/ Filling Room/ Store/	120
iv.	Satellite site office	140
	Total	480

Note :

Changes in the area to be provided for various subheads under B can be made as per the requirement of the Engineer keeping the overall area as 430sq/m

- (4) Plumbing fixtures shall be standard types made out of porcelain or stainless steel and all pipe work and fittings shall be polyvinyl chloride (PVC). All works, materials and fixtures shall comply with the national plumbing code, sanitary engineering standards, and other applicable regulations.
- (5) The equipment and furniture to be provided are listed in Table at the end of this Appendix. The equipment and furnitures shall be of suitable make/Brand, model, type, size and capacity.

5.2 Survey Equipment

- (1) The surveying instruments, to be provided for exclusive use of the Employer's and Engineer's site staff, shall be brand new, of the latest design and manufactured by Wild, Kern, Nikon or other reputable manufacturer as acceptable to the Engineer / Employer. The instruments shall include all items necessary for the Engineer to

be able to establish horizontal and vertical control both on the surface and underground and to check the Contractor's surveying work.

- (2) The Contractor shall present to the Engineer for consent the adequate number of equipment with proposed make, type, and models with parts and performance catalogues and manufacturer's warranty, prior to purchase.
- (3) The Contractor shall furnish the survey equipment within 56 days after the Commencement Date and maintained in good conditions until the issue of Taking- Over Certificate unless otherwise authorized by the Engineer.
- (4) All the survey instruments shall be maintained by the Contractor through service agent and shall be regularly checked and calibrated
- (5) The Contractor shall provide the Engineer with any additional surveying equipment and materials such as pegs, mallets, stakes, nails, paint, etc., as required, and shall make available to the Engineer any surveying instrument owned by his surveying department, but not included in the above list of equipment, which may be necessary for checking the Works. Any instrument which has been damaged or been non-operational shall be immediately replaced or repaired by the Contractor. Equivalent replacement shall be provided by the Contractor in such cases including for the equipment which is being repaired or serviced.

6. Temporary Utility Services for the Use by Employer and Engineer

The following temporary utility services shall be provided by the Contractor for the use by the Employer / Engineer until issue of Taking Over Certificate unless otherwise directed by the Engineer.

6.1 Electricity and Water Supply

Power and potable water supply systems for the Employer and Engineer's site offices (Provisional Site Offices, Engineer's Site Offices) shall be installed and made operational within the specified period of construction as mentioned above in respect of the respective site offices. The Contractor shall maintain and provide continuous and adequate supplies unless otherwise authorized by the Engineer.

6.2 Sanitation and Sewerage

- (a) Sanitation and Sewerage systems for the Employer and Engineer's site offices shall be installed and made operational within the specified period of construction as mentioned above in respect of the respective site offices.
- (b) The Contractor shall provide a properly designed and constructed septic tank approved by the Engineer for the disposal of domestic sewage from each building in the Engineer's site offices
- (c) Each septic tank shall be regularly emptied, maintained and serviced by the Contractor to ensure proper functioning.

6.3 Office Cleaning, Waste and Garbage Disposal

- (a) The Contractor shall provide personnel and perform daily cleaning of all rooms in the Employer and Engineer's site offices.
- (b) The Contractor shall collect and dispose of, in a location and manner consented by the Engineer, all domestic waste and garbage from the Employer's and Engineer's site offices on daily basis.

6.4 Fire Fighting Equipment:

Firefighting equipment shall be provided in all the site offices of the Engineer in accordance with the recommendations of the Local Fire Brigade Station.

6.5 Office Security

The services of a full time round the clock office security shall be provided for all the site offices of the Engineer/Employer.

6.6 Use of Contractor's First Aid Stations

The Contractor's emergency medical care and first aid services shall be made available, for use by the Employer's and Engineer's site staff and their families living at the Site or the Work Areas, free of charge,

TABLE 8-1
FIXTURES AND FURNISHINGS IN ENGINEER'S SITE OFFICE

<u>Fixture/Furnishing</u>	<u>Number of items to be furnished</u>
---------------------------	--

Executive desk (lockable) with drawer and chair	3
Desk (lockable) with drawer and chair	15
Side Table	3
Additional chairs	15
Plan table, adjustable w/lamp & stool	2
Conference Table	1 with 20 Chairs
Plan rack with holders	as one thinks fit
Drawing Hangers	as one thinks fit
Drawing Cabinets	3
Filing cabinet (4 drawer-lockable)	5
Steel cabinet (lockable)	5
Office safe (combination lock)	1
Book cabinet (glass fronted)	2
Wall shelving (set)	6
Window curtains (set)	as one thinks fit
Internet Connection	As per Engineer Consent
Fire extinguisher	as an applicable code stipulates
Wastepaper can	25
Color LaserWriter (FAX/Copier)	2
Plotter	1
Display boards (wall type)	3
Fully automatic camera with date and time recording facility downloadable to a PC	1

First aid box	3
Refrigerator	1
Crockery/cutlery set	2 sets
Hot and cold drinking water dispenser	1
Sink unit with worktops and geyser	1
Lavatories with water closet	3
Urinals with flush	3
Wall mirror	3
Safety helmets (various sizes)	20
Rain coats (various sizes)	10
Industrial safety goggles	10
Pair safety boots (various sizes)	20
Flashlight with batteries.	20
Wall clock	2
Lockers	15
Safety High Glow Jackets	20
Safety Harness (full body)	10

*** End of Appendix 6 ***

EMPLOYER'S REQUIREMENTS

APPENDIX 7

CONTRACTOR'S COORDINATION WITH OTHERS (INTERFACE MANAGEMENT)

1. General

The careful coordination of all technical and programming matters between the relevant parties is a critical element in achieving a fully coordinated design and construction. This appendix describes the Contractor's responsibilities with regard to interface management and coordination with those who are considered to be related with the Work. The Contractor's responsibility for interface coordination shall include interfacing with the Other Contractors, 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 Parties and all the interfaces as required in the Contract are the sole responsibility of the Contractor.

2. General Responsibility of the Contractor

- 2.1 The Contractor shall not impede but shall afford the Other Contractors and Interfacing Parties with all reasonable opportunities & facilities, access to the site and / or services to any related parties in the Contract including members of the Other Contractors, Interfacing Parties and the Engineer / Employer so as to ensure the whole project including Other Contractor's works as well as his Works shall be executed in the most efficient manner for the best interest of the Employer as a whole.
- 2.2 The Contractor shall, in accordance with the Employer's Requirements, coordinate and integrate the Contractor's own Works under the Contract with works of the Other Contractors and Interfacing Parties. In addition, the Contractor shall take all necessary means and steps to ensure that the Works are coordinated and integrated with the works of the Other Contractors and Interfacing Parties, and shall comply with any directions which the Engineer may give. Such responsibilities shall neither be mitigated nor in any way affected by virtue of similar responsibilities being placed on Other Contractors.
- 2.3 The Contractor shall be responsible for the detailed co-ordination of his design, installation, construction, testing activities and shall take the lead in the management of the coordination process with Other Contractors and Interfacing Parties.
- 2.4 The Contractor shall carefully review pertinent information made available

by the Engineer relating to the nature and programming of the related parties' contracts and use such information in his planning of the Works.

- 2.5 The Contractor shall communicate, and exchange information directly with the Other Contractors and Interfacing Parties, with a copy to the Engineer for information. Information as necessary to fulfill the Contractor's interface obligations shall be directly requested and obtained from the Other Contractors and Interfacing Parties with a copy to the Engineer for information and receipt acknowledged. Conversely, the Contractor shall provide directly to the Other Contractors and Interfacing Parties the information within the Contractor's scope that is required by them to meet their contractual obligations with a copy to the Engineer for information.
- 2.6 The Contractor shall ensure that the Contractor's requirements are provided to all the related parties of the Other Contractors and the Interfacing Parties before the cut off dates as identified in the Interface Management Plan to be developed by the Contractor and consented by the Engineer.
- 2.7 **Where the other contracts requiring interface are yet to be awarded, the Contractor shall proceed with the coordination activities with the Engineer,/Employer until such time the related parties including Other Contractor / Interfacing Party is engaged by the Employer or identified as an Interfacing Party.**
- 2.8 The Contractor shall take all reasonable steps to ensure that the Works are integrated with the design, installation, execution and testing of such other works and shall in particular (but without limitation) to:
- (a) comply with any direction which the Engineer may give for the integration of the design of the Works with the design of any other part of the Project;
 - (b) consult, liaise and co-operate 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, co-ordination drawings and specifications together with arrangements of service priorities and zoning; and
- 2.9 At the end of each such co-ordination period / exercise, the Contractor and the Other Contractors and Interfacing Parties with whose works the interface period / exercise refers, shall jointly state in writing that their design co-ordination activities are complete and that their respective designs are integrated and can be finalized without interference with each other's designs or the designs with which their designs have already been integrated. A copy of this joint written statement shall be provided to the Engineer within 7 days of the end of the said design co-ordination period/ exercise. Unless and until copies of all relevant and necessary design co-ordination statements have been submitted to the Engineer, the Engineer shall be entitled to suspend any review or further review of the Contractor's or the Other Contractor's and

/ or Interfacing Party's design submissions. Such suspension shall not be grounds for any claim by the Contractor nor shall the Contractor be entitled to receive an extension of time or additional payments.

- 2.10 During construction 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 Other Contractors, to a reasonable extent during their construction / execution, erection and commissioning process. Where possible separate locations shall be provided for each of the Other Contractor.. Specific details shall be coordinated and agreed during the design interface period with the Contractor and the Other Contractors.
- 2.11 Any other contract which depends for its execution on the Contract or upon which the Contract is dependent for its own execution shall be identified by the Engineer as a "Interface Contract". The Contractor shall provide attendance on Other Contractors and Interfacing Parties (if necessary) for meetings and correspondences in this regard in accordance with the Employer's Requirements and / or as instructed by the Engineer. The identity of the Other Contractor(s) for the Interface Contract may not be known before the execution of the Contract but this shall not be a ground for the Contractor to object to the subsequent appointment of any Other Contractor.
- 2.12 The Contractor shall in accordance with the requirements of the Contract and instructions of the Engineer coordinate his own Works with the works of Other Contractors strictly adherent to the Coordinated Construction Programme as detailed in Appendix 3 [Project Programme Requirements] to the Employer's Requirements, and shall afford the Other Contractors all reasonable opportunities for carrying out their works.
- 2.13 The Contractor shall, while carrying out his co-ordination responsibilities, provide sufficient information for the Engineer to decide on any disagreement between the Contractor and the Other Contractors / Interfacing Parties as to the extent of services or information required to pass between them.
- 2.14 If the Contractor suffers delay by reason of failure caused by any Other Contractor/ Interfacing Parties to meet the specified installation interfacing, co-ordination, and / or completion dates resulting in delay beyond the extent which could be reasonably foreseen by an experienced contractor at the time when the Coordinated Construction Programme is formulated and consented by the Engineer , then the Engineer shall take such delay into account in determining any extension of time to which the Contractor is entitled under the Contract.
- 2.15 If any act or omission of the Contractor whether directly or indirectly results in the delay in execution of the works of the Other Contractor and / or Interfacing Parties associated with the execution of the project, the matter will be settled by the Engineer under relevant Clause of the General Conditions of the Bid Documents.
- 2.16 The Contractor shall co-ordinate the access and delivery routes and

ensure that all provisions for access and delivery of plant & equipment is co-ordinated with and reflected in the delivery route drawings of the Other Contractor and Interfacing Party. The Contractor shall co-ordinate with the Other Contractors and Interfacing Parties with regard to the details to be provided by them for the openings to be left in the structure for their Plant & equipment in accordance with Coordinated Construction Programme.

- 2.17 All requests for information (RFI), acknowledgement of receipt of information and any official communication between the Contractor and the Other Contractor and Interfacing Parties shall be made in writing with a copy to the Engineer for information.
- 2.18 The Contractor shall advise the Engineer in writing of any problems encountered in obtaining necessary information and/or lack of cooperation from the Other Contractor. In the event that the Engineer considers that the resolution of the interface is not proceeding satisfactorily, the Engineer will review the matter and establish a coordinated plan directing the Contractor and the Other Contractor / Interfacing Party as to the required action. In such a case, the decision of the Engineer shall be final and binding.
- 2.19 The Contractor shall prepare minutes recording all the matters discussed and agreed at all the meetings.
- 2.20 The Contractor shall ensure that copies of all correspondence, drawings, meeting minutes, programmes, etc. relating to the Contractor's coordination with the Other Contractors/ Interfacing Parties are issued to all concerned parties and the Engineer no later than two calendar days from the date of such correspondence and meetings.
- 2.21 The Contractor shall note that the information exchange is an iterative process requiring the exchange and up-dating of information at the earliest opportunity and shall be carried out on a regular and progressive basis in order for the process to be completed for each design and construction stage.
- 2.22 The Contractor shall establish an Interface Management System and participate in the activities with the Other Contractors and Interfacing Parties. The Contractor's obligations shall include but not limited to the following:
 - (a) provide an Interface Co-ordinator 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 Co-ordinator;
 - (b) respond to, confirm and make written agreements with regard to interfaces;
 - (c) attend interface meetings that may be arranged by the Engineer, with a representative empowered to make agreements on interfaces. The Engineer / Employer shall arrange regular meetings to monitor the status of interfaces, and may

require special meetings as may be necessary to resolve specific issues. The Contractor may request assistance from the Engineer to arrange meetings on particular subjects;

- (d) provide the Engineer with regular status information and/or details of interfaces, including copies of relevant correspondence and material; and
- (e) provide the Engineer with access to information for the purpose of conducting audits on interface compliance and for confirming that interface coordination is proceeding consistently with the Employer's Requirements.

2.23 Should it appear to the Engineer that the Work Programme or three month rolling programme do not conform with the Coordinated Construction Programme, the Contractor shall be required to revise all such programmes so as to conform to Contractual Construction Programme.

3. Interface Co-ordination Team

3.1 The Contractor shall establish a interface co-ordination team led by an Interface Co-ordinator reporting to the Contractor's Representative. The primary function of the team is to provide a vital link between the Contractor's design & construction teams and the Other Contractors / Interfacing Parties.

3.2 The Interface Co-ordinator shall assess the progress of the co-ordination with Other Contractors / Interfacing Parties by establishing lines of communications as per pre- defined co-ordination model and promote regular exchange and updating of the information so as to maintain the Contractor's Programme.

4. Design Interface

4.1 General

- (1) The Key Dates & Milestones shown in Conditions of Contract included in the Bid Documents are critical to the timely completion of the project and the dates have been determined to create a time frame during which design interactions with the Other Contractors and Interfacing Parties on the project have to be completed in order for every interface activity to be streamlined through the time schedule.
- (2) The Contractor shall commence the design interface with the Other Contractors / Interfacing Parties as soon as he has been notified by the Engineer that an Other Contract has been awarded by the Employer or an Interfacing Party has been identified. There shall be a requirement for coordination during the Design Stage with respect to but not limited to track work, cable trenching, masts for OHE, construction of maintenance facilities, other allied structures and subsequently during the installation of systems including

telecommunications, signaling and traction power .

- (3) In the case of utility agencies and other statutory bodies, interfacing shall commence as soon as practicable.
 - (4) The Contractor shall, immediately upon award of the Contract, gather all necessary information and develop his design to a level where meaningful interaction with Other Contractors and Interfacing Parties can take place.
- 4.2 The Contractor shall support the Other Contractors and Interfacing Parties in the process of achieving a fully coordinated design for the Works, including but not limited to undertaking the following:
- (1) providing timely information when requested by Other Contractors and Interfacing Parties; anticipating the information needs of the Other Contractors / Interfacing Parties and transmitting such information as soon as it is available;
- 4.3 For the purpose of design coordination, the Contractor shall use the Coordination Drawings, and other drawings as necessary.
- 4.4 In advance of each Design Stage, the Contractor shall:
- (1) request in writing and obtain from the Other Contractors and Interfacing Parties, interface information required for that Design Stage.
 - (2) review the interface information received and agree in writing to the Other Contractors and Interfacing Parties that the interface information is adequate for that design stage.
- 4.5 In advance of the design stages of the Other Contractors' and Interfacing Parties' Design Stages, the Contractor shall when requested by them:
- (1) provide to the Other Contractors / Interfacing Parties interface information needed for their impending design stages; and
 - (2) confirm in writing that the interface information suitably represents the Contractor's interface requirements for that Design Stage.
- 4.6 The Contractor shall submit together with each of his design submissions a joint statement with the relevant Other Contractor / Interfacing Parties confirming that they have jointly reviewed the drawings and documents to ensure a consistent design that has no interference with others design and that their designs are already integrated. Unless all the relevant and necessary joint coordination statement have been submitted to the Engineer, the Engineer shall be entitled to suspend any reviews or further review the Contractor's design submission. Such suspension shall not be grounds for the Contractor to claim any extension of time or additional payment.
- 4.7 The Contractor shall ensure that the information he requires from Other Contractors / Interfacing Parties is made known at the outset of each design interface period / exercise and vice a versa so that the

information can be provided in time for the Contractor and Other Contractors / Interfacing parties to complete their design to meet their various design submission stages.

- 4.8 At the completion of each Design Stage of the Contractor, the Contractor shall:
- (1) transmit those portions of the design relevant to interface to the Other Contractors and Interfacing Parties for review; and
 - (2) agree in writing to the Other Contractors and Interfacing Parties on the incorporation of applicable review comments.
- 4.9 At the completion of each design stage of the Other Contractors and Interfacing Parties, upon receipt of the designs from them for review, the Contractor shall:
- (1) review those portions of the design relevant to interface and transmit comments to the Other Contractors and Interfacing Parties; and
 - (2) agree in writing that subject to the incorporation of the applicable comments.
- 4.10 Design coordination shall include definition, approach and agreement with the Other Contractors and interfacing Parties of interface areas, contract limits, shared loads and sequence of design activities and the definition and design approach for type, size and location of equipment, access thereto, cable routing and protection, agreement of installation programming, preparation of Interface Documents.
- 4.11 The Contractor shall liaise with the Engineer in developing a uniform identity code system which shall be used to uniquely identify each item of equipment and software components provided under the Contract. Such identity codes shall be used for labeling each item of equipment and shall also be used in design reports, drawings and operations and maintenance manuals. This identity code system shall be generally compatible with principles to be established by the Engineer and shall specifically be compatible with the use of the Engineer's defined names, mnemonics and codes for stations.

5. Construction Interface

- 5.1 Construction interfacing shall be necessary throughout the duration of the Contract and shall commence from the time the Contractor mobilizes on the site to the completion of the Works. Construction interfacing will overlap the design interface and involve the Other Contractors' and Interfacing Parties' requirements for provision of cast-in and buried items in the Contractor's works such as pipes for the Other Contractors' and Interfacing Parties' services, supports including support brackets, plinths, ducts, service buildings, openings, cableways, trenches etc., that are to be incorporated at the initial stages of the Contractor's installation up to provision of attendance during the testing

and commissioning stage.

- 5.2 The Contractor shall coordinate with the Other Contractors / Interfacing Parties to allow the efficient execution of the respective construction activities.
- 5.3 The Contractor shall coordinate and cooperate with Other 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 Other Contractors and Interfacing Parties in advance when a construction item is ready for field inspection to verify compatibility with the Other Contractors and Interfacing Parties' needs, and shall facilitate access to the site for the interfacing parties.
- 5.4 The Contractor shall ensure that there is no interference with the works of the Other Contractors / Interfacing Parties' and shall maintain close co-ordination with them to ensure that his Work progresses in a smooth and orderly manner.
- 5.5 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 instructed by the Engineer from time to time. The Contractor shall, be liable for and shall indemnify the Employer against all costs, charges, expanses and the like resulting from the failure of the Contractor to co-ordinate the Work.
- 5.6 The Contractor shall prepare a Coordinated Construction Programme on a works element basis covering the period of the Interfacing Contract access. It shall fully conform to the Contractual Construction Programme as specified in Appendix 4 [Project Programme Requirement] to the Employer's Requirements.
- 5.7 The Coordinated Construction Programme shall allow adequate time periods for Other Contractors / Interfacing Parties and the Contractor to install their plant and equipment in the designated areas.
- 5.8 The Coordinated Construction Programme shall be agreed with and be signed off by the concerned Other Contractors / Interfacing Parties and then submitted to the Engineer sufficiently in advance.
- 5.9 At or near the completion of the construction of any interface-related element of the Contractor's Work, the Contractor shall:
 - (a) advise Other Contractors and Interfacing Parties that the as-constructed interface- related Work can be inspected, and provide the necessary access to the Site and its occupation.
 - (b) agree in writing to the Other Contractors and Interfacing Parties and as consented by the Engineer on the adoption of any applicable comments on the constructed Work.
- 5.10 On advice from the Other Contractors and Interfacing Parties that an as-constructed interface-related element is ready for inspection, the

Contractor shall:

- (a) conduct on-site inspections of the Work elements, and give comments in writing to the Other Contractors and Interfacing Parties.
 - (b) agree in writing to the Other Contractors and Interfacing Parties that the as-constructed Work meets the interface requirements.
- 5.11 Prior to applying for a Taking-Over Certificate, the Contractor shall obtain written confirmation from each applicable Other Contractors and Interfacing Parties, that the interface elements meet the requirements of the Other Contractors and Interfacing Parties. If any Other Contractor or Interface 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.
- 5.12 Where Contractor's Works are identified as failing to meet the requirements of the Contract and which will impact the Other Contractors' and Interfacing Parties' works, the Contractor shall submit the proposed remedial measures to the Engineer for review and shall copy the same to the Other Contractors and Interfacing Parties.

6. Preparation of Interface Documents

- 6.1 The Contractor shall prepare as required the following interface documents which shall be used to completely define the Contractor's interface coordination details:
- (1) Interface Matrix;
 - (2) Coordinated Construction Programme (as specified in Appendix 3 [Project Programme Requirements] to the Employer's Requirements;
 - (3) Coordination Drawing
 - (4) Interface Management Plan (IMP).
- 6.2 These interface documents shall be submitted for review and consent to the Engineer. For all subsequent updates, these documents shall be submitted to the Engineer for information, review and comment. A summary of principal issues shall be included in each Monthly Progress Report.
- 6.3 The Interface Matrix which describes relations between Contractor and Other Contractors and Interfacing Parties and their roles and responsibilities as a key document and should be submitted to the Engineer for consideration as an overview of all subsequent interface related documents and drawings.

7. Coordinated Construction Programme

The Contractor shall prepare and submit a Coordinated Construction Programme in accordance with the requirements of Appendix 3 [Project Programme Requirements] to the Employer's Requirements and / or as instructed by the Engineer.

8. Coordination drawings

- 8.1 For the purpose of achieving a design which is fully coordinated with respect to track work, electrical, mechanical signaling & telecomm services and other railway systems elements; and ensuring compatibility between different services and adequate space requirements, the Contractor shall develop and maintain service coordination drawings that specifically detail the requirements of others in relation to the Contractor's design in terms of special arrangements, space allocation, cast in items, primary and secondary fixings, grouting of equipment/plants, drill and fix brackets and cast-in and surface-mounted conduit. These drawings shall also include composite cross-sections and layouts which show the spatial requirements of all interfacing parties .

9. Interface Management Plan (IMP)

- 9.1 The Contractor shall develop and submit to the Engineer within the specified schedule, an IMP for all the interface issues that may arise during the design, construction, testing and commissioning of the project in consultation with the Other Contractors / Interfacing Parties and the Engineer. The Contractor shall prepare an Interface Management Plan (IMP) for each segment of the Work on a works element basis covering the period of Interfacing Contract access. The IMP shall allow adequate time periods for each of the Other Contractor / Interfacing Party and the Contractor to install their Plant and equipment in the designated areas.
- 9.2 The IMP shall be agreed with and signed off by each of the Other Contractor / Interfacing Party and then submitted to the Engineer no later than six (6) months before the earliest Key Dates and Milestones as defined in Conditions of Contract
- 9.3 In case of any disagreement between the Contractor and Other Contractors / Interfacing Parties on the interface issues, the decision of the Engineer shall be final and binding.
- 9.4 After the review of the IMP with no objections by the Engineer, the Contractor shall strictly execute the Works accordingly.

10. Employer's / Engineer's Input

- 10.1 The Employer/Engineer shall coordinate the activities of the Contractor with reference to interfacing with third parties during all the phases of the Contract.
- 10.2 The Employer/Engineer, within the scope of the relevant Contract provisions, shall assist the Contractor in the following fields:

- (1) Interfacing state and local authorities for timely receipt of the required permits, certificates and approvals related to the design and construction process;
- (2) Interfacing state and local tax authorities for the Value Added Tax (VAT) reimbursement arrangements;
- (3) Interfacing state and local authorities for implementation of the additional land acquisition procedures; and
- (4) Any other fields of activities related to the Contract as may be required with the purpose of facilitating the Contractor's performance.

10.3 This support and assistance of the Employer/Engineer shall not release the Contractor of any of his obligations under this Contract.

11. Cost relating to the Interface Activities

Accepted Contract Price and Contractual Construction Programme shall be deemed to have included the provision in respect of the obligations relating to coordination and interface management activities. No separate payment will be made with regard to the activities as described herein above.

* End of Appendix 7 *

EMPLOYER'S REQUIREMENTS

APPENDIX 8

REQUIREMENTS ON DOCUMENTS AND DRAWINGS

Major submittals which the Contractor shall make to the Engineer for consent are summarized in the following Table [Programme Submissions] The submissions as indicated in these tables are not exhaustive and shall be supplemented meeting the Contract requirements and as instructed by the Engineer.

The Table shows all the Works Programmes (as specified in Appendix 3 [Project Programme Requirements] to the Employer's Requirements) to be submitted to the Engineer for consent at the timing as specified therein .

Programme Submission

Programmes	Initial Submission	Update Interval
Contractual Construction Programme	Within 28 days after Commencement Date	The timing as described in General Conditions
Works Programme:		
Survey Plan and Programme for Validation of Data Provided by Employer and Additional Survey, if Considered Necessary by the Contractor	Within 28 days after Commencement Date	Not more than one (1) month or as the Engineer instructs
Hydrological, Geotechnical Investigation Plan and Programme	Within 28 days after Commencement Date	Not more than one (1) month or as the Engineer instructs
Design Submission Programme	Within 42 days after Commencement Date	Not more than one (1) month and as the Engineer instructs
Construction Programme:		

Construction Programme for the Bridge and its Approaches Including Superstructure	Within 42 days after Commencement Date	Not more than one (1) month or as the Engineer instructs
Coordinated Construction Programme (Ref. Clause No. 10.2 of Appendix 3)	90 days before the start of respective construction activity.	Not more than one (1) month or as the Engineer instructs
Temporary Facilities Programme	Within 42 days after Commencement Date	Not more than one (1) month or as the Engineer instructs
Procurement Programme for Manufactured Items	Within 42 days after Commencement	Not more than one (1) month or as the Engineer instructs

* End of Appendix 8 *

EMPLOYER'S REQUIREMENTS

APPENDIX 9

DOCUMENT SUBMISSION AND REVIEW PROCEDURE

1. Document Control Procedure

- 1.1 Within **28 days** after Commencement Date, the Contractor shall submit the Document Control Procedure to the Engineer for review, which shall include but not be limited to the following:
- (1) a document consent / approval system which shall specify the level of authority for consent / approval of all documents before submission to the Engineer and in accordance with the requirements as specified in Appendix 4 [Quality Assurance] to the Employer's Requirements;
 - (2) a system of issuing documents to ensure that pertinent documents are issued to all appropriate locations; and
 - (3) a document change or re-issue system to ensure that only the latest revision of a document can be used:
 - (a) contract number;
 - (b) discipline;
 - (c) submission reference number; and
 - (d) revision indicator.
- 1.2 Project records will eventually be used by the Employer to manage, operate and maintain the Works after the completion of the Contract under construction and for future reference.
- 1.3 The Contractor shall submit the documents as required by the Engineer as project records in full and on time. The Engineer shall determine the adequacy of the project records.

2. Submission and Response Procedure

- 2.1 Except where specific procedures are given for certain items, all submissions shall be submitted and reviewed according to the procedure laid down in the following clauses.
- 2.2 Each submission shall be accompanied by a brief introduction to explain which subsystem - part of the Works to which the submission refers, listing the documents enclosed with the submission, and describing in outline how all relevant requirements of the Employer's Requirements are achieved by the proposals.

- 2.3 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, Technical Design, etc.), and the signature of the Contractor's Representative to confirm that, in the opinion of the Contractor, the submission:
- (1) complies with all relevant requirements of the Employer's Requirements;
 - (2) conforms to all interface requirements;
 - (3) contains, or is based on auditable and proven or verified calculations or design criteria;
 - (4) has been properly reviewed by the Contractor, according to the Contractor's Project Quality Assurance Plan, to confirm its completeness, accuracy, adequacy and validity;
 - (5) has taken account of all requirements for consent / approval by statutory bodies or similar organizations, and that where required, such consent / approvals have been granted; and
 - (6) contains six (6) properly signed copies of the "Design Certificate", if necessary, as required in Appendix 4 [Quality Assurance] and Appendix 10 [Requirements for Design] to the Employer's Requirements.
 - (7) In case of new products / technologies, certification from the client railway of the organized railway system certifying its established and proven record under similar atmospheric and operational conditions.
- 2.4 The Engineer's response to the submission will be made within 21 calendar days of receipt of the submission,.
- 2.5 Throughout the each Design Stage, the Contractor 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 programmed 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.
- 2.6 The Contractor shall record 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.
- 2.7 If, in the Engineer's opinion, following receipt of a submission there is benefit to be gained from a meeting with the Contractor to clarify or

discuss any of the contents of the submission, he will notify the Contractor accordingly with not less than 5 days advance notice, and the Contractor shall attend at the time and place appointed by the Engineer.

- 2.8 In case of use of new products / technologies (other than RDSO design), requiring evaluation and validation of RDSO, the Engineer's response to the submissions by the Contractor will be made within 126 days (18 weeks) from the date of submission of complete relevant data / certification by the Contractor.

3. Engineer's Response

- 3.1 The Engineer will respond in one of the following three ways:

- (1) Notice of No Objection
- (2) Notice of Objection (With "A" Comments)
- (3) Notice of No Objection with Comments

- 3.2 Definition of Engineer's response:

- (1) "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 programmed work.
- (2) "Notice of Objection (With "A" Comments)": 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 shall issue a "Notice of Objection" (NOO) with type "A" comments. 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 programmed 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.
- (3) "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" (NONOC) with Comments. 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 programmed work subject to the inclusion of amendments necessary to address the comments.

- (4) Proof Consultant: Engineer may appoint a proof consultant to verify the design parameters considered by the contractor and also to validate the structural design of permanent works of contractor. It will be the responsibility of the Engineer to coordinate with the proof consultant.

* End of Appendix 9 *

EMPLOYER'S REQUIREMENTS

APPENDIX 10

REQUIREMENTS FOR DESIGN

1. Contents of Design Stage Submissions

1.1 General

There are Four design submissions viz. Inception Report, Technical Design, Construction Design and As-Built Document;

1.2 Inception Report

1.2.1 Based on the Contractor's Bid Design and Technical proposals during the bidding process, the Inception Report submission shall provide reports, drawings and documents for the purpose of review of the Employer's Requirements and preparation of the Technical Design to be developed in the Design Phase. The Inception Report shall be sufficiently detailed to show the main elements of the design and to include the items necessary to develop the design. The Inception Report submission will generally consist of the following:

- (1) the first 3 month's Rolling Programme as described in Appendix 3 [Project Programme Requirements] to the Employer's Requirements;
- (2) the project organization plan as described in Employer's Requirements – Design;
- (3) Temporary facility and utility programme.
- (4) a review of Right of Way (ROW) indicated in the Alignment Drawing;
- (5) a validation of the Alignment indicated in the Alignment Drawing;
- (6) a validation of the Rail track Formation (embankment) for the approaches to the bridges as indicated in the Reference Drawings;
- (7) a review of the bridge structures indicated in the Reference Drawings;
- (8) preliminary General Arrangement Drawing of bridge;
- (9) proposed equipment to be used for construction of sub-structure, super-structure, embankment and their mobilization schedule;
- (10) proposed software's to be used for design activities;
- (11) the preliminary Design Manual including the identification of design codes and standards as per Employer's Requirements;
- (12) Three original sets of the full edition of the publication / technical standards including Codes & Standards and other documents that the Contractor proposes to use for the Work

- (13) Design Submission Programme as per of Appendix 3 [Project Programme Requirements] and Appendix 8 [Requirements on Documents and Drawings] to the Employer's Requirements;
- (14) the preliminary Construction Method Statement;
- (15) Contractor's Quality Assurance Plan;
- (16) the Project Quality Assurance Plan.
 - a) Design Quality Assurance Plan
 - b) Site Quality Plan including on site Inspection and test Provisions.
- (17) proposed on site and off site testing arrangements for testing and quality of control of input materials;
- (18) Initial Procurement Programme for Manufactured Items (As per Appendix 3 [Project Programme Requirements] to Employer's Requirements
- (19) Master list of technical documents, which Contractor proposes to prepare and submit to the Engineer for his consent
- (20) Design Warrantee Format as per of Employer's Requirement – Design.

1.2.2 Design Manual

- (1) The Design Manual shall include but not limited to
 - (a) Design Basis Report (DBR)
 - (b) All design requirements including 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.
 - (c) Reference 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 Works as a comprehensive reference text and efficient working document.

- (2) The initial submission of the Design Manual shall be with the Inception Report, and further developed during the Design Phase.

1.3 Technical Design

- 1.3.1 Based on the Contractor's Bid Design and Technical proposals during the bidding process and supplemented by the Inception Report, the design of the Works shall be developed to the Technical Design by the Contractor. The developed and updated drawings and documents shall be submitted in

the Technical Design Submission.

- 1.3.2 The Technical Design Submission may be divided into multiple submissions as consented by the Engineer. The divided Technical Design Submission shall be integrated and compiled into one package at the time when the final submission is made and the compiled documents and drawings shall be submitted to the Engineer for consent and issue of Notice of No Objection and will be collectively referred to as the Technical Design.
- 1.3.3 The Technical Design Submission shall be a coherent and complete set of documents, properly consolidated and indexed and shall fully describe the proposed Technical Design. In particular, and where appropriate, it shall generally define but not limited to:
- (1) the dimensions of all major features, structural elements and members;
 - (2) all materials;
 - (3) potential forces and movements due to all possible loadings and actions on the structures, and their accommodation;
 - (4) the location and nature of all relevant joints and connections and details thereof;
 - (5) standard details;
 - (6) location, geometry and setting-out of all main elements and features;
 - (7) provisions and proposals for construction interfacing with the Other Contractors and Interfacing parties;
 - (8) uncharted utilities to be diverted (if any) along with all the documentation for their physical diversion as per the consented procedure; and
 - (9) Traffic Management.
- 1.3.4 In the Technical Design Submissions of the Design Submission Programme, the Contractor shall not, without the prior written consent of the Engineer:
- (1) revise or alter the content of any document and / or drawings in the design package which have been submitted to and approved by the Engineer. The Technical design shall be developed based upon the previous submission(s) unless otherwise the Engineer consents the change in the contents;
 - (2) reduce the periods provided for review by the Engineer of any submission of design, design data and materials as set out in the Design Submission Programme;
 - (3) revise the sequence of submissions of design, design data and material as shown in the Design Submission Programme.
 - (4) Any non-conformity to the design development and the Design Submission Programme as stated in the above requirements shall

have no effect whatsoever under the Contract.

1.3.5 The Technical Design Submission shall include, where appropriate and without limitation, the following documents:

(1) **Design Manual**

The Design Manual initially submitted in the Inception Report shall be developed during the Design Phase and shall be included in the Technical Design submission.

(2) **Specifications**– As described in the specifications of Bid Documents.

(3) **Technical Drawings**

The Technical Drawings based on the technical design shall be in part a set of drawings which describe integral feature of the Permanent Works strictly in compliance with the Employer's Requirements including, but not limited to, general arrangements, layouts of structures, all materials with associated fittings, all machinery and equipment with associated fittings and drawings which supplement the above. The Contractor shall submit including but not limited to the following drawings as a Technical Drawings submission:

- (a) the validated Alignment Plan and Profile Drawings;
- (b) General arrangement drawing of the bridge and the detailed drawing of components.
- (c) reinforcement detailed drawing of structural concrete members;
- (d) location plan, geometry, and setting out drawings;
- (e) the Cross Section Alignment Drawings (for approaches to the bridge) and the Railtrack Formation Plan and Profile Drawings;
- (f) the Drainage System Drawings; and
- (g) the Combined Services Drawings (CSD).

(4) **Technical Design Report**

- a) The report shall be a narrative report describing the Design Submission including its extent and relationship with other submissions. It shall include, a guide to all relevant technical data used and outline the design approach, standards used, design calculations & analysis of a particular component.
- b) Structural analysis report including loading diagram and input & output files of the approved software used for the design of that particular component.

(5) **Testing Report**

Details of proposals for testing procedures for all relevant

elements contained in the Works as described in the Appendix 7 [Contractor's Coordination with Others] to the Employer's Requirements.

1.3.6 The Technical Design Submission shall also include generally following documents, which may be considered by the Engineer in his review. 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 Works.

(1) **Survey Report**

A report on all survey works undertaken by the Contractor including checks on mapping, survey stations, co-ordinates and setting out, traverse survey, topographical survey, centre line survey etc. Updated topographical and survey drawings shall also be included after validation of the data provided by the Employer and additional survey carried out, as considered necessary, by the Contractor. It shall include but not limited to the followings:

a) **DFC Benchmark Establishing Report**

A report summarizing the results of established horizontal and vertical control system at Site, a set of DFC Bench Marks based on GTS Bench Marks and Differential Global Positioning System (DGPS)

b) **Geotechnical Interpretative Report on Structure Foundation**

A report including site and laboratory investigation results covering the geotechnical interpretation of the investigation with sufficient details to confirm and justify parameters used in the geotechnical designs. The report shall include the full logs and descriptions of confirmatory / additional exploratory drillings carried out by the Contractor.

c) **Geotechnical Interpretative Report on Railtrack Formation (Embankment)**

A report including site and laboratory investigation results covering the geotechnical interpretation of the investigations with sufficient details to confirm and justify parameters used in the geotechnical designs. The report shall include the full logs and descriptions of confirmatory/ additional exploratory drillings, if necessary, and other tests carried out by the Contractor.

d) **Hydrological Report.**

The Report shall include the Contractor's application of the historic data of daily maximum temperature, daily rainfall, daily maximum wind velocity, water level, geographic location, etc. to his design in terms of design policy and criteria.

(2) **Slope Stability Analysis Report**

A report prepared to confirm the stability of any embankment higher than 6.0 meters. The Contractor shall perform the Slope Stability Analysis based on the dimensions of the objective embankment and proposed materials which are most likely utilized at the objective sites to ensure that the embankment designed by the Contractor is stable enough in any case. The Contractor shall include surveys and investigations necessary for this report as part of the Geotechnical Investigation Plan and fully utilize the data in this analysis.

(3) **Temporary Works Design Report**

A report which provides sufficient information on the design of the Temporary Works, including but not limited to construction depots, site offices, borrow areas and their managements, access roads and temporary roads, location of batching plants, labour camps, island / cofferdam / bunds / river diversions, concrete form works etc. and other temporary construction works (as detailed in Appendix 6 [Temporary Works] to the Employer's Requirements) to allow the Engineer to assess their effects on the Works and to enable these to be taken into account in the review of the technical design.

(4) **Construction Method Statement**

A report which provides sufficient information on the methods of construction of the Works and Contractor's resources applied to his construction including labour deployment, accessibility, availability and deployment of construction equipment and installation/ execution of Temporary Works to allow the Engineer to assess their effects on the Works and to check and monitor the quality and workmanship of the Works. The proposed methods shall have no adverse effects on partially completed works during the construction stage and shall ensure that the Works are statically and if appropriate aerodynamically stable.

(5) **Interface Report on Other Contractors**

The Report shall detail coordination and cooperation with the Other Contractors and specifically demonstrate provisions for them, indicating arrangements for accesses, fixings, casting-in, openings, supports, decks, , trenches as appropriate etc.

The Contractor shall refer the prepared Combined Services Drawings (CSD) with narrative clarifications.

(6) **Uncharted Utility Report**

A report giving details of the trial trenching and arrangements and working methods in respect of the existing uncharted utilities, if any, including proposed protection measures, diversions and reinstatements

(7) Report on use of the Work Areas: a report updating the

proposals from those contained in the Contractor's Proposals for the use of the Work Areas and their reinstatement detailing the access facilities.

- (8) Signage requirements and their design.
- (9) Manufacturing / Fabrication Management and Quality assurance plan in respect of manufactured material / fabricated components and shall contain all the data as specified in Employer's Requirements
- (10) Comprehensive Testing Programme as per Employer's Requirements
- (11) Inspection Programme and Testing Proposals defining quality assurance and controls.
- (12) Traffic and other services affected and their handling scheme / proposal during construction.
- (13) Erection methods and launching schemes / Box Girder Casting scheme:
The report shall contain all the design calculations and drawings proving the workability and safety of the scheme, documents / information showing the use of the proposed scheme on a previous similar project.
- (14) Casting yard/ fabrication yard Facility Report spans:
A report on the various plant, machinery for casting of spans/ fabrication / handling, Concreting, Pre –stressing including the stage inspections, checks, and quality assurance system to be adopted.

1.4 Construction Design

- 1.4.1 The Construction Design shall be the latest revisions of the documents and drawings comprised in the Technical Design, taking account of agreed responses to any comments appended to Notices of No Objection. The Construction Design shall also include the latest addition to the documents and drawings in the Technical Design to facilitate the construction execution.
- 1.4.2 The Construction Design and Construction Design Package shall meet all the requirements as specified Employer's Requirements – Design.
- 1.4.3 The Construction Design Package shall be a coherent and complete set of documents in line with the Technical Design which has received "Notice of No Objection" from the Engineer, properly consolidated and indexed and shall fully describe the proposed Construction Design.

1.4.4 Contents of Construction Design Package

The Construction Design Package is a set of the documents and drawings which is defined as the above mentioned Construction Design. The Construction Design Package shall be fully checked by the Chief Design Engineer in the Contractor's Design Team and by the Contractor's Representative in the Contractor's Construction Team and submitted by the Contractor to the Engineer for consent as described in Appendix 4 [Quality Assurance] to the Employer's Requirements.

The contents of construction design package are listed below:

- i) Working Drawings As- described in the Employer's Requirements - Design and as further detailed below.
 - a. the Shop Drawings: these are supplementary detail drawings which expand and explain the information shown on the Construction Technical Drawings;
 - b. the Fabrication Drawings: These are supplementary drawings of specific elements of the works shown on the Construction Technical Drawings and Shop Drawings for the purpose of manufacture or fabrication of those elements;
 - c. the Temporary Works Drawings including public utilities, traffic and erection drawings;
 - d. the Re-bar Drawings including Cutting/Bending and Reference Schedules; and
 - e. All other drawings as deemed necessary by the contractor for the accurate and safe construction of the Works in accordance with the Contract.
- (v) Construction Practicing Documents as described in Employer's Requirements - Design and as further detailed below.

1.5 As-Built Documents

1.5.1 The As-Built Documents shall contain the As-Built Drawings and Documents, the Operation and Maintenance (O&M) Manuals and all other records included in the list below:

- (1) As-Built Drawings and Documents showing all changes from the Construction Technical Drawings of the Permanent Works. The as-built information shall include, but not be limited to the following:
 - (a) Changes to dimension and detail from the Construction Technical Drawings;
 - (b) Components left in place, including temporary support systems, concrete outside of neat lines of permanent structures, and other such matters;
 - (c) Depths of all elements of foundations in relation to survey datum;
 - (d) Horizontal and vertical locations of public utilities related to the Works, including diverted public utilities and public utilities left in-place (if any);
 - (e) Location of appurtenances and public utilities concealed within a structure (if any); and
 - (f) Changes due to variation orders.

All As-Built Drawings and Documents shall be signed off by the Contractor's respective Construction Site Incharge and the Contractor's Authorised Representative.

- (2) Records data, as-built records, damage or settlement surveys, property surveys and similar final record information;
- (3) Compiled project photographs as defined as Progress Photographs;
- (4) Geotechnical data and records;
- (5) As-built survey data and drawings as specified;
- (6) Operation and Maintenance (O&M) Manuals
- (7) Official letters regarding the design change acceptance;
- (8) Certificates of acceptance between the Contractor and the Engineer;
- (9) A construction diary; and
- (10) Design Certificate (as specified in Appendix 4 [Quality Assurance] to the Employer's Requirements for all Internal Authorizations carried out.

2. Design Approval Procedure.

- 2.1 The Contractor shall submit complete documents and information pertaining to the methods of manufacture, installation and construction which the Contractor proposes to adopt or use, (and if applicable such calculations of stresses, strains and deflections and the like that could arise in the Works or to other Works comprising the project or any parts thereof during installation from the use of such methods). The Engineer shall then check to see whether, if such methods are adhered to, the Works can be executed in accordance with the Contract and without detriment to the Works (when completed) and to other works comprising the Project and in a manner which minimizes disruption to road and pedestrian traffic.
- 2.2 The Engineer shall inform the Contractor in writing within 21 days after receipt of the above information:
 - (1) that the Contractor's proposed methods of manufacture, installation and construction have the consent of the Engineer; or
 - (2) in what respects, in the opinion of the Engineer, the Contractor's proposed methods of manufacture, installation and construction:
 - (a) fail to comply with the Employer's Requirements and/or the Definite Design and/or the Final Design;
 - (b) would be detrimental to the Works and/or to the other Works comprising the project;
 - (c) do not comply with the other requirements of the Contract; or
 - (d) as to the further documents or information which are required to enable the Engineer to properly assess the proposed methods of manufacture, installation and construction.

- 2.3 In the event that the Engineer does not give his consent, the Contractor shall take such steps or make such changes in the said methods or supply such further documents or information as may be necessary to meet the Engineer's requirements and to obtain his consent. The Contractor shall not change the methods of manufacture, installation and construction which have received the Engineer's consent without further review and consent in writing of the Engineer.
- 2.4 Before communicating the Notice of No Objection to the Contractor, the Engineer shall seek the approval of the Employer for items mentioned in sub-clause 3.1 of GCC/PCC.
- 2.5 Notwithstanding the foregoing provisions or that certain of the Contractor's proposed methods of manufacture, installation and construction may be the subject of the consent of the Engineer, the Contractor shall not be relieved of any liability or obligation under the Contract.

3. Design Changes and Variation Procedure

3.1 Design Changes

In the event that the Contractor identified a problem or other cause for a change in his design after the Construction Design has been submitted and consented by the issue of Notice of No Objection during the Construction Phase, then the Contractor shall propose in writing a solution and procedure either a Field Change Notice (FCN), a Design Change Notice (DCN) or a Variation Notice (VN) depending on the severity of the change within the Contract.

A major design change shall warrant a Design Change Notice and shall go through the full process of the Design Review Procedure as described in the Employer's Requirements – Design and its Appendix 4 [Quality Assurance] to the Employer's Requirements. Whenever site changes may be agreed at site level by producing a Field Change Notice, the Engineer shall decide whether the proposal shall be DCN or FCN.

* End of Appendix 10 *

EMPLOYER'S REQUIREMENTS

APPENDIX 11

REQUIREMENTS FOR CONSTRUCTION

1. The Site

As described in Appendix 1 [Alignment of Trackway and Work Areas] to the Employer's Requirements, the Work Areas comprises the Site and areas for the Temporary Works within and outside the Right Of Way (ROW). In this appendix further clarification is made with respect to the construction execution.

1.1 Use of the Site and Work Areas

- (1) The Site or Contractor's Temporary Facilities including Contractor's equipment shall not be used by the Contractor for any purposes other than for carrying out the Permanent or Temporary Works or Contractor's Temporary Facilities except that, with the consent of the Engineer in writing.
- (2) The Employer shall hand over the Site to the Contractor free of encumbrances as per the agreed schedule. Once the Site is handed over to the Contractor, its integrity, safety and security etc. shall be the responsibility of the Contractor until the issue of Taking Over Certificate.
- (3) Following the handover of the railway envelope (as defined in the Employer's Requirement – General), the Employer shall control the railway envelope and the Contractor shall be responsible for all matters relating to its integrity, safety and security etc. until the issue of Taking Over Certificate unless otherwise directed by the Engineer.
- (4) The Borrow Pits and Quarries shall not be located within the Right of Way (ROW) and its adjacent locations and the locations of those shall be subject to consent by the Engineer taking into account quality of the materials and traffic conditions to the site and other prevailing conditions.
- (5) The location and size of material processing plants such as aggregate mixing and concrete batcher plants and each stockpile of materials, including excavated materials within the ROW shall be subject to consent by the Engineer. No rock crushing plant shall be installed in the urban areas as decided by the Engineer. Stockpiles shall be maintained at all times in a stable condition.
- (6) Entry to and exit from the Site shall be controlled in line with the Contractor's Site Safety Plan

- (7) The Contractor shall perform sufficient investigation in these Temporary Facilities to carry out the Works in a most efficient manner with the best quality assurance and summarize it into the Temporary Works Report and other required documents and drawings during the Technical Design development.

1.2 Access to the Site

- (1) The Contractor shall make its own arrangements, subject to the consent of the Engineer, for access required to the Site. The Contractor shall negotiate with the land owners or other appropriate government agencies to seek temporary occupation of land and seeking necessary permission for construction of temporary access roads.
- (2) The existing access roads may be used by the Contractor for transport of his men material and equipment. However, these shall be maintained by the Contractor to satisfactory level to allow uninterrupted flow of traffic including the public traffic otherwise using these roads.
- (3) In addition, the Contractor shall ensure that access to every portion of the Site is continuously available to the Employer and the Engineer and other entities authorized by the Employer / Engineer.

1.3 Access / Egress through Work Areas

The Contractor shall be responsible for ensuring that any access or egress through the Work Areas boundaries are controlled such that no disturbance to residents or damage to public or private property occur as a result of the use of such access or egress by his employees and Sub-Contractors.

1.4 Survey of the Work Areas

In addition to the validation of the data provided by the Employer and additional survey, as considered necessary by the Contractor, to check the Right of Way (ROW) the Contractor shall carry out survey to identify any encumbrance infringing the Permanent Works and shall advise the Engineer / Employer accordingly.

The survey shall be carried out before the site clearance wherever possible and in any case prior to the commencement of the Work in any Work Areas. The survey shall be carried out by the Contractor and agreed with the Engineer.

1.5 Temporary Fencing and Signboards

- (1) The Contractor shall erect hoardings, temporary fences and/or gates around the Work Areas specifically near the populated areas to prevent entry by unauthorized persons to his Work Areas as long as they are deemed to be necessary. The Contractor shall issue all his personnel including the personnel working with Sub- contractors, identity cards for entering the Work Areas. Necessary arrangements

to ensure that no unauthorized person enters the Work Areas and shall be made by the Contractor. Use of hoardings / temporary fencing / signboards etc. shall not be permitted for any kind of advertisement / publicity etc., without the consent of the Employer.

- (2) The Contractor shall submit proposals for the fencing of the Work Areas to the Engineer for review.
- (3) Project signboards shall be erected at the Site 28 days prior to the commencement of the construction activities of the relevant Work Area. The types, sizes and locations of project signboards shall be agreed with the Engineer before manufacture and erection of the signboards. Other advertising signs shall not be erected on the Site.
- (4) The consent of the Engineer shall be obtained before hoarding, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in positions after the issue of Taking-Over Certificate shall be repaired and repainted as instructed by the Engineer.
- (5) Hoardings, fences, gates and signs shall be maintained in good order by the Contractor until issue of Taking-Over Certificate.
- (6) Hoarding/fencing can be reused after removing from one place to other locations / sites provided they are in good condition and consented by the Engineer.
- (7) Damage/worn-out fencing/hoarding shall be replaced by the Contractor. Engineer's decision regarding need for replacement shall be final and binding and if no action is taken by Contractor the same shall be got done by the Engineer and cost of any repairs will be deducted by the Engineer from any payment due to the Contractor.

1.6 Clearance of the Site

All Temporary Works shall be removed by the Contractor upon issue of the Taking Over Certificate except the Temporary Facilities with necessary utility services required for completing his obligations, after the issue of Taking-Over Certificate unless otherwise directed by the Engineer . The Contractor shall dismantle and remove all Temporary Works and the land in which the Temporary Works have been located shall be properly treated to complete the Works as shown in the Construction Drawings.

2. Care of the Works

2.1 General

- (1) Unless otherwise permitted by the Engineer all works shall be carried out in dry conditions.
- (2) The Works, including materials for use in the Works, shall be protected from damage due to water. Water on the Site and water entering the Site shall be promptly removed by temporary drainage or pumping system or by other methods capable of keeping the Works

free of water.

- (3) The discharge points of the temporary drainage / pumping systems shall be as per the consent of the Engineer. The Contractor shall make all arrangements with and obtain the necessary consent / approval from the relevant authorities for discharging water to drains and watercourses etc. meeting all the requirements as described. The relevant work shall not be commenced until the consented arrangements for disposal of the water have been implemented.
- (4) The methods to be used for keeping the Works free of water shall be carefully chosen so that any settlement of or damage to the Works and / or adjacent existing structures should not occur.

2.2 Protection of the Works from Weather

- (1) Works shall not be carried out in weather conditions that may adversely affect the Works unless proper protection is provided to the satisfaction of the Engineer.
- (2) Permanent Works, including materials for such Works, shall be protected from exposures of weather conditions that may adversely affect such Permanent Works or materials.

3. Handling of Uncharted Public Utility

- 3.1 Major and majority of existing public utilities will have been relocated and/or diverted by the relevant public utility agencies at the Employer's cost before the Contractor's possession of the Site.
- 3.2 For the uncharted public utilities at the Site, the Contractor shall ascertain their actual location / condition by trial trenches, cable detection by cable locators, etc. as specified in Employer's Requirements – Construction. The Contractor shall be responsible for all the trial trenches, cable detection and associated works.
- 3.3 Any other public utility which interferes the Works and is required to be relocated and/or diverted and which the Contractor interprets as is not inclusive in the Contract, the Contractor shall notify the Engineer of the details of the public utility. The Contractor shall prepare schedule of such utilities indicating
 - (a) utilities requiring diversion including the proposed diversion plan, and
 - (b) utilities that will remain in place and require use of specific construction methods to complete the work including adequate supporting installations for the utilities during construction.

Upon consent by the Engineer and approval by the Employer, the Contractor shall carry out the diversion of such utilities under variation.

- 3.4 In case that no rate is stipulated in the Contract, the Contractor shall propose a unit rate of the work with enclosure of a price quotation prepared by the relevant public utility company. Such cost will be settled under

Variation Clause of the General Conditions of the Bid Documents.

- 3.5 For temporary and permanent relocation / diversion work as referred above, the work shall be carried out by the Contractor duly consented by the Engineer and approved by the Employer under the overall guidance of the respective public utility company and the costs thereof shall be paid under the Variation Order as described above.
- 3.6 The Contractor shall take in to account the likely time to be taken for diversion of such uncharted utilities, in the overall construction programme. The Contractor shall inform the Engineer about his programme of works relating to utilities diversion and shall take adequate measures to ensure that these utilities diversion works do not affect the Contractual Construction Programme as consented by the Engineer and as described in Employer's Requirements – General and Appendix 3 [Project Programme Requirements] to the Employer's Requirements.
- 3.7 Alternatively, the Employer may decide to carry out the works relating to temporary relocation or permanent diversion of utilities through its own or any other agency.
- 3.8 The Contractor shall liaise and coordinate with the relevant public utilities companies to ensure that all the above-mentioned works of relocation/diversion are executed satisfactorily.
- 3.9 Throughout the execution of the Contract the Contractor shall comply in all respects with the requirements of all the public utility companies and authorities concerned on the handling, protection and maintenance of the public utility facilities.
- 3.10 Records of the existing public utilities encountered shall be kept by the Contractor on the Site and a copy provided for the Engineer and the Employer. The records shall contain the following details:
- (a) location plan of public utility
 - (b) date on which the public utilities were encountered;
 - (c) nature and sizes of the public utilities;
 - (d) owner of the public utilities
 - (e) condition of public utility;
 - (f) temporary or permanent supports provided; and
 - (g) diversions made –temporary or permanent.
- 3.11 The Contractor shall include details (location, plan, size, ownership and materials) of all such utilities as a part of the As Built Documents/Drawings.

4. Other Interference

4.1 Alternative Access

Alternative access shall be provided by the Contractor at his own cost to all public or private premises when interference with the existing access occurs to enable the Works to be carried out. The arrangements for the alternative access shall be as agreed by the Engineer and the concerned agencies.

The permanent access shall be reinstated as soon as practicable after the Works are complete and the alternative access shall be removed and reinstated immediately as soon as it is no longer required. Proper signage and guidance shall be provided for the traffic / users regarding diversions.

4.2 Trees

Materials, including excavated materials, shall not be banked around trees. Trees shall be protected from damages at all times by the methods consented to by the Engineer.

4.3 Removal of Trees, Graves and Other Obstructions

If any trees, graves and other obstructions are required to be removed in order to execute the Works and such removal has not already been arranged for, the Contractor shall draw the Engineer's attention to them in good time to make necessary arrangement for authorizations for such removal. The Contractor shall not itself remove them unless the Engineer has given consent.

4.4 Protection of the Adjacent Structures and Works

The Contractor shall take all necessary precautions to protect the existing structures or works being carried out by others adjacent to and, for the time being, within the Site from the effects of vibrations, undermining and any other earth movements or the diversion of water flow arising from its work.

5. Use of Roads

5.1 General:

Measures shall be taken to prevent the excavated materials, silt or debris from entering gullies on roads and footpaths; entry of water to gullies shall not be obstructed.

5.2 Traffic Management Plan

The Contractor shall develop a detailed Traffic Management Plan for the Works under the Contract. The purpose is to develop a Traffic Management Plan to cope with the traffic disruption as a result of construction activities by identifying strategies for traffic management on the roads and neighborhoods impacted by the construction activities. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract.

The basis for the Plan shall take into consideration four principles:

- (1) to minimize the inconvenience of road users and the interruption to surface traffic through the area impacted by the construction activities;

- (2) to ensure the safety of road users in the impacted area;
- (3) to facilitate access to the Work Areas, and to maintain scheduled construction progress; and
- (4) to ensure traffic safety at each Work Area.

Wherever applicable, the Contractor shall obtain necessary consent / approval from the transport authorities and police department for temporary traffic arrangement and control on public roads.

5.3 Reinstatement of Public Roads and foot paths

- (1) Temporary diversions, pedestrian access and lighting, signage's, guarding and traffic control equipment, if any, shall be removed immediately when these are no longer required for the construction activities.
- (2) Roads, footpaths and other items affected by temporary traffic arrangements and control shall be reinstated to the same condition as existed before the work started or as consented by the Engineer immediately after the relevant work is complete or at other times permitted by the Engineer.
- (3) Wherever required, the Contractor shall submit his plan for reinstatement to relevant authorities and obtain their prior consent / approval to carry out the work

6. Security

- (1) The Contractor shall be responsible for the security of the Site for the full time till the issue of Taking Over Certificate except for specific cases of railway envelope after it is handed over to the Employer and / or as directed by the Engineer. The Contractor shall set up and operate a system whereby only those persons entitled to be involved in the construction activities in the Contract could enter the Work Areas. For the Site located near the populated areas, the Contractor shall with the consent of Engineer provide the specific points only at which entry through the security fence can be effected, and shall provide gates and barriers at such points of entry and maintain a twenty four (24) hours security guard. The Contractor shall also arrange for such other security personnel and patrols elsewhere as may be necessary to maintain security.
- (2) The Contractor shall maintain all site boundary fences, wherever provided, in good condition, and shall so arrange site boundary fences and security measures that the drainage arrangement is not affected. Notices shall be displayed at intervals around the Work Areas to warn the public of the dangers of entering the Work Areas.
- (3) During the progress of the Works the Contractor shall maintain such additional security patrols over the Works Areas as may be necessary to protect his own and his sub-contractor's facilities and

equipment as well as the Works. In addition, the Contractor shall coordinate and plans the security of both the Works under the Contract and works of the Other Contractors including Interfacing Parties requiring access to the Site.

- (4) In order to operate such a security system it will be necessary to institute the issue of unique passes to personnel and vehicles entitled to be on the Work Areas and a system of separately identifiable according to the shifts being worked on the Work Areas. The Contractor shall at the outset determine, together with the Engineer, a system including the design of passes to suit the requirements of the foregoing and to suit the methods of activities to be adopted by the Contractor for these purposes. The Contractor shall at all times ensure that the Engineer has an up to date list of all persons entitled to be on each Work Area at any time. The Contractor shall also introduce a system for issue of passes to any outsider or person/vehicles belonging to agencies other than Employer/ Engineer who may have to visit each of the Work Areas in connection with the Works.
- (5) The Contractor shall liaise with the Other Contractors and the Interfacing Parties responsible for security of the adjacent areas and ensures that coordinated security procedures are operated, in particular in respect of vehicles permitted to pass through the Site and/or the adjacent sites.

7. Testing of Works

7.1 Testing

- (1) The Contractor shall submit the Project Quality Assurance Plan and its sub-plans as described in Appendix 4 [Quality Assurance] to the Employer's Requirements. According to the plans, the Contractor shall implement tests which are listed, but not limited to, in the Appendix 4 [Quality Assurance] to the Employer's Requirements.
- (2) The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests may be carried out in the Contractor's laboratory, or tests may be carried out in other laboratories if consented by the Engineer:
- (3) All site specific and in-situ tests shall be done in the presence of the Engineer. The Employer may also be present if he so desires.
- (4) Equipment, apparatus and materials for all on site, off site and in-situ tests including laboratory compliance tests to be carried out by the Contractor and / or by the Engineer shall be provided by the Contractor. The equipment and apparatus shall be maintained by the Contractor and shall be calibrated before the testing starts, at regular intervals as specified and as directed 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.
- (5) 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 complying with the provisions which are submitted to the Engineer for consent prior to the testing.

- (6) Attendance on tests, including that by the Engineer, the Contractor and the designer shall be as laid down in the Quality Assurance Procedures.

7.2 Batches, Samples and Specimens

- (1) 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 to be delivered to the Site at the same time, then the material delivered to the Site over a period as consented by the Engineer 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 this period.
- (2) 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.
- (3) A specimen is the portion of a sample that is to be tested.

7.3 Samples for Testing

- (1) Samples shall be of sufficient size and in accordance with relevant Standards to carry out all specified tests.
- (2) 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.
- (3) 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.
- (4) 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 by the Contractor and as instructed by the Engineer.
- (5) Samples that have been tested may be incorporated in the Permanent Works provided that:
 - (a) the sample complies with the specified requirements
 - (b) the sample is not damaged; and
 - (c) the sample is not required to be retained under any other provision of the Contract; and

- (d) consent of the Engineer is obtained
- (6) Additional samples shall be provided for testing if in the opinion of the Engineer:
 - (a) material previously tested no longer complies with the specified requirements;
 - or
 - (b) material has been handled or stored in such a manner that it does not comply with the specified requirements.

7.4 Compliance of Batch

- (1) The results of tests on samples or specimens shall be considered to represent the whole batch from which the sample was taken.
- (2) A batch shall be considered as complying with the specified requirements for a material if the results of specific tests for the specified properties comply with the specified requirements for the properties.
- (3) 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 compliance criteria for the same shall be mutually decided by the Engineer and the Contractor.
- (4) Cost of all such tests shall be borne by the Contractor.

7.5 Records of Tests

- (1) 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:
 - (a) material or part of 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;
 - (g) size and description of samples and specimens;
 - (h) method of sampling;
 - (i) properties tested;

- (j) method of testing;
 - (k) 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 and / or as required by the Engineer.
- (2) Reports of tests shall be signed by the Contractor's site representative, or by any other representative authorized by the Contractor.
- (3) If requested, records of tests carried out by the Employer's staff or by the Engineer shall be given to the Contractor.

8. Records

8.1 Records Produced By The Contractor

All the documents produced by the Contractor including drawings of site layouts, Temporary Works etc. and the number of copies to be submitted to the Engineer shall be as per the requirements and standards specified in the Appendix 5 [CAD and Document Standards] to the Employer's Requirements.

8.2 Progress Photographs

- (1) The Contractor shall provide monthly progress photographs, 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. Three sets of photographs shall be provided on CD-ROM format with Three sets of color prints of 16 cm x 12 cm size as being consistent to the General Conditions of the Bid Documents.
- (2) 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 Labels which shall give record of the location, a brief description of the progress recorded and the date on which the photograph was taken.
- (3) All photographs shall be taken by a skilled photographer whose name and experience shall be submitted to the Engineer for consent.
- (4) The Contractor shall ensure that no photography other than meeting the contractual obligation is permitted on the Site without the specific consent of the Employer.
- (5) The said photographs shall become the property of the Employer and shall not be reproduced for any purpose without the consent of the Employer.

8.3 Records of Wage Rates

The Contractor shall keep monthly records of the average, high and low wage rates for each trade/tradesman employed on the Site and records shall be made available to the Engineer during inspection.

9. Materials

- 9.1 Materials and goods for inclusion in the Permanent Works shall be new and complies with the relevant specifications.
- 9.2 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.
- 9.3 True copies of certificates duly certified by the manufacturer and the Contractor shall be submitted if the original certificates could not be obtained from the manufacturer.
- 9.4 Parts of materials which are to be assembled on the Site shall be marked to identify the different parts.
- 9.5 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.
- 9.6 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.
- 9.7 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.
- 9.8 All excavated material shall be utilized for the subsequent Works (to the extent meeting the quality requirements) and / or stockpiled in the designated stockpile areas for the use at later stages within the Contract. All the surplus serviceable material (if not required by the Employer and unserviceable material shall be carried away from the Site by the Contractor and disposed off in the manner consented by the Engineer.

10. Treatment and Disposal of Earthwork Material

- 10.1 The Contractor shall be responsible for the provision of all classes of earthworks material required for the Works, whether sourced from the excavations within the site or obtained from any other sources, which are located outside the Site, for which the Engineer has given the consent.
- 10.2 All excavated material from the Site is deemed to be the property of the Employer and shall not be disposed off unless it is not suitable or otherwise not required by the Employer. All the excavated materials to the extent it is

suitable and is required at Site shall be consumed in the Site. Should the removal of the excavated material from the Site is considered to be necessary, the Contractor shall make all necessary arrangements and a comprehensive plan and programme for the activity and submit it to the Engineer for his consent.

- 10.3 The disposal of surplus material, waste material, bentonite fluid and material contaminated with bentonite, debris of demolished existing structures or buildings and unsuitable material etc. shall be the full responsibility of the Contractor and these materials shall be treated and disposed of by the Contractor at an approved location(s) at his own cost. The disposal plan and programme shall be subject to consent by the Engineer.

11. Contractor's Labour Camp

11.1 General

- (1) The Contractor shall comply with all requirements as specified in [Safety, Health and Environment (SHE) Requirements] in specifications of the Bid Documents.

11.2 Provision of Labour Camp

- (1) The Contractor, shall, at his own expense, make adequate arrangements for the housing, supply of drinking water and provision of bathrooms, latrines and urinals, with adequate water supply, for his staff and workmen at the location authorized by Engineer.
- (2) No labour camp shall be allowed at Site without the consent of the Engineer / Employer or any unauthorized place. The Contractor shall prepare a detailed labour camp plan to obtain the consent from the Engineer/ Employer
- (3) The Contractor at his own cost shall maintain all camp sites in a clean and sanitary condition.
- (4) The Contractor shall obey all health and sanitary rules and regulations, and carry out at his cost all health and sanitary measures that may from time to time be prescribed by the Local/Medical Authorities and permit inspection of all health and sanitary arrangements at all times by the Employer, Engineer and the staff of the local municipality or other authorities concerned.
- (5) Should the Contractor fail to provide adequate health and sanitary arrangements these shall be provided by the Employer and the cost recovered from the Contractor.
- (6) The Contractor shall at his own cost, provide First Aid Stations as described in Appendix 6 [Temporary Works] to the Employer's Requirements and [Safety, Health and Environment (SHE) Requirements] in specifications of the Bid Documents.
- (7) The Contractor shall at his own cost, provide the following minimum

requirements for fire precautions at suitable locations complying with the requirements of applicable Codes:

(a) Portable Fire Extinguishers.

(b) Manual Fire Alarms.

- (8) The Contractor at his own cost shall provide necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.
- (9) The Contractor shall ensure that electrical installations are done and maintained by trained electricians and as per the applicable Codes and Standards

11.3 Camp Discipline

- (1) The Contractor shall take requisite precautions, and use his best endeavours to prevent any riotous or unlawful behaviour by or amongst his workmen, and others, employed directly or through sub-contractors.
- (2) These precautions shall be for the preservation of the peace and protection of the inhabitants and security property in the neighborhood of the Works.
- (3) In the event of the Employer requiring the maintenance of a Special Police Force at or in the vicinity of the site, during the tenure of the work, the expenses thereof shall be borne by the Contractor.
- (4) The sale of alcoholic drinks or other intoxicating drugs or beverages upon the work, in any labour camp, or in any of the buildings, encampments or tenements owned or occupied by, or within the control of, the Contractor or any of his employees directly or through sub-contractors employed on the work shall be strictly prohibited and the Contractor shall ensure strict compliance with this condition.
- (5) The Contractor shall also ensure that no labour or employees are permitted to work at the site in an intoxicated state or under the influence of drugs.
- (6) The Contractor shall remove from his camp such labour and their families, who refuse protective inoculation and vaccination when called upon to do so by the Employer / Engineer on the advice of the Medical Authority.
- (7) Should Cholera, Plague or any other infectious disease break out, the Contractor shall at his own cost burn the huts, bedding, clothes and other belongings of or used by the infected parties.
- (8) The Contractor shall promptly erect new accommodation on healthy sites as required by the Employer / Engineer, within the time specified by the Employer / Engineer, failing which the work may be done by the

Employer and the cost recovered from the Contractor.

11.4 Labour Accommodation

The Contractor shall provide living accommodation for all staff employed by himself or his subcontractors as per applicable rules and regulations.

11.5 Water Supply

- (1) The Contractor shall make his own arrangements to provide adequate potable water supply in the Camp.
- (2) Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, storage tanks of metal or other consented material shall be provided.
- (3) The Contractor shall also at his expense make arrangements for the provision and laying of water pipe lines from the existing mains wherever available.

11.6 Drainage

- (1) The Contractor shall provide efficient arrangements for draining away surface water so as to keep the camp neat and tidy.
- (2) Surface water shall be drained away from paths and roads and shall not be allowed to accumulate into ditches or ponds where mosquitoes can breed.

11.7 Sanitation

- (1) The Contractor shall make arrangements for conservancy and sanitation in the labour camps according to the rules and regulations of the Local Public Health and Medical Authorities.
- (2) The Contractor shall provide a sewage disposal system that is adequate for the number of residents in the camp, and which meets the norms of the local authorities.
- (3) The provision of the latrines and wash places shall be in accordance with [Safety, Health and Environment (SHE) Requirements] in specifications of the Bid Document and as per applicable Codes and Standards. However the layout shall be subject to consent by the Engineer.
- (4) The Contractor shall be responsible for maintaining all latrines and wash places on the Site in a clean and sanitary condition and for ensuring that they do not pose a nuisance or a health threat.
- (5) The Contractor shall also take such steps and make such provisions as may be necessary or directed by the Engineer to ensure that vermin, mosquito breeding etc. are at all times controlled.
- (6) The Contractor shall be responsible for providing water, electricity, communication, sewage disposal arrangements, drainage,

roads, paths and parking facilities etc. for all the site accommodations, structures and buildings in accordance with Appendix 6 [Temporary Works] to the Employer's Requirements and meeting all the requirements as specified in [Safety, Health and Environment (SHE) Requirements] in specifications of the Bid Documents. The Contractor shall also be responsible to obtain the necessary consent / approval from the relevant civic and utility authorities and shall maintain all such services that are necessary for satisfactory performance of the Works.

* End of Appendix 11 *

APPENDIX 12

PUBLICITY AND PUBLIC RELATIONS

1. General

The responsibilities of the Contractor or his sub-contractors of any tier with the specific written consent of the Engineer / approval of the Employer shall without limitation include:

- (1) Promote the project to the public and the parties concerned with a positive message;
- (2) Highlight how the project improves the environment and transport condition of the people and brings about the benefits to the people;
- (3) Ensure adequate transparency of the project to the public and key stakeholders;
- (4) Provide proper responses to comments, criticism and complaints during the construction stage;
- (5) Resolve issues and crises arising during the course of construction;
- (6) Communicate with the concerned parties and to show them the team is keen to prevent and/or mitigate any nuisance due to the construction of the Project at the earliest possible time;
- (7) Provide assistance and information to facilitate all PR activities as instructed by the Project Quality Plan and / or as required by the Employer / Engineer.

2. Publicity

The Contractor/Subcontractors shall not publish, present at seminars, forums or otherwise circulate alone or in conjunction with any other person, any articles, photographs or other materials relating to the Contract, the site, the works, the project or any part thereof, nor impart to the Press, or any radio or television network any information relating thereto, nor allow any representative of the media access to the site, Contractor's work areas, or off – site place of manufacture, or storage except with the permission, in writing, of the employer. The provisions of this subclause shall not exempt the Contractor from complying with any statutory provision in regard to the taking and publication of photographs.

* End of Appendix 12 *

APPENDIX 13

DELETED

APPENDIX 14

POSSESSION MANAGEMENT

1. General

- 1.1 The definition of the "Possession" to be applied herein is the Possession of part of the Works required by the Contractor from the Employer after Taking Over Certificate and during the Defects Notification Period for maintenance / rectification of the defects in the Works.
- 1.2 The Contractor shall comply with the possession management system operated by the Employer.
- 1.3 The Contractor shall appoint a responsible person who shall coordinate with the Employer and who shall act as the possession coordinator for the Contractor only.

2. Possession Periods

- 2.1 The Contractor may use possessions on the line as follows:
 - a) For each particular possession and depending on the duration and the location of the possession, alternative route / mode of transport if required, and where provided this alternative route / mode of transport will be at the Contractor's cost.
 - b) The normal alternative mode of transport will be by DFC tracks / road and the route and timings of this alternative transport is to be agreed with the Employer prior to obtaining the Possessions. Employer shall however provide necessary assistance to the Contractor for arranging alternative mode of transport.
- 2.2 Line closures for limited period if required, may be agreed subject to consent of the Employer.
- 2.3 The Employer gives no guarantee that line closures and possession periods will be available during the period as requested by the Contractor. No claim shall be entertained by the Employer on this account.
- 2.4 The Employer shall however provide any assistance necessary to the Contractor to enable him to obtain the line closures and possessions required by him.
- 2.5 The Contractor shall prepare technological and organizational schedule for maintenance / rectification and submit the same to the Engineer for his consent.

* End of Appendix 14 *

PART – 3

Section - VI General Conditions of Contract (GCC)

As per FIDIC Yellow Book 1999-Edition

The conditions of Contract comprise the “General Conditions” which form part of the conditions of Contract for Plant and Design Build first edition 1999 published by the Federation Internationale Des Ingenieurs – Conseils (FIDIC) and the following “Particular Conditions” which include amendments and addition to such General Conditions.

Copies of the above FIDIC publication i.e. “Conditions of Contract for Plant and Design Build” can be obtained from

International Federation of Consulting Engineers
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

PART – 3

Section -VII

Particular Conditions of Contract (PCC)

Particular Conditions

The Conditions of Contract comprise the “**General Conditions**”, which form part of the “Conditions of Contract for Plant and Design Build for Electrical and Mechanical, and for Building and Engineering Works designed by the Contractor”, First Edition, 1999 published by the Federation Internationale des Ingénieurs-Conseils (**FIDIC**), and the following “**Particular Conditions**”, which include amendments and additions to such General Conditions. The General Conditions are incorporated herein by reference only and are not set out at length. The Contractor is deemed to have obtained for himself and read and fully understood the General Conditions in their entirety. The following Particular Conditions shall supplement the General Conditions in Section VI. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions.

Clause	PROVISIONS
Sub-Clause 1.1.3.10	Insert additional Sub-Clause 1.1.3.10 “Milestone” means the completion of a part of the Works, or the occurrence of an identified event.
Sub-Clause 1.1.3.11	Insert additional Sub-Clause 1.1.3.11 “Stage” means the part of the Works identified as such and more particularly described in the Price Schedules, Part 5 Bidding Document
Sub-Clause 1.1.6.9	Delete the existing clause and modified as under: “Variation” means any change to the scope of works, design criteria and specifications, and criteria for the testing and performance of the completed works specified in the Employer’s Requirements.
Sub-Clause 1.2. Interpretation	Insert the following sub-paragraphs after sub-paragraph (d): (e) the word “tender” is synonymous with “bid”, and “tenderer” with “bidder” and the words “tender documents” with “bidding documents”.
Sub- clause 1.7 Assignment	Delete Sub-clause 1.7 (a)
Sub- clause 1.9 Errors in Employer’s Requirements	Delete sub-clause 1.9 and replace with “If the Contractor suffers delay and/or incurs Cost as a result of an error in the Employer's Requirements with reference to purpose, scope, design and /or other technical criteria for the works and an experienced contractor exercising due care would not have discovered the error when scrutinizing the Employer's Requirements with respect to purpose, scope, design and/or other technical criteria for the works under Sub-Clause 5.1 [General Design Obligations], the Contractor shall give notice to the Engineer and shall

	<p>be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:</p> <p>(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and</p> <p>(b) payment of any such Cost plus reasonable profit, which shall be included in the Contract Price.</p> <p>After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been so discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.”</p>
<p>Sub- clause 1.14 Joint and Several Liability</p>	<p>Delete Sub- clause (b) and replace with:</p> <p>If the contractor constitutes (under applicable laws) a Joint Venture, etc, the following provisions will be applicable :</p> <p>(i) One of the members of the JV firm shall be its lead member who shall have majority (at least 51%) share of interest in the JV firm. The other members shall have a share of not less than 20% each in case of JV firms with upto 3 members.</p> <p>(ii) <u>Joint And Several Liability</u> - Members of the JV Firm to which the contract is awarded, shall be jointly and severally liable to the Employer (DFCCIL) for execution of the project in accordance with General and Special Conditions of Contract. The JV members shall also be liable jointly and severally for the loss, damages caused to the DFCCIL during the course of execution of the contract or due to non-execution of the contract or part thereof.</p> <p>(iii) <u>Duration of the Joint Venture Agreement</u> - shall be valid during the entire currency of the contract including the period of extension, if any and the defect liability (Notification) period after the work is completed.</p> <p>(iv) <u>Governing Laws</u> - The Joint Venture Agreement shall in all respect be governed by and interpreted in accordance with Indian Laws.</p> <p>(v) Once the Bid is submitted, the MOU shall not be modified / altered / terminated during the validity of the Bid. In case the bidder fails to observe/comply with this stipulation, the</p>

	<p>full <i>Bid Security Deposit/Earnest Money</i> shall be liable to be forfeited.</p> <p>(vi) Approval for change of constitution of JV Firm shall be at the sole discretion of the Employer (DFCCIL). The constitution of the JV Firm shall not be allowed to be modified after submission of the Bid by the JV Firm, except when modification becomes inevitable due to succession <i>laws</i> etc. and in any case the minimum eligibility criteria should not get vitiated. However, the Lead Member shall continue to be the Lead Member of the JV Firm. Failure to observe this requirement would render the offer invalid.</p> <p>(vii) Similarly, after, the contract is awarded, the constitution of JV Firm shall not be allowed to be altered during the currency of contract except when modification become inevitable due to succession laws etc. and in any case the minimum eligibility criteria should not get vitiated. Failure to observe this stipulation shall be deemed to be breach of contract with all consequential penal action as per contract conditions.</p> <p>(viii) <i>On issue of LOA (Letter of Acceptance), an agreement among the members of the JV Firm (to whom the work has been awarded) shall be executed and got registered before the Registrar of the Companies under Companies Act or before the Registrar/Sub - Registrar under the Registration Act, 1908. This JV Agreement shall be submitted by the JV Firm to the DFCCIL before signing the contract agreement for the work. In case the tenderer fail to observe/comply with this stipulation, the full BID SECURITY shall be forfeited and other penal actions due shall be taken against partners of the JV and the JV.</i></p> <p>(ix) No member of the Joint Venture Firm shall have the right to assign or transfer the interest right or liability in the contract without the <i>written</i> consent of the other members and that of the employer (DFCCIL) in respect of the said Bid/<i>contract</i>.</p>
--	--

**New Sub- clause 1.15
Fraud & Corruption**

If the Employer determines that the Contractor and/or any of its personnel, or its agents, or its Subcontractors, sub-consultants, services providers, suppliers and/or their employees has engaged in corrupt, fraudulent, collusive coercive, or obstructive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contractor's employment under the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such expulsion had been made under Sub-Clause 15.2.

For the purposes of this Sub-Clause,

- (i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party¹;
- (ii) "fraudulent practice" is 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 obligation²;
- (iii) "collusive practice" is an arrangement between two or more parties³ designed to achieve an improper purpose, including to influence improperly the actions of another party;
- (iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party⁴ or the property of the party to influence improperly the actions of a party;
- (v) "obstructive practice" is
 - (aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

1. Another party' refer to a public official action in relation to the procurement or contract Execution. In this context, public official' includes employees of other organsiation taking or reviewing procurement decisions.

2. "Party" refers to a p;ublic official; the terms "benefit and obligation " relate to the procurement process or contract execution and the "act or omission" is intended to influence the procurement process or contract execution.

3. "Parties" refer to partricipants in the procurement process (including public officials) attempting to establish bid process at artificial, non competitive level.

4. "Party" refers to a participant in the procurement process or contract execution.

<p>Sub- clause 2.1 Right to Access to Site</p>	<p>Delete Sub- clause (b) in para 3</p>
<p>Sub-Clause 3.1 Engineer’s Duties and Authorities</p>	<p>Add the following at the end of this Sub-Clause: Notwithstanding anything contained hereinabove, the Engineer is required to obtain approval of the Employer before exercising specific authorities as listed below:</p> <ul style="list-style-type: none"> i) giving consent to proposed Subcontractors pursuant to Sub-Clause 4.4 (b) earthwork and bridge; ii) <i>clearance of concept design & concept drawings and GADs submitted by the Contractor for alignment of bridge, and Works/ drawings requiring sanction of Commissioner of Railway Safety;</i> iii) Taking action in connection with variation in the Employers’ requirement which has been initiated by the Employer. iv) Employer’s taking over of the work as per clause 10. v) Issue of performance certificate as per sub clause 11.9; vi) Approving any extension of time for completion of work, vii) Instructing or approving Variations pursuant to Sub-Clauses 13.1, 13.2 and 13.3; except in an emergency affecting the safety of life or of the works or of adjoining property or track, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. In case the emergency mentioned above occurs on account of failure of Contractor, by way of not adhering to the sound industry practice or not taking adequate safety precautions, then no amounts shall be paid to the Contractor for attending to such emergencies.
<p>Sub-clause 4.2 Performance Security</p>	<p>Add the following at the end of para 4(d) – in which event the Employer shall forfeit the amount of the Performance Security as indicated in Sub-clause 15.4. Delete paragraph 5 of Sub-clause 4.2 “The Employer ... claim.” and substitute by the following: In case the Employer makes a claim on the Performance Security, which it was not entitled to make, the Employer shall forthwith refund such amount of claim to the Contractor.</p>
<p>Sub-clause 4.7</p>	<p>Delete paragraph 2,3 &4 of Sub-clause 4.7 and</p>

Setting Out	<p>substitute by the following: Accuracy of these specified items of reference shall be deemed to have been verified by the Contractor. Accordingly, the Contractor shall have no right to claim towards time or cost caused due to errors in these specified items of reference.</p>
Sub-Clause 4.10 Site Data	<p>Paragraph 1 of Sub-Clause 4.10. Add at the end of the paragraph Accordingly, the Contractor shall have no claim in this regard.” 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.</p>
Sub-clause 4.12 Unforeseeable Physical Conditions	<p>Delete the Sub-Clause and Substitute by the following: In this Sub-Clause, "physical conditions" means man-made or natural physical conditions including sub-surface and hydrological conditions which the Contractor encounters at site during the execution of the Works. Except as otherwise stated in the Contract: (a) the Contractor accepts total responsibility for having foreseen all difficulties and physical conditions; and (b) the Contract Price shall not be adjusted to take account of any unforeseen physical conditions</p>
Sub-clause 4.25 Change of Control	<p>Insert the following additional Sub-clause Any change in Control of the Contractor, or in case if the Contractor is a JV, any change of Control of any of the members of the JV, shall require prior approval of the Employer. Such approval shall not be unreasonably withheld, unless, such change in Control, if had taken prior to the date of submission of the bid, would have rendered the Contractor or any such member in case the Contractor is a JV, ineligible to bid for the Project in terms of the Instructions to Bidders or in the opinion of the Employer such change in Control shall jeopardize national security or interest. For the purposes of this clause “Control” shall mean the possession, directly or indirectly, of the power to direct or cause the direction of the management and affairs of such person, whether through the legal and beneficial ownership of more than 50% (fifty percent) of the voting securities of such person, by agreement or otherwise or the power to elect majority of directors, partners or other individuals exercising similar authority with respect to such person.</p>
Sub-clause 5.1	Delete Sub-Clause 5.1 and substitute the

<p>General Obligations</p>	<p>Design following:</p> <p>The Contractor shall carry out, and be responsible for, the design of the Works. Design shall be prepared by qualified designers who are engineers or other professionals who comply with the criteria (if any) stated in the Employer's Requirements with reference to purpose, scope, design and/or other technical criteria for the works. Unless otherwise stated in the Contract, the Contractor shall submit to the Engineer for consent the name and particulars of each proposed designer and design Subcontractor.</p> <p>The Contractor warrants that he, his designers and design Subcontractors have the experience and capability necessary for the design. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer at all reasonable times, until the expiry date of the relevant Defects Notification Period.</p> <p>Upon receiving notice under Sub-Clause 8.1 [<i>Commencement of Works</i>], the Contractor shall scrutinise the Employer's Requirements with reference to purpose, scope, design and /or other technical criteria for the works (including design criteria and calculations, if any). Within the period stated in the Appendix to Tender, calculated from the Commencement Date, the Contractor shall give notice to the Engineer of any error, fault or other defect found in the Employer's Requirements with reference to purpose, scope, design and /or other technical criteria for the works.</p> <p>After receiving this notice, the Engineer shall determine whether Clause 13 [<i>Variations and Adjustments</i>] shall be applied, and shall give notice to the Contractor accordingly. If and to the extent that (taking account of cost and time) an experienced contractor exercising due care would have discovered the error, fault or other defect when examining the Site and the Employer's Requirements with reference to purpose, scope, design and/or other technical criteria for the works before submitting the Bid, the Time for Completion shall not be extended and the Contract Price shall not be adjusted.</p>
<p>Sub-Clause 6.12 of Employment Foreign Nationals</p>	<p>New Sub-Clause</p> <p>The Contractor acknowledges, agrees and undertakes that employment of foreign personnel by the Contractor and/or its Subcontractors may be subject to grant of requisite regulatory permits and approvals including employment/residential visas and work permits, required if any, and the obligation to apply for</p>

	<p>and obtain the same shall always be of the Contractor. Notwithstanding anything to the contrary contained in the Contract, refusal of or inability to obtain any such permits and approvals by the Contractor or any of its Subcontractors shall not constitute Force Majeure event, and shall not in any manner excuse the Contractor from the performance and discharge of its obligations and liabilities under the Contract.”</p> <p>The Employer, on a best effort basis, will provide reasonable assistance in obtaining such visas and permits, but without thereby incurring any liability whatsoever towards the Contractor.</p>
Sub-Clause 7.4 Testing	<p>Insert the following at the end of this Sub-Clause:</p> <p>The Contractor shall not be released from any liability or obligation under the Contract by reason of any such inspection or testing or witnessing of testing, or by the submission of reports of inspection or testing to the Engineer.</p>
Sub Clause 8.2 Time for Completion	<p>Delete this Sub-Clause and substitute by the following:</p> <p>The Permanent Works of entire geographical jurisdiction shall be completed in stages as under:</p> <p>1. Completion of :</p> <p>1a) 60% of Well foundations including well cap– 730 days. (Milestone 1a)</p> <p>1b) Completing casting of 40% of Sub-structure including pier/abutment cap. (bed block) – 730 days. (Milestone 1b)</p> <p>1c)30% of PSC Box girders including casting and launching – 730 days. (Milestone 1c)</p> <p>2. Completion of all works by the Contractor and taking over of the works by the Employer - 1216 days. (Milestone 2).</p>
Sub-Clause 8.3	<p>Delete para 3 of Sub- Clause 8.3</p> <p>“The Contractor shall [<i>Variation Procedure</i>].”</p>
Sub-Clause 8.4	<p>Delete Sub-Clauses (c)</p> <p>Delete “(d)” and substitute as under:-</p> <p>Unforeseeable shortages in the availability of Goods caused due to changes in laws in accordance with the provisions of Sub-Clause 13.7</p> <p>Add sub-clause (f) - A cause of delay in handing over possession of Site in accordance with the provisions of Sub-clause 2.1</p>
Sub-Clause 8.7 Delay Damages	<p>Delete Sub-Clause 8.7 and substitute by the following:</p> <p>The Contractor shall complete the Works in accordance with the programme set forth in Sub-Clause 8.2 [Time for Completion]. In the event that the Contractor fails to achieve any Milestone on the date</p>

	<p>set forth for such Milestone in the Time for Completion, unless such failure has occurred due to Force Majeure or for reasons solely attributable to the Employer, it shall pay Delay Damages to the Employer in a sum calculated at the rate stated in the Appendix to Tender until such Milestone is achieved; provided that if the construction period for any or all Milestones is extended in accordance with the provisions of this Contract, the dates set forth in the Sub-Clause 8.2 [Time for Completion] shall be deemed to be modified accordingly and the provisions of this Contract shall apply as if Appendix to Tender has been amended as above; provided further that in the event Project is completed within the Time for Completion as stated in the Appendix to Tender, the Delay Damages paid under this Sub-Clause shall be refunded by the Employer to the Contractor, but without any interest thereon. It is agreed that recovery of Damages under this Sub-Clause shall be without prejudice to the rights of the Employer under this Contract including the right of Termination thereof.</p> <p>The Parties hereby accept that delays cause loss to the public and the national economy for whose benefit the Works is meant, and that the loss is not susceptible to precise measurement. The Parties hereby agree that the rate of Delay Damages agreed in this Clause 8.7 is a reasonable pre-determined amount, and that the Delay Damages are not by way of penalty.</p> <p>The Employer shall notify the Contractor of its decision to impose Delay Damages in pursuance with the provisions of this Sub-Clause. Provided that no deduction on account of Delay Damages shall be effected by the Employer without notifying the Contractor its decision to impose the Damages. Further, the total amount of Delay Damages under Sub-Clause 8.7 shall not exceed the maximum amount of delay damages (if any) stated in the Appendix to Tender.</p>
<p>Sub-Clause 8.8 Suspension of Work</p>	<p>Delete Sub-Clause 8.8, Substitute deletion by the following:</p> <p>In the event of the failure of the Contractor to duly and effectively perform any of its obligations or to perform proper execution of the Works in accordance with the provisions of this Contract, the Engineer may by notice require the Contractor to suspend forthwith the performance of any obligations under the Contract or the whole or any part of the Works.</p> <p>The Contractor shall, pursuant to the notice under this</p>

	<p>Sub-Clause, suspend the Works or any part thereof for such time and in such manner as may be specified by the Engineer and thereupon carry out remedial measures to rectify the defects and secure the safety of the suspended works. The Contractor may by notice require the Engineer to inspect such remedial measures forthwith, with a request that the suspension hereunder may be revoked. The Engineer shall either revoke such suspension or instruct the Contractor to carry out such other and further remedial measures as may be necessary and the procedure set forth in this Sub-Clause shall be repeated until the suspension hereunder is revoked.</p> <p>All reasonable costs incurred for maintaining and protecting the Works and remedying the defects during the period of suspension shall be borne by the Contractor.</p> <p>During the period of Suspension, the Employer may at its own discretion, on behalf of the Contractor, undertake to fulfill any of the Contractor's obligations for remedying and rectifying the cause of Suspension. Provided that any cost incurred by the Employer in fulfilling the obligations of the Contractor for the remedying or rectifying the cause of Suspension shall be borne by the Contractor. The Employer shall have the right to deduct any such expense incurred and another twenty percent thereof as Damages from any payment due or to be due to the Contractor under the provisions of this Contract.</p> <p>If and to the extent the cause for the suspension is the responsibility of the Contractor, the following Sub-Clauses 8.9, 8.10, and 8.11 shall not apply.</p> <p>The Contractor shall not be entitled to extra cost (if any), incurred by him, during the period of suspension of Work, if such suspension is:</p> <ul style="list-style-type: none"> (a) provided for in the Contract; or (b) necessary for proper execution of Works or by reasons of weather condition or by some default on the part of the Contractor; or (c) necessary for the safety of Works or any part thereof; or (d) necessary for the safety of adjoining public or other property or safety of the public or workmen or those who have to be at the site; or (e) to ensure safety and to avoid disruption of traffic and utilities, as also to permit fast repairs and restoration of any damaged utilities.
<p>Sub-Clause 10.2 Taking Over of Parts of the Works</p>	<p>Delete.</p>

<p>Sub-Clause 13.3 Variation procedure</p>	<p>Add the following below the last paragraph: For varied works of items due to variation as per Sub-Clause 1.1.6.9 determination of adjustment to the Contract Price shall be based on the following:</p> <ul style="list-style-type: none"> a. Inputs of man-days, machine hours and quantities of materials; b. (i) Prevailing market rates for Materials, hiring of equipment; (ii) Rates being paid by the Contractor for unskilled, semi-skilled and skilled worker as per the records maintained by the Contractor in accordance with the Laws; c. Contractor's overheads and profit at the rate of 15 (fifteen) per cent of the cost arrived at on the basis of (a) and (b) above and; d. Applicable taxes. <p>No price adjustment shall apply. The approval for Variation shall state the period of extension of time, if any, allowed for the Variation. If no extension of time is allowed, the same shall be stated.</p>
<p>Sub-Clause 13.4 Payment in Applicable Currencies</p>	<p>Delete Sub-Clause 13.4 and Substitute deletion by the following: The contract provides for payment of contract price in Indian Rupees only.</p>
<p>Sub-Clause 13.7 Adjustments Changes Legislation for in</p>	<p>Delete first paragraph of the Sub-Clause and Substitute deletion by the following: The Contract Price shall be adjusted to take account of any increase or decrease in Cost after the Base Date resulting from:</p> <ul style="list-style-type: none"> a. a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws); or b. in the judicial or official governmental interpretation of such Laws, or c. the commencement of any Indian law which has not entered into effect until the Base Date; or d. any change in the rates of any of the Taxes or royalties on Materials that have a direct effect on the Project which affect the Contractor in the performance of obligations under the Contract. <p>End of the Sub-Clause Insert at the end of the Sub-Clause: If as a result of change in law, interpretation, or rates of taxes or royalties, the Contractor benefits from any reduction in costs for the execution of this Contract, save and except as expressly provided for in this Sub-Clause or in accordance with the provisions of this Contract, the Contractor shall, within [28] days from the date he becomes reasonably aware of such</p>

	reduction in cost, notify the Employer with a copy to the Engineer of such reduction in cost.																
Sub-Clause 13.8 Adjustment Changes in Cost	<p>for Delete Paragraph 3 of this Sub-Clause and Substitute deletion by the following:</p> <p>The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the amount certified in Payment Certificates, shall be determined from formulae.</p> <p>The formula for adjustment for changes in cost shall be as follows:</p> $P_n = a + b(L_n/L_0) + c(C_n/C_0) + d(S_n/S_0) + e(F_n/F_0)$ <p>where:</p> <p>"P_n" is the adjustment multiplier to be applied to the contract amount paid against cost center / stage as per Price Schedule for the completed stage of work;</p> <p>"a" is a fixed coefficient, stated in the table of adjustment data as given below, representing the non-adjustable portion of the work;</p> <p>"b" is a fixed coefficient, stated in the table of adjustment data as given below, representing the adjustable portion for labour component;</p> <p>"c" is a fixed coefficient, stated in the table of adjustment data as given below, representing the adjustable portion for cement component;</p> <p>"d" is a fixed coefficient, stated in the table of adjustment data as given below, representing the adjustable portion for steel component;</p> <p>"e" is a fixed coefficient, stated in the table of adjustment data as given below, representing the adjustable portion for fuel & lubricant;</p> <p>Values of a, b, c, d and e are as under :</p> <table border="1"> <tr> <td>Fix Component (a)</td> <td>0.15</td> </tr> <tr> <td>Labour (b)</td> <td>0.30</td> </tr> <tr> <td>Cement (c)</td> <td>0.15</td> </tr> <tr> <td>Steel (Bars & rods) (d)</td> <td>0.25</td> </tr> <tr> <td>Fuel & Lubricant(e)</td> <td>0.15</td> </tr> </table> <p>Values for "L_n", "C_n", "S_n" and "F_n" correspond to the date 49 days prior to the last day of the period (to which the particular payment certificate relates) and shall be as follows :</p> <table border="1"> <tr> <td>"L_n"</td> <td>The All India Consumer Price Index for Industrial Works as published by the Labour Bureau, Ministry of Labour, Govt. of India.</td> </tr> <tr> <td>"C_n"</td> <td>The Wholesale Price Index for Cement Code-1309030001 as published by Economic Advisor, Ministry of Commerce, Govt. of India.</td> </tr> <tr> <td>"S_n"</td> <td>The Wholesale Price Index for Steel (Rebars Code : 1310010201)) as published</td> </tr> </table>	Fix Component (a)	0.15	Labour (b)	0.30	Cement (c)	0.15	Steel (Bars & rods) (d)	0.25	Fuel & Lubricant(e)	0.15	"L _n "	The All India Consumer Price Index for Industrial Works as published by the Labour Bureau, Ministry of Labour, Govt. of India.	"C _n "	The Wholesale Price Index for Cement Code-1309030001 as published by Economic Advisor, Ministry of Commerce, Govt. of India.	"S _n "	The Wholesale Price Index for Steel (Rebars Code : 1310010201)) as published
Fix Component (a)	0.15																
Labour (b)	0.30																
Cement (c)	0.15																
Steel (Bars & rods) (d)	0.25																
Fuel & Lubricant(e)	0.15																
"L _n "	The All India Consumer Price Index for Industrial Works as published by the Labour Bureau, Ministry of Labour, Govt. of India.																
"C _n "	The Wholesale Price Index for Cement Code-1309030001 as published by Economic Advisor, Ministry of Commerce, Govt. of India.																
"S _n "	The Wholesale Price Index for Steel (Rebars Code : 1310010201)) as published																

		<i>by Economic Advisor, Ministry of Commerce, Govt. of India.</i>	
	<i>"Fn"</i>	<i>The Wholesale Price Index for Fuel (High Speed Diesel – code: 1200020005) as published by Economic Advisor, Ministry of Commerce, Govt. of India.</i>	
	<i>Values for "Lo", "Co", "So" and "Fo" correspond to the base date and shall be as follows :</i>		
	<i>"Lo"</i>	<i>The All India Consumer Price Index for Industrial Works as published by the Labour Bureau, Ministry of Labour, Govt. of India.</i>	
	<i>"Co"</i>	<i>The Wholesale Price Index for Cement Code-1309030001) as published by Economic Advisor, Ministry of Commerce, Govt. of India.</i>	
	<i>"So"</i>	<i>The Wholesale Price Index for Steel (Rebars Code : 1310010201) as published by Economic Advisor, Ministry of Commerce, Govt. of India.</i>	
	<i>"Fo"</i>	<i>The Wholesale Price Index for Fuel (High Speed Diesel – code: 1200020005) as published by Economic Advisor, Ministry of Commerce, Govt. of India.</i>	
Sub-Clause 14.1 Contract Price	Add the following after the last paragraph – The Contract Price includes all duties, taxes, royalties, premiums for various insurances, licenses and fees that may be levied in accordance with the laws and regulations in force as on the Base Date on the Contractor's Equipment, Plant, Materials and supplies acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from its responsibility to pay any tax including any tax that may be levied in India on profits made by it in respect of the Contract.		
Sub-Clause 14.2 Advance Payment	Delete Paragraph 1 and substitute by the following : The Employer shall make an advance payment, as an interest bearing loan for mobilisation and design, when the contractor submits a guarantee in accordance with this Sub-clause. The total advance payment, the number and timing of instalments (if more than one), the rate of interest, and the applicable currencies and proportions shall be as stated in the Appendix to Tender.		
Sub-Clause 14.3 Application for Interim	Delete first paragraph of this Sub-Clause and substitute by the following:		

<p>Payment Certificates</p>	<p>The Contractor shall prepare his monthly bill, in the format agreed with the Engineer, in six copies (hard) and a soft copy. This shall be accompanied by supplementary details in two hard copies and a soft copy. All hard copies shall bear the original signatures of the Contractor and submitted to the Engineer.</p> <p>If these are found in order then Engineer shall forward and the same with copy of supplementary details to the Employer, with Interim Payment Certificate, as per clause 14.6, for payment to the Employer, otherwise return back all documents to the Contractor for rectification and resubmission.</p> <p>Responsibility of preferring the bill and entering the details shall vest with the Contractor. It is his responsibility to ensure that under no circumstances the payment claimed is more than the amount equivalent of Work done for that stage. If it is discovered otherwise during the check by the Engineer or the Employer then a warning will be issued in the first instance and in the second instance amount equivalent to 10% of excess claimed shall be forfeited besides denying the extra claim.</p> <p>While submitting the bills all supplementary details like measurements, sketches, drawings, approvals, calculations etc. shall accompany the bill so that payment can be substantiated by the Engineer as well as the Employer.</p> <p>Even if no stage of work is completed during the month or Contractor does not choose to prefer a bill a 'NIL' bill shall be submitted by him.</p> <p>Paragraph 2 (a) third line Delete the word “(g)” and substitute by “(h)”</p> <p>Add the following paragraph at the end</p> <p>(h) any amount to be deducted for taxes in accordance with the applicable laws.</p>
<p>Sub-Clause 14.4 Schedule of Payments</p>	<p>Delete this Sub-Clause and substitute by the following:</p> <p>The Employer shall make interim payments to the Contractor as certified by the Engineer under Sub-Clause 14.6 on the basis of the estimated value of the Works executed as determined in accordance with the following procedure:</p> <p>(a) Schedule 'A' (Part -5 Price Schedule of Bid Document) specifies the lump sum cost given by the contractor and accepted by the employer.</p> <p>(b) The above lump sum cost/contract price has been apportioned in 6 cost centres to facilitate stage payment. (Schedule 'B') (Part -5 Price Schedule of Bid Document).</p> <p>(c) Each cost centres indicated in Schedule 'B' has been further sub-divided into different items of work</p>

	<p>alongwith their corresponding weightages (i.e. Schedule 'B' has been further sub-divided into Price Schedule B-1 to B-6) (Part -5 Price Schedule of Bid Document).</p> <p>(d)The payment procedure has also been indicated in each Price Schedule (B-1 to B-6) and payment will be done accordingly.</p> <p>(e)The description of items of work in the Schedules does not limit in any way the Contractor's obligations under the Contract to provide all the Works described in the Employer's Requirements.</p> <p>(f) The Bidder shall compute, and supply to the Engineer, the total quantities (in units as described in the Price Schedule) of various items of works and components on the basis of detailed design reviewed/approved by the Engineer.</p> <p>(g)The Contractor shall base its claim for interim payment for each stage for various items of the work on completion till the end of the month for which the payment is claimed, supported with documents and an up-dated programme in accordance with the Employer's Requirements.</p> <p>(h)The weightage/percentage assigned to cost centre will apply only to the Contract Price stated in the Contract Agreement. It shall not apply to any additions or subtractions to the Contract Price arising from the issue of any Variation Orders. Each Variation Order shall specify the manner of interim payments and completion of stages for it.</p>
<p>Sub-Clause 15.3 Valuation at Date of Termination</p>	<p>Delete the last line of this Sub-clause "work executed Contract" and substitute by the following:</p> <p>Work completed upto any defined stage of payment in accordance with the Contract. Extent of damages to the Employer due to termination under sub-clause 15.2 has been fixed as (1) Forfeiture of Performance Security (2) Forfeiture of Retention money/Security Deposit (3) five percent (5%) of the cost of the balance work at the date of termination. The Parties hereby agree that the rate of these damages agreed in this is a reasonable pre-determined amount, and that these damages are not by way of penalty.</p>
<p>Sub-Clause 15.4 Payment Termination after</p>	<p>Delete the Sub-Clause 15.4 and substitute the following:</p> <p>After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may:</p> <p>(a) proceed in accordance with Sub-Clause 2.5 [Employer's Claims],</p> <p>(b) withhold further payments to the Contractor</p>

	<p>until the actions in accordance with sub-paragraphs (c), and (d) are completed.</p> <p>(c) encash and forfeit the whole of the amounts of Performance Security and Retention Money and take possession of Plant and Materials delivered to Site, for which payment has been made by the Employer.</p> <p>(d) encash and appropriate the bank guarantee for the Advance Payment to recover the outstanding amount, if any, of the Advance Payment</p> <p>(e) pay to the Contractor any sums due under Sub-clause 15.3 [Valuation at Termination], after the full amounts of the Performance Security and Retention Money/Security Deposit and five percent(5%) of the cost of the balance work (as per clause 15.3) and any other amount due from the Contractor have been received by the Employer. Any outstanding amounts against the Contractor shall immediately become due and payable by the Contractor to the Employer.</p>
Sub-Clause 16.2 Termination by the Contractor	Delete the subclause 16.2 (a), (b), (c), (d), (e) & (f)
Sub-Clause 17.3 Employer's Risks	Sub-paragraph (h) - Delete
Sub-clause 18.1 General Requirement of Insurance	Sub –paragraph 7 (b) Modify as following “copies of the policies for the insurances described in Sub-clause 18.2 (Insurance for works and Contractor's Equipment), Sub Clause 18.3 (Insurance against Injury to Person and Damage to Property) and Sub Clause 18.5 (Professional Indemnity Insurance)”.
Sub-Clause 18.2 Insurance of Works and Contractor's Equipment	Sub-paragraph 4 (d) Delete the words “(c), (g) and (h)”, and substitute by the words “(c) and (g)”.
Sub-Clause 18.3 Insurance Against Injury to Persons and Damage to Property	Add the following at the end of this Sub-Clause: The insurance policy shall include a cross liability clause such that the insurance shall apply to the Employer, the Contractor and Subcontractors (wherever applicable) as separately insured. The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Sub- Contractor (wherever applicable), other than death or injury resulting from any act or default of the Employer, his agents or employees. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

<p>Sub-Clause 18.5 Professional Indemnity Insurance</p>	<p>Add new sub-clause</p> <p>The Contractor shall provide evidence of professional indemnity insurance carried by its Designer for the Works.</p> <p>The professional indemnity insurance shall cover the risk of professional negligence in the design of the Works. This insurance shall be for a limit of not less than that set down in the Appendix to Tender and shall be maintained in full force and effect from the Commencement Date of the Works until 03 years after the date of completion of the Defect Notification period.</p> <p>The Engineer will not issue any payment certificate until the Contractor has provided evidence of this insurance and its period of effectiveness.</p>
<p>Sub Clause 20.6 Arbitration</p>	<p>Delete Sub-paragraph 1 (a, b & c) and replace as under –</p> <p>Unless settled amicably, any dispute in respect of which the DAB's decision (if any) has not become final and binding shall be finally decided by reference to arbitration by a Board of Arbitrators appointed in accordance with sub-clause (i) below. Such arbitration shall be held in accordance with the Indian Arbitration and Reconciliation Act, 1996. The seat of such arbitration shall be New Delhi, and the language of arbitration proceedings shall be English.</p> <p>i) The employer shall provide a panel of five (5) arbitrators to the contractor. 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 qualification of the said Arbitrators nominated in the panel along with their professional experience, phone no. and address to the contractor. The contractor shall have to choose one Arbitrator from the panel of five. The employer shall also choose one Arbitrator from this panel of five.</p> <p>The third arbitrator shall be appointed by the two arbitrators from the panel of five so selected and shall act as presiding arbitrator. In case of failure of the two Arbitrators, appointed by the parties, to reach upon a consensus within a period of 28 days from their appointment as Arbitrators, the Presiding Arbitrator shall then be appointed by MD/DFCCIL.</p> <p>Arbitrator's Fee and other admissible expenses shall be as per DFCC letter No. HQ/Procurement/Arbitration Panel dated 28.3.2013.</p>

APPENDIX TO TENDER

Item	GC Sub- Clause	Data									
Employer	1.1.2.2, 1.3	Dedicated Freight Corridor Corporation of India Limited, 5 th Floor Pragati Maidan, Metro Station Building Complex New Delhi, India – 110001									
Contractor	1.1.2.3 & 1.3	To be filled in									
Engineer	1.1.2.4, 1.3 & 3.1	to be filled in									
Time for Completion	1.1.3.3	As per Sub-clause 8.2 of GC									
Defects Notification Period	1.1.3.7	Defect Notification Period for the Works shall be two years from the date of Taking Over of the Works (Sub-clause 10.1) and issue of Taking-Over Certificate by the Engineer.									
Communications	1.3	By fax and e-mails but confirmed in hard paper copy within 48 hours.									
Law and Language	1.4	Indian Laws & English Language									
Right of Access to the Site	2.1	The Employer shall give Right to Access to site to the Contractor as per the following schedule subject to the Contractor providing Performance Security in terms of Sub-Clause 4.2 of General Conditions of Contract. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">SN</th> <th style="text-align: center;">Period after Commencement Date in days</th> <th style="text-align: center;">Cumulative percentage of site to be handed over for work with respect to total length</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">28</td> <td style="text-align: center;">80%</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">91</td> <td style="text-align: center;">100%</td> </tr> </tbody> </table>	SN	Period after Commencement Date in days	Cumulative percentage of site to be handed over for work with respect to total length	1	28	80%	2	91	100%
SN	Period after Commencement Date in days	Cumulative percentage of site to be handed over for work with respect to total length									
1	28	80%									
2	91	100%									
Amount of Performance Security	4.2	(Five) 05 Percent of the Accepted Contract Amount, in INR currency.									
General Design Obligation	5.1	56 days.									
Normal working hours	6.5	(Eight) 8 hours shift in a day and total (Forty eight) 48 hours in a week.									
Amount of Delay Damages	8.7	For Milestone 1(a) - (Rupees Twenty Five thousand) Rs.25,000/- per day of delay. For Milestone 1(b) - (Rupees Twenty Five thousand) Rs.25,000/- per day of delay. For Milestone 1(c) - (Rupees Twenty Five thousand) Rs.25,000/- per day of delay. For Milestone 2 - ` (Rupees Three Lakhs) Rs .3,00,000/- per day of delay.									
Limit of Delay Damages for the whole of the Works	8.7	(Five) 05 per cent of the Accepted Contract Amount in INR ` Indian currency.									
Provisional Sum	13.5	No Provisional Sum is payable under this Contract.									
Advance Payment	14.2	Delete Paragraph 1 and substitute by the following : Mobilization Advance: The Employer shall pay on written request by the Contractor a Mobilization Advance up to (Ten) 10 per cent of the Contract Price at an interest rate of 4.5% per annum above the base rate of State Bank of India as effective on the date of approval of payment of mobilization advance by the Competent Authority,									

		<p>compounded yearly. The Mobilization Advance shall be released in two installments as under:</p> <p>(a) Upto (Five) 5 per cent: On Submission of Performance Security and commencement of mobilization process; and</p> <p>(b) Upto (Five) 5 per cent: On Submission of the Inception Report and details of utilisation of initial Mobilization Advance of 5% to the satisfaction of Engineer.</p> <p>The Advance Payment will be released on submission of unconditional Bank Guarantee for an amount equivalent to 110% of the component of the advance payment requested by the Contractor.</p> <p>Note: The Contractor shall have a one time option to reduce the Bank Guarantee for the mobilization advance by the amount already recovered, once the 50% of mobilization advance has been recovered.</p>
Percentage of Retention	14.3 (c)	(Ten) 10 per cent
Limit of Retention Money	14.3 (c)	(Five) 5 per cent of the Contract Price
Payment	14.7	As per Sub-clause 13.4 of GC above
Delayed Payment	14.8	These financing charges shall be calculated at an annual rate of 8% (Eight percent) of Indian Currency.
Retention money	14.9	A retention amounting to 10 (ten) per cent of the value of the work done shall be deducted by the Engineer in the first and following Interim Payment Certificates, until the amount so retained reaches a limit of retention money of 5 (five) percent of the Contract Price. The Contractor may, at his option, replace the Retention Money with an unconditional bank guarantee from the Bank, and valid for the period up to the end of the Defect Notification Period.
Currencies of Payment	14.15	Currency of Payment shall be INR.
Evidence of Insurance	18.1 (a), 18.5	Before Commencement Date of Works
Relevant Policies	18.1(b)	Within 84 days of Commencement Date of Works
Insurance of Works and Contractors Equipment	18.2	Full Replacement Cost+15%; The Insurance Policy to cover the Employer's Risk as per Sub-Clause 17.3 of GC shall be taken by the Employer.
Minimum amount of third party Insurance	18.3	Rs.50 lakhs for any one occurrence.
Professional Indemnity Insurance	18.5	Rs.3 crores (Rs. Three Crores)
Appointment of Dispute Adjudication Board	20.2	The DAB shall comprise of one Sole member and sole member shall be appointed by Managing Director/DFCCIL. List of DAB members will be provided to the contractor by the Employer within three months of commencement date.
Failure to Agree Dispute Adjudication Board	20.3 (d)	Managing Director/DFCCIL

CONTRACT FORMS

Section VIII Contract Forms (CF)

Table of Forms

CF No	Sub- Clause of GC	Description
01	1.1.1.3	Letter of Acceptance
02	1.6	Form of Contract Agreement
03	4.2	Form of Performance Security (Guarantee) By Bank
04	14.2	Mobilization Advance Payment Guarantee Form
05	14.3, 14.9	Form of Retention Money Guarantee
06	5.1, 18.5	Form of Designer's Warranty
07	18	Insurance Requirement

LETTER OF ACCEPTANCE

(Sub-Clause 1.1.1.3)

To

Date:.....

Dear Sir

Project: Design and Construction of Important Bridge across river Sone (approximate length 3.06 Kms), its approaches (on both sides) and other miscellaneous works for double track electrified railway line on Design Build Lump Sum Basis between Sonnagar (Rly.Km.549) and Dehri-on-Sone (Rly.Km.554) Railway Stations on Mughalsarai - Sonnagar Section of Eastern Dedicated Freight Corridor.

To,

This is to notify you that your bid proposal dated.....for execution of the above Project for the firm Contract Price of (INR) and as corrected and modified in accordance with the bidding documents, is hereby accepted by DFCC.

You are requested to furnish the performance security as required by the contract and bidding document.

You are hereby instructed to proceed and prepare your mobilization for the execution of the said Contract works. Contract Agreement documents will be prepared and forwarded to you for signature.

Yours truly,

For – Dedicated Freight Corridor Corporation of India Limited

(_____)

Name:.....

Signature

Stamp

**Article 2.
Contract Price and
Terms of Payment**

2.1 **Contract Price** (Reference GC Clause 14.1)
The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations pursuant to the Contract. The Contract Price shall be as specified in Schedule A Price Schedule, or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.2 **Terms of Payment** (Reference GC Clause 14.4)
The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in Terms and Procedures of Payment subject to such additions thereto or deductions there from as may be made under the provisions of the contract at the times and in the manner prescribed by the Contract. The amount payable under Schedule – B (B1 to B6) is adjusted in accordance with GC 13.8 or with any of the other terms of the Contract.

**Article 3.
Commencement
Date**

3.1 **Commencement Date** (Reference GC Clause 1.1.3.2)
42days from the date of receipt of letter of acceptance or as indicated in the Letter of Acceptance.

**Article 4.
Time for
Completion**

4.1 **Completion** (Reference Clause 1.1.3 GC & ----
Employer's Requirements)
In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the contractor hereby covenants with the Employer to execute and complete the Works by 1216 days and remedy any defects therein in conformity in all respects with the provisions of the Contract.

**Article 5.
Communications**

5.1 The address of the Employer for notice purposes, pursuant to GC 1.3 is:
The Director Project & Planning,
Dedicated Freight Corridor Corporation,
5th Floor Pragati Maidan, Metro Station Building Complex
New Delhi, India – 110001

5.2 The address of the Contractor for notice purposes, pursuant to GC 1.3 is: _____.

**Article 6.
Obligations of the
Contractor**

6.1 **Contractor's General Obligation** GC 4.1
The Contractor shall ensure full compliance with the laws of India including taxation and other fiscal laws, with regard to the Contract and the Works shall be solely responsible for the same. The Contractor shall submit copies of acknowledgements evidencing filing of returns every year and shall keep the Employer fully indemnified against liability of levies, custom duties, tax, interest, penalty etc. of the Contractor in respect thereof, which may arise.

IN WITNESS WHEREOF the parties hereto have caused their respective Common

Seals to be hereunto affixed/ (or have hereunto set their respective hands and seals) the day and year first above written.

For and on behalf of the Contractor

For and on behalf of the Employer

Signature of the authorized official
official

Signature of the authorized

Name of the official

Name of the official

Stamp/seal of the Contractor

Stamp/Seal of the Employer

SIGNED, SEALED AND DELIVERED

By the said

By the said

_____ Name

_____ Name

_____ on behalf of the Contractor in the presence of:

_____ on behalf of the Employer in the presence of:

Witness _____

Witness _____

Name _____

Name _____

Address _____

Address _____

CF-3
EXAMPLE FORM OF PERFORMANCE SECURITY
(GURANTEE) BY BANK

(Sub-Clause 4.2)

This deed of guarantee made this day of Between Bank of (hereinafter called the “**Bank**”) of the one part, and Dedicated Freight Corridor Corporation of India Limited called the “**Employer**” of the other part.

Whereas Dedicated Freight Corridor Corporation of India Limited has awarded the contract for (Hereinafter called the Contract) to (Hereinafter called the **Contractor**). (Name of the Contractor)

AND WHEREAS the Contractor is bound by the said Contract to submit to the Employer a Performance Security for a total amount of Rs..... (Amount in figures and words). Now we the undersigned(Name of the Bank) being fully authorized to sign and to incur obligations for and on behalf of and in the name of(full name of the Bank), hereby declare that the said bank will guarantee the Employer the full amount of Rs.(Amount in figures and words).

After the Contractor has signed the aforementioned Contract with the Employer, the Bank is engaged to pay the Employer, any amount up to and inclusive of the aforementioned full amount of the Performance Security upon written order from the Employer to indemnify the Employer for any liability of damage resulting from any defects or shortcomings of the Contractor or the debts he may have incurred to any parties involved in the Works under the Contract mentioned above, whether these defects or shortcomings or debts are actual or estimated or expected. The Bank will deliver the money required by the Employer immediately on demand without delay and demur and without reference to the Contractor and without the necessity of a previous notice or of judicial; or administrative procedures and without it being necessary to prove to the Bank the liability or damages resulting from any defects or shortcomings or debts of the Contractor. The Bank shall pay to the Employer any money so demanded notwithstanding any dispute/disputes raised by the contractor in any suit or proceedings pending before any court, Tribunal or Arbitrator/s relating thereto and the liability under this guarantee shall be absolute and unequivocal.

This guarantee is valid till(the initial period for which this Guarantee will be valid must be for at **least 6 months (six months) longer than the anticipated expiry date of Defects Notification Period as stated in Clause 1.1.3.7 of the Appendix to Tender.**

At any time during the period in which this guarantee is still valid, if the Employer agrees to grant a time extension to the Contractor or if the Contractor fails to complete the Works within the time of completion as stated in the Contract, or fails to discharge himself of the liability or damages or debts as stated in the Contract, or fails to discharge himself of the liability or damages or debts as stated in the Contract, it is understood that the Bank will extend this guarantee under the same conditions for the required time on demand by the Employer and at the cost of the Contractor.

The Guarantee hereinbefore contained shall not be affected by any change in the Constitution of the Bank or of the Contractor.

The neglect or forbearance of the Employer in enforcement of payment of any moneys, the payment whereof is intended to be hereby secured or the giving of time by the Employer for the payment hereof shall in no way relieve the Bank of their liability under this deed.

The expressions “**the Employer**”, “**the Bank**” and “**the Contractor**” hereinbefore used

shall include their respective successors and assigns.

Notwithstanding anything contained herein:

Our liability under this bank Guarantee shall not exceed Rs.....(Rupees).

This bank guarantee shall be valid up to

We are liable to pay the guarantee amount or part thereof under this bank Guarantee only and only if you serve upon us a written claim or demand on or before.....

In witness whereof I/We of the Bank have signed and sealed this guarantee on the day of (Month) being herewith duly authorized.

For and on behalf of
Thebank
Signature of Authorized bank Official

Name
Designation
Stamp/seal of the Bank:.....
Signed, sealed and delivered
For and on behalf of the
Bank of the above

Name_____in
The presence of :
Witness 1.
Signature
Name
Address

Witness 2.
Signature
Name
Address

CF-4
**EXAMPLE FORM FOR MOBILISATION ADVANCE PAYMENT
GUARANTEE**

(Sub-Clause 14.2)

Bank guarantee made on this Between
..... (hereinafter called "**the Bank**") of the One Part and Dedicated
Freight Corridor Corporation of India Limited. (hereinafter called "**the Employer**") of the
other Part.

WHEREAS Dedicated Freight Corridor Corporation of India Limited has awarded the
Contract no..... for "....." (hereinafter called "**the
Contract**") to Having its registered office at
(hereinafter called "**the Contractor**").

AND WHEREAS vide Clause 14.2 of the General Conditions of Contract, Mobilization
Advance up to ---% (--- percent) of the original contract value of Rs..... is
payable to the contractor against Bank Guarantees, the Contractor hereby applies for
Mobilization Advance of --% (--- percent) amounting to Rs...../-
(Rupees.....) of the Contract Price, as per Appendix to
Tender

AND WHEREAS this Bank Guarantee is for Rs...../-
(Rupees.....) being the 1st one of the two Bank Guarantees,
totalling to the above Mobilization Advance amount of Rs...../-.

Now, we the undersigned, Bank of, being fully authorized to sign and to incur
obligations for and on behalf of and in the name of Bank ofhereby declare
that the said Bank will guarantee the Employer the full amount of Rs.-/
(Rupees.....) as stated above.

We, Bank of, do hereby unconditionally, irrevocably and without demur
guarantee and undertake to pay the Employer immediately on demand any or all
money payable by the Contractor to the extent of Rs.-/
(Rupees.....) without any demur, reservation, context, recourse or
protest and/or without any reference to the Contractor. Any such demand made by the
Employer on the Bank shall be conclusive and binding notwithstanding any difference
between the Employer and the Contractor on any dispute pending before any court,
Tribunal, Arbitrator or any other authority. We agree that the guarantee herein
contained shall be irrevocable and shall continue to be enforceable till the Employer
discharges this guarantee.

This guarantee is valid till

At any time during the period in which this guarantee still valid of the Contractor fails to
fulfill its obligation under the Contract, it is understood that the Bank will extend this
guarantee under the same condition for the required time on demand by the Employer
at the cost of the Contractor.

The Guarantee hereinbefore contained shall not be affected by any change in the
constitution of the Bank or of the Contractor.

The neglect or forbearance of the Employer in enforcement of payment of any money,
the payment whereof is intended to be hereby secured or the giving of time by the
Employer for the payment hereof shall in no way relieve the Bank of their liability under
this Deed.

The expressions "the Employer", "the Bank" and "the Contractor" hereinbefore used
shall include their respective successors and assigns.

Notwithstanding anything contained herein:

Our liability under this Bank Guarantee shall not exceed Rs...../-
(Rupees.....)

this bank Guarantee shall be valid up to.....

We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before(date of expiry of Guarantee).

In witness whereof we of the Bank have signed and sealed this Guarantee on theday ofbeing herewith duly authorized.

For and on behalf of the Bank of.....

Signature of Authorized Bank Official

Name _____

Designation _____

Stamp/Seal of the bank _____

Signed, sealed and delivered for and on

Behalf of the bank by the above named

..... in the presence of

Witness 1

Signature _____

Name _____

Address _____

Witness 2

Signature _____

Name _____

Address _____

CF-5
EXAMPLE FORM OF RETENTION MONEY GUARANTEE
(Sub-Clause 14.3 c, 14.9)

Brief description of Contract

Name and address of Beneficiary

_____ (whom the Contract defines as the Employer).

We have been informed that _____ (hereinafter called the "Principal") is your Contractor under such Contract and wishes to receive early payment of [part of] the retention money, for which the Contract requires him to obtain a guarantee.

At the request of the Principal, we (*name of bank*) _____ hereby irrevocably undertake to pay you, the Beneficiary / Employer, any sum or sums not exceeding in total the amount of _____ (the "Guaranteed Amount", say: _____) upon receipt by us of your demand in writing and your written statement stating:

- a) that the Principal has failed to carry out his obligation(s) to rectify certain defect(s) for which he is responsible under the Contract, and
- b) the nature of such defect(s).
- c) That the Principal has failed to carry out his obligation(s) for which he is responsible under the Contract,

At any time, our liability under this guarantee shall not exceed the total amount of retention money released to the Principal by you, as evidenced by your notices issued under Sub-Clause 2.5 and 14.9 of the Conditions of the Contract with a copy being passed to us.

Any demand for payment must contain your signature(s) which must be authenticated by your Bankers. The authenticated demand and statement must be received by us at this office on or before (*the date 56 days after the expected expiry of the Defects Notification Period for the Works*) _____ (the "**Expiry Date**"), when this guarantee shall expire and shall be returned to us.

We have been informed that the Beneficiary may require the Principal to extend this guarantee if the performance certificate under the Contract has not been issued by the date 28 days prior to such Expiry Date. We undertake to pay you such Guaranteed Amount upon receipt by us, within such period 28 days, of your demand in writing and your written statement that the performance certificate has not been issued, for reasons attributable to the Principal, and that this guarantee has not been extended.

This guarantee shall be governed by the laws of Republic of India.

Date

Signature(s)

terminate the Consultancy Agreement or to treat the same as having been repudiated or to discontinue the performance thereof shall cease if, within such period of notice and subject to Clause 4, the Employer shall give notice in writing to the Designer requiring the Designer to accept the instructions of the Employer or his appointee to the exclusion of the Contractor in respect of the carrying out and completion of the Contract Works upon the terms and conditions of the Consultancy Agreement.

4 Any notice given by the Employer under Clause 2 or 3 above shall state that the Employer or his appointee accepts liability for payment of the fees payable to the Designer under the Consultancy Agreement and for performance of the Contractor's obligations under the Consultancy Agreement, including payment of any fees outstanding at the date of such notice.

5 The Employer shall be entitled to assign the benefit of this Warranty at any time without the consent of the Designer being required.

6 All documents arising out of or in connection with this Warranty shall be served:

(1) upon the Employer at [] marked for the attention of [];

(2) upon the Designer at [].

7 The Employer and the Designer 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 demands and 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 (i) In the event that the Contract or the employment of the Contractor under the Contract is terminated for any reason whatsoever and if so requested by the Employer in writing within 21 days of such termination, the Designer shall carry out and complete his obligations under this Warranty and shall enter into a novation agreement with the Employer and the Contractor in which the Designer will undertake inter alia to perform the Design and be bound by its terms and conditions as if the Employer had originally been named as a contracting party in place of the Contractor. The said novation agreement will be in such form as the Employer may reasonably require.

(ii) In the event that the Employer does not require the Designer to enter into a novation agreement as required by Sub-clause 9 (i), the Designer shall have no claim whatsoever against the Employer for any damage, loss or expense howsoever arising out of or in connection with this Warranty.

Except to the extent (if any) expressly permitted by the Consultancy Agreement, the Designer shall not sub-contract any of the Designer's obligations under the Consultancy Agreement without the prior written consent of the Engineer.

10 Without prejudice to its obligations under this Warranty, the Designer shall maintain with well established underwriters of repute and on terms and conditions reasonably acceptable to the Employer, professional indemnity insurance (as per sub-clause 18.5 of the Particular Conditions of Contract) in respect of the Designer and its sub-consultants for Indian Rupees Five Crores (5,00,00,000 Rupees) in relation to his design of the Works for any one occurrence or series of occurrences arising out of any one event from the date of notification of acceptance until 3 years after the issue of Performance Certificate for the whole of works. The Designer shall immediately inform the Employer if for any reason professional indemnity insurance is not maintained in accordance with this Warranty or becomes void or unenforceable.

11 Insofar as the patent, copyright or other intellectual property rights in any Design Data (as defined in the Contract), plans, calculations, drawings, documents,

materials, computer software, know-how and information relating to the Works shall be vested in the Designer, the Designer grants to the Employer his successors and assigns a royalty-free, non-exclusive and irrevocable license (carrying the right to grant sub-licenses) 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 (including without limitation the design, construction, reconstruction, completion, reinstatement, extension, repair and operation of the Works). To the extent beneficial ownership of any such patent, copyright or other intellectual property right is vested in anyone other than the Designer or the Contractor, the Designer shall use his best endeavors to procure that the beneficial owner thereof shall grant a like license to the Employer. Any such license granted shall not be determined if the Designer shall for any reason cease to be employed in connection with the Works.

- 12 (i) Any dispute or difference of any kind whatsoever between the Employer and the Designer arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with Clause 20 of GC "Dispute" as defined in the Contract shall be deemed to include any such dispute or difference between the Employer and the Designer.
- (ii) 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, the Employer may by notice in writing to the Designer require and the Designer 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.
- (iii) 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, statement of objection, determination, certificate, assessment or valuation by the Engineer or the Contractor, relating to the dispute or difference.
- (iv) This Warranty shall be governed by and construed according to the laws for the time being in force in India and the Designer agrees to submit to the jurisdiction of the courts of Delhi/New Delhi.

IN WITNESS whereof this Warranty has been executed as a deed on the date first before written.

THE COMMON SEAL of
[Designer]
was affixed hereto in
the presence of:-

Insurance Requirements

[Sub Clause- 18]

Insurance to be taken by the Contractor

In accordance with the provision of GC Clause 18, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

(A) **Insurance of Works and Contractor's equipments-**

In accordance with the provision of sub clause 18.2 contractor shall insure to cover loss or damage to works, plants, materials and contractor's documents occurring prior to completion of the facility until the date of issue of the performance certificate.

Amount (in currency (ies))	Deductible limits ((in currency (ies))	Parties insured (names)	From	To
As per GCC/ PCC/Appendix to Tender	-	Contractor and Employer	Commencement Date	Issue of Performance certificate

(B) **Insurance against Injuries to Person and Damage to property**

Covering any loss, damage, death or bodily injuries which may occur to any physical property or to any person covering loss and damage to Employers property and Employer's personal.

Amount (in currency (ies))	Deductible limits ((in currency (ies))	Parties insured (names)	From	To
As per GCC/ PCC/Appendix to Tender	-	Contractor and Employer	Commencement Date	Issue of Performance certificate

(C) **Automobile liability Insurance -**

Covering use of all vehicle used by the contractors or its sub contractors (whether or not owned by them) in connection with the design, construction testing and commissioning of the facilities under the contract in accordance with statutory requirements.

(D) **Workers' Compensation -**

In accordance with the statutory requirements applicable in any country where the facilities or any part thereof is executed.

(E) **Professional Indemnity Insurance-**

To cover professional negligence in the design of the Works.

Amount (in currency (ies))	Deductible limits ((in	Parties insured	From (Place)	To (Place)
----------------------------	------------------------	-----------------	--------------	------------

	currency (ies)	(names)		
As per GCC/ PCC/Appendix to Tender	-	Contractor and Employer	Commencement Date	3 Years beyond defect liability (notification) period

Insurance to be taken by the Employer - Nil

PART – 4

Reference Documents

Reference Documents

1.Site Data

- I. Key Plan and alignment drawing
- II. General Arrangement Drawing of Bridge
- III. General Arrangement Drawing showing Typical Abutment & Foundation
- IV. General Arrangement Drawing showing Typical Pier & Foundation
- V. General Arrangement Drawing showing Typical Post Tensioned PSC Box Girder
- VI. DFC alignment between Dehri-on-sonne and Sone Bridge.
- VII. Detgails of Available Railway Land (2 sheets).
- VIII. Geo Technical Reports
- IX. Earthing arrangement at PSC/RCC bridge/viaduct.

PART – 5

**Price Schedules
(See Separate Booklet)**