

**ಬೆಂಗಳೂರು ಸಂಯೋಜಿತ ರೈಲು ಮೂಲಸೌಲಭ್ಯ
ಅಭಿವೃದ್ಧಿ ಉದ್ಯಮ ನಿಯಮಿತ (ಬಿ-ರೈಡ್)**

BENGALURU INTEGRATED RAIL INFRASTRUCTURE DEVELOPMENT ENTERPRISE LIMITED (Bi-RIDE)

Bi-RIDE

C2/PACKAGE – 2

“NAME OF WORK: “Design & Construction of formation in embankments, cutting including blanketing, Major bridges, Minor bridges, RuB, ERS/retaining wall, sacrificial retaining wall, drains, boundary wall ,fencing works and Station boxes of Nagawara & Kanakanagar for at-grade section of length 11.569 km (Ch: -0.964km to Ch -0.675 km & Ch -0.050km to Ch 4.700km & Ch 4.700km to Ch 11.230km) for BSTP Corridor and also (Ch 4.700km to Ch 10.800km) 6.10 km (approximate) for IR corridor and other related infrastructural works (balance works) from Bennigenahalli to Banaswadi & Banaswadi to Hebbal including validation of design and stability check wherever applicable for works executed by previous contractor (excluding station buildings) of Corridor - 2 of Bengaluru Suburban Transport Project (BSTP)”.

BID DOCUMENT

SECTION 8A EMPLOYERS' REQUIREMENT 2 GENERAL INFORMATION AND SCOPE OF WORK

SECTION - VIIIA

EMPLOYER'S REQUIREMENT - VOL 2 GENERAL INFORMATION AND SCOPE OF WORK

**EMPLOYER'S REQUIREMENTS
TABLE OF CONTENT**

Section	Contents	Page
	SECTION VIII - VOL-2 - EMPLOYER'S REQUIREMENTS	
	SECTION A - EMPLOYER'S REQUIREMENTS –GENERAL	
1.	Introduction	
2.	Definitions and Interpretations	
3.	Relevant Documents	
4.	Phases (Design and Construction)	
5.	Specifications	
6.	Specifications in Metric and Imperial Units	
7.	Works Programme	
8.	Monitoring of Progress	
9.	Quality Assurance	
10.	Digital Delivery of the project and software support	
	A) Digital Delivery	
	B) Software Support	
11.	Co-ordination with Designated and other Contractors	
12.	Dedicated co-ordination team	
13.	Design and construction interface	
14.	Contractor's Project Organisation	
15.	Technology Transfer	
16.	Maintenance Report	
	SECTION B - EMPLOYER'S REQUIREMENTS -FUNCTIONAL	
1.	General	
2.	Co-Ordination/Co-operation with other Contractors & Agencies (External/Internal)	
3.	Traffic Management	
4.	Structures	
	4.1 Reference to the standard codes of practice	
	4.2 Dimension	
	4.3 Associated Works	
	4.4 Construction of casting & Dumping yards	
	4.5 Time Schedule & Monitoring of Progress	
	4.6 Utilities	
	4.7 Inspection	
5.	Alignment of Track ways	
6.	Clearances	
7.	Design Life	
8.	Durability and Maintenance	
9.	Operational Requirements	
10.	Environmental Considerations	
11.	Urban Planning Functional Requirements	
12.	Traffic Management	
13.	Miscellaneous	
14.	Standards	

Section	Contents	Page
	SECTION C EMPLOYER'S REQUIREMENT — DESIGN	
1.	Introduction	
2.	Requirements during Design Phase	
3.	Requirements during Construction Phase	
4.	Design Interface with Designated Contracts	
5.	Design Submissions	
	5.1 Preliminary Design Submission	
	5.2 Definitive Design Submission	
	1. General	
	2. Drawings	
	3. Contract Specification	
	Specification for Formwork	
	1.0 Formwork for Exposed Concrete Surfaces	
	2.0 Formwork for Sloped Surfaces	
	3.0 Formwork for Curved Surfaces	
	4.0 Aesthetic Finishes	
	4.1 General	
	4.2 The manufacturers of proprietary systems shall supply the following information	
	5.0 Supporting Documents	
6.	Notice on Definitive Design Submission	
	6.1 Submission of Design Data	
7.	Design Submissions - GFC Drawings Submissions	
8.	Design Submissions – Construction Phase	
9.	Design Submissions - Review Procedures	
10.	Design Submission Programme	
11.	Programme for Submissions during the Construction Phase	
12.	Calculations	
13.	Documents Requirement	
14.	Liability for review of Documents and Drawings	
15.	Attachment D 1 Design Certificate	
	SECTION D - EMPLOYER'S REQUIREMENTS —CONSTRUCTION	
1.	Contractor's Superintendence	
2.	Checking of the Contractor's Temporary Works Design	
3.	The Site	
4.	Survey	
5.	Safety, Health & Environmental Requirements	
6.	Other Safety Measures	
7.	Care of the Works	
8.	Damage and Interference	
9.	Work on Roads	
	1. Traffic Management Plan	
	2. Mitigation of Traffic Disturbances	
	3. Approval of Temporary Traffic Arrangements and Control	
	4. Temporary Traffic Arrangements and Control	
	5. Particulars of Temporary Traffic Arrangements and Control	

Section	Contents	Page
	6. Use of Roads and Footpaths	
	7. Reinstatement of Public Roads and Footpaths	
10.	Site Establishment: Site Laboratories	
11.	Security	
12.	Testing General	
13.	Records	
14.	Materials	
15.	Provisions for Designated Contractor	
16.	Restoration of Areas Disturbed by Construction	
17.	Contractor's Labour Camp	
	SECTION E – GENERAL PLANNING CRITERIA	
1.	General	
2.	Codes and Standards	
3.	BSTP Railway Alignments	
	3.1 Criteria	
4.	BSTP Design Requirements	
	4.1 General	
	4.2 Stray Current Corrosion Control	
	4.3 Railway Cross Sections & Standard Gauges	
5.	Structural Design Criteria	
6.	Serviceability	
7.	Structural System	
	7.1 BSTP Railway Live Loads	
	7.2 General	
	7.3 Nominal Loads (As per DBR)	
	7.4 Loading Combination	
	7.5 Design Loads (As per DBR)	
	7.6 Wind Loading (As per DBR)	
	7.7 Temperature Loading (As per DBR)	
	7.8 Seismic Loading (As per DBR)	
	7.9 Erection forces and Effect (As per DBR)	
	7.10 Shrinkage and creep	
	7.11 Differential settlement (As per DBR)	
	7.12 Noise Abatement	
8.	BSTP Requirements	
	8.1 Emergency Evacuation	
	8.2 Parapet	
	8.3 Vertical Profile	
	8.4 Span/Depth Ratios	
	8.5 Minimum thickness of members	
	8.6 Span arrangement	
9.	Design Considerations	
	9.1 Vibration and Deflection Limitations (As per DBR)	
	9.2 Design Procedures	
	9.3 Substructure and Foundations	

Section	Contents	Page
	9.4 Method of Construction	
	9.5 Movement/Expansion Joints	
	9.6 Design Surface Crack Width	
	9.7 Temperature Effects	
	9.8 Sway of Viaduct/Bridge Column	
	9.9 Structural Members with Bearing	
	9.10 Thermal Rail Forces	
	9.11 Access to Voids	
	9.12 Pre-stressed Concrete	
	9.13 Bearings	
	9.14 Vertical Clearances	
	9.15 System wide Requirements	
10.	Foundation & Geotechnical Works	
	SCHEDULES -SITE OF THE PROJECT	
1.	Annexure-1- Site	
2.	Annexure-1A – Signed Joint Measurement Sheet	
3.	Annexure-2- Right of Access to the site	
4.	Annexure -3- Alignment Plans (GAD)	
5.	Annexure -4 – Tree Cutting and Forest Clearances-in Process	
6.	Annexure -5- Time Schedule for Review of Drawings by the authority	
7.	Annexure-6- Applicable Permits	
8.	Annexure -7- Provisional Certificate	
9.	Annexure -8- Completion Certificate	

SECTION VIII - VOL-2 **EMPLOYER'S REQUIREMENTS**

C2/PACKAGE – 2

"NAME OF WORK: "Design & Construction of formation in embankments, cutting including blanketing, Major bridges, Minor bridges, RuB, ERS/retaining wall, sacrificial retaining wall, drains, boundary wall ,fencing works and Station boxes of Nagawara & Kankanagar for at-grade section of length 11.569 km (Ch: -0.964km to Ch -0.675 km & Ch -0.050km to Ch 4.700km & Ch 4.700km to Ch 11.230km) for BSTP Corridor and also (Ch 4.700km to Ch 10.800km) 6.10 km (approximate) for IR corridor and other related infrastructural works (balance works) from Bennigenahalli to Banaswadi & Banaswadi to Hebbal including validation of design and stability check wherever applicable for works executed by previous contractor (excluding station buildings) of Corridor - 2 of Bengaluru Suburban Transport Project (BSTP)".

EMPLOYERS REQUIREMENT - SCOPE OF WORK

1. INTRODUCTION

These Employer's Requirements are divided into four sections as follows:

- (a) General: these apply throughout the Contract.
- (b) Functional: these include the specific core requirements for the design and performance of the Works.
- (c) Design: these apply in respect of requirements relating to the design of the Permanent Works.
- (d) Construction: these apply in respect of other requirements relating to the construction of the Works.

2. DEFINITIONS AND INTERPRETATIONS

In addition to the words and expressions defined in the General Conditions of Contract (GCC), further following words and expressions shall have the meaning assigned to them except where the context otherwise requires:

"As-Built Drawings": means those drawings produced by the Contractor and endorsed by him as true records of construction of the Permanent Works and which have been agreed with the Engineer.

"Combined Services Drawings" (CSD): means drawings showing the locations, layouts and sizes of all services including those of other contractors coordinated so as to eliminate all clashes.

"Construction Phase": has the meaning identified in Clause 4 of the Employer's Requirements - General.

"Good for Construction Drawings" (GFC): means those drawings referred to in Clause 2(B) of the Employer's Requirements - Design in respect of which a Notice has been issued.

"Construction Specification": means those parts of the Standard Outline Specification which relate to construction.

"Definitive Design Submission": means the submission of documents which comprise the whole or parts of the proposed Definitive Design and for which the Contractor seeks a Notice.

"Design Manual": means the manual to be prepared and submitted by The Contractor as part of the Definitive Design and as described in the Employer's Requirements Design.

"Design Package": has the meaning identified in Clause 2(5) of the Employer's Requirements - Design.

"Design Phase": has the meaning identified in Clause 4 of the Employer's Requirements - General.

"Design Criteria": means those parts of the Standard Outline Specification which relate to design.

"Final Design": has the meaning identified in Clause 3(5) of Employer's Requirements -Design.

"Notice": means a Notice of No Objection.

"Particular Specification": means the combined specifications prepared by the Contractor in CSI format which combines the Employers Design Criteria, the Employer's Outline Construction Specifications and those parts of the Contractor's Technical Proposals which specify standards for design and construction which are developed

during the Design Phase.

"Preliminary Design": means the submission of documents which comprise the initial stage of the design phase. **"Railway Envelope"**: means the zone or zones within the Works containing the track work and equipment necessary for the operation of the railway.

"Services, Electrical, Mechanical Drawings"(SEM): means those drawings produced by the contractor executing the service works showing the locations, sizes and details for openings in structural elements for mechanical and electrical facilities and other related contracts.

"Standard Outline Specification": means the Design Criteria and the Outline Construction Specifications that specify standards issued by the Employer for development by the Contractor for design and construction.

"Specification": has the meaning identified in Clause 5 of the Employer's Requirements -General. **"Structure Gauge"**: means the profile related to the designed normal coordinated axis of the track into which no part of any structures or fixed equipment may penetrate.

"Working Drawings": comprise the GFC Drawings and such other drawings and documents, such as bar bending schedules and manufacturing drawings, as are necessary to amplify the GFC Drawings for construction purposes and endorsed as required by the Engineer.

3. **RELEVANT DOCUMENTS**

The Design Criteria shall be read in conjunction with the General Conditions of Contract (GCC), the Particular Conditions of Contract (PCC), the Employer's Requirements, the Drawings and any other document forming part of the Contract.

In the event of a conflict between the Employer's Requirements and any Design Criteria, the Design criteria shall prevail.

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

Notwithstanding the precedence specified above the Contractor shall always immediately seek advice from the Engineer in the event of conflicts in Specifications among various standards.

The order of precedence is:

- i. Design Criteria
- ii. Employer's Requirements
- iii. Indian and other International Standards referenced herein.
- iv. Indian and other International Standards

4. **PHASES (DESIGN AND CONSTRUCTION)**

- (1) The Contractor shall execute the Works in two phases, the Design Phase, and the Construction Phase.
- (2) The Design Phase shall commence upon the date of issue of Letter of Acceptance. This phase shall include the preparation and submission of:
 - (a) The Preliminary Design
 - (b) The Definitive Design; and
 - (c) The GFC Drawings.

The Design Phase will be complete upon the issue of a Notice in respect of the comprehensive and complete GFC Drawings Submission for the whole of the Permanent Works.
- (3) The requirements for the Preliminary Design, Definitive Design and GFC Drawings are stated in Employer's Requirements-Design.
- (4) The Construction Phase for the whole or a part of the Permanent Works shall commence immediately upon the issue of a Notice by the Engineer/Employer in respect of the relevant GFC Drawings Submission. Such Notice may be issued by the Engineer in respect of a GFC Drawing Submission covering a major and distinctive part of the Permanent Works. However, construction shall not be commenced until the original negatives of the appropriate Working Drawings have been endorsed:

- (a) by the Contractor as "Good for Construction"; and
 - (b) by the Engineer that he has no objections to the drawing with the approval of Authority/Employer.
- The Construction Phase shall include the completion and submission of the Final Design and the preparation and submission of the As Built Drawings and other records as specified.

- (5) Notwithstanding Clause 4 (4) above, for those elements identified under Clause 2 of the Employer's Requirements - Design, the Construction Phase may commence immediately upon the issue of the Notice in respect of the Definitive Design Submission in respect of each such element subject to availability of the site in accordance with agreed programme.

5. SPECIFICATIONS

In accordance with the provisions of these Employer's Requirements, the Contract Specification contained in the Contract shall be developed during the design stage and submitted as part of the Definitive Design Submission. When the Specification has received a Notice of No Objection from the Engineer it shall become the Particular Specifications and shall take precedence over the other Specifications for construction purposes.

6. SPECIFICATIONS IN METRIC AND IMPERIAL UNITS

- (1) 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.
- (2) Conversion between metric units and imperial units shall be in accordance with the relevant Indian Standards.

7. WORKS PROGRAMME

- (1) The Key Dates are defined in **Contract Key Dates of PCC**.
- (2) The Contractor shall prepare and submit its Works Programme and three-month rolling programmes and the detailed requirements to these Employer's Requirements.
- (3) 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, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors, the review procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or license is required prior to the execution of any work.
- (4) The Works Programme shall take full account of the Design Submission Programme.

8. MONITORING OF PROGRESS

- (1) The contractor shall submit to the site Engineer three copies of a Monthly-Progress Report (MPR), as described in Employer's requirements describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.
- (2) The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from twenty sixth day of the last month and up to twenty fifth day of the current month.
- (3) The MPR shall be divided into two sections. The first section shall cover progress and current status relating to design and the second section shall cover progress and current status relating to construction.
- (4) A monthly meeting to monitor & review the progress of the project shall be convened by the Engineer and chaired by the Employer's nominated official(s). Contractor's site Representative & Designer Representative of Contractor and site agent of all interfacing contractors shall also attend the meeting. The Employer's representative may also be present in the meeting.
- (5) The Employer/Engineer/both may also conduct progress review meetings on alternate day/periodical/weekly /bi-weekly/monthly intervals depending upon the requirements or urgency of works. In these review meetings Contractor's Supplier/Sub-Contractor/Designer etc. also may be called as per the requirements.

9. QUALITY ASSURANCE

The Contractor shall establish and maintain a Quality Assurance System in accordance with **Appendix-3 / Annexure - 1 of Section VIII, Employer Requirements** for design and construction procedures and the interfaces between them. This Quality Assurance system shall be applied without prejudice to, or without in any way limiting, any Quality Assurance Systems that the Contractor already maintains.

10.DIGITAL DELIVERY OF THE PROJECT AND SOFTWARE SUPPORT**(A) DIGITAL DELIVERY**

Bi-RIDE envisages digitization of BIM (Building Information Model). The Designer and Contractor should be familiar with operations of a digital project platform enabling a fully integrated solution for employer & contractors.

The Contractor will be required to work on a digital delivery for built assets based on international standards and methodologies including:

- i. PAS 1192-2/2013 - "Specification for information management for the capital/delivery phase of construction projects using building information modeling"
- ii. PAS 1192-3 2014 - "Specification for information management for the operational phase of assets using building information modeling"
- iii. AIA Document E203TM-2013, Building Information Modeling and Digital Data Exhibit
- iv. CIC BIM Protocol 2013
- v. BIM Forum LOD Specification 2013
- vi. Software packages that may be considered to specify and integrate the system solution that will support the Digital Project Office may include Oracle, SAP, Microsoft Dynamics, CMiC, RiB AG, Autodesk, Bentley, Trimble, Synchro etc.

(B) SOFTWARE SUPPORT

- (1) The Contractor shall provide full support to the Employer and the Engineer for all computer programs provided by the Contractor under the Contract.
- (2) The Contractor shall submit a software support plan at least 90 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 and the Engineer to maintain and re-configure all the software provided under the Contract.
- (4) The Contractor shall submit all new versions to the Employer for review at least 2 weeks prior to their installation. New Versions of any program shall not result in any non-conformance with the Specification or degrade the operation of the System. The Contractor shall:
 - i. Ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.
 - ii. Ensure that all new versions are fully tested and commissioned once installed on the Site.
 - iii. Deliver to the Employer/Engineer any new version, together with the updated Operation and Maintenance Manuals.
- (5) The Employer / 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 Employer's and Engineer's attention including updating the files to suit new version.
- (6) Within 14 days of the installation of any software into the Permanent Works by the Contractor, the Contractor shall submit to the Employer/Engineer for retention by the Employer/Engineer two backup copies (2 copies of the software one for Engineer and one for Employer) of the software, which shall include, without limitation:
 - i. All licenses in favour of Employer for their use.
 - ii. All source and executable code;
 - iii. All design documentation relating to the software; and
 - iv. Any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.
- (7) When a fault is discovered within delivered software or documentation, the Contractor shall take necessary steps to rectify errors or faults at the earliest.

- (8) The Contractor shall provide written details as to the nature of the proposed correction to the Engineer.
- (9) The Contractor shall notify the Employer promptly of any fixes or patches that are available to correct or patch faults.
- (10) The Contractor shall detail any effect such fixes or patches are expected to have, upon the applications.
- (11) The Contractor shall provide training for the Employer's staff to enable the Employer to make proper use of any software and its new versions.

11. CO-ORDINATION WITH DESIGNATED AND OTHER CONTRACTORS' GENERAL

- (1) The Contractor is responsible for detailed co-ordination of his design and construction activities with those of the Designated Contractors, Civil Contractors, Utility Agencies, Statutory Authorities, Private Service Providers, Developers, Consultants, and other Contractors whether or not specifically mentioned in the contract, that may be working on or adjacent to the site for the purpose of the Project. For the purpose of this Specification, all of the above parties shall be referred to as Interfacing Contractors. The Contractor shall note that there are other contractors, consultants, etc. which the Employer will engage from time to time with whom the Contractor shall have to similarly co-ordinate. Such co-ordination responsibilities of the Contractor shall include the following:
 - (a) To provide all information reasonably required by the Interfacing Contractors in a timely and professional manner to allow them to proceed with their design or construction activities, and specifically to meet their contractual obligations.
 - (b) To ensure that the Contractor's requirements are provided to all other Interfacing contractors before the cut-off dates to be identified in the Interface Management Plan (IMP).
 - (c) To obtain from the Interfacing Contractors information reasonably required to enable the Contractor to meet the design submission dates as identified in **Annexure-3 of Section VIII Employers' Requirement.**
 - (d) Where the execution of the work of the Interfacing Contractors depends upon the site management or information to be given by the Contractor, the Contractor shall provide to such Interfacing Contractors the services or correct, and accurate information required to enable them to meet their own programme or construct their work.
 - (e) To co-ordinate access and delivery routes, and to ensure that all provisions for access and delivery of Plant is coordinated with and reflected in the Interfacing Contractor's Delivery Route Drawings. The Interfacing Contractors shall ensure that all Plants are delivered at the time agreed to allow openings left in the structure for such delivery to be sealed in accordance with the Contractor's programme.
 - (f) To co-ordinate with the Interfacing Contractors on attendance.
 - (g) To attend regular co-ordination meetings convened by the Engineer with the Interfacing Contractors. The Contractor shall conduct separate meetings with the Interfacing Contractors as necessary to clarify particular aspects of the interfacing requirements of the Works. The party who convenes the meeting shall prepare minutes recording all matters discussed and agreed at the meeting.
- (2) To ensure that copies of all correspondence, drawings, meeting, minutes, programmes, etc. relating to the Contractor's co-ordination with the Interfacing Contractors are issued to all concerned parties and four (4) copies issued to the Employer/Engineer no later than two (2) calendar days from the date of such correspondence and meetings. The Contractor, shall in carrying out his co-ordination responsibilities, raise in good time and provide sufficient information for the Engineer to decide on any disagreement between the Contractor and the interfacing Contractors as to the extent of services or information required to pass between them. If such disagreement cannot be resolved by the Contractor despite having taken all reasonable efforts, then the decision of the Engineer shall be final and binding on the Contractor.

- (3) Where an Interfacing Contract is yet to be awarded the Contractor shall proceed with the coordination activities with the Engineer until such time when the Interfacing Contractor is available. The Contractor shall provide the Interfacing Contractor with all information necessary to enable the Interfacing Contractor to follow-on and proceed with their coordination.
- (4) The Contractor shall note that the information exchange is an iterative process requiring the exchange and update of information at the earliest opportunity and shall be carried out on a regular and progressive basis so that the process is completed for each design stage by the cut-off dates.
- (5) The Contractor shall co-ordinate with the Engineer on all matters relating to works that may affect the Operation & Maintenance of the already operational Section corridor of the Employer in general. Such work shall be subject to the rules and regulations imposed by the Employer.

12.0 DEDICATED CO-ORDINATION TEAM

- (1) The Contractor shall establish a dedicated co-ordination team, led by a Chief Co-Ordinator in Bangalore reporting to the Contractor's Site Agent (Team Leader). The primary function of the team is to provide a vital link between the Contractor's design and construction teams and the Interfacing Contractors.
- (2) The Chief Co-Ordinator shall assess the progress of the co-ordination with Interfacing Contractors by establishing lines of communications as indicated in the co-ordination model shown in Figure 1 and promote regular exchange and updating of information so as to maintain the Contractor's programme.
- (3) The complexity of the Project and the importance of ensuring that work is executed within time limitations require detailed programming and monitoring of progress so that early programme adjustments can be made in order to minimise the effects of potential delays.
- (4) The Chief Co-ordinator in conjunction with the Interfacing Contractors shall identify necessary provisions in the Works for plant, equipment and facilities of the Interfacing Contractors. These provisions shall be allowed by the Contractor in his design of the Works.
- (5) During the course of the contract, information will be obtained in a number of ways. These may include direct inspection, regular site meetings, the obtaining of progress reports and the use of turn round document to obtain design and programme data. Turn round document shall be issued to the Interfacing Contractors to be returned giving the current positions on their programme.

13.0 DESIGN & CONSTRUCTION INTERFACE

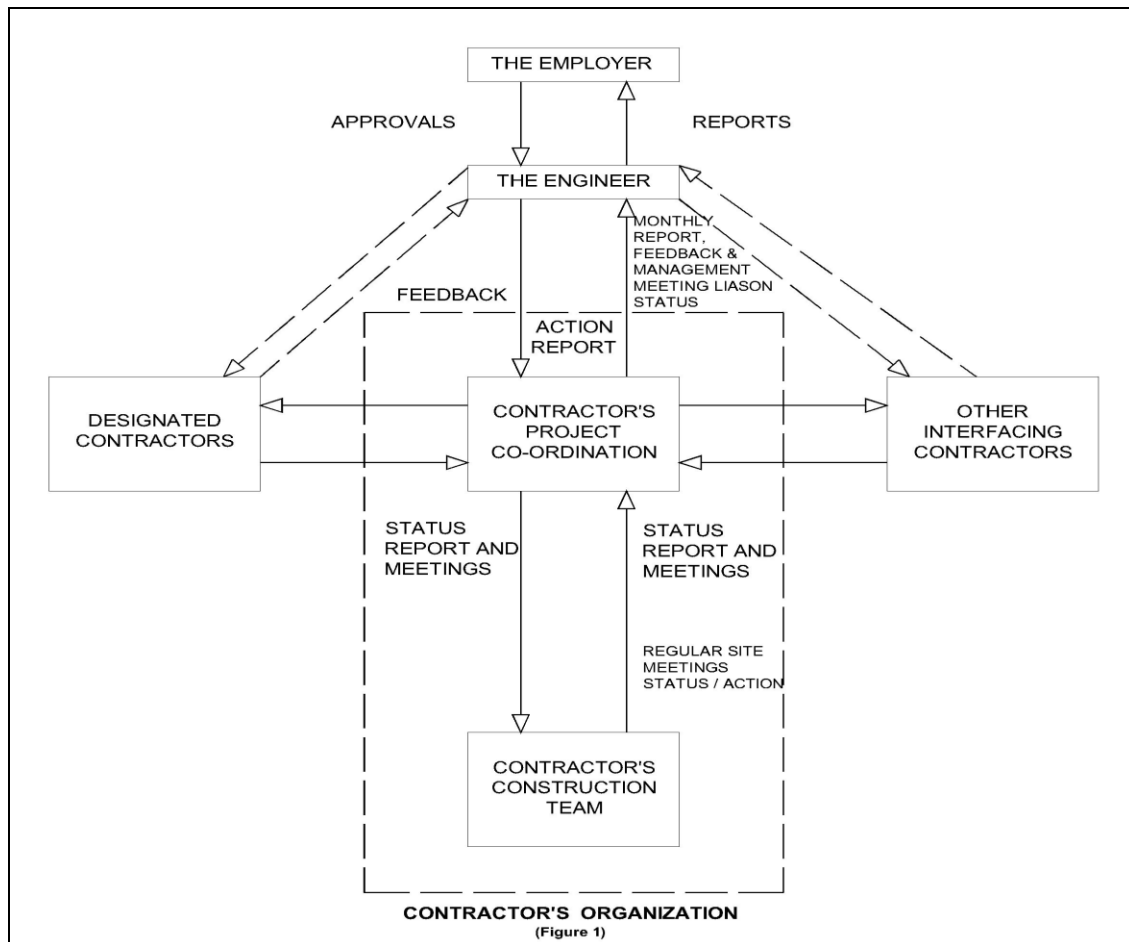
- (1) The dates shown in Employer's Requirements **Annexure- 3 of Section VIII-Employers' Requirement.** are critical to the timely completion of the project. The Contractor shall commence design interface with the Interfacing Contractors as soon as he has been notified by the Engineer that such Interfacing Contract has been awarded. In the case of utility agencies and other statutory boards, interface shall commence as soon as it is practicable. Where no design interface date has been established because the Interfacing Contractors have not been identified or for whatever reason, the Contractor shall liaise with such Interfacing Contractor/s as soon as they have been awarded.
- (2) The Contractor shall immediately upon award of the Contract gather all necessary information and develop his design to a level where meaningful interaction can take place as soon as the Interfacing Contracts are available. The Contractor shall submit together with each of his Design Submissions a joint statement from the Contractor and the relevant Interfacing Contractor confirming that design co-ordination has been completed and that they have jointly reviewed the appropriate document to ensure that a consistent design is being presented.
- (3) The design interface is an iterative process requiring regular exchange and update of interfacing information. The Contractor shall ensure that the information he requires from the Interfacing Contractors is made known at the outset of each design interface and vice versa so that the information can be provided in time for the Contractor and the Interfacing Contractors to complete their design to meet their various design submission stages.

CONSTRUCTION INTERFACE

- (1) Construction interface will be necessary throughout the duration of the Works commencing from the

time the Contractor mobilizes to the Site to the completion of the Works. Construction interface will overlap design interface, involving cast-in and buried items such as pipes for electrical and mechanical services, supports, brackets, plinths, ducts, service buildings if arising, openings, cableways, trenches etc. that are to be incorporated at the early stage of the construction up to provision of attendance during the testing and commissioning stage.

- (2) The Contractor shall ensure that there is no interference with the Works of the Interfacing Contractors and shall maintain close co-ordination with them to ensure that his work progresses in a smooth and orderly manner. The Contractor shall carry out and complete the Works, or any part thereof, in such order as may be agreed by the Engineer or in such revised order as may be requested by the Engineer from time to time. The Contractor shall, unless otherwise provided, be liable for and shall indemnify the Employer against all costs, charges, expenses, and the like resulting from failure of the Contractor to co-ordinate the Works as specified.
- (3) For effective document/record control consisting of Design reports and GFCDs to make the design interface more efficient.



14. CONTRACTOR'S PROJECT ORGANISATION

- (1) The Contractor shall have a competent team of Managers, Engineers, Technical staff etc so as to complete the work satisfactory as per various requirements of the contract.
- (2) A control room with round the clock radio communication or telephone switch board links with all safety offices, works sites, site offices, batching plants, casting yards, workshops, fabrication yard, off site offices, Engineers site office, Resident Engineer's office, testing labs etc shall be maintained and manned round the clock. Residences of all senior project team members shall also be linked with the control room. Vehicles for emergency use should be on stand-by at the control room around the

clock.

- (3) The designations of the various project organizations team members shall be got approved by the Engineer before adoption so as to avoid any duplication of the designations with those of the Employer or the Engineer.

15. TECHNOLOGY TRANSFER

- (1) The Contractor shall ensure that all local contractors and sub-contractors engaged in the works are given training, guidance, and the necessary opportunity for transfer of technology in various areas of construction such as instrumentation, safety, quality assurance, fabrication, piling etc.

16. MAINTENANCE REPORT

- (1) The Maintenance Report shall be submitted as part of the Definitive Design and shall include full details of the long-term inspection and maintenance operations for each major component of Project
- (2) For each area an inspection checklist shall be supplied giving 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. The recommended regular maintenance regime of each area shall also be given including cleaning methods and frequency for different Surfaces; removal of leakage borne salts from concrete surfaces; cleaning of drainage channels, sumps and pipes; repainting of metallic items.
- (3) A long-term monitoring regime shall also be included covering items such as
 - i. Viaduct/Bridge
 - ii. Differential movement at viaduct / Bridge/station junctions or other areas identified in the design.
 - iii. Loss of prestress in the girders with passage of time.
- (4) All instruments necessary to carry out the inspections and monitoring that are identified in their port shall be provided by the Contractor within the lump sum tender price.

SECTION-B EMPLOYER'S REQUIREMENTS – FUNCTIONAL

OBJECTIVE

The objective of the contract is, construction, completion, testing and commissioning of the permanent works by the Contractor (including without limitation, construction, and removal of the Temporary Works) and the rectification of defects appearing in Permanent Works in the manner and to the standards and within the time stipulated by the Contract. In full recognition of this objective, and with full acceptance of the obligations, liabilities and risks which may be involved, the Contractor shall undertake the execution of the Work.

1. GENERAL

1. The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Employer's Requirements-Functional.
2. The design of the Permanent Works shall be developed in accordance with these Employer's Requirements - Functional, the Contractor's Technical Proposals and the other requirements of the Contract.
3. The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date good Engineering practices. The Specification shall in any case not specify standards which, in the Engineer's opinion, are less than or inferior to those described in the Design Basis Report (Design Criteria) and Technical/Construction Specifications contained in the Tender Documents. Construction shall be carried out employing the procedures established by the Contractor in his Quality, Safety Health and Environmental management plans.
4. The Contractor shall be responsible for obtaining all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies in the construction of the works.

2. CO-ORDINATION/CO-OPERATION WITH OTHER CONTRACTORS & AGENCIES (EXTERNAL/INTERNAL)

- i. In addition, the Contractor shall be required to carry out various miscellaneous works as per interfacing requirements. The contractor shall carry out necessary co-ordination with various system contractors pertaining to traction power supply, signalling, telecommunication etc. for keeping provisions pertaining to cut outs, shafts, concealed conduits, other conduits, fixtures, inserts clearances etc. all complete.
- ii. Earthing and lightning protection measures wherever required.
- iii. The track supporting structure will support ballast less track (long welded rail) which will be laid later by a separate contractor. Arrangements required for provision of such ballast less track will have to be incorporated in the deck, in consultation with the Engineer. Where the ballast less track concrete is to be laid on the top of the deck slab, as directed by the Engineer, contractor will make suitable arrangements for proper keying up further concrete layers /or casting blocks which will form part of track work to be done by a separate contractor.
- iv. The contractor shall cooperate with the other contractors appointed by the employer so that the work proceeds smoothly to the specifications of the Engineer. The contractor shall plan & execute the works with proper intimation to the other contractors.
- v. NOC & Approval of schemes of diversion of utilities from the concerned regulatory / statutory /Local authority is the responsibility of the contractor.
- vi. The contractor shall attend regular coordination meetings convened by the employer / engineer for interface and adhere to the decisions taken in the meeting.
- vii. Access will be provided to the staff of the other Contractor appointed by the employer for

carrying out their works and bringing materials and equipment at the site. However, the security of materials and Equipment's brought at the site will be the responsibility of the respective Contractors.

- viii. The contractor shall, in carrying out his coordination responsibility, raise in good time and provide sufficient information for the employer to decide on any disagreement with other contractor. If the contractor despite having taken all reasonable efforts cannot resolve such disagreement, then the decision of the Engineer shall be final and binding on the contractor.

3. TRAFFIC MANAGEMENT

The Contractor shall make the detailed traffic diversion plans in consultation with Bangalore Traffic Police. The work is to be executed with proper liaison with Bangalore Traffic Police. Necessary assistance will be given by Bi-RIDE. The scheme should be such that preferably two lanes limiting to minimum of one lane of traffic in each direction of the road should be available for the smooth flow of traffic. The Contractor should inspect the site. The Contractor shall also strengthen the road where the diversions are planned by widening, repairing to the road surface etc.

4. STRUCTURES

The construction of structures will have to be planned in such a manner that they do not obstruct or interfere with the existing roads/railways and other utilities. Where work is required to be carried out at locations adjacent to such roads/railways, utilities, structures, monuments etc. suitable safety and protection arrangements will have to be ensured for which nothing extra will be payable. It should be ensured that no damage is caused to any such elements and engineer/employer shall be indemnified against such damage at no extra cost.

Any other item of work as may be required to be carried out for completing the construction of elevated structure of specified length including all necessary interfaces works with station and system Contractors in all respects in accordance with the provisions of the Contract and/or to ensure the structural stability and safety during and after construction are included in the scope.

DESIGN CRITERIA (VIADUCT/BRIDGE)

Design shall be carried out as per design basis report. Indicative parameters for designing of viaduct/Bridge are given below:

A. SPACING OF TRACKS.

Since the U-Girders are preferred in superstructure, the spacing of the tracks shall be considered in conformity with SOD.

If independent girders carry each track, then the Structure gauge on each track will determine the spacing of tracks when there is a structure between tracks. Ex: parapet wall, web of girder in case of trough type girder, etc. Since end evacuation is adopted in BSTP, Tenderers may note that side walkways are not a must in the viaduct/Bridge, and this may be taken note of while designing the girders for the viaducts/Bridges".

B. ADDITIONAL ELEMENTS

The Girder deck shall carry in addition to the two tracks,

- i) Rail plinths (since the track is ballast less track), Two numbers supporting the two rails of each track, totalling to four plinths ('L' shaped). **The rail plinths are also called 'derailment up stands'.**
- ii) Dowels for rail plinth are covered in the scope of the work.
- iii) The parapet wall shall be designed to accommodate all system requirements including cable ducts

as specified and approved.

C. CLEARANCE BETWEEN CABLES

Since power cables and S&T cables will be close to each other, to prevent induction, etc a Minimum clearance shall be kept between them.

Note: B and C above will have to be additionally considered by the tenderer while fixing the Deck width of the girder. It may be noted that the tenderer cannot have any claim for minor changes which may be required to be made after award of contract. **The final parameters/dimensions shall be decided as an interfacing activity.**

Engineer's decision will be final and binding on the tenderer in this respect. Inserts/Fixtures/Supports/Hangers for system contractors shall be supplied and installed at no extra cost, by the contractor.

4.1 REFERENCE TO THE STANDARD CODES OF PRACTICE

All Standards, Technical Specifications and Codes of practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Indian Standard Codes of practice and IRS & IRC Codes as applicable.

4.1.1 Wherever Indian Standards do not cover some particular aspect of design/ construction, relevant British/German Standards will be referred to. The Contractor shall make available at site such standard codes of practice.

4.1.2 In case of discrepancy among Standard codes of practice, Technical Specifications, and provisions in sub clauses of NIT, the order of precedence will be as below:

- i) Provision in ITT and Employers Requirements
- ii) Technical Specifications provided in the tender doc, (Order of priority IRS, IS, IRC codes)
- iii) MORTH Specification for road & Bridges
- iv) CPWD specifications
- v) Standard Codes of Practice

In case of discrepancy among Standard Codes of Practice, the order of precedence will be IRS, IS, IRC, BS, DIN, FIP, AASHTO, ASTM.

4.2 DIMENSIONS

4.2.1 As regards errors, omissions and discrepancies in Specifications and Drawings, relevant clause of Particular Conditions of Contract will apply.

4.2.2 The levels, measurements and other information concerning the existing site as shown on the conceptual / layout drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or strata turning out different from what is shown on the drawings.

4.3 ASSOCIATED WORKS

Works to be performed shall also include all general works preparatory to the construction and works of any kind necessary for the due and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and technical specifications, to best Engineering standards and orders that may be issued by the Employer/Engineer from time to time, compliance by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient

protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first -aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the erection of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

4.4 CONSTRUCTION OF CASTING & DUMPING YARDS.

No land for casting yard or offices/laboratories etc. will be provided by the employer. However, the employer will give the necessary assistance required for seeking permissions but without any responsibility for the same. Contractor should make his arrangements at his own cost which is deemed to be included in Lump sum price in **Schedule-A, B & C**

Satisfactory tyre washing arrangements of each, and every vehicle shall be made by the contractor for the vehicles leaving the depot to avoid the spillage on the connecting roads.

4.5 TIME SCHEDULE & MONITORING OF PROGRESS

- (i) The agency shall submit with the tender "Time Schedule" for completion of various portions of works. This schedule is to be within the overall completion period of months. The detailed programme in the form of a quantified bar chart or CPM network shall include all activities starting design to completion.
- (ii) In compiling its Works Programme and in all subsequent updating and reporting, the contractor shall make provision for the time required for co-coordinating- and completing the design, testing, commissioning, and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors, the review procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or license is required prior to the execution of any work.
- (iii) The Contractor shall submit to both the Employer & Engineer Four copies of a Monthly Progress Report (MPR), describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.
- (iv) The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from twenty sixth day of the last month and up to twenty fifth day of the current month.
- (v) A monthly / biweekly meeting to monitor the progress of the project shall be convened by the Engineer, Contractor's site agent and site agent of all interfacing contractors shall attend the meeting. The Employer may also be present in the meeting.

4.6 UTILITIES

Utility identification at foundation locations will be done by the contractor and in case utility (ies) is encountered or obligatory requirement is to be met out; the contractor shall modify the span configuration at such location to save the utility (ies) or to meet obligatory requirements within the accepted price. No payment shall however be made for supporting the utilities during course of work. Any other utilities shifted by the contractor as directed by Engineer/Employer, will be paid separately under **Schedule-C**.

The utilities are to be diverted with proper liaison and approval of the utility owning agencies. The utilities which are not diverted but require supporting, proper supporting is to be done so that they are not damaged along their branches. Precautions to be taken while handling the utilities are mentioned as under.

- (i) Utilities must not be damaged at any cost. If due to some reason or the other, mishap occurs, it should be rectified immediately by the Contractor at his own cost under intimation of Engineer / Employer.

- (ii) Till rectification of the damaged trunk sewers, the Contractor shall arrange substitute arrangement for sewage pumping and its disposal as per directions of Engineer. Similar arrangement is to be done for other utilities.
- (iii) The manholes of Trunk/Sewers should not be covered under the foundation as these may create hindrances to the annual de-silting/cleaning of sewer lines.
- (iv) Sufficient distance of foundation from outer edge of Trunk / Sewers is kept in view of further maintenance/Safety of Trunk/Sewers.
- (v) The covers of manholes be saved from heavy machinery movement to avoid any accident/Slippage of malba in manholes etc into the Trunk /Sewers which may cause blockage of lines. In case of damage of manhole cover & frame the same shall be replaced immediately by the Contractor at his own cost.
- (vi) Manholes of the trunk sewer should be kept freely accessible for cleaning and removal of blockages and malba should not be dumped over these manholes.
- (vii) Branch sewer connections which are connected with the trunk sewers should also be taken care of. If the same are damaged, the same should be restored immediately on priority.
- (viii) NOC & Approval of schemes of Diversion of Utilities from the concerned regulatory / statutory / Local Authority will be got done by contractor. However, necessary assistance will be provided by K-RIDE.

These are only indicative for one of the utilities only. Similarly, necessary precautions which are specified from time to time by the utility owning agencies shall also be followed. The Central verge/footpath furnishings which are to be dismantled be handed over to the concerned department in their stores at contractor's own cost.

4.7 INSPECTION

Engineer / Employer may appoint an independent agency to ensure the quality checking of design, supply, fabrication, erection, and construction of all the work under 'scope of work'. The contractor shall ensure complete co-operation with the agencies to perform their work satisfactorily. In addition, Engineer / Employer also reserves the right to undertake quality check and inspection directly by itself.

5. ALIGNMENT OF TRACKWAYS

- (1) The alignment shall be as shown in the tender drawings. The alignment has been developed by the Employer to meet operational and technical criteria. The Contractor is not required to evaluate the alignment for compliance with these criteria but shall review it with respect to his own design and construction proposals and shall satisfy himself that there is no conflict with existing structures which are to be preserved.
- (2) The Contractor is permitted to propose minor deviations in alignment to suit his construction proposals, but he must demonstrate that any such deviations shall comply with good design practice and the

alignment requirement of the Design Criteria. Such deviations shall require prior approval of the Employer subject to following conditions: -

- i. There is no extra cost to the employer.
- ii. Changes proposed are essentially required to suit the contractor's specific design.
- iii. There is no change at the contract boundaries or if there is any, the same is agreed by the contractor of the adjoining section without any extra cost to the employer.

6. CLEARANCES

- (1) The Permanent Works shall not infringe the Structure Gauge. Extra clearances shall be provided on curved alignment as per the Schedule of Dimensions (SOD)/Design Basis Report (DBR).
- (2) The Permanent Works shall provide for the installation by the Designated Contractors of operating equipment for the railway/BSTP and without infringement of the Structure Gauge.
- (3) Railway clearances:
Various clearances shall be provided as per the schedule of dimensions approved for the Engineer / Employer.
- (4) Construction limits:
 - (a) The limits of land for the Works will be given to successful tenderer. The Contractor shall design the Works to be contained totally within these limits, respecting the regulations concerning construction and property boundaries of the local authorities such as BMRCL, BDA, BBMP, SWR, BWSSB, BESCOM, DULT etc., In the event that the Contractor, having used its best endeavours, is unable to design the permanent works and utilities to be contained totally within these limits, then the Employer will obtain the necessary additional land or the Contractor may be required to redesign the structure as instructed by Engineer.
 - (b) The limits of land will be given to successful tenderer but for general guidance it is 4.5 m on either side of the center line in Viaduct/ Bridge portion and limits of the land for At-Grade portion as per the Tender drawing. However, the permission for barricading etc. will be given depending upon the preparedness of the contractor, issues concerning traffic department etc. as is the usual practice. It may undergo changes after final survey and the Contractor shall make any adjustments necessary to the design to acknowledge the changes to the limits as then defined. Site will be made available progressively depending upon the requirement.
 - (c) The approval for viaduct, major bridges, minor bridges, ROB's, RUB drawings from railway to be obtained by the contractor. The necessary assistance will be provided by Engineer / Employer.

7. DESIGN LIFE

The design life of all Permanent Works shall be **100 Years**. Bridge bearings and movement joints shall have a minimum design life of 50 years Paint systems for steelwork shall ensure a minimum life of 15 years.

8. DURABILITY AND MAINTENANCE

- (1) The Permanent Works shall be designed and constructed such that, if maintained reasonably and in accordance with the Contractor's statement of maintainability contained in the Contract, they shall endure in a serviceable condition throughout their minimum lives
- (2) The permanent Works shall be designed and constructed so as to minimize the cost of tenancy whilst not compromising the performance characteristics and ride quality of the railway.
- (3) Restoration of roads, utilities and other services dislocated during construction is the responsibility of the contractor.
- (4) Survey, instrumentation, ground treatment, ground and building monitoring, risk analysis, settlement prediction, preventive and corrective actions is the responsibility of the contractor.
- (5) Traffic management along the worksite including works connected with traffic management is the responsibility of the contractor.
- (6) Reinstatement of services (such as street lighting, signalling system, bus stand, footpath including kerb stone, boundary wall, horticulture work and any other work to bring the site to original position) within barricading area as per current standards with new materials (except electrical/signal post which may

be reused if they are usable.

- (7) The contractor shall be responsible for obtaining relevant certificates or clearance from local civic authorities.
- (8) The contractor shall be responsible for obtaining approval by all relevant civic authorities having jurisdictional authority wherever required.

9. OPERATIONAL REQUIREMENTS

- (1) The Permanent Works shall be designed to permit the BSTP to operate satisfactorily at a maximum design speed as described in Design Basis Report.
- (2) The vertical and horizontal alignments for the main line track work shall comply with the conditions laid in para (3) and (4) of this document.
- (3) Particular attention shall be paid to locations where flooding could damage the railway. In particular Construction of surface water drainage systems including plinths and ducts shall be avoided in the vicinity of traction substations to obviate any risk of flooding of electrical equipment areas.
- (4) During construction the contractor shall be responsible for providing and maintaining adequate flood protection to ensure protection of the works.

10. ENVIRONMENTAL CONSIDERATIONS

All provisions and conditions contained in the conditions of contract on safety, health & environment and Section-8C of the tender document shall be strictly complied with. Bidders should note that any stipulations specified by the funding agency in relation to environment, social, health and safety (eshs) shall be complied in all respect. Such stipulations will be uploaded along with as addendum in due course of bid process.

11. URBAN PLANNING FUNCTIONAL REQUIREMENTS

1. Requests for temporary power supplies for the construction of the works must be submitted by the contractor to the concerned authorities. Alternatively separate power supplies may be arranged by the Contractor independent of concerned electricity distribution/ transmission authority subject to compliance with all necessary statutes.
2. In addition, a number of agencies are involved in the reinstatement works, permanent road accesses, temporary road accesses, refuse collection accesses, street lighting, traffic management and fire hydrant positions. The Contractor is responsible for obtaining the approvals for these other works.
3. The Contractor is responsible for obtaining the approval of applications from the above authorities for the design and construction of works. The Employer may provide assistance in order to obtain any permission on clearances.

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 in co-ordination with Engineer and in conjunction with Bangalore Traffic Police. He shall comply strictly with the approved plan during construction of his works. The design shall provide for temporary road decking wherever necessary to provide minimum no. of traffic lanes as agreed with Bangalore Traffic Police.

13. MISCELLANEOUS

The Contractor shall note that the Commissioner for Railway Safety (CRS) will inspect the Works from time to time for the purpose of determining whether the Bangalore Suburban Rail Corridor Project complies in terms of operational and infrastructural safety in accordance with the Laws of India. The contractor shall note that CRS approval is mandatory for commissioning the system. Notwithstanding other provisions of the

Contract, the Contractor shall ensure that the Works comply with the requirements of CRS in terms of construction to the drawings and shall assist the representatives of CRS in carrying out their inspection duties and also comply with their instructions regarding rectifying any defects and making good any deficiencies.

14. STANDARDS

- (1) Equipment, materials, and systems shall be designed, manufactured and tested in accordance with the latest issue of International and/or National codes and standards. The Contractor shall submit hard copies in original to the Employer/ Engineer of all codes and standards used for the work.
- (2) Reference to standards or to materials and equipment of a particular manufacturer shall be regarded as followed by the words "or equivalent". The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified. If the Contractor for any reason proposes alternatives to or deviations from the specified standards or desires to use materials or equipment not covered by the specified standards, the Contractor shall apply for the consent of the Engineer. The Contractor shall state the exact nature of the change, the reason for making the change and relevant specifications of the materials and equipment in the English language. The decision of the Engineer in the matter of quality will be final. No compensation or extra money shall be paid.

SECTION C**EMPLOYER'S REQUIREMENTS -DESIGN****1. INTRODUCTION**

- (1) The Employer's Requirements - Design, specifies the procedural requirements for the preparation of the design of the Permanent Works. These requirements are subdivided into those that are to occur during the Design Phase, those that are to occur during the Construction Phase, and those that are of general application.

- (2) Obligations prior to commencement of Works relating to Design and Construction.

Within 20 (twenty) days of the LOA, the Contractor shall:

- (a) appoint its representative, duly authorized to deal with the Authority in respect of all matters under or arising out of or relating to this Agreement;
- (b) appoint a Design Director who will head the Contractor's design unit and shall be responsible for surveys, investigations, collection of data, and preparation of preliminary and detailed designs;
- (c) undertake and perform all such acts, deeds and things as may be necessary or required before commencement of Works under and in accordance with this Agreement, Applicable Laws and Applicable Permits; and
- (d) make its own arrangements for quarrying and procurement of materials needed for the Railway Project under and in accordance with Applicable Laws and Applicable Permits.

- (3) DESIGN AND DRAWINGS

Design and Drawings shall be developed in conformity with the Specifications and Standards set forth in Schedules and Employers Requirement and scope of work. In the event, the Contractor requires any relaxation in design standards due to restricted Right of Access in any section, the alternative design criteria for such section shall be provided for review of the Authority's Engineer.

The Contractor shall appoint a proof check consulting agency (the "Proof Consultant") after proposing to the Authority a panel of 3 (three) names of qualified and experienced firms and Authority will select 1 Proof Consultant from panel. The Parties agree that no firm or person having any conflict of interest shall be engaged hereunder.

The Proof Consultant shall:

- a) evolve a systems approach with the Design Director so as to minimise the time required for final designs and construction drawings; and
- b) proof check the detailed calculations, drawings, and designs, which have been approved by the Design Director.

No review and/or observation of the Authority's Engineer and/or its failure to review and/or convey its observations on any Drawings shall relieve the Contractor of its obligations and liabilities under this Agreement in any manner nor shall the Authority's Engineer or the Authority be liable for the same in any manner; and if errors, omissions, ambiguities, inconsistencies, inadequacies or other Defects are found in the Drawings, they shall, along with the affected Works, be corrected at the Contractor's cost.

The Contractor shall be responsible for delays in submitting the Drawings, caused by reason of delays in surveys and field investigations, and shall not be entitled to seek any relief in respect thereof from the Authority; and

the Contractor warrants that its designers, including any third parties engaged by it, shall have the required experience and capability in accordance with Good Industry Practice and it shall indemnify the

Authority against any damage, expense, liability, loss or claim, which the Authority might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty as set out in this Clause.

Any cost or delay in construction arising from review by the Authority's Engineer shall be borne by the Contractor.

The Contractor shall appoint a safety consultant and the Safety Consultant shall:

- i. evolve a system approach for undertaking a safety audit of the Railway Project during construction phase; and
- ii. proof check the detailed safety plan covering all aspects of including safety of Users, workers, and equipment.

(4) CONSTRUCTION OF THE BSTP PROJECT

The Contractor shall construct the Railway Project as specified in Schedules, and in conformity with the Specifications and Standards. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions, or alignment of the Works. For works involving existing yards, the non-interlocking programme for each year shall be drawn by the Authority's Engineer and provided to the Contractor. The Contractor and the Authority's Engineer, within a period of 30 days, will discuss the same and issue a jointly agreed programme. The execution of work during the non-interlocking period will be the responsibility of the Contractor. The work during non-interlocking period in yards will be executed directly under the supervision of Employer / Railways, however, the timely completion of non-Interlocked working will be the responsibility of the Contractor and the Contractor agrees and undertakes that the construction shall be completed on or before the Scheduled Completion Date, including any extension thereof, in which case the Scheduled Completion Date will be the extended date as per the time extension granted.

In addition to the express requirements herein, the Contractor shall, whenever the Engineer so requests, provide information and participate in discussions that relate to design matters.

The Contractor shall engage the Designer who shall undertake and prepare the design of the Permanent Works and Temporary Works. The Contractor shall establish an office for his core design team at the Site in Bangalore. The core design team shall function from this office and all meetings and discussions relating to design shall be held in this office.

The Contractor shall ensure that the Designer continues to be represented in Bangalore 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.

The Contractor shall submit his Quality Assurance Plan as required at **Appendix-3 / Annexure 1 of Section VIII - Employer Requirements** for the design required by the Contract.

2. REQUIREMENTS DURING DESIGN PHASE

- (1) The principal requirements of the Design Phase are the production of the Preliminary Design, the Definitive Design and Good for Construction Drawings (GFC).

- (2) Preliminary Design

The Preliminary Design shall incorporate guidelines provided in tender documents and conceptual arrangements submitted. In addition, general construction methods and documentation needed to develop the Definitive Design shall be submitted.

- (3) Definitive Design shall accord with and incorporate the Contractor's Technical Proposals and shall be the design developed to the stage at which all elements of the structures are fully defined and specified and in particular:

- (a) Calculation and analysis are complete;
 - (b) All main and all other significant elements are delineated;
 - (c) All tests and trials and all selection of materials and equipment are complete;
 - (d) Shall take full account of the effect on the Permanent Works of the proposed methods of construction and of the Temporary Works.
- (4) During the preparation of the Definitive Design, the Contractor shall complete all surveys investigations and testing necessary to complete the design of the Permanent Works.
- (5) The Contractor shall sub-divide the proposed Definitive Design into Design Packages to be submitted in advance of the Definitive Design Submission and to be identified in the Design submission Programme. The Design Packages are to relate to the significant and clearly identifiable parts of the proposed Definitive Design and shall address the design requirements as described herein. The Design Packages shall facilitate the review and understanding of the definitive Design as a whole and shall be produced and submitted in an orderly sequential and progressive manner.
- (6) Separate Definitive Design Submissions may be prepared for those major elements to be procured by sub-contract and which sub-contracts include design. Where such work is to be procured by the Contractor on the basis of outline design, design briefs and performance specifications, such documents may be submitted as Definitive Design Submissions.
- (7) Upon issue of the Notice in respect of the Definitive Design Submission, the Contractor shall complete the design in all respects and produce the GFC Drawings, the purpose of which is to illustrate all the Permanent Works and to be the drawings governing construction.
- (B) GFC Drawings shall fully detail for the construction of the elements covered by the Definitive Design and shall show in full the works to be constructed.

3. REQUIREMENTS DURING CONSTRUCTION PHASE

- (1) The principal requirements relating to design during the Construction Phase are the production of Working Drawings, the preparation of technical submissions as required under the Contract, the compilation of the Final Design and the production of the As-Built Drawings.
- (2) Working Drawings shall be prepared as required under the Contract. They shall be endorsed by the Contractor as being in accordance with the GFC Drawings.
- (3) The Contractor shall endorse the submissions required under the contract that "all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of these parts"
- (4) At least 3 months but not more than 6 months prior to the anticipated date of substantial completion of the Works, the Contractor shall submit the Final Design to the Engineer.

- 5) The Final Design is the design of the Permanent Works embodied in:
- (a) The latest revisions of the documents comprised in the Definitive Design, taking account of comments in the schedules appended to Notices of No Objection
 - (b) The latest revisions of the GFC Drawings;
 - (c) The calculations (see Clause 11 herein); and
 - (d) Such other documents as may be submitted by the Contractor at the request of the Engineer to illustrate and describe the Permanent Works and for which a Notice has been issued.
- (6) The Contractor shall maintain all records necessary for the preparation of the As-Built Drawings. Upon completion of the Works or at such time as agreed to or required by the Engineer, the Contractor shall prepare drawings which, subject to the Engineer's agreement, shall become the As-Built Drawings. All such drawings shall be endorsed by the Contractor as true records of the construction of the Permanent Works and of all temporary works that are to remain on the site. The Contractor shall also show the locations of utilities exposed and retained as directed.

4. DESIGN INTERFACES WITH DESIGNATED CONTRACTOR

The Contractor shall coordinate all design and installation works with the various Designated contractors and establish the Co-ordinate Installation Plan (CIP). The coordinated installation Plan (CIP) shall be developed by the contractor in a format acceptable to the Engineer. The Contractor shall co-ordinate with all interfacing designated contractors to produce a detailed programme of access dates, equipment delivery routes and occupation periods for each room and area inside the station envelope. The CIP shall be signed off by each Designated Contractor and Submitted to the Engineer not later than **3 (Three) months** before basic structure is completed as described in **Annexure-3 of Section VIII ,Employers' Requirement**.

5. DESIGN SUBMISSIONS

5.1. PRELIMINARY DESIGN

SUBMISSION GENERAL

The preliminary design shall provide initial design documents for review and shall be sufficiently detailed to show the design of main elements and documents required for preparation of the definitive design. It shall also include:

- a) The quality assurance plan for design
- b) A review of the outline design criteria
- c) The submission of design manuals
- d) The submission of proposed software
- e) The preliminary equipment layouts and details
- f) The preliminary maintenance analysis
- g) The preliminary off-site testing recommendation
- h) The submission of specifications proposed for the work
- i) The identification of design codes and standards
- j) The CAD procedures
- k) Deleted
- l) Preliminary viaduct/Bridge sizing
- m) An alignment reviews
- n) The preliminary construction methodology
- o) The design submission programme (update)
- p) The utility diversion plan
- q) Proposed site surveys and other field surveys
- r) A review of permanent land requirement
- s) The preliminary ground treatment and building protection proposal.
- t) The preliminary reinstatement drawings.

5.2. DEFINITIVE DESIGN SUBMISSION**1. GENERAL**

The Definitive Design Submission shall be a coherent and complete set of documents properly consolidated and indexed and shall fully describe the proposed Definitive Design. In particular, and where appropriate, it shall define:

- (a) The dimensions of all major features, structural elements and members;
- (b) All materials;
- (c) Potential forces and movements due to all possible loadings and actions on the structures, and their accommodation;
- (d) All second order effects;
- (e) The layout and typical details of reinforcement in structural concrete members;
- (f) The locations and nature of all relevant joints and connections and details thereof;
- (g) Standard details;
- (h) Location, geometry and setting-out of all main elements and features;
- (i) Electrical and mechanical services and equipment and their interaction with the structures;
- (j) Provisions and proposals for construction interfacing with the Designated Contractors;
- (k) Utilities to be diverted/supported;
- (m) Traffic or other civic service affected.

2. DRAWINGS

The Definitive Design Submission shall include drawings that shall illustrate the proposed Definitive Design and in particular shall include, without limitation:

- (i) General arrangements;
- (ii) Layouts and details of structural elements;
- (iii) Associated fittings;
- (iv) Structural and surface drainage
- (vii) Existing and proposed utilities;
- (viii) Road works and works related to traffic management including decking.

3. CONTRACT SPECIFICATION

The Specification included in the tender documents together with the Outline Design Specification and Outline Construction Specifications shall be amplified so as to specify comprehensively the design and construction of the Permanent Works.

DESIGN MANUAL

The Design Manual shall incorporate all design requirements, standards, codes, loading cases, permissible movements and deflections, limit states, design-stresses and strains, material properties and all other documents or matters which are relevant to and govern the design. The Design Manual shall refer to all materials, codes and standards used, making clear their specific applications. The Design Manual shall be produced so that it can be used by those involved in the preparation or review of the design of the Permanent Works as a comprehensive reference text and efficient working document.

INTERFACE REPORT ON DESIGNATED CONTRACTS

This will include the following:

Details of the design and construction of the Works adjacent to other contracts. Details of provisions for the Designated Contractors, indicating arrangements for accesses, fixings, casting- in, openings, supports, decks, manholes, trenches, and the like; updated interface management plan relating to design integration and co-ordination.

TESTING AND COMMISSIONING REPORT

Details of proposals for testing and commissioning procedures for all relevant elements and equipment contained in the Permanent Works.

MAINTENANCE REPORT

A report updating the Statement of Maintainability in the tender documents and Detailing maintenance routines necessary for the achievement of the required life of the various elements of the Works.

AESTHETICS**REPORT: BRIDGE****AESTHETICS:**

Bridge structures are important landmarks and play a significant impact in the collective experience of the built environment. Hence there is a clear need for these structures to be, put in simple words, good looking & aesthetically pleasing.

1. The general arrangement shall have good proportions, of harmonic proportions between length and height, between span clearance and depth, between the supporting and the supported structures
2. The product, or the structure, must be shaped in a way to allow easy fabrication or construction. This means that the material used has an influence on the design. The final shape should also display special qualities of the material, for instance high strength should lead to slenderness or gracefulness.
3. All sharp edges shall generally and preferably rounded off with minimum 50 mm radius curves.
4. All surfaces beyond 1 m width shall be provided with aesthetically designed grooves, as approved by Authority/Employer. Grooves, wherever provided shall be on the vertical plane to avoid accumulation of dust.

The following bridge aesthetic aspects shall be considered in design:

5. Bridges shall have a minimum structural depth consistent with their spans and method of construction.
6. The design of bridges shall address the slenderness aspects of the structure and consider the effects of the parapets and all other elements of the structure in the determination of the apparent visual slenderness.
7. All structures shall present smooth, clean lines and continuous lines.
8. Bridge proportions shall represent spanning and supporting requirements and shall respond to the context of the individual bridge localities.
9. Length of spans shall be maximised where practical, within the context of the necessary bridge length and constructability.
10. Bridge structural elements such as piers, sill beams and abutments shall be aesthetically integrated.
11. The bridge deck, kerb and barriers shall extend beyond the deck units to prevent water staining of the units to improve aesthetics.
12. All the elements of superstructure and substructure shall be gracefully harmonized (angles, curbs, shapes, geometry, etc.) to ensure aesthetics.
13. Drip moulds / Drip Courses shall be provided monolithically with the structural concrete.
14. Form Finishes: All exposed surfaces shall be necessarily form finished to category Finish F4.

To meet with requirements for F4 finish, forms shall be manufactured in a skilful, workmanlike manner, accurately to dimensions. There should be no visible offsets, bulges, or misalignment of concrete. At

construction joints, the forms shall be rightly set and securely anchored close to the joint. Abrupt and gradual irregularities shall not exceed 3mm. All joints or any infirmities in the surfaces shall be made good to be absolutely uniform, at no extra cost.

SPECIFICATION FOR FORMWORK

1.0 FORMWORK FOR EXPOSED CONCRETE SURFACES

The facing formwork shall be specifically approved by the Engineer in writing, shall generally be made with materials not less than the thickness mentioned below for different elements of the structure:

- 1.1 Plain slab soffit, and sides of beams, girders, joists and ribs and side of walls, fins, parapets, pardis (Roofing Material), sun-breakers, etc shall be made with Steel plates not less than 4mm thick of specified sizes stiffened with a suitable structural framework and fabricated true to plane.
- 1.2 Bottoms of beams, girders and ribs, sides of columns shall be made with steel plates not less than 5mm thick of specified sizes stiffened with a suitable structural framework and fabricated true to plane.
- 1.3 For Precast segments, piers, pier heads, portals etc. suitable steel form work is to be used unless otherwise specified by Engineer.

2.0 FORMWORK FOR SLOPED SURFACES

- 2.1 Forms for sloped surfaces shall be built so that the formwork can be placed board-by-board immediately ahead of concrete placement so as to enable ready access for placement, vibration, inspection and finishing of the concrete, as approved by Engineer In-Charge.
- 2.2 The formwork shall be built in such a way so that the boards can be removed one by one from the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 2 horizontals: 1 vertical shall be formed as required herein.
- 2.3 All construction joints shall be harmoniously treated, as per the directions of Engineer In-Charge, at no extra cost.

3.0 FORMWORK FOR CURVED SURFACES

- 3.1 The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form lumber shall be built up of laminated splices cut to make tight, smooth form surfaces.
- 3.2 After the forms have been constructed, all surface imperfections shall be corrected and all surface irregularities at matching faces of form material shall be dressed to the specified curvature, as directed by the Engineer In-Charge

4.0 AESTHETIC FINISHES

Special approved aesthetic finishes like grooves, logos, engravings/projections in inset and out set as per the approved design shall be provided by fixing monolithic rubber forms or any other approved material fixed on the entire surface of the form work. The shore hardness of the rubber shall ensure strength, flexibility, and elasticity. The rubber shall be cold cured (preferably polyurethane based) and fixed to the formwork under controlled conditions in shade and air temperature.

The form liners should be shrinkage free, solvent free and should be impervious to abrasion by Concrete, resistant to concrete pressure and heat resistant as per latest NFPA guidelines. Formwork liner fixation should be factory made under close tolerances and stage inspections.

If proprietary system of formwork is used, detailed information as given below herein shall be furnished to Engineer for approval before use.

4.1. GENERAL

- a. The information which the manufacturer is required to supply shall be in such detail as to obviate unsafe

erection and use of equipment due to the intention of the manufacturer not having been made clear or due to wrong assumptions on the part of the Contractor.

- b. The Contractor shall refer unusual problems of erection/assembly not in keeping with intended use of equipment, to the manufacturer of the equipment.

4.2. THE MANUFACTURERS OF PROPRIETARY SYSTEMS SHALL SUPPLY THE FOLLOWING INFORMATION.

- a. Description of basic functions of equipment.
- b. List of items of equipment available, giving range of sizes, spans, and such like, with manufacturer's identification number or other references.
- c. The basis on which safe working loads have been determined and whether the factor of safety given applies to collapse or yield.
- d. Whether the supplier's data are based on calculations or tests. This shall be clearly stated as there may be wide variations between results obtained by either method.
- e. Instructions for use and maintenance, including any points which require special attention during erection, especially where safety is concerned.
- f. Detailed dimensional information, as follows:
 - i. Overall dimensions, depths and widths of members.
 - ii. Line drawings including perspectives and photographs showing normal uses.
 - iii. Self-weight.
 - iv. Full dimensions of connections and any special positioning and supporting arrangements.
 - v. Sizes of members, including tube diameters and thicknesses of material.
 - vi. Any permanent camber built into the equipment.
 - vii. Sizes of holes and dimensions giving their positions.
 - viii. Manner of fixing including arrangements for sealing joints.
 - ix. Method of de-stripping, storing & shifting.
- g. Data relating to strength of equipment as follows:
 - i. Average failure loads as determined by tests.
 - ii. Recommended maximum working loads for various conditions of use.
 - iii. Working r e s i s t a n c e moments derived from tests.
 - iv. Working shear capacities derived from tests.
 - v. Recommended factors of safety used in assessing recommended loads and deflections based on test results.
 - vi. Deflections under load together with recommended pre-camber and limiting deflections.
 - vii. If working loads depend on calculations, working stresses should be tested. If deflections depend on theoretical moments of inertia or equivalent moments of inertia rather than tests, this should be noted.
 - viii. Information on the design of sway bracing against wind and other horizontal loadings.
 - ix. Allowable loading relating maximum extension of bases and/or heads.
 - x. Any restrictions regarding usage of any component or full assembly with regard to spans, heights and loading conditions.

5.0 SUPPORTING DOCUMENTS

The Definitive Design Submission shall be accompanied by the following documents, which will be considered by the Engineer in his review of the Definitive Design Submission. Where relevant or required, these documents shall be accompanied by a design note stating clearly how information has been used in the design of the Permanent Works.

GEOTECHNICAL INTERPRETATIVE REPORT

A report including site investigation results and covering the geotechnical interpretation of site investigation work including that undertaken by the Contractor in sufficient detail to confirm and justify parameters used in the foundation and geotechnical designs. The report shall include the full logs and descriptions of confirmatory boreholes drilled by the Contractor.

SURVEY REPORT

A report on all survey work undertaken by the Contractor, including checks on mapping, survey stations, co-ordinates and setting-out. Updated topographical and survey drawings shall also be included.

UTILITIES REPORT

A report giving details of arrangements and working methods in respect of the existing utilities, including protection measures, diversions, reinstatements and programme allowances.

TEMPORARY WORKS DESIGN REPORT

A report which provides sufficient information on the design of the Temporary Works to allow the Engineer to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the Definitive Design.

CONSTRUCTION / INSTALLATION ANALYSIS REPORT

A report containing a stage-by-stage construction / installation sequence for all structures / equipment.

CONSTRUCTION METHOD STATEMENT

A report which provides sufficient information on the methods of construction, execution and launching systems proposed and Contractor's Equipment to allow the Engineer to assess their effects on the Permanent Works and to enable these to be taken into account in the review of the Definitive Design.

PROJECT SCHEDULE REVIEW

- (i) The Contractor shall, prior to submitting the Definitive Design Submission, review the Project Schedule against the current version of the Design Submission Programme.
- (ii) In the event that the Contractor considers that there are any discrepancies or inconsistencies between the Design Submission Programme and the Project Schedule, the Contractor shall submit with the Definitive Design Submission its proposed revisions to the Project Schedule such that the discrepancies or inconsistencies are removed.
- (iii) The Contractor shall provide details of submissions of the proposed Working Drawings and their anticipated timing during the Construction Phase and shall identify information required from or actions to be undertaken by the Employer or others which are necessary to permit the completion of the design of the Permanent Works and the Working Drawings. Desired Dates for the receipt required by the Contractor of such information or for the completion of such actions shall be included with appropriate justification.

REPORT ON THE USE OF WORKS AREAS

A report updating the proposals from those contained in the Contractor's Technical Proposals for the use of Works Areas and their reinstatement and accesses facilities.

6.0 NOTICES ON DEFINITIVE DESIGN SUBMISSION

The Contractor may make Definitive Design Submissions and seek separate Notices in respect of:

- (a) The temporary works for construction of the viaduct/Bridge works (Wherever required).
- (b) All works related to the viaduct/Bridge sections.
- (c) Major elements as identified under Clause 2(6) herein.

The issue of such separate Notices under (a) and (b) above shall be conditional upon the Contractor having demonstrated, to the satisfaction of the Engineer, that the effect of each structure on other structures, utilities, etc., has been fully accommodated in the design.

6.1 Submission of Design Data

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

The Contractor shall submit to the Engineer all Design Data, together with the relevant Design Certificates certified by the Contractor, on or before the respective dates for submission shown on the Design Submission Programme or, as the case may be, the Works Programme. In the event that a re-submission of Design Data is required, such re-submission 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.

Following receipt of a submission of Design Data the Engineer shall, within 2B days, return one copy of the Design Data to the Contractor, together with either a Notice of No-Objection, or a statement of objections which shall identify the aspects of the Design Data which do not conform to the above requirements. If the Engineer returns any Design Data with a Notice of No Objection, the Contractor shall proceed with the Works in accordance with the Contract.

If the Engineer provides that revisions to a submission of Design Data/ are appropriate but that such revisions are of minor design significance, the Engineer may issue a Notice of No Objection subject to an appended schedule of comments identifying the relevant revisions. The Contractor shall revise such Design Data in accordance with such comments but shall not be obliged to re- submit such Design Data solely on account of such revisions.

If the Engineer returns any Design Data with a statement of objections the Contractor shall revise the Design Data to take account of the stated objections and re-submit such Design Data to the Engineer, together with new Design Certificates signed by the Designer and the Contractor.

The issue of a Notice of No Objection in relation to any submission of Design Data shall be entirely without prejudice to the review of subsequent submissions of Design Data or to any subsequent request for a Contractor's Variation, and shall not bind or fetter the Engineer in any manner whatsoever when deciding whether or not to raise objections in relation to any subsequent submission of Design Data or when dealing with a subsequent request for a Contractor's Variation.

Neither an objection raised to the Design Data nor revisions of minor design significance under this Clause will, under any circumstances, constitute an Employer's Variation.

7.0 DESIGN SUBMISSIONS - GFC DRAWINGS SUBMISSIONS

- (1) The GFC Drawings shall be derived directly from the Definitive Design and shall detail and illustrate in full the Permanent Works. The Construction' Reference Drawings shall form part of the Working Drawings to be used for construction purposes.
- (2) Prior to any GFC Drawings Submission, the Contractor shall prepare a full list of GFC Drawings in order to demonstrate, to the satisfaction of the Engineer, that such GFC Drawings will be sufficient in extent to cover the construction of the whole of the Permanent Works.
- (3) Unless otherwise required by the Engineer, the GFC Drawings need not include bar bending schedules, bar reference drawings, fabrication or shop drawings as well as other schedules or erection drawings which are to be provided by the Contractor during the Construction Phase.

8.0 DESIGN SUBMISSIONS – CONSTRUCTION PHASE

- (1) On the issue of a Notice in respect of the GFC Drawings the Contractor shall produce the proposed Working Drawings. These- shall either be identical to the GFC Drawings or shall be further drawings developed in accordance with the GFC Drawings such as site sketches, bar bending schedules, bar reference drawings, fabrication and shop drawings, construction erection sequences and the like. All such drawings shall comply with the requirements of the Contract.

- (2) Prior to submission of the proposed Working Drawings, the Contractor shall endorse the appropriate original paper drawings as "Good for Construction". If the Engineer so requires, the endorsed original shall be submitted to the Engineer who shall, if he has no objection to the contents of the submission, further endorse the original by stating that he has no objection to the proposed Working Drawings. On the endorsement by the Engineer, the original forthwith be returned to the Contractor as the Working Drawings.
- (3) Only the Working Drawings endorsed as in 7(2) above or those that the Engineer has expressly stated as not requiring his endorsement shall be issued to the Site. The construction of the Works shall be strictly in accordance with these Working Drawings.
- (4) The contractor shall finalize details of the proposed method of construction and submit such finalised details to the Engineer for review. The proposed method shall have no adverse effects on the partially completed Permanent Works and shall ensure the Works are statically and, if appropriate, aerodynamically stable.
- (5) The Contractor shall undertake and submit a stage-by-stage construction sequence and the effect of any Temporary Works and the Contractor's Equipment on the Permanent Works. This analysis shall be in sufficient detail to demonstrate that the Contractor's proposals are safe and have no adverse effects upon any parts of the Permanent Works.
- (6) As-Built Drawings, endorsed by the Contractor shall be submitted to the Engineer for agreement.

9.0 DESIGN SUBMISSIONS - REVIEW PROCEDURES

- (1) Submissions of Design Data shall be made and reviewed by the Engineer. The form and detail of the review shall be as determined by the Engineer and will not release or remove the contractor's responsibility for the design under the contract.
- (2) The issue of a Notice shall be without prejudice to the issue of any future Notices.
- (3) The Contractor shall, prior to the submission of the Design Data, obtain all required and/or statutory approvals that relate to that submission including, where appropriate, the approval of the Concerned Government Authorities and utility undertakings, and demonstrate that all required approvals have been obtained.
- (4) All submissions shall be accompanied by two original copies of a 'Design Certificate' as set out in Attachment - D1 hereto and signed by the Contractor and the Designer.

10.0 DESIGN SUBMISSION PROGRAMME

- (1) The Contractor shall prepare the Design Submission Programme which is to set out fully the Contractor's anticipated programme for the preparation, submission and review of the Design Packages, the Definitive Design Submission and the GFC Drawings Submissions and for the issue of Notices in relation thereto.
- (2) The Design Submission Programme shall:
 - (a) Be consistent with and its principal features integrated into the Works Programme, and show all relevant Key Dates;
 - (b) Identify dates and subjects by which the Engineer's decisions should be made;
 - (c) Make adequate allowance for periods of time for review by the Engineer and other review bodies;
 - (d) Make adequate allowance for the design and development of specialist works;
 - (e) Include a schedule identifying, describing, cross-referencing, and explaining the Design Packages into which the Contractor intends to divide the Definitive Design and GFC Drawings; and
 - (f) Indicate the Design Interface and Co-ordination periods for each Designated Contractor.
- (3) The Contractor shall submit the Design Submission Programme to the Engineer within thirty (30) days of the date of Notice to Proceed, and thereafter up-dated versions thereof at intervals of not more than one (1) month throughout the Design Phase.

11.0 PROGRAMME FOR SUBMISSIONS DURING CONSTRUCTION PHASE

In accordance with Clause 4 of the employer requirements – General, the contractor shall identify submissions required during the construction phase.

12.0 CALCULATIONS

- (1) Unless otherwise required by the Engineer, calculations relevant to the Definitive Design and GFC Drawings shall be submitted for review with the respective Design Packages or Submissions. The Engineer may require the submission of applicable software including in house software programmes / worksheets developed by the Contractor, computer input and programme logic for its review prior to the acceptance of the computer output.
- (2) The Contractor shall prepare and submit a comprehensive set of calculations for the Definitive Design in a form acceptable to the Engineer. Should the design of the Permanent Works be revised thereafter, and such revision renders the calculations as submitted obsolete or inaccurate, the Contractor shall prepare and submit the revised calculations.
- (3) Similarly, the Contractor shall submit such further calculations as have been prepared in connection with the GFC Drawings.
- (4) Calculations to be included as part of the submission herein shall comprise the up-to-date calculations in respect of the Definitive Design, the GFC Drawings and such further calculations which the Contractor has prepared during the production of Working Drawings.
- (5) The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

13.0 DOCUMENTS REQUIREMENTS

- (1) Drawings shall be prepared generally to A1 size, but to ISO AO size where appropriate. **Appendix - 9 / Annexure - 1 of Section VIII, Employer Requirements** to these Employers Requirements defines the Drawings and CAD Standards required for drawing preparation and submittal.
- (2) The Contractor shall submit 6 copies of his design and/or drawings for review by the Engineer. After receipt of "No Objection" from the Engineer's Representative, the Contractor shall submit 6 copies of design and/or drawing for the use of the Engineer.
- (3) The submission of drawings may be by CAD Media files and **Appendix - 9 / Annexure -1, Section VIII, Employer Requirements** to these Employers Requirements specifies the drawing submission requirements for CAD Media files.

14.0 LIABILITY FOR REVIEW OF DOCUMENTS AND DRAWINGS

Except to the extent expressly provided in this Agreement:

- (a) no review, comment or approval by the Authority or the Authority's Engineer of any Document or Drawing submitted by the Contractor nor any observation or inspection of the construction of the Railway Project nor the failure to review, approve, comment, observe or inspect hereunder shall relieve or absolve the Contractor from its obligations, duties and liabilities under this Agreement, Applicable Laws, and Applicable Permits; and
- (b) the Authority shall not be liable to the Contractor by reason of any review, comment, approval, observation, or inspection referred to in Sub-clause (a) above.

ATTACHMENT D 1**DESIGN CERTIFICATE**

This design Certificate refers to design submission no which comprises of Definitive Design submission / GFC Drawings submission, working drawing submission scheduled in the attached transmittal, in respect of:

(Description of Permanent Works to which the submission refers)

DESIGNER'S STATEMENT:

We certify that:

- a) The outline designs, design briefs and performance specifications of those elements of the Permanent works as illustrated and described in the documents scheduled in the attached transmittal, complies with the design basis criteria and other contract provisions.
- 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 the attached transmittal.
- c) All necessary and required approval relating to the design of the Permanent Works, as illustrated, and described in the documents listed in the attached transmittal, have been obtained.
- d) All effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of those parts.

Signed by Designer's Authorized Representative Name :

Position :

Date :

CONTRACTOR'S CERTIFICATE:

The Certifies that all design has been performed utilizing the skill and care to be expected of a professionally qualified and competent designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us and the design proposed by the designer has been accepted by us.

Signed by Contractor's authorized representative.

Name :

Position :

Date :

Note 1

The Contractor shall insert one of the following, as applicable:

- (i) The Contractor's Technical Proposals
- (ii) The Contractor's Technical Proposals and Design Packages Nos for which a Notice of No Objection has been issued.
- (iii) Design Packages Nos for which a Notice of No Objection has been issued if such Design Packages develop and amplify the Contractor's Technical Proposals.
- (iv) The Definitive Design.

SAMPLE DRAWING TEMPLATE(a) Design Quality Assurance' by designer &contractor:

DESIGN QUALITY ASSURANCE			
The responsibility of control, Check and verification of accuracy, correctness, completeness, integration and full compliance of contract provisions in respect of design analysis and drawings rests with the design consultants and the contractor.			
By Designer			By Contractor
Sig:	Sig:	Sig:	Sig:
<u>Date:</u>	<u>Date:</u>	<u>Date:</u>	<u>Date:</u>
<u>Name:</u>	<u>Name:</u>	<u>Name:</u>	<u>Name:</u>
<u>Designed By</u>	<u>Checked by</u>	<u>Approved by</u>	<u>Accepted by</u>

(b) Notice of 'No Objection' from Engineer's representatives:

Notice of 'No Objections' from Engineer's			
	Remarks	Date	Signature
Chief Design Expert	Reviewed		
Deputy Project Director	Reviewed & comments as marked on drawing		
Project Director	Reviewed & No objection issued with comments as marked on Drawing		

Section C

[Contractor to attach copies of necessary and required approvals]

SECTION D**EMPLOYER'S REQUIREMENTS -CONSTRUCTION****1. CONTRACTORS SUPERINTENDENCE**

- (1) The Contractor shall submit a Staff Organization Plan in accordance with the ITT/Employer's Requirement. This plan shall be updated and resubmitted whenever there are changes to the staff. The plan shall show the management structure and state clearly the duties, responsibilities, and authority of each staff member.
- (2) The site agent and his associates/supervisors shall have experience and qualification appropriate to the type and magnitude of the Works. Full details shall be submitted of the qualifications and experience of all proposed staff to the Engineer for his approval.

2. CHECKING OF THE CONTRACTOR'S TEMPORARY WORKS DESIGN

The Contractor shall, prior to commencing the construction of the Temporary Works, submit a certificate to the Engineer signed by him certifying that the Temporary Works have been properly and safely designed and checked and that the Contractor has checked the effect of the Temporary Works on the Permanent Works and has found this to be satisfactory. The contractor to obtain the approval for designs and drawings of temporary structures from Railways and CRS. The necessary assistance will be given by Engineer / Employer.

3. THE SITE

- (1) Works Areas are those areas identified in **Annexure-1 to these Employer's Requirements** and on the Drawings.

No land shall be made available by the employer for casting yard, site offices, and site laboratories. Contractor shall make his own arrangements at his own cost. In case the Railway land is arranged adjacent to near to railway track for casting of Segmental Box/U-Girders & for initial erection and launching activity temporarily, the necessary land rent / lease charges shall be levied as per Railway guidelines /Bi-RIDE norms and the same will be deducted from RA bills of the Contractor.

USE OF THE SITE

- (2) The Site or Contractor's Equipment shall not be used by the Contractor for any purpose other than for carrying out the Works in the scope of this contract, except that, with the consent in writing of the Engineer, the Site or Contractor's Equipment such as batching and mixing plants for concrete and bituminous materials may be used for the work in connection with other contracts under the Employer.
- (3) Rock crushing plant shall not be used on the Site.
- (4) The location and size of each stockpile of materials, including excavated materials, within the Site shall be as permitted by the Engineer. Stockpiles shall be maintained at all times in a stable condition.
- (5) Entry to and exit from the Site shall be controlled and shall be only available at the locations for which the Engineer has given his consent.

ACCESS TO THE SITE

- (6) The Contractor shall make its own arrangements, subject to the consent of the Engineer, for any further access required to the Site.
- (7) In addition, the Contractor shall ensure that access to every portion of the Site is continually available to the Employer and Engineer.
- (8) Following the handover of the Railway Envelope, (as defined in the Employer's Requirements- General), to the Employer, the Employer will control the Railway Envelope and will be responsible for all matters relating to security and safety therein. Access to the Railway Envelope by the Contractor shall be in accordance with any procedure's requirements and conditions.

ACCESS TO OUTSIDE THE SITE

- (9) The Contractor shall be responsible for ensuring that any access or egress through the Site 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 its employees and sub-contractors.

SURVEY OF THE SITE

- (10) A survey shall be carried out of the Site to establish its precise boundaries and the existing ground levels within it. This survey shall include a photographic survey sufficient to provide a full record of the state of the Site before commencing the work with particular attention paid to those areas where reinstatement will be carried out later on. The survey shall be carried out before the site clearance wherever possible and in any case prior to the commencement of work in any Works Area. The survey shall be carried out by the Contractor and agreed with the Engineer.

BARRICADES AND SIGN BOARDS

- (11) The Contractor shall erect barricades and gates around its areas of operations to prevent entry by unauthorized persons to his Works Areas and necessary identity cards /permits should be issued to workers and staff by the contractor. The Contractor shall submit proposal for barricades of the complete perimeter of all works areas to the Engineer. The safety barricading as per Drawing No. K-RIDE/ BSTP/ C4/TD/BD/04/01&02 with Contractor's material labour including foundation works are required adjacent to IR tracks along the alignment for ensuring the safety of running trains. The temporary barricades of 2m heights of line MS sheets 16 gauge as per Bi-RIDE drawing are required to be provided near to IR/BSTP boundary. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re- painting of the entire barricades on an annual basis. No work shall be commenced in any Works Area until the Engineer has been satisfied that the barricades installed by the Contractor are sufficient to prevent, within reason, unauthorized entry.
- (12) Project signboards shall be erected within four (4) weeks, or such other period as the Engineer has given his consent, after the date of commencement of the Works. The types, sizes and locations of project signboards shall be agreed with the Engineer before manufacture and erection. Other advertising signs shall not be erected on the Site. The cost of these signboards is included in quoted price.
- (13) The consent of the Engineer shall be obtained before hoardings, fences, gates, or signs are removed. Hoardings, fences, gates, and signs which are to be left in positions after the completion of the Works shall be repaired and repainted as instructed by the Engineer.
- (14) Hoardings, barricades, gates, and signs shall be maintained in clean and good order by the Contractor until the completion of the Works, whether such hoardings, fences, gates, and signs have been installed by the Contractor or by others and transferred to the Contractor during the period of the Works. All the fencing, hoardings, gates, and signs etc. shall be mopped minimum once in a week and washed monthly.
- (15) All hoardings, barricades, gates, and signs installed by the Contractor shall be removed by the Contractor upon the completion of the Works, unless otherwise directed by the Engineer.
- (16) Hoarding/ barricades can be reused after removing from one place to other locations / sites provided they are in good condition and approved by Engineer.
- (17) Damage/worn-out barricades /hoarding shall be replaced by contractor within 24 hours. Engineer's decision regarding need for replacement shall be final and binding and if no action is taken by contractor, the Engineer may get it repaired through other agency and the cost of any repairs will be deducted by the Engineer from any payment due to the contractor.

CLEARANCE OF THE SITE

- (18) All Temporary Works which are not to remain on the Site after the completion of the Works shall be removed prior to completion of the Works or at other times instructed by the Engineer. The Site shall be cleared and reinstated to the lines and levels and to the same condition as existed before the Works started except as otherwise stated in the Contract.

4. SURVEY

- (1) While doing the survey work, the fact that similar work will have to be done once again on the completed earth work in formation for fixing up the longitudinal levels of the installed P. Way should be kept in view.
- (2) The Contractor to fix alignment reference points at regular intervals all along the alignment. The contractor along with the Engineer should verify the details of these alignment pillars. If any mistakes are detected in these details, the same should be indicated to the Engineer before starting any work. These detected mistakes should be corrected by the Contractor in consultation with the Engineer. These corrections should be got approved from the Engineer.
- (3) The Contractor shall relate the construction of the Works to the Site Grid. To facilitate this, survey reference points have to be established by the contractor and benchmarks in the vicinity of the Site.
- (4) Before the Contractor commences the setting out of the Works, the Contractor shall satisfy itself that there are no conflicts and shall establish and provide all subsidiary setting out points, monuments, towers, and the like which may be necessary for the proper and accurate setting out and checking of the Works.
- (5) The Contractor shall carefully protect all the survey reference points, bench marks, setting out points, monuments, towers and the like from any damages and shall maintain them and promptly repair or replace any points damaged from any causes whatsoever. The Contractor shall regularly recheck the position of all setting out points, bench marks and the like to the satisfaction of the Engineer.
- (6) The survey reference points will become the responsibility of the Contractor. The Contractor shall, by annual or more frequent review, ensure that these survey points continue to remain consistent with the benchmarks.

5. SAFETY, HEALTH, AND ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with in the conditions stipulated in the Conditions of contracts on Safety, Health & Environment (SHE) including ESMP plan attached with SHE manual.

5.1 TRAINING OF CONTRACTOR'S EMPLOYEES/STAFF/WORKERS: -

Contractor shall provide a training/workshop on safety, Health & Environment (SHE) to all its workers/staff/employees/subcontractors of at least 2 weeks (96hrs.) at the time of induction. Before postings of any his workers/staff/employees/subcontractors, the contractor shall give a certificate that the said person had undergone the requisite SHE training. Non-compliance of the above will invoke penalties as per condition of contract on SHE, **Section-8C** of Tender document.

In case of any mishap/ accident-causing death/injury to public or damage to public/private property or damage to public/private vehicles or damage to railway property, the employer, will impose a penalty to the contractor as deemed fit and appropriate in addition to the cost of damage caused due to the mishap/accident.

5.2 USE OF "TRACTOR TRANSMISSION TYPE" PICK AND CARRY HYDRA CRANE: -

"Tractor Transmission type" Pick and Carry Hydra crane - 1st Generation model is prohibited at BSTP works, Contractor shall mobilize "Truck Transmission type" pick and carry hydra crane - 2nd Generation model only.

6. OTHER SAFETY MEASURES**SITE SAFETY, HEALTH & ENVIRONMENT PLAN**

- (1) The Contractor shall, within 60 days of the date of Notice to Proceed, prepare and submit to the Engineer for review his proposed safety, Health and Environment plan which shall contain as a minimum those items set out in Conditions of Contract on Safety, Health & Environment Plan.

FIRE REGULATIONS AND SAFETY

- (2) The Contractor shall provide and maintain all necessary temporary fire protection and firefighting facilities on the Site during the construction of the Works and shall comply with all requirements of the Bangalore

Fire Services Department. 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.
- (4) If, in the Engineer's opinion, the use of naked lights may cause a fire hazard, the Contractor shall take such additional precautions and provide such additional firefighting equipment (including breathing apparatus) as the Engineer considers necessary. The term "naked light" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.
- (5) Oxyacetylene burning equipment will not be permitted in any confined space; Burning equipment of the oxpropane type shall be used.

HAZARD AND RISK ASSESSMENTS

- (6) The Contractor shall, prior to the commencement of any operation carry out a detailed hazard and risk assessment. The results of such assessments shall be recorded, and the records kept for inspection by the Engineer.
- (7) The Contractor shall produce detailed method statements for all medium and high-risk operations and shall submit them to the Engineer for his consent prior to commencement of any task to which they relate.
- (8) The Contractor shall produce and implement a Permit to Work system for all high-risk operations. The Permit to Work system shall be submitted to the Engineer for consent before application.

EXPLOSIVES

- (9) Explosives shall not be used without prior written consent of the Engineer. Before consent to blasting is granted, the Contractor shall prepare a Specification as to the size of charge, the method of firing and any other restrictions that may be imposed from time to time.
- (10) Where the Engineer has consented to the use of explosives, the Contractor shall be responsible for obtaining the requisite licences and permits for complying with all statutory requirements for blasting.
- (11) The storage, transportation and use of explosives shall at all times be governed by the Explosives Acts and such other statutory regulations which may be applicable and as imposed by the Statutory Authority.

LAUNCHING GIRDER/ LAUNCHING CRANE

- (12) No Launching Girder or Launching Crane shall be used without written consent of the Engineer.
- (13) The Contractor shall prepare a detailed specification for the operation of Launching Girder and submit it to the Engineer for review and approval.

STANDBY EQUIPMENT

- (14) The Contractor shall provide adequate stand-by equipment to ensure the safety of personnel, the Works, and the public. These measures shall include as a minimum the following: -
 - (a) stand-by pumping and generating equipment for the control of water;
 - (b) stand-by equipment and spares for illumination of the Works; and
 - (c) stand-by generating equipment and equipment for the lighting for the works.

CO-OPERATION

- (15) 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 site agent's removal from the Site.

7. CARE OF THE WORKS

- (1) Any error in the execution of work leading to redesign work shall be duly compensated by the
Bi-RIDE (C2/ BNH-HBL /AT GRADE)

contractor as per the decision of Engineer. Any error attributable to the construction including failure to locate underground utilities shall attract penalties.

- (2) Unless otherwise permitted by the Engineer all works shall be carried out in dry conditions.
- (3) The works, including materials for using in the works, shall be protected from damage due to water. Water on the site and water entering the site shall be promptly by temporary drainage or pumping system or by other methods capable of keeping the works free of water. Silt and debris shall be removed by traps before the water is discharged and shall be disposed of at a location or locations to which the engineer has given his consent.
- (4) The discharge points of the temporary systems shall be as per the consent of the engineer. The contractor shall make all arrangements with and obtain the necessary approval from the relevant authorities for discharging water to drains, watercourses etc. The relevant work shall not be commenced until the approved arrangements for disposal of the water have been implemented.
- (5) The methods used for keeping the works free of water shall be such that settlement of, or damage to, new and existing structure does not occur. Measures shall be taken to prevent flotation of new and existing structures.

PROTECTION OF THE WORKS FROM WEATHER

- (6) Work 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.
- (7) Permanent Works, including materials for such Works, shall be protected from exposures of weather conditions that may adversely affect such Permanent Works or materials.
- (8) During construction of the Works storm restraint systems shall be provided where appropriate. These systems shall ensure the security of the partially completed and ongoing stages of construction and in all weather conditions. Such storm restraint systems shall be installed as soon as practicable and shall be compatible with the Right of Access or other access around or through-out the Site.
- (9) The contractor shall at all-time programme and order progress of the work and make all protective arrangements such that the works can be made safe in the event of storms.

PROTECTION OF THE FINISHED WORKS

- (10) The finished works shall be protected from any damage that could arise from any activities on the adjacent site/ works.

8. DAMAGE AND INTERFERENCE

- (1) Work shall be carried out in such a manner that there is no damage to or interference with:
 - (a) watercourses or drainage systems; (b) utilities; (c) structures (including foundations), roads, including street furniture, or other properties; (d) public or private vehicular or pedestrian access; (e) monuments trees, 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. 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 need 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.
- (2) Items which are damaged or interfered with as a result of the Works and items which are removed to enable work to be carried out shall be reinstated to the satisfaction of the Engineer and to at least the same condition as existed before the work started. Any claims by Utility Agencies due to damage of utilities by the Contractor shall be borne by the Contractor.

UTILITIES

- (3) Please refer Employer's Requirement –Functional
Bi-RIDE (C2/ BNH-HBL /AT GRADE)

STRUCTURES, ROADS, AND OTHER PROPERTIES

- (4) The Contractor shall immediately inform the Engineer of any damage to structures, roads or other properties.

ALTERNATIVE ACCESS

- (5) Alternative access shall be provided to all premises if interference with the existing access, public or private, is necessary to enable the Works to be carried out. The arrangements for the alternative access shall be as agreed by the Engineer and the concerned agency. Unless agreed otherwise, the permanent access shall be reinstated as soon as practicable after the work is complete and the alternative access shall be removed immediately as it is no longer required, and the ground surfaces reinstated to the satisfaction of the Engineer. Proper signage and guidance shall be provided for the traffic / users regarding diversions.

REMOVAL OF GRAVES AND OTHER OBSTRUCTIONS

- (6) If any graves and other obstructions are required to be removed in order to execute the Works and such removal has not already been arranged for, the Contractor shall draw the Engineer's attention to them in good time to allow all necessary arrangements and authorizations for such removal, and it shall not itself remove them unless the Engineer has given consent.

PROTECTION OF THE ADJACENT STRUCTURES AND WORKS

- (7) The Contractor shall take all necessary precautions to protect the 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.

9. WORK ON ROADS**(1) TRAFFIC MANAGEMENT PLAN**

The Contractor shall develop a detailed Traffic Management Plan for the work 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 neighbourhoods impacted by the construction activities. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract.

PRINCIPLES FOR TRAFFIC MANAGEMENT

The basis for the Plan shall take into consideration four principles:

- a. to minimize the inconvenience of road users and the interruption to surface traffic through the area impacted by the construction activities;
- b. to ensure the safety of road users in the impacted area;
- c. to facilitate access to the construction site, and to maintain reasonable construction progress.
- d. to ensure traffic safety at each construction site.

INTEGRATED TRAFFIC MANAGEMENT PLAN

The Contractor shall prepare an integrated plan showing the arrangements to be made for accommodating road and pedestrian traffic, at individual construction sites and continuously along the alignment, to smooth traffic operations and for the safety of both construction workers and road users. The Plan shall consider different measures such as:

- i. Proper phasing and timing of traffic signals;
- ii. Modifications to intersection geometry;
- iii. Changes in lane usage;
- iv. parking prohibitions;
- v. relocation of bus stops;
- vi. reducing width of footpaths and median

- vii. right turn prohibition;
- viii. work site access management;
- ix. minimizing the duration of any road closure;
- x. reversible lane operations;
- xi. modification of roadway alignment affected by the construction, which shall be in conformance with the requirements and regulations defined by the relevant authorities; and may include widening of roads, Construction of temporarily new road etc.
- xii. other traffic engineering measures as may be applicable.

(2) MITIGATION OF TRAFFIC DISTURBANCES

The Contractor shall manage the vehicular and pedestrian Right of Access during the period of construction. The Contractor shall take account of the need to maintain essential traffic requirements, as these may influence the construction process.

The Contractor shall include local traffic diversion routes and assess traffic impacts caused by the construction in the affected areas. Signage layout shall be included to ensure that adequate motorist information will be provided for traffic diversions.

Where it becomes necessary to close a road or intersection, or supplementary lanes are required to satisfy the traffic demands, traffic diversion schemes to adjacent roadways shall be developed with quantitative justifications. The Contractor shall co-ordinate with all relevant authorities.

Other considerations include:

- i. The minimum lane widths for fast traffic and mixed traffic shall follow the regulations of the different authorities.
- ii. Any roads or intersections that have no alternative access shall not be fully closed for construction.
- iii. Emergency access to all properties shall be maintained at all times.
- iv. Access to business premises and property shall be maintained to the extent that normal activities are not seriously disrupted.
- v. Minimum footpath width shall be 1.5 m, unless otherwise indicated. The footpath shall be separated from vehicle traffic and not necessarily immediately adjacent to vehicle traffic;
- vi. Where existing footbridges and underpasses are demolished or closed, provisions shall be made for pedestrian crossing to minimise the conflicts between a traffic lanes.
- vii. Construction traffic shall be separated from other traffic wherever possible;
- viii. Any traffic related facilities (bus stops, parking, etc.) which are affected by the construction works shall be maintained or relocated to appropriate locations;
- ix. Motorists, pedestrians, workmen, plant and equipment shall be protected from accident at all times;
- x. Roadway designs, traffic management schemes, and installation of traffic control devices shall be in conformance with the requirements and regulations defined by the relevant authorities. And
- xi. Where applicable, utility diversions shall be incorporated in the traffic management plan.

(3) APPROVAL FOR TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

The Contractor shall make all arrangements with and obtain the necessary approval from the transport authorities and the Police Department for temporary traffic arrangements and control on public roads. In the event that the Contractor, having used its best endeavours, fails to secure the necessary approval from the transport authorities and the Traffic Police Department for temporary traffic arrangements and control on public roads, then the Employer will use its best endeavours to assist the Contractor to secure such approval but without responsibility on the part of the Employer to do so.

(4) TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

- i. Temporary traffic diversions and pedestrian routes shall be surfaced and shall be provided where work

on roads or footpaths obstruct the existing vehicular or pedestrian access. The relevant work shall not be commenced until the approved temporary traffic arrangements and control have been implemented.

- ii. Temporary traffic arrangements and control for work on public roads and footpaths shall comply with the requirements of the Traffic Police. Copies of documents containing such requirements shall be kept on the Site at all times.
- iii. Temporary traffic signs, including road marking, posts, backing plates and faces, shall comply with the requirements the traffic police and should be in accordance with the requirements of Ministry of Surface Transport. All overhead traffic management signs that are fixed to bridges and gantries shall be illuminated at night. Pedestrian routes shall be illuminated at night to a lighting level of not less than 50 lux.
- iv. Adequate number of traffic guards, supervisors and in charge shall be deployed for smooth regulation of traffic.
- v. Temporary traffic arrangements and control shall be inspected and maintained regularly, both by day and night. Lights and signs shall be kept clean and legible. Equipment which are damaged, dirty, incorrectly positioned or not in working order shall be repaired or replaced promptly.

(5) PARTICULARS OF TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

The following particulars of the proposed temporary traffic arrangements and control on public roads shall be submitted to the Engineer for consent at least 28 days before the traffic arrangements and control are implemented:

- (a) details of traffic diversions and pedestrian routes;
- (b) details of lighting, signage, guarding and traffic control arrangements and equipment;
- (c) any conditions or restrictions imposed by Traffic Police or any other relevant authorities, including copies of applications, correspondence, and approval.

Where concrete barriers are used to separate flows of traffic, the barriers shall be in a continuous unbroken line. No gaps shall be left between any section of the barrier.

Site perimeter fencing and barriers along the roadway, shall have flashing amber lights positioned on the top of them every 50 meters apart and at every abrupt change in location. Directly below the flashing light shall be fixed, in the vertical position, a white fluorescent, with a waterproof cover.

(6) USE OF ROADS AND FOOTPATHS

Public roads and footpaths on the Site in which the work is not being carried out shall be maintained in a clean and passable condition.

1. Measures shall be taken to prevent the excavated materials, silt or debris from entering gullies on roads and footpaths, entry of water to the gullies shall not be obstructed.
2. Surfaced roads on the Site and leading to the Site shall not be used by tracked vehicles unless protection against damage is provided.
3. Contractor's Equipment and other vehicles leaving the Site shall be loaded in such a manner that the excavated material, mud or debris will not be deposited on roads. All such loads shall be covered or protected to prevent dust being emitted. The wheels of all vehicles shall be washed, when necessary, before leaving the Site to avoid the deposition of mud and debris on the roads.

(7) REINSTATEMENT OF PUBLIC ROADS AND FOOTPATHS

1. Temporary diversions, pedestrian access, and lighting, signing, guarding and traffic control

equipment shall be removed immediately when they are no longer required. 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 permitted by the Engineer immediately after the relevant work is complete or at other times permitted by the Engineer.

2. The contractor shall submit his design for the reinstatement to the relevant authorities and obtain their prior approval to carrying out the work. Reinstatement works shall include:

- i. Parking bays
- ii. Footpath and kerbs
- iii. Road Signage
- iv. Street Lighting
- v. Landscaping
- vi. Traffic Lights and Control Cable
- vii. Road painting

10. SITE ESTABLISHMENT: SITE LABORATORIES

- (1) The Contractor shall provide, erect, and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of concrete, soil and rock samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in **Appendix 14 / Annexure 1 of Section VIII, Employers' Requirement.**

(2) CONTRACTOR'S SITE ACCOMMODATION

The Contractor shall provide and maintain its own site accommodation at locations consented to by the Engineer. Offices, sheds, stores, mess rooms, garages, workshops, latrines and other accommodation on the Site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the Site. The Contractor shall comply with the requirements of **Appendix 13 / Annexure 1 of Section VIII, Employers' Requirement.**

(3) LATRINES AND WASH PLACES

The Contractor shall provide latrines and wash places for the use of its personnel and all persons who will be on the Site. The size and disposition of latrines and wash places shall accord with the numbers and dispositions of persons entitled to be on the Site, which may necessitate their location on structures and, where necessary there shall be separate facilities for males and females. The capacities and layout shall be subject to approval of the Engineer. The Contractor shall arrange regular disposal of effluent and sludge in a manner that shall be in accordance with local laws/ regulations.

- (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. 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.

(5) SITE UTILITIES AND ACCESS

(a) The Contractor shall be responsible for providing water, electricity, telephone, sewerage and drainage facilities for contractor's site offices, structures and buildings and for all site laboratories in accordance with **Appendix 14 / Annexure 1 of Section VIII, Employers' Requirement** to these Employer's Requirements and all such services that are necessary for satisfactory performance of the Works. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant civil and utility authorities for the facilities.

(b) The contractor shall be responsible for provision of power supply for his works including for launching girder and the like. The Employer cannot guaranty provision of adequate, continuous power supply however assistance will be given in obtaining the necessary permissions for site generators and the like.

- (6) Access roads and parking areas shall be provided within the Site as required and shall be maintained in a clean, acceptable, and stable condition. For lengths of roadway longer than 100 m and heavy commercial vehicle are to ply the Contractor shall provide paved surfacing of adequate thickness and quality to the satisfaction the Engineer.

SUBMISSION OF PARTICULARS

- (7) The following particulars shall be submitted to the Engineer for his consent not more than thirty (30) days after the date of commencement of the Works:
- (a) drawings showing the formation works and the layout within earmarked area for the Contractor's offices, project signboards, principal access and other major facilities required early in the Contract, together with all service utilities;
 - (b) drawings showing the details to be included on the project signboards and diversion boards.
- (8) Drawings showing location of stores, storage areas, concrete batching plants and other major facilities and their access roads/paths shall be submitted to the Engineer for his consent as early as possible but in any case, not less than twenty-eight (28) days prior to when such facilities are intended to be constructed on the Site.

11. SECURITY

- (1) The Contractor shall be responsible for the security of the site for the full time the site is in its possession, except for the specific case of the Railway Envelope after handover to the Railway Operator. It shall set up and operate a system whereby only those persons entitled to be on the Site can enter the Site. To this end, the Contractor shall with the consent of Engineer provide the specific points only at which entry through the security fence can be affected, and shall provide gates and barriers at such points of entry and whereby maintain a twenty-four (24) hours security guard, and such other security personnel and patrols elsewhere as may be necessary to maintain security.
- (2) The Contractor shall maintain all site boundary fences in first class condition and shall so arrange site boundary fences at all access drainage points of work areas that its use of such access points etc., are not restricted by the system or method of achieving the required security measures. Notices shall be displayed at intervals around the Site to warn the public of the dangers of entering the Site.
- (3) During the progress of the Works the Contractor shall maintain such additional security patrols over the areas of the Works as may be necessary to protect its own and its subcontractor's work and equipment.
- (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 Site, and which may need to be separately identifiable according to the shifts being worked on Site. The Contractor shall at the outset determine, together with the Engineer, a system, and the design of passes to suit the requirements of the foregoing and to suit the methods of work to be adopted by the Contractor. The Contractor shall at all times ensure that the Engineer has an up-to-date list of all persons entitled to be on the Site at any time. The contractor shall also introduce a system of issue passes to any outsider or person/vehicles belonging to agencies other than employer/ Engineers who may have to visit the site in connection with work.
- (5) The Contractor shall liaise with the Designated Contractors and the contractors responsible for the adjacent and other interfacing contracts and ensure that coordinated security procedures are operated, in particular in respect of vehicles permitted to pass through the Site and/or the adjacent sites.
- (6) Security and checking arrangements as felt necessary shall be provided with advice and help of Police.
- (7) Contractor's as well as his Subcontractor's employees and representative shall wear Identification Badges (cards), uniforms, helmets, safety shoes/gum boots & other safety/protection wear as directed by Engineer, and to be provided by the Contractor. Badges shall identify the Contractor/ Subcontractor and show the employee's name and number and shall be worn at all times

while at site.

- (8) All vehicles used by the Contractor/ Subcontractor shall be clearly marked with the Contractor's / Sub Contractor's name or identification mark.
- (9) The Contractor shall co-ordinate and plants the security of both the works under this Contract and the works of other engaged in adjacent and interfacing contractor's and requiring access to the site. 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 Site, system of separately identifiable according to the shifts being worked on Site. 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 works to be adopted by the Contractor. The Contractor shall at all times ensure that the Engineer has an up-to-date list of all persons entitled to be on the Site at any time. The Contractor shall also introduce a system for issue of passes to any outsider or persons/ vehicles belonging to agencies other than Employer/ Engineer who may have to visit the site in connection with work.

12. TESTING - GENERAL

- (1) The Contractor shall provide and perform all forms of testing procedures applicable to the Works and various components and the interfacing of the Works with the other Contract works and shall conduct all necessary factory, site, and acceptance tests.
- (2) All testing procedures shall be submitted at least thirty (30) days prior to conducting any Test. The Testing procedures shall show unambiguously the extent of testing covered by each submission, the method of testing, the Acceptance Criteria, the relevant drawing (or modification) status and the location.
- (3) The testing Procedures shall be submitted as required, by the contractor during the duration of the contract to reflect the changes in system design or the identification of additional testing requirements.
- (4) The Engineer shall have the facilities for monitoring all tests and have access to all testing records. Ample time shall be allowed within the testing programmes for necessary alterations to equipment, systems and designs to be undertaken, together with re-testing prior to final commissioning.
- (5) All costs associated with the Testing shall be borne by the Contractor, unless otherwise specified, including the services of any specialized personnel or independent assessors. The Contractor shall also bear any expenses incurred due to resetting caused by defects or failure of equipment to meet the requirements of the Contract in the first instance.
- (6) Unless agreed in writing by the Engineer, the personnel engaged on testing shall be independent of those directly engaged in the design or installation of the same equipment.
- (7) All testing equipment shall carry an appropriate and valid calibration label.

BATCHES SAMPLES AND SPECIMENS

- (8) A batch of material is a specified quantity of the material that satisfies the specified conditions. If one of the specified conditions is that the material is delivered to the Site at the same time, then material delivered to the Site over a period of a few days may be considered as part of the same batch if in the opinion of the Engineer there is sufficient proof that the other specified conditions applying to the batch apply to all of the material delivered over the period.
- (9) 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.
- (10) A specimen is the portion of a sample that is to be tested.

SAMPLES FOR TESTING

- (11) Samples shall be of sufficient size and in accordance with relevant Standards to carry out all specified tests.

- (12) 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.
- (13) 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.
- (14) Samples shall be delivered by the Contractor, under the supervision of the Engineer, to the specified place of testing. Samples on which non-destructive tests have been carried out shall be collected from the place of testing after testing and delivered to the Site or other locations instructed by the Engineer. '
- (15) Samples which 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.
- (16) 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 may not comply with the specified requirements.

TESTING

The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests shall be carried out in the Contractor's laboratory, unless otherwise permitted or required by the Engineer. Where the laboratory is not appropriately equipped and/or staffed for some tests, or if agreed to by the Engineer, tests may be carried out in other laboratories. All materials required approval of Engineer after 3rd party test at approved or reputed laboratory at the discretion of engineer.

Authority & Engineer in charge may recommend any test pertain to work or material to any laboratory of repute if they are accredited for the relevant work to a standard acceptable to the Engineer. The cost of such tests shall be borne by contractor.

- (17) In-situ tests shall be done in the presence of the Engineer.
- (18) Equipment, apparatus and materials for in-situ tests and laboratory compliance tests carried out by the Contractor shall be provided by the Contractor. The equipment and apparatus shall be maintained by the Contractor and shall be calibrated before the testing starts and at regular intervals as permitted by the Engineer. The equipment, apparatus, and materials for in situ tests shall be removed by the Contractor as soon as practicable after the testing incomplete.
- (19) 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 Clause 12 above and particulars of the laboratory proposed shall be submitted to the Engineer for consent prior to the testing.
- (20) Attendance on tests, including that by the Engineer, Contractor, and Designer, shall be as laid down in the Quality Assurance procedures.

COMPLIANCE OF BATCH

- (21) The results of tests on samples or specimens shall be considered to represent the whole batch from which the sample was taken.

- (22) A batch shall be considered as complying with the specified requirements for a material if the <2 results of specific tests for of the specified properties comply with the specified requirements for the properties.
- (23) If additional tests are permitted or required by the Engineer but separate compliance criteria for the additional tests are not stated in the Contract, the Engineer shall determine if the batch complies with the specified requirements for the material on the basis of the results of all tests, including the additional tests, for every property.

RECORDS OF TESTS

- (24) 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 the works checked
 - (b) location of the batch from which 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.
- (25) Reports of tests shall be signed by the site agent or his assistant, or by another representative authorized by the Contractor.
- (26) If requested, records of tests carried out by the Employer's staff or by the Engineer shall be given to the Contractor.

13. RECORDS

DRAWINGS PRODUCED BY THE CONTRACTOR

- (1) Drawings produced by the Contractor including drawings of site layouts, Temporary Works, etc. for submission to the Engineer shall generally be to ISO A1 size. They shall display a title block with the information as detailed in **Appendix - 9 / Annexure - 1 Section VIII, of Employers' Requirement** to these Employer's Requirements. The number of copies to be submitted to the Employer / Engineer shall be as stated in the Contract, or as required by the Employer / Engineer.

PROGRESS PHOTOGRAPHS

- (2) The Contractor shall provide monthly progress photographs which have been properly recorded to show the progress of the works to the Employer / Engineer. The photographs, of not less than 72 in number, shall be taken on locations agreed with the Employer / Engineer to record the exact progress of the Works. Two sets of photographs shall be provided on Memory Device with two sets of colour prints of 175 mm x 125 mm size.
- (3) The Contractor shall mount each set of each month's progress photographs in a separate album of a type to which the Engineer has given his consent and shall provide for each photograph two typed self-adhesive labels, one of which shall be mounted immediately below the photograph and one on the back of the photograph. Each label shall record the location, a brief description of the progress recorded and the date on which the photograph was taken.

- (4) All photographs shall be taken by a skilled photographer whose name and experience shall be submitted to the Engineer for consent and approval received. Processing shall be carried out by a competent processing firm to the satisfaction of the Engineer.
- (5) The Contractor shall ensure that no photography is permitted on the Site without the agreement of the Engineer. Contractor should be aware of the legal regulations and conditions with regard to Photography in 'RESTRICTED AREA' in Bangalore.

RECORDS OF WAGE RATES

- (6) 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.

14. MATERIALS

- (1) Materials and goods for inclusion in the Permanent Works shall be new unless the Engineer has consented otherwise. Preference shall be given to local materials where available. Approved Manufacturers/Suppliers of few important items have been given in **Appendix 15 & 16 / Annexure 1 of Section VIII, Employers' Requirement**. These materials shall be procured only from these manufacturers/Suppliers. Under special circumstances provision of sub para 4 below may be invoked.
- (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. Certified true copies of certificates may be submitted if the original certificates could not be obtained from the manufacturer.
- (3) Parts of materials which are to be assembled on the Site shall be marked to identify the different parts.
- (4) 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.
- (5) Samples of materials submitted to the Engineer for information or consent shall be kept on the Site and shall not be returned to the Contractor or used in the Permanent Works unless permitted by the Engineer. The samples shall be used as a mean of comparison which the Engineer shall use to determine the quality of the materials subsequently delivered. Materials delivered to the Site for use in the Permanent Works shall be of the same or better quality as the samples which have received consent.

PROVISION AND DISPOSAL OF EARTHWORKS MATERIALS

- (6) 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 Contract or obtained from any other sources, which are located outside the Site, for which the Engineer has given the consent.
- (7) For fill or dumping sites, the Contractor shall prepare a land plan with details of surface drainage requirements, final formation levels, spreading and compaction of the fill during dumping acceptable to the Engineer. The Contractor shall also provide security for such sites.
- (8) All excavated material, excluding waste material, bentonite/polymer fluid and bentonite/polymer contaminated material shall be disposed of at the appointed site only. This material shall be placed and compacted in accordance with the Construction Specification for Earth Works or as otherwise directed by the Engineer's Representative. The disposal of waste material shall be the full responsibility of the Contractor and these materials shall be disposed of by the Contractor at an approved location. No dumping sites will be provided by the Employer.
- (9) Rock deposited as fill material at the dumpsites shall be capable of compaction with single pieces no larger than 300mm.

15. PROVISIONS FOR DESIGNATED CONTRACTORS

- (1) The contractor shall make all reasonable provision to accommodate the fastenings and fixings of the

designated contractors. Such provisions will be notified by the designated contractors during design interface stage. The contractor shall take a lead in developing the interface management Plan (IMP) with respect to the other contracts having interfacing with the works under the scope of present contract. The IMP will be prepared in conjunction with the other designated contractor to cover all aspects of the implementation of the interface works required. The IMP will define the interface works necessary to complete all the works under this contract.

16. RESTORATION OF AREAS DISTURBED BY CONSTRUCTION.

Unless otherwise directed by the engineer, any area disturbed by the construction activity, either inside or outside the project Right of Access, 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, and adjacent roads, properties, and landscaping. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

17. CONTRACTORS LABOUR CAMPS

- (1) The employer will not provide living accommodation for use of the contractor or any of his staff or labour employed on the works. Living accommodation shall not be established on any land provided to the contractor by the employer for the works.
- (2) Provisions of Labour Camps.

The contractor, shall, at his own expense make adequate arrangements for the housing, supply of drinking water and provisions for bathrooms, latrines, and urinals, with adequate water supply for his staff as well as for workman employed on the works directly or through subcontractors at the locations authorized by engineers. No labour camp shall be allowed at work site or any unauthorized place.

The contractor at his own cost shall maintain all camp site in a clean and sanitary conditions, 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, the employer and the staff of the local municipality or the other authority concerned. Should the contractor failed to provide adequate health and sanitary arrangement these shall be provided by the Employer and the cost will be recovered from the contractor.

The contractor shall, at his own cost, provide first-aid and medical facilities at the labour camp and at work sites on the advice of the medical authority consistent with the strength of the contractor's staff and workman, employed directly or through subcontractors.

The contractor shall at his own cost, provide the following minimum requirements for meeting the fire hazards.

- i. Portable fire extinguishers
- ii. Manual fire alarms
- iii. Water supply for use by the fire service.

The contractor at his own cost shall provide necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers. He should also ensure that electrical installations done by trained electricians. These installations shall be maintained, and daily maintenance record must be made available for inspection by the engineer.

(3) CAMP DISCIPLINE

The contractor shall take requisite precautions, use his best endeavours to prevent any riotous or unlawful behaviour by or amongst his workmen, others, employed directly or through sub- contractors. These precautions shall be for the preservation of the peace and protection of the inhabitants and the security of the property in the neighbourhood of the Works. In the event of the Employer requiring the

maintaining 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 and if paid by the Employer, shall be recoverable from the contractor.

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, own or occupied by, or with the control of, the contractor or any of his personnel employed on the work directly or through sub-contractors shall be forbidden, and the contractor shall exercise his influence and authority to secure strict compliance with this condition. 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.

The contractor shall remove from his camp such labour and their families, as refuse protective inoculation and vaccination when called upon to do so by the Engineer on the advice of his Medical Authority. Should Cholera, Plague or any other infectious disease break out, the Contractor shall at his own cost burn the huts, bedding, cloths and other belongings of or used by the infected parties. The contractor shall promptly erect new heads on healthy sides as required by the Employer. Within the time specified by the Employer, failing which the work may be done by the Employer and the cost recovered from the Contractor.

(4) LABOUR ACCOMODATION

The contractor shall provide living accommodation that is equal to or exceeds the minimum criteria established in the following sub-sections, needed to house his staff as well as workers employed directly or through sub-contractor. The buildings shall be constructed so as to have a minimum life of not less than the length of contract.

- (a) The roof shall be watertight and laid with suitable non-flammable materials. permissible for residential use under local regulation and for which the consent of the Engineer has been obtained.
- (b) Each hut shall have suitable ventilation. All doors, windows, and ventilators shall be provided with security leaves and fasteners. Back-to-back units may be avoided.
- (c) The minimum height of each unit shall be 2.1m and shall have separate cooking place.
- (d) Suitable number of common toilets / bathrooms shall be provided.

(5) WATER SUPPLY

The contractor shall provide an adequate supply of water for the use of labours in the camp. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand post and where the supply is from wells or river, tanks that may be of metal or masonry shall be provided. The contractor shall also at his expense make arrangements for the provision and laying of water pipelines from the existing mains wherever available and shall pay for all the fees and charges thereof.

(6) DRAINAGE

The contractor shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy. Surface water shall be drained away from the paths and roads and shall not be allowed to accumulate into ditches or ponds where mosquitoes can breed.

(7) SANITATION

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.

The contractor shall provide a sewerage system that is adequate for the number of the residents in the camp, and which meets the requirements of the Municipal Authorities.

SECTION E

GENERAL PLANNING CRITERIA

PURPOSE AND SCOPE

The purpose of this Appendix is to include other criteria and requirements not included elsewhere that are necessary for the full development and Detailed Design of Viaduct/Bridge.

OUTLINE DESIGN CRITERIA FOR VIADUCT/BRIDGE PORTION

1. GENERAL

- 1.1 This Outline Design Criteria and the Appendices hereto provide minimum standards which are to govern the design of the Permanent Works.
- 1.2 The Outline Design Criteria shall be read in conjunction with the other contract documents including the Outline Construction Specifications.
- 1.3 The Design of the Permanent Works shall comply with codes of practice and standards current at the time of submission of Tender Documents, Regulations made and requirements issued by the Indian Government and by relevant utility companies shall be followed and specified.
- 1.4 Alternative or additional codes, standards and specifications proposed by the Contractor shall be internationally recognized codes and shall be equivalent to or better than, Indian Standards subject to being, in the opinion of the Engineer, suitable for incorporation into the Specifications.

2. CODES AND STANDARDS

Design and loading requirements for the structures shall be not less than the following Indian Standards and Codes of Practice, together with all applicable amendments.

Where other standards and codes of practice are referred to in the text of other Appendices then the designer is expected to apply those Standards and Codes of Practice unless the designer can show that an economic case exists for use of an Indian Standard. However, preferences of codes will be as follows: -

- i. IRS
- ii. IS
- iii. IRC
- iv. AASHTO

INDIAN RAILWAY STANDARDS (IRS)

- IRS - Bridge Rules for loading (Min. of Railway) IRS- Code of practice for Steel bridges.
- IRS - Code of practice for plain, reinforcement and pre-stressed concrete for general Bridge construction, latest revision.
- IRS - Code of practice for the design of substructures and foundation of bridges.

INDIAN ROADS CONGRESS (IRC) STANDARDS (WITH LATEST REVISIONS, ADDENDUM & CORRECTIONS)

- IRC 5: 1985 Standard Specifications and Code of Practice for Road Bridges, Section I
 - General Features of Design
- IRC 6: 2000 Standard Specifications and Code of Practice for Road Bridges, Section II
 - Loads and Stresses

IRC 10:	1961	Recommended Practice for Borrow pits for Road Embankments Constructed by Manual Operation
IRC 19:	1977	Standard Specifications and code of Practice for Water Bound Macadam
IRC 21:	2000	Standard Specifications and code of Practice for Cement Concrete (PCC& RCC)
IRC 22:	2008	Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction for Road Bridges
IRC 24:	2010	Standard Specifications and Code of practice for Road Bridges, Section V – Steel Road Bridges
IRC 36:	2010	Recommended Practice for the Construction of Earth Embankments for Road Works
IRC 37:	1984	Guidelines for the Design of Flexible Pavement
IRC 45:	1972	Recommendations for Estimating the Resistance of Soil below the maximum Scour Level in the Design of Well Foundations of Bridges
IRC 48:	1972	Tentative Specifications for Bituminous surface Dressing using Pre-coated Aggregates
IRC 75:	1979	Guidelines for the Design of High Embankments
IRC 78:	2014	Standard Specifications and Code of Practice for Road Bridges, Section VII (Parts 1 and 2), foundations and Substructure.
IRC 83:	1999	Standard Specifications and code of practice for Road Bridges, Section IX
IRC 83:	2002	Standard Specifications & Code of Practice for Road Bridges, Part-III Pot, Pot-Cum-PTFE, Pin and Metallic Guide Bearings
IRC 87:	2011	Guidelines for the Design and Erection of False Work for Road Bridges
IRC 112:	2011	Code of Practice for Concrete Road Bridges
1RC: SP 11	1958	Handbook of quality Control for Construction of Roads and Runways.
1RC: SP 65	2018	Guidelines for the Design and Construction of Segmental Bridges.
1RC: SP 71	2006	Guidelines for the Design and Construction of Precast Pre tensioned Girders.

IS: CODES: NATIONAL BUILDING CODE

SP 7:	2015	Bureau of Indian Standards
1S 73:	1992	Paving Bitumen
1S 215:	1995	Road Tar
1S 217:	1988	Cutback Bitumen
1S 226:	1975	Structural steel (standard quality)
1S 269:	2013	Spec s for Ordinary and low heat Portland Cement
1S 278:	1978	Galvanised steel barbed wire for fencing
1S 280:	1978	Mild Steel wire for general engineering purposes
1S 281:	2009	Mild Steel siding door bolts for use with Padlocks
1S 383:	1970	Coarse and fine aggregates
1S 432:	1982	Mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement
	(Part 1)	Mild steel and medium tensile steel bars
	(Part 2)	Hard-drawn steel wire
1S 455:	1989	Portland slag cement
1S 456:	2000	Code of practice for plain and reinforced concrete
1S 457:	1957	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures
1S 460:	1985	Test sieves

IS 515:	1959	Natural and manufactured aggregates for use in mass concrete
IS 516:	1959	Method of test for strength of concrete
IS 650:	1991	Standard sand for testing cement
IS 800:	2007	Code of practice for general construction in steel structures
IS 814:	1991	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel
IS 815:	1974	Classification coding of covered electrodes for metal arc welding of structural steel
IS 823:	1964	Code of procedure for manual metal arc welding of mild steel
IS 875:	1987	Code of practice for design loads (other than earthquake) for buildings and structures (Parts I, II, IV & V)
IS 875:	2015	Code of practice for design loads (other than earthquake) for buildings and structures (Part III)
IS 1077:	1992	Common burnt, clay building bricks
IS 1080:	1986	Design and construction of shallow foundation in soil (other than raft and shell)
IS 1161:	1998	Steel tubes for structural purposes
IS 1239:	1990	Mild steel tubes, tubular and other wrought steel fittings
	(Part 1) 2004	Mild steel tubes
	(Part 2) 1992	Mild steel tubular and other wrought steel pipe fittings
IS 1322:	1993	Bitumen felts for water proofing and damp-proofing
IS 1343:	2012	Code of practice for Pre-stressed Concrete
IS 1364:	1992	Hexagon Head bolts, screws & nuts of product grades A & B (Part I)
IS 1489:	1991	Portland Pozzolana Cement
IS 1732:	1989	Dimensions for round and square steel bars for structural and general engineering purposes
IS 1785:	1983	Plain hard-drawn steel wire for pre-stressed concrete
	(Part 1)	Cold-drawn stress – relieved wire
	(Part 2)	As drawn wire

IS 1786:	2008	High strength deformed steel bars and wire for concrete reinforcement
IS 1791:	1985	Batch type concrete mixers
IS 1834:	1984	Hot applied sealing compound for joint in concrete
IS 1838:	1983	Pre-formed fillers for expansion joint in concrete pavements and structures (non-extruding and resilient type)
	(Part 1)	Bitumen impregnated fiber
IS 1888:	1982	Method of load tests on soils
IS 1892:	1979	Code of practice for sub surface investigations for foundations
IS 1893: Part I	2001	Criteria for earthquake resistant design of structures
IS 1893: Part II	2014	Criteria for earthquake resistant design of structures
IS 1893: Part III	2014	Criteria for earthquake resistant design of structures
IS 1893: Part IV	2005	Criteria for earthquake resistant design of structures
IS 1904:	1986	Design and construction of foundations in soils General Requirements
IS 1905:	1987	Code of practice for Structural use of unreinforced Masonry
IS 1977:	1976	Low Tensile Structural steel
IS 2062:	2006	Steel for general structural purposes
IS 2090:	1983	High tensile steel bards used in pre-stressed concrete
IS 2116:	1980	Sand for masonry mortars (first revision)
IS 2119:	1980	Code of practice for construction of brick-cum-concrete composite
IS 2386:	1963	Methods of test for aggregate for concrete
	(Part 1)	Particle size and shape
	(Part 2)	Estimation of deleterious materials and organic impurities
	(Part 3)	Specific gravity, density, voids, absorption, and bulking
	(Part 4)	Mechanical properties

INFORMATION AND SCOPE OF WORK

	(Part 5)	Soundness
	(Part 6)	Measuring mortar properties of fine aggregates
	(Part 7)	Alkali aggregate reactivity
	(Part 8)	Petrography examination
IS 2430:	1986	Methods of sampling of aggregate for Concrete
IS 2502	1963	Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement
IS 2751:	1979	Recommended practices for welding of mild steel plain and deformed bars used for reinforced construction
IS 2911:	2010	Code of practice for design and construction of pile foundations
	(Part 1)	Concrete piles 3
	Section 1	Driven cast-in-situ concrete piles
	Section 2	Bored cast-in-situ concrete piles
	Section 3	Driven precast concrete piles
	Section 4	Bored precast concrete piles
	(Part 3)	Under-reamed piles
	(Part 4)	Load test on piles
	(2013)	
IS 2950:	1981	Code of practice for design and construction of raft foundations.
IS 3812:	2003	Fly ash for use as pozzolana and admixture
IS 3955:	1967	Code of practice for design and construction of well foundations
IS 4000:	1992	High Strength Bolts in Steel Structures- Code of Practice (First Revision)
IS 4082:	1996	Recommendations on stacking and storage of construction materials at Site
IS 4138:	1977	Safety code for working in compressed air
IS 4326:	1993	Earthquake resistant design and construction of buildings – code of Practice
IS 4656:	1968	Form vibrators for concrete
IS 4736:	1986	Hot-dip zinc coating on mild steel tubes
IS 4826:	1979	Hot-dipped galvanized coatings – round steel wires
IS 4925:	1968	Concrete batching and mixing plant

IS 4926:	1976	Ready mixed concrete
IS 4923:	1997	Hollow steel sections for structural use -specification
IS 4968:	1976	Method for sub surface sounding for soils
IS 5525:	1969	Recommendations for detailing of reinforcement in reinforced concrete works
IS 5529:	1985	Code of practice for in-situ permeability tests
IS 5640:	1970	Method of test for determining aggregate impact value of soft coarse Aggregate
IS 5816:	1970	Method of test for splitting tensile strength of concrete cylinders
IS 5889:	1994	Vibratory plate compactor
IS 5892:	1970	Concrete transit mixers and agitators
IS 6003:	1983	Specification for indented wire for pre-stressed concrete
IS 6006:	1983	Specification for uncoated stress relieved strands for pre-stressed concrete
IS 6403:	1981	Code of practice for determination of bearing capacity of shallow foundations
IS 6603:	1972	Stainless steel bars and flats
IS 6911:	1992	Stainless steel plate, sheet and strip
IS 7205:	1974	Safety codes for erection of structural steel work
IS 7293:	1974	Safety code for working with construction machinery
IS 7320:	1974	Concrete slump test apparatus
IS 7861:	1975	Code of practice for extreme weather concreting
	(Part 1)	For Hot Weather
	(Part 2) 1981	For Cold Weather
IS 7969:	1975	Safety code for handling and storage of building materials
IS 8009	1976	Calculation of settlement of shallow foundations

IS 8041:	1990	Rapid - hardening Portland cement
IS 8112:	1989	43 grade ordinary Portland cement
IS 8142:	1994	Method of test for determining setting time of concrete by penetration resistance
IS 8500:	1991	Structural steel-micro alloyed (medium and high strength qualities)
IS 9013:	1978	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens
IS 9103:	1979	Admixtures of concrete
IS 9284:	1979	Method of test for abrasion resistance of concrete
IS 9417:	1989	Recommendations for welding cold worked bars for reinforced concrete Construction
IS 9595:	1996	Recommendations for metal arc welding of carbon and carbon manganese steels
IS 10262:	1982	Recommended guidelines for concrete mix design
IS 10379:	1982	Code of practice for field control of moisture and compaction of soils for embankment and sub-grade
IS 11384:	1985	Code Of Practice for Composite Construction in Structural Steel and Concrete
IS 12070:	1987	Code of Practice for Design and Construction of Shallow Foundations on Rocks
IS 12269:	2013	53 grade ordinary Portland cement
IS 12894:	2002	Fly ash line bricks
IS 13920:	2016	Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces
IS 14268:	1995	Uncoated Stress Relieved Low relaxation Seven-ply Strands for Prestressed Concrete
IS 14593:	1998	Design And Construction of Bored Cast-In-Situ Piles Founded on Rocks-Guidelines.
		IS 15658 : Precast Blocks

FOREIGN STANDARDS**FOREIGN STANDARDS**

ASTM	D-297	Methods for Rubber Product Chemical Analysis ASTM D-395 Compression set of vulcanized rubber
ASTM	D-412	Tension testing of vulcanized rubber ASTM D-429 Adhesion of vulcanized rubber metal
ASTM	D-573	Accelerated ageing of vulcanized rubber by the oven method
ASTM	D-624	Tear resistance of vulcanized rubber
ASTM	D-797	Young's Modulus in flexure of elastomer at normal and subnormal temperature
ASTM	D-1149	Accelerated Ozone cracking of vulcanized rubber
ASTM	D-1559	Test for resistance to plastic flow of bituminous mixtures using Marshall Apparatus
ASTM	D-2166	Test methods for Unconfined Compressive Strength of Cohesive Soils
ASTM	0-2172	Extraction, quantitative, of bitumen from bituminous paving mixtures
ASTM	0-2240	Indentation hardness of rubber and plastic by means of a Durometer
ASTM	0-2434	Test methods for permeability of Granular Soils
ASTM	0-30B0	Method for direct shear test of soils under consolidated drained condition
ASTM	E-11	Specification for wire cloth sieve for testing purpose

AASHTO OM 57-80	Materials for embankments and sub-grade
AASHTO OM 147-67	Materials for aggregate and soil (1980) base and surface courses
AASHTO M 282-80	Joints sealants, not poured, elastomeric type,
(ASTM: D 3406)	for Portland cement cure rate pavements
AASHTO LRFD	Bridge Design Specification

Note: - The above list is not exhaustive and shall be augmented during detailed design and construction of the viaduct/Bridge.

OTHER PUBLICATIONS

Indian Standard Handbook on Steel sections Part I
Indian Railways Manual on Design and Construction of well and pile foundations.

UIC/772 - R The International Union of Railways Publication. IEC International Electromechanical Commission

UIC/772 -2R The Code for usage of Rubber Bearings for Rail Bridges

The provision of UIC-774-3 in relation to rail-structure interaction is well known and is being used in many rail-based structures.

ACI CODE -318-19: Building code requirements for structural concrete.

FIP -Recommendations for the acceptance of post-tensioning systems.

The design relating to fire safety and escape shall be in accordance with the requirements of NBC/NFPA 130 Standard for Fixed Guide way Systems.

3. BSTP ALIGNMENT

3.1 CRITERIA

3.1.1 Any modification to the railway alignment design shall comply with the requirements of the project and as approved by Engineer / Employer.

4. BSTP DESIGN REQUIREMENTS

4.1 GENERAL

4.1.1 The Railway Envelope is defined as the extent of works to be constructed to allow installation and operation of the railway equipment.

4.1.2 TRACK SUPPORTING STRUCTURE

The contractor shall be responsible for the first stage primary concrete for track supporting structure. Others will undertake the design of the secondary concrete, track slabs and track work under contracts with the Engineer / Employer. A fundamental obligation of the contractor is to co-ordinate and co-operate with the Track work contractor so that the design of all components of the railway are compatible.

4.1.3 SECOND POUR CONCRETE

The Contractor will carry out the second pour concrete for the track work. In this regard, the

contractor shall provide starter bars in the primary concrete pour to facilitate anchorage of the second pour concrete. The contractor shall co-ordinate with the contractor as to the size and location of the starter bars.

4.1.4 The Contractor shall provide drainage pipes, channels and catch basins to be in the first pour concrete.

4.1.5 The design of all railways operating equipment, including signals and signalling cables, the traction power electrification equipment, electrical cables, electrical and mechanical equipment, telecommunication links, etc. that are required for the railway will be undertaken by other contractors working with the Employer. Similar co-ordination and co-operation obligations as expressed in Clause 4.1.2 above apply.

4.1.6 The Contractor shall include in the civil works blind holes, plinths, trenches etc. as required by the other DDC. The extent and detail of such provisions are to be determined by the Contractor making due enquiries, as design co-ordination, from DDCs engaged to provide railway-operating equipment

4.1.7 The Contractor shall include in the design, terminals as required from the continuous electrical path through the structures to external connections. The terminals shall be suitable for the connection of 35 mm² copper cable. At each connection, four such terminals shall be provided at the track level, two on each side of the viaduct/Bridge, one of which shall be kept as spare and suitably protected. Similar terminals, spare terminals and connections shall be provided over any joint of the structure.

4.1.8 General requirements for earthing and bonding the structures are to be determined in liaison with the system wide Contractor.

4.1.9 Cross bonding of the running rails, stray current return cabling etc. will be carried out by the system wide Contractor.

4.1.10 The Contractor shall take account in his design of the fact that the Contract will be integrated with others in the Project in respect of the control of stray currents and may therefore carry stray currents corrosion control measure arising from any foreseeable operating condition of the Project.

4.3 RAILWAY CROSS SECTIONS AND STRUCTURE GAUGES

4.3.1 The Kinematic Envelope for the rolling stock of the railway, and Structure Gauges for straight and curved track as provided by Bi-RIDE is to be followed.

4.3.2 the Contractor shall ensure that the proposed size of structure is adequate to contain the equipment, required under Clause 4.1 above, outside the Structure Gauge.

4.3.3 Structures shall not infringe the clearances specified. See also Clause 4.3.2 above.

5. STRUCTURAL DESIGN CRITERIA

5.1 DESIGN LIFE Clauses 6 to 9 below define the design life and serviceability requirements for the various elements of the structures.

5.2 The design life of a structure is that period for which it is designed to fulfil its intended function when inspected and maintained in accordance with agreed procedures. 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. Neither will it necessarily continue to be serviceable for that length of time without adequate and regular inspection and routine maintenance.

5.3 All Design Life criteria shall be confirmed during detailed design by the Employer's Representative.

5.4 CIVIL ENGINEERING STRUCTURES

All components of Permanent Works including viaduct/Bridge structures shall be designed for a design life of 100 years.

5.5 BRIDGE BEARINGS AND MOVEMENT JOINTS

Bridge bearings and movement joints shall have a minimum design life of 50 years apart from inner components that can be replaced without complete removal and without interruption to traffic.

6. SERVICEABILITY

- 6.1 Paint systems for steelwork shall ensure a minimum life of 15 years before full maintenance painting is required.
- 6.2 The corrosion protection of non-structural steel items shall be appropriate to the accessibility of the item for inspection and maintenance.
- 6.3 Serviceability of electrical and mechanical equipment included in this Contract shall be 5 to 25 years, depending on the various items.

7. STRUCTURAL SYSTEM

Span arrangement shall be made by the Contractor. Span arrangement may have to be adjusted based on existing utilities and other street furniture. Certain restrictions for location of piers are given below: -

The structural system shall comprise of pre-stressed segmental super structure/U-Girder Superstructure, sub structure (pier & pier cap) and foundations (pile, based on above provisions. However, the Contractor has to provide alternatives for cost effective design and in such case, load combination is to be suggested by Design and construction contractor for approval of Authority.

Load Combinations for Simply Supported Spans Superstructure Constructed by Precast Segmental Construction/U-Girder Superstructure (As per DBR/SOD)

7.1 BSTP LIVE LOADS (AS PER DBR)**7.2 GENERAL**

The railway loading applied to structures on the Project shall generally be in accordance with IRS Bridge Rules except as detailed below (Refer DBR)

Dead loads shall be used that are in accordance with IRS Bridge Rules and IS 456 (for buildings) and IS 875 part 1 for unit weights of materials and self-weight of all structural elements shall be worked out as per DBR. Axle Loads and spacing are as per DBR.

7.3 NOMINAL LOADS (AS PER DBR)

7.3.1 For the purpose of computing stresses and deformations, the following loads and consequential effects shall be taken into account as applicable.

7.3.2 Dead loads

7.3.3 Super imposed Dead Load

SIDL -OC s Signalling (MISc)- 4 kN/m

5.4.3 Viaduct SIDL (Variable):

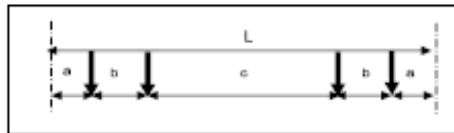
S.no	Structural Component	Double Track (MT/m)	Single Track (MT/m)
1	Rails + Pads	0.30	0.15
2	Cables	0.07	0.04
3	Cable trough cell	0.74	0.35
4	Cable trays	0.01	0.01
5	Hand-rail	0.08	0.08
6	Plinth (slab track)	3.44	1.72
7	Lightweight deck drainage concrete	0.24	0.12
8	OHE mast signaling etc.	0.40	0.20
9	miscellaneous (OCS, signaling, fasteners)	0.40	0.20
	Total (MT/m)	6.05	3.05

Solar Panel

On the parapets of viaducts/Bridge, solar panels are planned to be fixed. The designer shall consider in their design and all fixtures required to mount the panels. The loading of 50 Kg / m shall be considered on both the parapets while designing.

7.3.4 Live Loads Dynamic effects

- Each component of the structure will be designed / checked for all possible combinations of these loads and forces. They will resist the effect of the worst combination:



Axle loads = 17 MT

Maximum number of successive cars in a train = 6 (extendable to 9) Wheel Configuration

$a = (\text{balance})$

$b = 2300 \text{ mm to } 2500 \text{ mm}$ (Wheel base in a bogie)

$c = 11700 \text{ mm to } 12700 \text{ mm}$ (Distance between Axle-2 and Axle-3

in the car)

Total Length of one car $L = 2a + 2b + c = 21740 \text{ mm}$.

Equivalent UDL (EUDL) as provided in Annexure -1 of K-Ride DBR for various simply supported span for flexure and Shear force will be used for design and analysis of superstructure and substructure except for frame type structure like Minor bridges and Minor RUB (LC Boxes) where Moving load analysis will be carried out. The said EUDL for various spans has been enclosed in Annexure I of this DBR.

Braking and Traction (Longitudinal Forces):

Braking load will be taken as 18% of the un-factored vertical Axle loads

Traction load will be taken as 20% of the un-factored vertical Axle loads

Tractive force of one track and braking force of another track will be considered in the same direction to produce worst condition of loading

As per IRS: Seismic Code Cl. 7.1, when considering seismic forces, only 50% of gross tractive effort /

braking force will be considered.

7.3.5 Long welded rail forces Racking forces.

Longitudinal temperature force due to continuation of long welded rails on bridges is computed as per provisions of UIC 774-3R, 2002 EDITION. This works out to a maximum of For Short Piers where pier height is lesser than 6 times the longitudinal pier dimension ($H/d < 6$) – LWR force = 2.4 t/m for two tracks and For Slender Piers where pier height is more than 10 times the longitudinal pier dimension ($H/d > 10$) – LWR force = 1.2 t/m for two tracks and In transverse direction = $650 / R$ KN/m/track.

The longitudinal force due to the case of one of one rail fracture will also be considered in the design of the structures with increase in allowable stresses by 33.3%.

7.3.6 Forces due to curvature or eccentricity of track

7.3.7 Temperature effects

7.3.8. Frictional resistance of expansion bearings Longitudinal forces

7.3.9. Forces on parapets Wind pressure effect

7.3.10. Forces and effect due to earthquake Erection forces and effects Buoyancy Differential settlement.

7.4 LOADING COMBINATIONS

The various combinations of loads and forces to which components of the structures can be subjected are given in Bridge Rules/IRS CBC & DBR. Each component of the structure shall be designed checked for all applicable combinations of these loads and forces. They shall resist the effect of the worst combination. The allowable unit stress in a member subjected to a particular combination loading shall not exceed the percentage indicated below against the respective combination.

The loading combinations indicated are not exhaustive. The Contractor shall analyse the effects of any other combination as deemed appropriate.

7.5 DESIGN LOADS (AS PER DBR)

When a structure carries two tracks, both tracks shall be considered to be occupied simultaneously. Traction forces shall act on one track and braking forces acting on the other, with both acting in the same direction to produce the worst loading condition.

Longitudinal forces acting on the track shall be considered to be dispersed through the track before being transmitted to the substructure. This shall be calculated based on IRS Bridge Rules and IS Codes

Provision shall be made for effect of horizontal and longitudinal forces in the rail, especially in the girders with ballast less deck.

Additional permissible stresses while considering this contingency will be proposed by the CONTRACTOR for review by the Employer's Representative. Forces shall be calculated for continuous welded rail with a concrete structure interaction resulting from temperature differential of rail and concrete. Rail structure interaction analysis on representative stretches based on UIC 774 3-R shall be adopted to work out the LWR forces.

Longitudinal forces shall consider the effects on stability and safety arising from a broken rail in ballast less track.

Centrifugal load based on relevant IRS codes/ IRS Bridge Rules shall be worked out for the given track geometry.

Train Derailment Load: Check for derailment loads shall be made as per IRS Bridge Rules.

7.6 WIND LOADING (AS PER DBR)

The viaduct/Bridge structure shall be designed for wind loading as per IRS Bridge Rules.

However, a bridge shall not be considered to be carrying any live load when the wind pressure at deck level exceeds 150 kg/m². Wind load shall be taken as 400-kg/meter length of train in transverse direction and 90-kg/meter length in longitudinal direction. These are computed for length of train as seen in elevation normal to longitudinal axis. The transverse load will be applied to train as concentrated at axle locations at a height of 3.2 m or at C.G. of projected area of the vehicle as accepted by the Employer's Representative above top of lowest rail and normal to track. The horizontal force component transmitted to rails and superstructure by an axle will be treated as a concentrated load at rail having direct wheel flange to railhead contact.

7.7 TEMPERATURE LOADING (AS PER DBR)

Overall temperature and differential temperature effects shall be determined as per provisions of DBR.

7.8 SEISMIC LOADING (AS PER DBR)

Seismic effects shall be considered on all structures, except culverts as per DBR. It is also required to check the structures for seismic forces as per IS: 1893- 2016 and Latest RDSO guidelines for seismic design of bridges.

Seismic Load (EQ) "Seismic Code for Earthquake Resistant Design of Railway Bridges" shall be followed. The code also covers load combination and ductile detailing. Bangalore District area is in Seismic Zone II and all the designs shall be carried out for one zone classification above.

7.9 ERECTION FORCES AND EFFECTS (AS PER DBR)

The weight of all permanent and temporary materials together with all other forces and effects which can operate on any part of structure during erection shall be taken into account. Allowance shall be made in the design for stresses caused in any member during erection. For extra allowance in permissible stresses when erection forces are also considered, relevant codal provisions should be followed.

7.10 SHRINKAGE AND CREEP

Provision shall be made for the effects of shrinkage and creep of the concrete in the structure.

- The shrinkage strains shall be evaluated as per clause 6.2.4 of IS:456 for Plain and Reinforced Concrete Structures and clause 6.2.4 of IS :1343 for prestressed concrete structures and for structure supporting rail loading the effects of creep as per clause 5.2.3 of IRS-CBC shall be considered.
- The creep strains shall be evaluated as per clause 6.2.5 of IS:456 for Plain and Reinforced Concrete Structures and clause 6.2.5 of IS :1343 for prestressed concrete structures and for structure supporting rail loading the effects of shrinkage as per clause 5.2.4 of IRS-CBC shall be considered.

7.11 DIFFERENTIAL SETTLEMENT: AS PER DBR

- 7.12** In addition, for derailment loads "Sacramento derailment criteria" is intended to be used. This criterion corresponds to the application of 40% of one coach weight applied horizontally as a 3m long uniform impact load on the Box girder top flange. This derailment load corresponds to an ULS load. For SLS combination (Group V), a 1/1.75 co-efficient shall be applied to the derailment load.

7.13 NOISE ABATEMENT

Allowable Range of Noise Levels:

Generally, the allowable range of noise levels for different land uses is:

- | | | |
|-----|-----------------------|-------------|
| i. | Residential | 50 - 70 dbA |
| ii. | Business & Commercial | 75 dbA |

iii.	Hospitals	60 dbA
iv.	Rural	45 - 50 dbA

Provision of Noise Barriers:

Structures shall be designed to reduce noise to locally acceptable levels by provision of low vibration track forms, resilient base plates and also design of parapet walls and treatment of their track side surfaces. They can be supplemented by providing sound elimination material on sides of the viaduct/Bridge superstructures. But in many locations, existing noise level itself may be much higher at 1.0 to 1.2 meters above walkway level. Noise barriers may be required in some lengths of viaducts and bridges passing through sensitive residential or hospital zones. The choice of type and their disposition along the parapet railing is also closely related to aesthetics of the structure.

8. BSTP REQUIREMENTS**8.1 EMERGENCY EVACUATION**

Provision for emergency evacuation shall be provided along the railway / BSTP for the full length of the structure. Routes assigned for emergency evacuation shall be designed for footway loading in accordance with the requirements.

8.2 PARAPET

8.2.1 Parapet shall be provided on both sides of all viaducts/Bridges for the full length of the structure. For providing signal mast, CBTC radio tower. They shall be designed to act as the support structure to the railway cabling and junction boxes as appropriate and will be cast inbuilt with box segments.

8.2.2 Parapets shall be designed to resist the wind load and other relevant loads based on the codal provision & DBR.

8.2.3 Parapets shall be provided for all transition structures to protect the guide way from intrusion by trespassers, vandals, and road vehicles.

8.2.4 Parapets shall be designed to function as Noise Containment Barriers.

8.2.5 Parapets shall be designed to cater the forces of Signal masts, OHE masts and related structures. Bidder to suitably assume OHE locations as per track geometry and traction requirement. Generally, on an average, there will be one OHE on each side in a 25 m span (approximately).

8.3 VERTICAL PROFILE**8.3.1 Profile grade:**

The superstructure shall be so designed that, when subject to dead load only, the rail level would be above the theoretical vertical profile of the system by an amount equal to permissible LL deflection for the structure.

Provision for super-elevation shall be made preferably as part of the track structure over the deck. The dead load is to be considered at such locations.

8.3.2 Camber:

The superstructure deck, including the soffit of any overhead structure above the deck, shall be cambered so as to compensate for the combined effect of:

- i. Vertical Curvature, if any;
- ii. Dead load deflection; and
- ii. Permissible live load plus-impact deflection as accepted by the Employer's Representative.

8.4 SPAN/DEPTH RATIOS:

Span-to-depth ratio should as far as possible be restricted to:
Bi-RIDE (C2/ BNH-HBL /AT GRADE)

- i. Reinforced concrete member - 10
- ii. Pre-stressed concrete member - 14
- iii. Composite members - 16,
- iv. Desirable 12

In Box girders these ratios shall be further subject to stipulations made with regard to internal dimensions required for inspection and future pre-stressing.

8.5 MINIMUM THICKNESS OF MEMBERS

DESIRABLE MINIMUM THICKNESS OF ANY RC MEMBER

- | | | |
|--|---|---------------------------------|
| i. Deck | - | 200 mm |
| ii. Web of T-beam | - | 250 mm |
| iii. Web of pre-stressed girders | - | 150 + d |
| iv. If there are 2 cables at any level | - | 150+3d, d - diameter cable duct |

BOX GIRDERS: MINIMUM MEMBER THICKNESS:

- | | | |
|-------------------|---|--------|
| i. Deck slab | - | 200 mm |
| ii. Bottom flange | - | 300 mm |
| iii. Web | - | 250 mm |

or as required by IRS Concrete Bridge Code whichever is greater.

In an aggressive environment, an additional thickness of 10 to 20 mm shall be used.

8.6 SPAN ARRANGEMENT

8.6.1 The Tenderer shall provide, by suitable choice of span lengths, a sufficiently stiff deck and supporting sub-structure to resist loading as defined in various Clauses stated above. Static and dynamic rail live load responses, at essential movement joint locations, shall be in compliance with the Employer's Requirements.

8.7 Rail Structural interaction analysis due to continuous welded rail with direct fixation or structure shall be performed in accordance with proven international practice.

8.8 Approach slabs of sufficient sizes shall be provided between abutments and at-grade sections.

An approach slab shall be provided in rear of all abutments of elevated structures and bridges.

This should not be less than 6 m in length nor be less than the length computed from the formula:

$$L = 1.5 h \tan (45^\circ - \phi/2)$$

Where h = Depth from bottom of slab to bottom of abutment (top of footing)

ϕ = Angle of internal friction of backfill soil in degrees

Slab shall be designed assuming that it does not receive any support from the backfill for a distance of not less than 4.0 m or less than $h \tan (45^\circ - \phi/12)$ from back of abutment or as required by IRS Concrete Bridge Code whichever is greater.

9 DESIGN CONSIDERATIONS

9.1 VIBRATION AND DEFLECTION LIMITATIONS (AS PER DBR)

The Vibration and Deflection Limitations as per DBR. The overall deflection for elevated structure will be limited taking into consideration the effect of vibration in addition to other considerations. Suitable provisions shall be provided at the ends of beams and jacking pads on pier caps shall be provided to allow for replacement of bearings and for any repairs during service.

Provision should be made for adequate fixtures of the superstructure to the substructure, if any loading or loading combination increased by 100% of live load plus impact is likely to cause uplift of any support.

9.2 DESIGN PROCEDURES

Reinforced and pre-stressed concrete members of elevated structures shall be designed in conformity with the provisions of DBR, IRS and IRC Codes.

9.3 SUBSTRUCTURE AND FOUNDATIONS

Substructure and Foundations: As per DBR.

9.4 METHOD OF CONSTRUCTION

Stresses in partially completed structures shall be analysed for appropriate critical conditions at various stages of the construction. Any restriction on the construction operations resulting from the design assumptions shall be clearly specified on the contract drawings and specifications. Conversely, advantage may be taken by the designer of specified construction procedures or sequences to affect a more favourable distribution of loads or stresses.

9.5 MOVEMENT/EXPANSION JOINTS

Movement/expansion 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/expansion joints shall be designed to be easily maintained and replaceable.

9.6 DESIGN SURFACE CRACK WIDTH

Design Surface Crack Width: As per DBR.

9.7 TEMPERATURE EFFECTS

Temperature effects: As per DBR.

9.8 SWAY OF VIADUCT/BRIDGE COLUMN

Longitudinal sway at the top of viaduct/Bridge columns due to live loads shall be restricted to a maximum of 5mm.

9.9 STRUCTURAL MEMBERS WITH BEARING

Consideration shall be given for the easy maintenance and replacement of viaduct/Bridge bearings. The minimum clearance between structural members separated by bearings shall be as follows:

Precast Viaduct/Bridge Beam/Cross Head :	150mm
In-Situ Viaduct/Bridge Beam/Column:	250mm

These are absolute minimum values and the requirement for easy maintenance and replacement of bearings shall prevail.

9.10 THERMAL RAIL FORCES

Provision shall be made for horizontal transverse and longitudinal forces due to temperature variation in rail. The forces shall be applied in a horizontal plane at the top of low rail as follows:

- (1) Transverse Force. The transverse force (T) per linear meter of structure per rail shall be determined by the following formula:

$$T = \frac{650}{R} \text{ kN}$$

Where R = radius of rail curvature in meters

- (2) Longitudinal Force. A longitudinal force shall be applied in accordance with Indian Standards.
- (3) Provision of UIC 774 3-R shall be used for working out LWR forces.

9.11 ACCESS TO VOIDS

Continuous access between the deck voids shall be provided wherever possible. An easily removable, watertight manhole access to deck voids shall be provided in every span.

9.12 PRE-STRESSED CONCRETE

Non-shrink grout shall be used for grouting of post-tensioned tendon ducts.

Pre-stressing anchorages shall be detailed such that they are easily accessible for inspection and maintenance. The detailing shall also prevent the accumulation of water and dirt around the anchorage.

All assumptions made in the determination of the design pre-stress loads, e.g. curvature, friction, cross section and mechanical properties of strand and concrete shall be clearly stated on the drawings.

9.13 BEARINGS

9.13.1 The details in DBR may be referred.

9.13.2 In the selection of the bearing layout in viaducts/Bridges, consideration shall be given to their performance in relation to the supporting structures, economy as well as maintenance and replacement of the bearings.

9.13.3 Due care must be taken to ensure that no pair of bearings act against one another in service conditions to the detriment of the structure and to the bearings themselves.

9.13.4 Design Life

Whenever the expected design life of the bearings is significantly less than that of the structure, provision shall be made for the removal and replacement of the whole or parts of the bearings.

9.13.5 Types of Bearings

Type of Bearing adopted shall be justified by detailed design calculations and codal provisions as per DBR.

9.13.6 Bearing Design

Unless otherwise specified, bearings shall be designed in accordance with the requirements of DBR (IRS or IRC Codes or any other equivalent Code).

Bearings for viaducts/Bridges shall be designed as per DBR to allow for the following movements:

- i. Thermal expansion and contraction
- ii. Shrinkage of concrete
- iii. Creep in concrete
- iv. Elastic shortening under pre-stress
- v. Displacements of structure under load:

Differential settlement between viaduct/Bridges piers shall re-considered.

Rotation and sway of columns and crossheads under the worst load combination including the effects of temporary loads during construction shall be considered.

Schedule listing the performance requirements for each type of bearings for viaduct/Bridges shall be incorporated in the drawings. The schedule shall indicate the following:

- i. Dead load to be supported (SLS and ULS)
- ii. Maximum and minimum vertical live load to be supported (SLS and ULS)
- iii. Horizontal forces to be resisted (SLS and ULS)
- iv. Rotation capacity required.
- v. Translation capacity required (both reversible and irreversible). In the case of in-situ

viaducts/Bridges, the amount of pre-setting required for the bearings should be clearly indicated.

Calculations for movements of bearings shall take into account the variability of materials and conditions that the structure is expected to encounter during its design life.

In the above ULS and SLS mean Ultimate Limit State and Serviceability Limit State respectively.

Design of the bearings, derailment loads requirements specified in DBR shall be taken into consideration. The corresponding viaduct/Bridges rotation under derailment loads shall be controlled to minimize damage to the viaduct/Bridges elements.

In the design of the bearings to resist lateral loads, friction between the bearing and mortar shall be ignored.

Mortar bedding composing of sand and either cement, polyester resin or epoxy resin shall have a crushing strength of at least twice the average contact stress. In the choice of bedding due consideration shall be given to the future removal and replacement of the bearing without damage to bedding or to the structural elements bonded to it.

Shear studs or bolts shall be provided to secure the bearing top and bottom plates to the structure. The shear studs or bolts shall be designed in accordance with international practice.

The fixing method to be adopted shall be such that it is convenient and possible to replace the bearings at some future date.

The designer shall ensure that the bearings can be produced to satisfy the design requirements; and that the space allowed for in the overall design is sufficient to accommodate the bearings and enable them to be inspected, maintained and replaced when required.

Highway Clearances

The vertical and horizontal highway clearances required for the structures shall generally be in accordance with the requirements described below.

9.14 VERTICAL CLEARANCES

The minimum clearance between the elevated structures and highways, railways, utility lines and other structures and property should be greater by a minimum of 250 mm on those prescribed by the agencies involved. The minimum vertical clearance below the bottom of the structure for any highway road passing below will be 5.5 meters as prevailing presently. In case of minor roads/streets a lower clearance may be adopted with specific approval of the agency owning and/or maintaining the road/street.

9.14.1 HORIZONTAL CLEARANCES

The clear span over the roads passing below the viaduct/bridge shall be determined after evaluation of present and future needs.

Protection shall be necessary for piers against accidental impact from road vehicles on a case by case basis. IRC/UIC codes shall be applied.

9.14.2 VIADUCT/BRIDGES DECK FURNITURE, DRAINAGE AND WATERPROOFING

Viaduct/Bridges deck furniture, drainage and waterproofing system shall be designed for all effects and requirements of the railway.

Cast-in drains shall be used, provided with rodding eyes at every bend. Runoff on viaduct/Bridges structures and bridges shall be collected through surface drains that shall lead to down drains at the support columns. The down drains shall be connected to a drainage system which shall consist of collection header pipe and manholes which shall discharge to the nearest suitable drainage system. Silt removal shall be provided where necessary.

9.15 SYSTEM WIDE REQUIREMENTS

9.15.1 System wide requirements must be considered in the development of the structural design. Such consideration shall include:

1. The incorporation of a stray current corrosion control system
2. The incorporation of an adequate water drainage system
3. The necessary design of reinforcement in plinth and deck so as to avoid interference with and attenuation of the signalling circuits
4. Special care taken with the location of gullies in points and crossing areas.
5. Provision for future pre-stressing of cable/strands as per IRS code shall be made for all pre-stressed concrete members (External pre-stressing) as indicated in the conceptual drawings.

9.15.2 System wide details are liable to changes as the requirements of various contracts become known and their designs are developed. The Contractor shall be responsible for incorporating all System wide requirements as they become available.

9.15.3 All details provided to meet System wide requirements shall be subject to the acceptance by the Employer's Representative.

9.15.4 Rail Structural Interaction analysis (RSI) and LWR forces: RSI analysis shall be carried out for the alignment of BSTP project so as to determine the effects of thermal interaction between the elevated viaduct/Bridges (Box girder/U-Girder) and continuously welded rail (CWR/LWR). The analysis should incorporate the behaviour of various elements of the structure i.e., rail fasteners, stiffness of rail, the deck, the substructure, and foundations. As per DBR of Bi-RIDE, clause 5.16, page 23, RSI shall be carried out duly following the BS report no. 119 of RDSO "Guidelines for carrying out rail structure interaction studies on metro system (version 2)". The contractor shall do the necessary design in the connection, which shall be proof checked by GC and approved by Bi- RIDE with minimum. If required, a second opinion can be obtained from a reputed academic institution like IISc or IIT.

But a minimum load of 1.6t/m as used in other Metro, without dynamic augment must be used for designs. The LWR forces should be minimum 1.6t/m and if any additional LWR forces arrived during detailed design & analysis, the same shall be adopted as per the directions of the Engineer / Employer.

10. FOUNDATIONS AND GEOTECHNICAL WORKS**GEOTECHNICAL DATA**

10.1 "Geotechnical works" shall mean foundations, earthworks, deep excavations, slopes, embankments, and earth retaining structures. It shall also include dewatering and any ground related activities in soil and rock.

10.2 The Contractor shall be responsible for determining for his design purposes the Geology and the Geotechnical parameters of the sub-surface strata along the route.

The Geo-Technical Investigation details/reports relevant to this contract as available with Bi-RIDE are enclosed with tender. Further GT investigation details/reports as available with Bi-RIDE will be supplied during execution of work. **The results can be of use for broad reference and information and tentative only.** The geo-technical investigations are to be carried out by the Contractor on which the design should be based. GT Investigation shall be carried out at each pier and bridge locations as directed by Engineer.

The Contractor shall carry out the installation of test piles and testing as per relevant codes. If necessary, modification to design of piles after testing shall be done.

10.3 The design of pile foundation as per DBR (IS 2911). A safety factor of not less than 2.5 should be adopted as test load for a single pile and safety factor of not less than 2.0 shall be adopted when considering pile and pile group capacities. A safety factor of at least 1.75 for a single pile and at least

1.5 for group piles shall be adopted when the negative skin friction (which results from downward movement of adjacent soil relative to the pile caused by dewatering and/or the placement of fill) is considered. The Engineer's decision is final.

- 104 In his design the Contractor shall take adequate measures to minimize the amount of local differential settlement of road surfaces around underground works.
- 105 Minimum No. of piles in a pile group is generally four (4) / Six (6). However, in special spans it should be minimum 8 no's and for balanced cantilever it should be minimum 12 nos.
- 106 The type of foundation shall depend on soil and site condition, and, where the Bi-RIDE alignment is close to the Railway line, the foundation design of the adjacent structure.
- 107 EARTH WORKS FOR FORMATION, MINOR BRIDGES, MAJOR BRIDGES, ROB & RUB

Earth Works For Formation: The details given in DBR shall be referred. As per Comprehensive guidelines and specifications for railway formation, specification no. RDSO/2020/GE: IRS-0004 (Including ACS No-01 dated 16.12.2021) and latest guidelines. IRS Codes shall be followed for minor Bridges, Major Bridges, ROB's & RUBs.

The Standard Drawings of box culverts (25 T Axle loading) of RDSO for minor bridges may be referred and the tentative spans are given in the minor bridges list. The standard drawings of RDSO for major bridges & ROB may be referred. The standard RUB Drawings (Segmental Construction) as per IRS Codes may be referred, if available otherwise the same shall be designed as per IRS Codes/DBR. IRS Codes shall be followed in-principle, and the design criteria is based on IRS Codes viz. IRS-Bridge Rules, IRS Concrete Bridge Code & IRS Bridge Substructure & Foundation Code

SCHEDULES

SITE OF THE PROJECT

THE SITE

- 1 Site of the BSTP includes the land, buildings, structures as described.
- 2 Access and RUC shall be arranged progressively, as per **Section VIII, Employer Requirement Vol-2, Annexure 2.**
- 3 An inventory of the Site including the land, buildings, structures, trees, and any other immovable property on, or attached to. The Site inventory details shall be prepared jointly by the Authority's Representative and the Contractor, and such inventory shall form part of the contract.
- 4 The tentative alignment plans, tentative L-sections, and cross sections of the BSTP are specified in Tender Drawings, Section - **XI**
- 5 The status of the environment clearances and forest clearances obtained or awaited is given in **Section VIII, Employer Requirement Vol-2, Annexure 4.**

ANNEXURE- I

SCHEDULE OF SITE

1. SITE

The Site of the BSTP comprises the section commencing from km (-)0.964 to 11.23 i.e., the –Benniganahalli to Hebbal section. The land and other structures comprising the Site are described below:

2. ROUTE LENGTH

The route length of Corridor-1 of BSTP Project comprises the section as described below (Dead end of yard to dead end of yard):

Sl. No	Name of location from	Name of location to	Start Chainage (km)	End Chainage (km)	Length (km)	Remarks
1	BENNIGANAHALLI	BANASWADI	(-) 0.964 to (-) 0.675	(-) 0.050 to 4+700	5.039	At-grade
2	BANASWADI	HEBBAL	4.700	11.230	6.530	At-grade (including raising of formation to eliminate 6 LC's duly inserting the precast box segment) and Construction of additional RUB's

3. ALIGNMENT AND LAND PLAN:

The tentative land plan and alignment plan are attached.

4. DETAILS OF EXISTING STRUCTURES AND PROPOSED STRUCTURES (FOR BSTP).

4.1 Major Bridges: The Site includes the following Major Bridge

Sl. No.	Existing	Proposed			
	Bridge No. and location (km)	Type of Structure			No. of Spans with span length (m)
		Foundation	Sub-structure	Superstructure	
1	Bridge No 560 @Ch: 9.989	Pile Foundation	RCC abutment	COMPOSITE STEEL GIRDER	4X30.5 (two spans for BSTP tracks and two spans for IR tracks)

4.2 Minor Bridges: The Site includes the following Minor Bridges:

4.2(a) Part Barrel Length to be executed left out by previous contractor

Sl. No.	Existing		Proposed (Tentative)		Balance Barrel Length to be executed (m)
	Chainage (km)	Bridge No.	Type of Structure	Size (m)	
1.	1.668	536	RCC Box	1 X 2 X 2.5	1.00
2.	1.827	537	RCC Box	1 x 2 X 2.65	1.00
3.	4.981	542	RCC Box	1 X 2 X 1.5	19.32
4.	4.953	543	RCC Box	1 X 2X3.75	26.68
5.	5.401	545	RCC Box	1 X 2.00 X 3.20	32.25
6.	5.570	546	RCC Box	1 X2 X 3.30	37.00
7.	5.810	547	RCC Box	1 X 2 x 3.20	35.14
8.	6.489	548	RCC Box	1 X 2.0 X 1.80	19.00
9.	6.912	549	RCC Box	1 X 2.0 X 2.5	20.70
10.	7.032	550	RCC Box	2 X 2.0 X 2.50	23.82
11.	7.208	551	RCC Box	1X2.0X3.2	45.86
12.	7.403	552	RCC Box	1X2.0X3.70	33.88
13.	8.240	553	RCC Box	1 X 2.0 X 2.50	27.83
14.	8.610	555	RCC Box	1 x 2.00 X 1.30	33.20
15.	8.755	556	RCC Box	1 X 2.0 X 1.95	29.00
16.	9.460	558	RCC Box	1 X 2.00 X 1.80	20.66
17.	9.890	559	RCC Box	1 x 2.0 x 1.80	21.04
18.	10.146	562	RCC Box	1 X 2 X 3.70	20.36
19.	10.244	563	RCC Box	1 X 2 X 2	20.34
20.	10.560	564	RCC Box	1X2.0X1.80	17.90
Total Barrel length (m)					485.98

4.2(b) Full Barrel Length:

Sl. No.	Existing		Proposed (Tentative)		Barrel Length (m)	Remarks
	Chainage (km)	Bridge No.	Type of Structure	Size (m)		
1.	0.195	534	RCC Box	1 X 3.5 X 1.5	10.24	Yet to start
2.	0.409	535	RCC Box	1 X 3.7 X 4.3	11.50	Raft Completed
3.	3.657	538(1)	RCC Box	1 X 2 X 4.5	14.82	Yet to start
4.	4.287	540	RCC Box	1 X 2 X 3	13.65	Yet to start
5.	7.135	550A	RCC Box	1 X 5.0 X 3.00	41.88	Yet to start
6.	8.380	554	RCC Box	1 x 2.00 X 1.80	40.18	Yet to start
7.	9.192	557	RCC Box	1 X 2 X 1.95	25.00	Yet to start
8.	10.748	565	RCC Box	1 x 2.00 X 2.65	12.26	Yet to start
9.	10.961	566	RCC Box	1 x 2 x 2.65	23.02	Yet to start
10.	11.082	567	RCC Box	1 X 1.50 X 1.50	15.03	Yet to start
Total Barrel length (m)					207.58	

4.3 Road Under Bridges (RUB): The Site includes the following RUB (Road Under Railway line)

4.3(a) : Part Barrel Length:

Sl. No	Existing		Proposed		Balance Barrel Length to be executed (m)
	Chainage (km)	Bridge No.	Type of Structure	Span (Nos. x length) (m)	
1.	5.411	RUB-2	RCC Box	1No X 9.5 M X 3.95	34.25
2.	6.265	LC No-140	RCC box	1 No X 9.5 M X 3.95M	24.00
3.	6.512	RUB-1	RCC Box	1 No. X 5.5M X 2.65M	13.13
4.	6.650	LC No-141	RCC box	1No. X 9.5M X 4.65M	17.918
5.	7.430	LC No-143	RCC box	1no (9.5x4.65) RCC Box/ New construction	25.83
6.	8.760	LC No-144A	RCC box	1no (9.5x4.65) RCC Box/ New const.	50.000
Total Barrel Length (m)					165.128

4.3(b) : Full Barrel Length:

Sl. No	Existing		Proposed		Barrel Length (m)
	Chainage (km)	Bridge No.	Type of Structure	Span (Nos. × length) (m)	
1.	4.137	539	RCC Box	1 No X 6.1 M x 3M	20.51
2.	4.720	541B	RCC Box	1 No X 5.6 MX 2.8M	14.42
3.	2.627	LC No-137	RCC Box	1No. X 5.5M X 2.65M	29.458
4.	0.534	Additional RUB	RCC Box	1 No. X 9.5 M X 5.65M	54.865
5.	6.920	LC No-142	RCC box	2no (9.5x5.650) RCC Box/ New	41.00
6.	7.659	RUB-3	RCC box	1No X 9.5M X 3.750	26.75
7.	8.120	LC No-144	RCC box	1no (9.5x3.750) RCC Box/ New construction	34.415
8.	9.231	RUB-4	RCC box	1 Nos X 9.5M X 3.750	26.43
9.	10.058	RUB-5	RCC box	1Nos X 9.5M X 3.350	31.54
10.	11.180	Hebbal RUB	RCC box	1 X 5 X 2.75	13.425
Total Barrel Length (m)					292.813

4.4 Railway level crossings: The Site includes the following railway level crossings and to be eliminated by constructing the RUB's as tabulated above para 4.3

Sl. No.	Chainage (km)	LC No:	Remarks	Proposal
1.	2.627	LC No-137	To be Eliminated	RUB
2.	6.265	LC No-140	To be Eliminated	RUB
3.	6.650	LC No-141	To be Eliminated	RUB
4.	6.920	LC No-142	To be Eliminated	RUB
5.	7.430	LC No-143	To be Eliminated	RUB
6.	8.120	LC No-144	To be Eliminated	RUB
7.	8.760	LC No-144A	To be Eliminated	RUB

4.5 BSTP/Railway yards: The Site includes the following BSTP/Railway yards:

Sl. No.	Name of Yard	Chainage (KM)	Number of Lines	Remarks
1	Benniganahalli	(-) 1+320 to (- 0.964)	2 lines	BSTP Stabling/shunting Lines
2	Banasawadi	3.542 to 3.878	1 line	BSTP Stabling Lines
3	Kasturi Nagar			
4	Hebbal (Pocket)		1 line	BSTP Stabling Lines

4.6 Transmission lines crossing the Right of Way (For information): Not included in the scope of work.

The Site includes the following transmission lines crossing the Right of Way:

Sl. No.	Section	IR Chainage	HT/LT	OH/UG	Height above IR RL/ Depth below RL (m)
1	Nagavara- kanakanagar	213/300 - 400	High tension line- 66KV	OH	9.224
2	Nagavara- Kaveri nagar	211/500 - 600	High tension line- 66KV	OH	8.300

The above schedule of work is covered in EPC Contract and Contractor shall complete all the works as per tender drawing, Employer's Requirement, Technical specification, GAD's, Plan & Profile, duly ensuring safety, Quality, EHS including Design/ Structure validation and stability & Integrity check for the works executed by previous Contractor. The statement of works executed by previous Contractor as Annexure 1A and also highlighted in attached GADs of various structures.

All the chainages mentioned are tentative/indicative.

ANNEXURE – 1A**Statement of Part Works executed by earlier Contractor in Corridor-2.**

Levels sheet of At- Grade from Ch:- (-)0+964 to 4+700					
S.NO	BSTP Chainage	Length	OGL as per site condition up to executed by previous contractor	Formation Level	Sub Grade Top level
1	-0+964	0+024	893.003	896.104	895.704
2	-0+940	0+020	893.594	896.151	895.751
3	-0+920	0+020	894.034	896.218	895.818
4	-0+900	0+020	894.315	896.494	896.094
5	-0+880	0+020	894.137	897.004	896.604
6	-0+860	0+020	893.822	897.559	897.159
7	-0+840	0+020	893.649	898.115	897.715
8	-0+820	0+020	893.475	898.67	898.270
9	-0+800	0+020	893.451	899.226	898.826
10	-0+780	0+020	893.679	899.782	899.382
11	-0+760	0+020	894.038	900.337	899.937
12	-0+740	0+020	894.113	900.893	900.493
13	-0+720	0+020	894.104	901.442	901.042
14	-0+700	0+020	894.507	901.808	901.408
15	-0+680	0+020	894.431	901.924	901.524
16	-0+060	0+020	895.858	905.743	905.343
17	-0+040	0+020	896.064	905.727	905.327
18	-0+020	0+020	896.5	905.712	905.312
19	0+000	0+020	897.71	905.697	905.297
20	0+020	0+020	897.14	905.682	905.282
21	0+040	0+020	897.28	905.667	905.267
22	0+060	0+020	896.91	905.651	905.251
23	0+080	0+020	896.605	905.636	905.236
24	0+100	0+020	896.025	905.621	905.221
25	0+120	0+020	895.53	905.606	905.206
26	0+140	0+020	895.57	905.59	905.190
27	0+160	0+020	895.53	905.575	905.175
28	0+180	0+020	895.96	905.567	905.167
29	0+200	0+020	895.895	905.617	905.217
30	0+220	0+020	896.07	905.667	905.267
31	0+240	0+020	895.651	905.717	905.317
32	0+260	0+020	895.785	905.767	905.367

33	0+280	0+020	895.985	905.817	905.417
34	0+300	0+020	896.406	905.867	905.467
35	0+320	0+020	896.448	905.917	905.517
36	0+340	0+020	896.409	905.967	905.567
37	0+360	0+020	896.391	906.017	905.617
38	0+380	0+020	896.766	906.067	905.667
39	0+400	0+020	897.173	906.117	905.717
40	0+420	0+020	897.303	906.167	905.767
41	0+440	0+020	897.913	906.217	905.817
42	0+460	0+020	898.532	906.267	905.867
43	0+480	0+020	898.71	906.317	905.917
44	0+500	0+020	900.152	906.367	905.967
45	0+520	0+020	900.482	906.417	906.017
46	0+540	0+020	905.764	906.467	906.067
47	0+560	0+020	901.462	906.517	906.117
48	0+580	0+020	902.567	906.567	906.167
49	0+600	0+020	903.22	906.62	906.220
50	0+620	0+020	904.043	906.764	906.364
51	0+640	0+020	904.54	906.975	906.575
52	0+660	0+020	905.19	907.187	906.787
53	0+680	0+020	908.891	907.398	906.998
54	0+700	0+020	908.23	907.61	907.210
55	0+720	0+020	908.544	907.821	907.421
56	0+740	0+020	909.352	908.033	907.633
57	0+760	0+020	909.634	908.245	907.845
58	0+780	0+020	909.952	908.456	908.056
59	0+800	0+020	910.984	908.668	908.268
60	0+820	0+020	910.978	908.879	908.479
61	0+840	0+020	910.87	909.091	908.691
62	0+860	0+020	911.07	909.303	908.903
63	0+880	0+020	911.19	909.513	909.113
64	0+900	0+020	911.51	909.619	909.219
65	0+920	0+020	911.55	909.62	909.220
66	0+940	0+020	911.58	909.62	909.220
67	0+960	0+020	911.56	909.62	909.220
68	0+980	0+020	911.51	909.62	909.220
69	1+000	0+020	911.978	909.62	909.220
70	1+020	0+020	912.08	909.62	909.220
71	1+040	0+020	912.276	909.62	909.220
72	1+060	0+020	912.209	909.62	909.220

73	1+080	0+020	912.465	909.62	909.220
74	1+100	0+020	912.796	909.62	909.220
75	1+120	0+020	912.718	909.62	909.220
76	1+140	0+020	912.858	909.62	909.220
77	1+160	0+020	913.131	909.62	909.220
78	1+180	0+020	912.756	909.62	909.220
79	1+200	0+020	912.756	909.6	909.200
80	1+220	0+020	912.589	909.43	909.030
81	1+240	0+020	912.419	909.23	908.830
82	1+260	0+020	912.309	909.03	908.630
83	1+280	0+020	911.609	908.83	908.430
84	1+300	0+020	911.204	908.63	908.230
85	1+320	0+020	910.494	908.43	908.030
86	1+340	0+020	909.199	908.23	907.830
87	1+360	0+020	908.859	908.03	907.630
88	1+380	0+020	908.902	907.83	907.430
89	1+400	0+020	908.902	907.67	907.270
90	1+420	0+020	907.666	907.565	907.165
91	1+440	0+020	907.405	907.465	907.065
92	1+460	0+020	907.17	907.365	906.965
93	1+480	0+020	905.91	907.265	906.865
94	1+500	0+020	905.46	907.165	906.765
95	1+520	0+020	904.93	907.065	906.665
96	1+540	0+020	904.91	906.965	906.565
97	1+560	0+020	904.82	906.865	906.465
98	1+580	0+020	904.745	906.765	906.365
99	1+600	0+020	904.525	906.705	906.305
100	1+620	0+020	904.056	906.7	906.300
101	1+640	0+020	903.826	906.7	906.300
102	1+660	0+020	903.256	906.7	906.300
103	1+680	0+020	903.555	906.7	906.300
104	1+700	0+020	902.945	906.7	906.300
105	1+720	0+020	902.625	906.7	906.300
106	1+740	0+020	902.474	906.7	906.300
107	1+760	0+020	902.25	906.7	906.300
108	1+780	0+020	902	906.701	906.301
109	1+800	0+020	902.012	906.782	906.382
110	1+820	0+020	902.001	906.974	906.574
111	1+840	0+020	907.188	907.177	906.777
112	1+860	0+020	903.904	907.38	906.980

113	1+880	0+020	904.674	907.583	907.183
114	1+900	0+020	905.024	907.786	907.386
115	1+920	0+020	905.787	907.989	907.589
116	1+940	0+020	906.502	908.192	907.792
117	1+960	0+020	907.212	908.395	907.995
118	1+980	0+020	908.572	908.598	908.198
119	2+000	0+020	909.482	908.801	908.401
120	2+020	0+020	910.092	909.004	908.604
121	2+040	0+020	910.212	909.207	908.807
122	2+060	0+020	910.131	909.41	909.010
123	2+080	0+020	910.284	909.613	909.213
124	2+100	0+020	910.53	909.816	909.416
125	2+120	0+020	910.71	910.019	909.619
126	2+140	0+020	910.666	910.222	909.822
127	2+160	0+020	911.349	910.425	910.025
128	2+180	0+020	911.525	910.629	910.229
129	2+200	0+020	911.73	910.832	910.432
130	2+220	0+020	911.563	911.035	910.635
131	2+240	0+020	912.343	911.238	910.838
132	2+260	0+020	912.299	911.441	911.041
133	2+280	0+020	912.301	911.644	911.244
134	2+300	0+020	912.712	911.847	911.447
135	2+320	0+020	913.201	912.05	911.650
136	2+340	0+020	912.991	912.253	911.853
137	2+360	0+020	912.62	912.456	912.056
138	2+380	0+020	912.97	912.591	912.191
139	2+400	0+020	912.703	912.608	912.208
140	2+420	0+020	912.917	912.608	912.208
141	2+440	-3+403	912.84	912.608	912.208
142	-0+963	3+443	912.55	912.608	912.208
143	2+480	0+020	912.897	912.608	912.208
144	2+500	0+020	912.827	912.608	912.208
145	2+520	0+020	912.946	912.608	912.208
146	2+540	0+020	913.312	912.608	912.208
147	2+560	0+020	913.235	912.608	912.208
148	2+580	0+020	913.212	912.608	912.208
149	2+600	0+020	913.616	912.608	912.208
150	2+620	0+020	913.345	912.608	912.208
151	2+640	0+020	913.214	912.608	912.208
152	2+660	0+020	913.16	912.608	912.208

153	2+680	0+020	913.541	912.606	912.206
154	2+700	0+020	913.668	912.52	912.120
155	2+720	0+020	913.385	912.327	911.927
156	2+740	0+020	912.979	912.127	911.727
157	2+760	0+020	912.89	911.926	911.526
158	2+780	0+020	912.559	911.726	911.326
159	2+800	0+020	912.597	911.525	911.125
160	2+820	0+020	912.553	911.325	910.925
161	2+840	0+020	912.27	911.124	910.724
162	2+860	0+020	912.529	910.924	910.524
163	2+880	0+020	912.38	910.723	910.323
164	2+900	0+020	912.46	910.523	910.123
165	2+920	0+020	912.538	910.322	909.922
166	2+940	0+020	912.382	910.122	909.722
167	2+960	0+020	911.61	909.936	909.536
168	2+980	0+020	911.525	909.881	909.481
169	3+000	0+020	911.632	909.881	909.481
170	3+020	0+020	911.542	909.881	909.481
171	3+040	0+020	911.946	909.881	909.481
172	3+060	0+020	911.302	909.881	909.481
173	3+080	0+020	910.632	909.881	909.481
174	3+100	0+020	916.97	909.881	909.481
175	3+120	0+020	916.142	909.881	909.481
176	3+140	0+020	911.56	909.881	909.481
177	3+160	0+020	912.277	909.881	909.481
178	3+180	0+020	911.189	909.881	909.481
179	3+200	0+020	910.203	909.881	909.481
180	3+220	0+020	910.407	909.877	909.477
181	3+240	0+020	910.851	909.81	909.410
182	3+260	0+020	910.186	909.708	909.308
183	3+280	0+020	910.275	909.607	909.207
184	3+300	0+020	910.603	909.505	909.105
185	3+320	0+020	909.926	909.404	909.004
186	3+340	0+020	910.6	909.302	908.902
187	3+360	0+020	909.398	909.2	908.800
188	3+380	0+020	909.223	909.099	908.699
189	3+400	0+020	908.929	908.997	908.597
190	3+420	0+020	908.963	908.896	908.496
191	3+440	0+020	908.604	908.794	908.394
192	3+460	0+020	908.217	908.692	908.292

193	3+480	0+020	907.484	908.591	908.191
194	3+500	0+020	907.46	908.489	908.089
195	3+520	0+020	907.712	908.388	907.988
196	3+540	0+020	907.447	908.286	907.886
197	3+560	0+020	908.134	908.236	907.836
198	3+580	0+020	908.079	908.186	907.786
199	3+600	0+020	907.69	908.136	907.736
200	3+620	0+020	907.083	908.086	907.686
201	3+640	0+020	906.55	908.036	907.636
202	3+660	0+020	904.618	907.986	907.586
203	3+680	0+020	906.697	907.936	907.536
204	3+700	0+020	907.718	907.886	907.486
205	3+720	0+020	907.761	907.836	907.436
206	3+740	0+020	907.934	907.786	907.386
207	3+760	0+020	907.81	907.736	907.336
208	3+780	0+020	908.043	907.686	907.286
209	3+800	0+020	908.822	907.636	907.236
210	3+820	0+020	908.079	907.586	907.186
211	3+840	0+020	907.833	907.536	907.136
212	3+860	0+020	908.965	907.486	907.086
213	3+880	0+020	907.278	907.436	907.036
214	3+900	0+020	907.487	907.386	906.986
215	3+920	0+020	907.367	907.336	906.936
216	3+940	0+020	907.512	907.286	906.886
217	3+960	0+020	907.64	907.236	906.836
218	3+980	0+020	908.205	907.186	906.786
219	4+000	0+020	907.709	907.136	906.736
220	4+020	0+020	907.232	907.126	906.726
221	4+040	0+020	907.036	907.126	906.726
222	4+060	0+020	906.617	907.126	906.726
223	4+080	0+020	906.554	907.126	906.726
224	4+100	0+020	906.044	907.126	906.726
225	4+120	0+020	905.66	907.126	906.726
226	4+140	0+020	905.201	907.126	906.726
227	4+160	0+020	903.948	907.126	906.726
228	4+180	0+020	905.392	907.126	906.726
229	4+200	0+020	905.099	907.126	906.726
230	4+220	0+020	905.036	907.126	906.726
231	4+240	0+020	903.851	907.126	906.726
232	4+260	0+020	903.871	907.126	906.726

233	4+280	0+020	903.808	907.118	906.718
234	4+300	0+020	903.04	907.101	906.701
235	4+320	0+020	902.99	907.084	906.684
236	4+340	0+020	903.43	907.067	906.667
237	4+360	0+020	903.28	907.05	906.650
238	4+380	0+020	903.53	907.033	906.633
239	4+400	0+020	906.34	907.016	906.616
240	4+420	0+020	906.79	906.999	906.599
241	4+440	0+020	906.96	906.982	906.582
242	4+460	0+020	907.25	906.965	906.565
243	4+480	0+020	907.27	906.948	906.548
244	4+500	0+020	908.244	906.931	906.531
245	4+520	0+020	908.02	906.914	906.514
246	4+540	0+020	908.815	906.897	906.497
247	4+560	0+020	908.56	906.88	906.480
248	4+580	0+020	908.496	906.863	906.463
249	4+600	0+020	909.041	906.846	906.446
250	4+620	0+020	909.252	906.829	906.429
251	4+640	0+020	907.774	906.812	906.412
252	4+660	0+020	908.853	906.795	906.395
253	4+680	0+020	908.921	906.778	906.378
254	4+700	0+020	908.921	906.778	906.378

Levels sheet of At- Grade from Ch:- 4+700 to 11+200					
S.NO	BSTP Chainage	Length	OGL as per site condition up to executed by previous contractor	Formation Level	Sub Grade Top level
1	4700	20	908.452	906.761	906.361
2	4720	20	908.452	906.744	906.344
3	4740	20	907.545	906.727	906.327
4	4760	20	907.584	906.710	906.310
5	4780	20	907.573	906.693	906.293
6	4800	20	906.298	906.676	906.276
7	4820	20	906.001	906.659	906.259
8	4840	20	906.053	906.574	906.174
9	4860	20	904.651	906.423	906.023
10	4880	20	903.725	906.271	905.871
11	4900	20	903.850	906.120	905.720
12	4920	20	903.952	905.968	905.568
13	4940	20	902.913	905.817	905.417
14	4960	20	902.572	905.665	905.265
15	4980	20	900.837	905.514	905.114
16	5000	20	901.782	905.363	904.963
17	5020	20	901.489	905.211	904.811
18	5040	20	902.334	905.060	904.660
19	5060	20	901.734	904.908	904.508
20	5080	20	900.747	904.757	904.357
21	5100	20	900.935	904.605	904.205
22	5120	20	900.923	904.454	904.054
23	5140	20	901.581	904.302	903.902
24	5160	20	901.333	904.151	903.751
25	5180	20	900.576	903.999	903.599
26	5200	20	900.969	903.848	903.448
27	5220	20	900.484	903.696	903.296
28	5240	20	899.809	903.545	903.145
29	5260	20	900.147	903.393	902.993
30	5280	20	899.570	903.244	902.844
31	5300	20	900.642	903.189	902.789
32	5320	20	900.505	903.189	902.789
33	5340	20	900.407	903.189	902.789
34	5360	20	900.516	903.189	902.789
35	5380	20	900.145	903.189	902.789
36	5400	20	898.287	903.189	902.789

37	5420	20	898.936	903.189	902.789
38	5440	20	898.143	903.189	902.789
39	5460	20	899.445	903.189	902.789
40	5480	20	897.088	903.189	902.789
41	5500	20	898.395	903.189	902.789
42	5520	20	897.024	903.153	902.753
43	5540	20	897.000	903.002	902.602
44	5560	20	896.629	902.833	902.433
45	5580	20	894.896	902.663	902.263
46	5600	20	894.711	902.494	902.094
47	5620	20	895.771	902.324	901.924
48	5640	20	896.122	902.154	901.754
49	5660	20	896.358	901.985	901.585
50	5680	20	896.284	901.815	901.415
51	5700	20	896.262	901.646	901.246
52	5720	20	896.079	901.476	901.076
53	5740	20	896.083	901.306	900.906
54	5760	20	895.776	901.137	900.737
55	5780	20	896.129	900.967	900.567
56	5800	20	896.569	900.798	900.398
57	5820	20	895.710	900.628	900.228
58	5840	20	895.411	900.458	900.058
59	5860	20	895.191	900.289	899.889
60	5880	20	895.291	900.119	899.719
61	5900	20	895.625	899.950	899.550
62	5920	20	895.622	900.307	899.907
63	5940	20	895.760	900.197	899.797
64	5960	20	895.809	900.087	899.687
65	5980	20	896.067	899.978	899.578
66	6000	20	896.808	899.868	899.468
67	6020	20	896.440	899.758	899.358
68	6040	20	895.829	899.649	899.249
69	6060	20	896.111	899.539	899.139
70	6080	20	895.734	899.429	899.029
71	6100	20	895.465	899.319	898.919
72	6120	20	895.467	899.210	898.810
73	6140	20	895.276	899.100	898.700
74	6160	20	895.368	898.990	898.590
75	6180	20	895.258	898.881	898.481
76	6200	20	895.344	898.771	898.371

77	6220	20	895.450	898.661	898.261
78	6240	20	895.323	898.552	898.152
79	6260	20	894.754	898.442	898.042
80	6280	20	894.477	898.332	897.932
81	6300	20	894.015	898.223	897.823
82	6320	20	894.192	898.113	897.713
83	6340	20	894.003	898.003	897.603
84	6360	20	893.246	897.894	897.494
85	6380	20	894.548	897.784	897.384
86	6400	20	893.567	897.674	897.274
87	6420	20	893.548	897.564	897.164
88	6440	20	893.357	897.455	897.055
89	6460	20	893.120	897.345	896.945
90	6480	20	891.581	897.235	896.835
91	6500	20	891.459	897.126	896.726
92	6520	20	891.728	897.016	896.616
93	6540	20	891.488	896.906	896.506
94	6560	20	891.380	896.797	896.397
95	6580	20	891.320	896.687	896.287
96	6600	20	890.758	896.577	896.177
97	6620	20	890.572	896.468	896.068
98	6640	20	890.085	896.358	895.958
99	6660	20	889.779	896.248	895.848
100	6680	20	889.391	896.138	895.738
101	6700	20	889.919	896.029	895.629
102	6720	20	889.255	895.919	895.519
103	6740	20	888.943	895.809	895.409
104	6760	20	889.066	895.700	895.300
105	6780	20	888.026	895.590	895.190
106	6800	20	887.395	895.480	895.080
107	6820	20	887.383	895.371	894.971
108	6840	20	887.588	895.261	894.861
109	6860	20	887.373	895.151	894.751
110	6880	20	887.449	895.042	894.642
111	6900	20	887.462	894.932	894.532
112	6920	20	887.422	894.822	894.422
113	6940	20	887.493	894.712	894.312
114	6960	20	887.731	894.603	894.203
115	6980	20	887.320	894.493	894.093
116	7000	40	886.913	894.383	893.983

117	7040	20	887.817	894.274	893.874
118	7260	20	887.061	894.632	894.232
119	7280	20	887.969	894.632	894.232
120	7300	20	888.070	894.632	894.232
121	7320	20	888.075	894.642	894.242
122	7340	20	889.298	894.758	894.358
123	7360	20	889.955	894.926	894.526
124	7380	20	889.890	895.095	894.695
125	7400	20	890.756	895.263	894.863
126	7420	20	889.930	895.431	895.031
127	7440	20	890.065	895.599	895.199
128	7460	20	890.814	895.767	895.367
129	7480	20	891.201	895.935	895.535
130	7500	20	890.813	896.103	895.703
131	7520	20	891.172	896.271	895.871
132	7540	20	891.569	896.439	896.039
133	7560	20	892.143	896.607	896.207
134	7580	20	892.591	896.798	896.398
135	7600	20	893.223	896.988	896.588
136	7620	20	893.364	897.479	897.079
137	7640	20	893.475	897.369	896.969
138	7660	20	894.053	897.560	897.160
139	7680	20	894.743	897.750	897.350
140	7700	20	894.456	897.940	897.540
141	7720	20	894.716	898.131	897.731
142	7740	20	895.381	898.321	897.921
143	7760	20	896.177	898.512	898.112
144	7780	20	895.675	898.702	898.302
145	7800	20	895.401	898.893	898.493
146	7820	20	896.435	899.083	898.683
147	7840	20	897.071	899.274	898.874
148	7860	20	897.202	899.464	899.064
149	7880	20	897.328	899.655	899.255
150	7900	20	897.034	899.845	899.445
151	7920	20	897.605	900.036	899.636
152	7940	20	897.436	900.226	899.826
153	7960	20	898.089	900.417	900.017
154	7980	20	898.060	900.607	900.207
155	8000	20	898.415	900.798	900.398
156	8020	20	898.712	900.988	900.588

157	8040	20	898.953	901.179	900.779
158	8060	20	898.920	901.369	900.969
159	8080	20	898.789	901.560	901.160
160	8100	20	898.817	901.730	901.330
161	8120	20	898.866	901.784	901.384
162	8140	20	898.724	901.819	901.419
163	8160	20	898.137	901.853	901.453
164	8180	20	898.086	901.888	901.488
165	8200	20	897.481	901.922	901.522
166	8220	20	897.679	901.956	901.556
167	8240	20	898.778	901.991	901.591
168	8260	20	896.601	902.025	901.625
169	8280	20	896.500	902.059	901.659
170	8300	20	896.612	902.094	901.694
171	8320	20	896.525	902.128	901.728
172	8340	20	896.452	902.163	901.763
173	8360	20	896.469	902.197	901.797
174	8380	20	896.536	902.231	901.831
175	8400	20	896.262	902.266	901.866
176	8420	20	896.666	902.300	901.900
177	8440	20	896.885	902.300	901.900
178	8460	20	896.673	902.300	901.900
179	8720	20	897.830	902.300	901.900
180	8740	20	898.814	902.300	901.900
181	8760	20	898.913	902.300	901.900
182	8780	20	898.668	902.300	901.900
183	8800	20	898.836	902.296	901.896
184	8820	20	898.840	902.194	901.794
185	8840	20	898.645	902.052	901.652
186	8860	20	899.049	901.910	901.510
187	8880	20	898.340	901.768	901.368
188	8900	20	989.399	901.626	901.226
189	8920	20	897.970	901.484	901.084
190	8940	20	897.714	901.342	900.942
191	8960	20	897.786	901.200	900.800
192	8980	20	897.452	901.058	900.658
193	9000	20	897.227	900.916	900.516
194	9020	20	897.006	900.774	900.374
195	9040	20	896.810	900.632	900.232
196	9060	20	896.709	900.490	900.090

197	9080	20	896.433	900.348	899.948
198	9100	20	896.296	900.206	899.806
199	9120	20	896.021	900.064	899.664
200	9140	20	895.956	899.922	899.522
201	9160	20	895.713	899.780	899.380
202	9180	20	895.763	899.638	899.238
203	9200	20	896.429	899.496	899.096
204	9220	20	896.262	899.354	898.954
205	9240	20	896.146	899.212	898.812
206	9260	20	895.921	899.070	898.670
207	9280	20	895.724	898.929	898.529
208	9300	20	895.730	989.787	989.387
209	9320	20	895.335	898.645	898.245
210	9340	20	895.216	898.503	898.103
211	9360	20	894.956	898.361	897.961
212	9380	20	894.627	898.219	897.819
213	9400	20	894.372	898.065	897.665
214	9420	20	894.221	897.874	897.474
215	9440	20	894.262	897.684	897.284
216	9460	20	893.992	897.493	897.093
217	9480	20	893.781	897.303	896.903
218	9500	20	894.163	897.112	896.712
219	9520	20	893.557	896.922	896.522
220	9540	20	893.106	896.731	896.331
221	9560	20	892.787	896.541	896.141
222	9580	20	892.435	896.350	895.950
223	9600	20	893.092	896.160	895.760
224	9620	20	893.402	895.969	895.569
225	9640	20	891.767	895.779	895.379
226	9660	20	891.303	895.588	895.188
227	9680	20	891.128	895.398	894.998
228	9700	20	890.820	895.207	894.807
229	9720	20	890.652	895.017	894.617
230	9740	20	891.349	894.827	894.427
231	9760	20	891.569	894.636	894.236
232	9780	20	891.272	894.446	894.046
233	9800	20	890.905	894.255	893.855
234	9820	20	890.791	894.065	893.665
235	9840	20	890.411	893.874	893.474
236	9860	20	889.849	893.684	893.284

237	9880	20	890.024	893.493	893.093
238	9900	20	889.907	893.303	892.903
239	9920	20	889.720	893.113	892.713
240	9940	20	889.094	893.018	892.618
241	9960	20	889.626	893.017	892.617
242	9980	20	889.581	893.017	892.617
243	10000	20	888.748	893.017	892.617
244	10020	20	889.909	893.017	892.617
245	10040	20	889.692	893.017	892.617
246	10060	20	889.463	893.017	892.617
247	10080	20	889.344	892.959	892.559
248	10100	20	889.795	892.779	892.379
249	10120	20	889.107	892.588	892.188
250	10140	20	889.207	892.398	891.998
251	10160	20	888.756	892.207	891.807
252	10180	20	889.093	892.017	891.617
253	10200	20	889.622	891.827	891.427
254	10220	20	889.929	891.636	891.236
255	10240	20	889.393	891.446	891.046
256	10260	20	889.941	891.255	890.855
257	10280	20	889.801	891.065	890.665
258	10300	20	889.847	890.874	890.474
259	10320	20	889.853	890.684	890.284
260	10340	20	890.086	890.493	890.093
261	10360	20	889.836	890.355	889.955
262	10380	20	889.682	890.398	889.998
263	10400	20	890.058	890.622	890.222
264	10420	20	890.351	890.898	890.498
265	10440	20	891.788	891.174	890.774
266	10460	20	891.909	891.450	891.050
267	10480	20	891.494	891.726	891.326
268	10500	20	891.519	892.003	891.603
269	10520	20	891.663	892.279	891.879
270	10540	20	891.737	892.555	892.155
271	10560	20	892.284	892.831	892.431
272	10580	20	891.934	893.107	892.707
273	10600	20	892.157	893.383	892.983
274	10620	20	891.957	893.660	893.260
275	10640	20	892.049	893.936	893.536
276	10660	20	892.444	894.196	893.796

277	10680	20	892.762	894.281	893.881
278	10700	20	893.267	894.281	893.881
279	10720	20	893.096	894.281	893.881
280	10740	20	893.458	894.281	893.881
281	10760	20	893.330	894.281	893.881
282	10780	20	893.316	894.281	893.881
283	10800	20	893.285	894.281	893.881
284	11060	20	893.721	894.281	893.881
285	11080	20	893.748	894.281	893.881
286	11100	20	894.687	894.281	893.881
287	11120	20	903.874	894.281	893.881
288	11140	20	894.860	894.281	893.881
289	11160	20	894.073	894.281	893.881
290	11180	20	893.736	894.281	893.881
291	11200		893.519	894.365	893.965

Statement of Part Works executed by earlier Contractor in Corridor-2

At-grade ERS balance reinforcement available at site

Sr. no	Chainage		Length	Inner reinforcement								Outer reinforcement								Total Qty (MT)
	From	To		Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	
1	0+420	0+440	20	25	2.94	72	817.92	25	2.38	144	1320.28	20	4.04	72.00	719.02	20	3.10	72.00	551.91	3.41
2	0+440	0+460	20	32	5.93	76	2847.30	25	5.55	76	1628.19	16	3.97	36.00	225.79	16	2.79	36.00	158.61	4.86
3	0+460	0+480	20	32	3.51	75	1663.05	25	1.33	75	384.26	16	3.84	37.00	224.64	16	1.90	38.00	114.30	2.39
4	0+480	0+500	20	32	3.58	75	1696.00	25	1.41	75	408.71	16	3.89	38.00	233.47	16	1.98	38.00	118.60	2.46
5	0+500	0+520	20	25	4.15	78	1248.24				0.00	16	4.10	34.00	220.10	16	0.76	34.00	41.02	1.51
6	0+560	0+580	20	25	2.90	83	928.63	16	2.45	83	321.34	12	3.60	84.00	268.80				0.00	1.52
7	0+580	0+590	10	20	1.80	46	204.44	16	1.60	46	116.31	12	2.80	46.00	114.49				0.00	0.44
8	1+640	1+660	20	12	1.84	101	165.37				0	12	1.842	101	165.37				0	0.33
Total		150				9570.95				4179.09				2171.68				984.44	16.91	

Solar panels column reinforcement available at site

Sr. no	Chainage		Length	Inner reinforcement								Outer reinforcement								Total Qty (MT)
	From	To		Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	
1	0+790	0+990	200	12	1.75	100	155.56													0.16
2	1+220	1+400	180	12	1.75	90	140.00													0.14
3	1+620	1+640	20	12	1.75	10	15.56													0.02

4	1+720	1+740	20	12	1.75	10	15.56												0.02
5	1+838	1+870	32	12	1.75	16	24.89												0.02
Total		452				351.56													0.35

Drain wall reinforcement available at site

Sr. no	Chainage		Length	Outer reinforcement main bar				Inner reinforcement main bar				Binder reinforcement								Total Qty (MT)
	From	To		Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos	Qty (Kg)	
1	0+980	0+990	10	10	0.93	66	37.89	8	0.93	66	24.25	8	9.90	3	11.73					0.07
2	1+280	1+300	20	10	0.93	133	76.16	8	0.93	133	48.74	8	19.90	2	15.72					0.14
3	1+320	1+340	20	10	0.93	133	76.16	8	0.93	133	48.74	8	19.90	2	15.72					0.14
4	1+360	1+380	20	10	0.93	133	76.16	8	0.93	133	48.74	8	19.90	2	15.72					0.14
5	1+388	1+400	12	10	0.93	79	45.54	8	0.93	79	29.15	8	11.90	2	9.40					0.08
Total		82	311.91				199.62				68.31				0.00				0.58	

MIB wall reinforcement available at site

Sr. no	Chainage		Barrel Length	Inner reinforcement					Outer reinforcement							Total Qty (MT)	
	From	To		Dia	Length	Nos	Qty (Kg)	Remarks	Dia	Length	Nos	Qty (Kg)	Dia	Length	Nos		Qty (Kg)
1	0+397	MIB 535	11.83	25	4.70	120	2175.93	Vertical main outer bar									2.18
2				16	4.70	236	1752.81	Vertical main inner bar									1.75
3				10	11.73	68	492.37	Wall binder bars 2.3m ht									0.49
4				10	0.63	472	183.56	Wall binder link bars									0.18
Total		12				4604.66											4.60
													Total (MT)				22.44

Statement of Part Works executed by earlier Contractor in Corridor-2

At-grade ERS

SI No.	Chainage		Structure ID	Unit	Scope of length	Measurements in Mtr.				Balance steel qty at site (MT)
	From	To				L	B	D	Qty	
1	4888	4900	ERS	Meter	12.00	12				1.22
2	5320	5340	ERS	Meter	20.00	20				5.09
3	5340	5360	ERS	Meter	20.00	20				5.09
4	5360	5380	ERS	Meter	20.00	20				5.09
5	5810	5830	ERS	Meter	20.00	20				1.93
6	5830	5850	ERS	Meter	20.00	20				1.22
7	5850	5867	ERS	Meter	17.00	17				0.26
8	6330	6350	ERS	Meter	20.00	20				0.32
9	6350	6370	ERS	Meter	20.00	20				0.63
10	6370	6390	ERS	Meter	20.00	20				1.19
11	6390	6410	ERS	Meter	20.00	20				1.12
12	6410	6430	ERS	Meter	20.00	20				1.14
13	6620	6640	ERS	Meter	20.00	20				1.08
14	6640	6652	ERS	Meter	12.00	12				1.44
15	6720	6740	ERS	Meter	20.00	20				1.44
16	6780	6800	ERS	Meter	20.00	20				1.86
17	6800	6820	ERS	Meter	20.00	20				1.79
18	6820	6840	ERS	Meter	20.00	20				3.19
19	6840	6860	ERS	Meter	20.00	20				3.19
20	6860	6880	ERS	Meter	20.00	20				4.37

21	6880	6900	ERS	Meter	20.00	20				4.23
22	7240	7260	ERS	Meter	20.00	20				4.23
23	7260	7280	ERS	Meter	20.00	20				1.90
24	7280	7300	ERS	Meter	20.00	20				1.90
25	7300	7320	ERS	Meter	20.00	20				1.90
26	7320	7340	ERS	Meter	20.00	20				1.90
27	7340	7360	ERS	Meter	20.00	20				1.90
28	7360	7380	ERS	Meter	20.00	20				2.87
29	8280	8300	ERS	Meter	20.00	20				2.87
30	8300	8320	ERS	Meter	20.00	20				0.81
31	8320	8340	ERS	Meter	20.00	20				2.37
32	8340	8360	ERS	Meter	20.00	20				2.85
33	8400	8420	ERS	Meter	20.00	20				2.64
34	8420	8440	ERS	Meter	20.00	20				1.58
35	8440	8460	ERS	Meter	20.00	20				1.58
36	8460	8470	ERS	Meter	10.00	10				1.58
37	8685	8705	ERS	Meter	20.00	20				0.00
38	8705	8725	ERS	Meter	20.00	20				0.91
39	8920	8940	ERS	Meter	20.00	20				0.82
40	9240	9260	ERS	Meter	20.00	20				0.81
41	9260	9280	ERS	Meter	20.00	20				1.38
42	9280	9300	ERS	Meter	20.00	20				2.42
43	9300	9320	ERS	Meter	20.00	20				3.11
44	9320	9340	ERS	Meter	20.00	20				3.24
45	9340	9360	ERS	Meter	20.00	20				1.98
46	9360	9380	ERS	Meter	20.00	20				1.91
47	9380	9400	ERS	Meter	20.00	20				1.93

48	9470	9480	ERS	Meter	10.00	10				0.54
49	9480	9500	ERS	Meter	20.00	20				0.86
50	9500	9520	ERS	Meter	20.00	20				0.84
51	9520	9540	ERS	Meter	20.00	20				0.84
52	9540	9560	ERS	Meter	20.00	20				0.53
53	9560	9580	ERS	Meter	20.00	20				0.42
54	9660	9680	ERS	Meter	20.00	20				0.85
55	9680	9700	ERS	Meter	20.00	20				1.21
56	9700	9720	ERS	Meter	20.00	20				1.23
57	9720	9740	ERS	Meter	20.00	20				1.23
58	9740	9760	ERS	Meter	20.00	20				0.86
59	9760	9780	ERS	Meter	20.00	20				0.83
60	9780	9800	ERS	Meter	20.00	20				0.91
61	9800	9820	ERS	Meter	20.00	20				0.89
62	9820	9840	ERS	Meter	20.00	20				1.18
63	9840	9860	ERS	Meter	20.00	20				1.15
64	10080	10100	ERS	Meter	20.00	20				1.75
65	10100	10120	ERS	Meter	20.00	20				2.30
66	10120	10136	ERS	Meter	16.00	16				2.67
67	10160	10180	ERS	Meter	20.00	20				1.58
68	10180	10200	ERS	Meter	20.00	20				1.49
69	10200	10220	ERS	Meter	20.00	20				1.37
					1337.00	1337			Total	123.81

Statement of Part Works executed by earlier Contractor in Corridor-2 (MIB)									
SI No.	Chainage		Structure ID	Unit	Measurements in Mtr.				Remarks of GC Engineer
	From	To			Scope	L	D	Qty	
1	8.607		MIB 555 Raft	Meter	43.007	9.9			Partially Box Completed (BSTP Side)
2	10.564		MIB 564 Raft	Meter	26.048	8.1			Partially Box Completed (BSTP Side)
3	8.607		MIB 555 Wall	Meter	43.007	9.9			Partially Box Completed (BSTP Side)
4	10.564		MIB 564 Wall	Meter	26.048	8.1			Partially Box Completed (BSTP Side)
5	8.607		MIB 555 Slab	Meter	43.007	9.9			Partially Box Completed (BSTP Side)
6	10.564		MIB 564 Slab	Meter	26.048	8.1			Partially Box Completed (BSTP Side)
7	8.75		MIB 556 Raft	Meter	36.128	15			Raft Completed or 15 mts
8	8.75		MIB 556 Wall	Meter	36.128	7			Box completed for 7m of length
9	8.75		MIB 556 Slab	Meter	36.128	7			Box completed for 7m of length

Statement of Part Works executed by earlier Contractor in Corridor-2 (Sacrificial Wall)									
SI No.	Chainage		Structure ID	Unit	Measurements in Mtr.				Balance steel on site qty (MT)
	From	To			Scope	L	D	Qty	
1	7760	7780	Sacrificial wall	Meter	20.00	20.00			235.78
2	7900	7920	Sacrificial wall	Meter	20.00	20.00			235.78
3	7920	7940	Sacrificial wall	Meter	20.00	20.00			235.78
4	7960	7980	Sacrificial wall	Meter	20.00	20.00			235.78
5	8000	8020	Sacrificial wall	Meter	20.00	20.00			388.46
6	8020	8040	Sacrificial wall	Meter	20.00	20.00			235.78
7	8040	8060	Sacrificial wall	Meter	20.00	20.00			235.78
8	8060	8080	Sacrificial wall	Meter	20.00	20.00			235.78

9	8080	8100	Sacrificial wall	Meter	20.00	20.00			388.46
10	8840	8860	Sacrificial wall	Meter	20.00	20.00			200.96
11	8860	8880	Sacrificial wall	Meter	20.00	20.00			200.96
12	8880	8900	Sacrificial wall	Meter	20.00	20.00			200.96
13	8900	8920	Sacrificial wall	Meter	20.00	20.00			200.96
15	8920	8940	Sacrificial wall	Meter	20.00	20.00			0.00
								Total (MT)	3.23

Statement of Part Works executed by earlier Contractor in Corridor-2 (ERS Column)

Solar panel column reinforcement available at site

SI No	Structure	BSTP Chainage		Length (M)	UOM	Inner Wall				Total Quantity
		From	To			Nos	Dia	Height	No of Bars	
1	ERS-Column	5010	5020	10	Kgs	5	12	1.7	4	30.22
2	ERS-Column	5020	5040	20	Kgs	10	12	1.7	4	60.44
3	ERS-Column	5040	5060	20	Kgs	10	12	1.7	4	60.44
4	ERS-Column	5060	5080	20	Kgs	10	12	1.7	4	60.44
5	ERS-Column	5080	5100	20	Kgs	10	12	1.7	4	60.44
6	ERS-Column	5130	5150	20	Kgs	10	12	1.7	4	60.44
7	ERS-Column	5200	5220	20	Kgs	10	12	0.8	4	28.44
8	ERS-Column	5220	5240	20	Kgs	10	12	0.8	4	28.44
9	ERS-Column	5240	5260	20	Kgs	10	12	0.8	4	28.44
10	ERS-Column	5260	5280	20	Kgs	10	12	0.8	4	28.44
11	ERS-Column	5540	5560	20	Kgs	10	12	1.7	4	60.44

12	ERS-Column	5910	5920	10	Kgs	5	12	1.7	4	30.22
13	ERS-Column	5920	5940	20	Kgs	10	12	1.7	4	60.44
14	ERS-Column	5940	5960	20	Kgs	10	12	1.7	4	60.44
15	ERS-Column	6530	6550	20	Kgs	10	12	0.8	4	28.44
16	ERS-Column	6550	6560	10	Kgs	5	12	0.8	4	14.22
17	ERS-Column	6720	6740	20	Kgs	10	12	1.7	4	60.44
18	ERS-Column	8840	8860	20	Kgs	10	12	1.7	4	60.44
19	ERS-Column	8860	8880	20	Kgs	10	12	1.7	4	60.44
20	ERS-Column	8880	8900	20	Kgs	10	12	1.7	4	60.44
21	ERS-Column	8900	8920	20	Kgs	10	12	1.7	4	60.44
22	ERS-Column	8920	8940	20	Kgs	10	12	1.7	4	60.44
23	ERS-Column	8940	8960	20	Kgs	10	12	1.7	4	60.44
24	ERS-Column	8960	8980	20	Kgs	10	12	1.7	4	60.44
25	ERS-Column	8980	9000	20	Kgs	10	12	1.7	4	60.44
26	ERS-Column	9000	9020	20	Kgs	10	12	1.7	4	60.44
27	ERS-Column	9020	9040	20	Kgs	10	12	1.7	4	60.44
28	ERS-Column	9400	9420	20	Kgs	10	12	1.7	4	60.44
29	ERS-Column	9420	9440	20	Kgs	10	12	1.7	4	60.44
30	ERS-Column	10252	10270	18	Kgs	9	12	1.7	4	54.40
31	ERS-Column	10620	10630	10	Kgs	5	12	1.7	4	30.22
32	ERS-Column	10630	10650	20	Kgs	10	12	1.7	4	60.44
33	ERS-Column	10700	10720	20	Kgs	10	12	1.7	4	60.44
34	ERS-Column	10720	10740	20	Kgs	10	12	1.7	4	60.44
				638	Kgs				Total (MT)	1.75

Statement of Part Works executed by earlier Contractor in Corridor-2 MIB wall, Raft, Top Slab reinforcement available at site (Dowels)				
SI No	Structure	BSTP Chainage	UOM	Total Quantity
1	MIB-542	4.802	Kgs	41.72
2	MIB 543	4.974	Kgs	86.76
3	MIB 545	5.398	Kgs	86.17
4	MIB-546	5.566	Kgs	81.05
5	MIB-547	5.806	Kgs	71.11
6	MIB 548	6.49	Kgs	63.09
7	MIB 549	6.913	Kgs	173.78
8	MIB 550	7.028	Kgs	124.44
9	MIB 551	7.205	Kgs	164.51
10	MIB 552	7.408	Kgs	179.94
11	MIB 553	8.236	Kgs	82.47
12	MIB 555	8.607	Kgs	56.67
13	MIB 556	8.75	Kgs	0.00
14	MIB 558	9.466	Kgs	126.33
15	MIB 559	9.9	Kgs	67.44
16	MIB 562	10.15	Kgs	130.34
17	MIB 563	10.244	Kgs	64.20
18	MIB 564	10.564	Kgs	57.96
				1.66 MT

Statement of Part Works executed by earlier Contractor in Corridor-2 RUB wall, Raft, Top Slab reinforcement available at site (Dowels)			
SI No	Structure	UOM	Total Quantity
1	RUB 5+411	Kgs	1052.44
2	RUB 6+512	Kgs	434.88
3	LC 141	Kgs	1537.44
4	LC 141	Kgs	586.59
5	LC 143	Kgs	624.36
6	LC 143	Kgs	229.93
			4.47 (MT)

Statement of Part Works executed by earlier Contractor in Corridor-2 Sacrificial Wall balance reinforcement available at site (cast in situ)											
SI No	Structure	BSTP Chainage		Length (M)	SRW Wall height from founding level (M)	Executed height of SRW Wall height (M)	Remaining ERS SRW height (M)	Founding Level	Wall Concrete top level	UOM	Total Quantity
		From	To								
1	SRW	7760	7780	20	3	1.25	1.6	894.32	895.92	Kgs	235.78
2	SRW	7900	7920	20	3	1.25	1.6	895.904	897.5	Kgs	235.78
3	SRW	7920	7940	20	3	1.25	1.6	896.089	897.69	Kgs	235.78
4	SRW	7960	7980	20	3	1.25	1.6	896.434	898.03	Kgs	235.78
5	SRW	8000	8020	20	3	0	2.85	896.82	897.17	Kgs	388.46
6	SRW	8020	8040	20	3	1.25	1.6	897.004	898.6	Kgs	235.78
7	SRW	8040	8060	20	3	1.25	1.6	897.235	898.84	Kgs	235.78
8	SRW	8060	8080	20	3	1.25	1.6	897.355	898.96	Kgs	235.78
9	SRW	8080	8100	20	3	0	2.85	897.415	897.77	Kgs	388.46
10	SRW	8840	8860	20	3.5	1.8	1.45	897.702	899.9	Kgs	200.96
11	SRW	8860	8880	20	3.5	1.8	1.45	897.657	899.86	Kgs	200.96
12	SRW	8880	8900	20	3.5	1.8	1.45	897.612	899.81	Kgs	200.96
13	SRW	8900	8920	20	3.5	1.8	1.45	897.472	899.67	Kgs	200.96
14	SRW	8920	8940	20	3.5	1.8	1.45	897.737	899.94	Kgs	0
							Total			Kgs	3.23

Major Bridge Test Pile at site						
Type of Structure: MJB 560						
SI No.	Chainage		Structure ID	Remarks		
	From	To		Depth of Pile from COL (M)	Dia of Pile (M)	
1	9+992	BH-178	MJB-560	23.80	1.2	1. Permanent liner used. 2. Both Vertical and Lateral test pile done and approved.

Statement of Part Works executed by earlier Contractor in Corridor-2 Precast Sacrificial Wall and Cast In situ wall									
Pre cast						Cast In-situ			
SI No	Height (M)	Scope	Completed (Nos)	Balance		SI No	SCOPE	Completed	Balance
1	2.0	290.0	240	50.0		1	1000.0	600.0	400.0
2	2.5	116.0	91	25.0		Total	1000	600	400
3	3.0	214.0	194	20.0					
4	3.5	143.0	43	100.0					
Total		763	568	195					

SI No	Section	BSTP Chainage from	BSTP Chainage to	Total Length (M)	Height of SRW (M)	Segment-1	Segment-2	Segment-3	Segment-4	Segment-5	Segment-6	Segment-7	Segment-8	Total number of segments casted
1	2	4980	5000	20										0
2	2	5000	5020	20										0
3	2	5020	5040	20										0
4	2	5040	5060	20										0
5	2	5060	5080	20										0
6	2	5080	5100	20										0
7	2	5100	5120	20										0

8	2	5120	5140	20										0
9	2	5140	5160	20										0
10	2	5160	5180	20										0
11	2	5180	5200	20										0
12	2	5200	5220	20										0
13	2	5220	5240	20										0
14	2	5240	5260	20										0
15	2	5260	5280	20										0
16	2	5280	5300	20										0
17	2	5300	5320	20										0
18	2	5320	5340	20										0
19	2	5340	5360	20										0
20	2	5360	5380	20										0
21	2	5380	5400	20										0
22	2	5400	5420	20										0
23	2	5420	5440	20										0
24	2	5440	5460	20										0
25	2	5460	5480	20										0
26	2	5480	5500	20										0
27	2	5500	5520	20										0
28	2	5520	5540	20										0
29	2	5540	5560	20										0
30	2	5560	5580	20										0
31	2	5580	5600	20										0
32	2	5600	5620	20	1.6	1	1	1	1	1	1	1	1	8

33	2	5620	5640	20	2.1	1	1	1	1	1	1	1	1	8
34	2	5640	5660	20	2.7	1	1	1	1	1	1	1	1	8
35	2	5660	5680	20	3.0	1	1	1	1	1	1	1	1	8
36	2	5680	5700	20	3.1	1	1	1	1	1	1	1	1	8
37	2	5700	5720	20	3.2	1	1	1	1	1	1	1	1	8
38	2	5720	5740	20	3.2	1	1	1	1	1	1	1	1	8
39	2	5740	5760	20	3.1	1	1	1	1	1	1	1	1	8
40	2	5760	5780	20	3.0	1	1	1	1	1	1	1	1	8
41	2	5780	5800	20	2.8	1	1	1	1	1	1	1	1	8
42	2	5800	5820	20	2.8	1	1	1	1	1	1	1	1	8
43	2	5820	5840	20	2.7	1	1	1	1	1	1	1	1	8
44	2	5840	5860	20	2.6	1	1	1	1	1	1	1	1	8
45	2	5860	5880	20	2.4	1	1	1	1	1	1	1	1	8
46	2	5880	5900	20	2.3	1	1	1	1	1	1	1	1	8
47	2	5900	5920	20	2.1	1	1	1	1	1	1	1	1	8
48	2	5920	5940	20	1.9	1	1	1	1	1	1	1	1	8
49	2	5940	5960	20	1.8	1	1	1	1	1	1	1	1	8
50	2	5960	5980	20	1.7	1	1	1	1	1	1	1	1	8
51	2	5980	6000	20	1.7	1	1	1	1	1	1	1	1	8
52	2	6000	6020	20	1.7	1	1	1	1	1	1	1	1	8
53	2	6020	6040	20	1.5	1	1	1	1	1	1	1	1	8
54	2	6040	6060	20	1.4	1	1	1	1	1	1	1	1	8
55	2	6060	6080	20	1.4	1	1	1	1	1	1	1	1	8
56	2	6080	6100	20	1.3	1	1	1	1	1	1	1	1	8
57	2	6100	6120	20	1.3	1	1	1	1	1	1	1	1	8

58	2	6120	6140	20	1.3	1	1	1	1	1	1	1	1	8
59	2	6140	6160	20	1.2	1	1	1	1	1	1	1	1	8
60	2	6160	6180	20										0
61	2	6180	6200	20										0
62	2	6200	6220	20										0
63	2	6220	6240	20										0
64	2	6240	6260	20										0
65	2	6260	6280	20										0
66	2	6280	6300	20										0
67	2	6300	6320	20										0
68	2	6320	6340	20										0
69	2	6340	6360	20										0
70	2	6360	6380	20										0
71	2	6380	6400	20										0
72	2	6400	6420	20										0
73	2	6420	6440	20										0
74	2	6440	6460	20										0
75	2	6460	6480	20										0
76	2	6480	6500	20										0
77	2	6500	6520	20										0
78	2	6520	6540	20										0
79	2	6540	6560	20										0
80	2	6560	6580	20										0
81	2	6580	6600	20										0
82	2	6600	6620	20										0

83	2	6620	6640	20										0
84	2	6640	6660	20										0
85	2	6660	6680	20										0
86	2	6680	6700	20	1.4	1	1	1	1	1	1	1	1	8
87	2	6700	6720	20	2.2	1	1	1	1	1	1	1	1	8
88	2	6720	6740	20	3.1	1	1	1	1	1	1	1	1	8
89	2	6740	6760	20										
90	2	6760	6780	20										
91	2	6780	6800	20										
92	2	6800	6820	20										
93	2	6820	6840	20										
94	2	6840	6860	20										
95	2	6860	6880	20										
96	2	6880	6900	20										
97	2	6900	6920	20										
98	2	6920	6940	20										
99	2	6940	6960	20										
100	2	6960	6980	20										
101	2	6980	7000	20										
102	2	7000	7200	200										
103	2	7200	7220	20	3.4	1	1	1						8
104	2	7220	7240	20	3.2									8
105	2	7240	7260	20	3.1									8
106	2	7260	7280	20	3.1									8
107	2	7280	7300	20	3.2									8

108	2	7300	7320	20	3.2									8
109	2	7320	7340	20	3.2									8
110	2	7340	7360	20	3.3									8
111	2	7360	7380	20	3.4									
112	2	7380	7400	20										
113	2	7400	7420	20										
114	2	7420	7440	20										
115	2	7440	7460	20										
116	2	7460	7480	20										
117	2	7480	7500	20										
118	2	7500	7520	20										
119	2	7520	7540	20										
120	2	7540	7560	20										
121	2	7560	7580	20										
122	2	7580	7600	20										
123	2	7600	7620	20										
124	2	7620	7640	20										
125	2	7640	7660	20										
126	2	7660	7680	20										
127	2	7680	7700	20										
128	2	7700	7720	20										
129	2	7720	7740	20										
130	2	7740	7760	20										
131	2	8100	8120	20	3.5									8
132	2	8120	8140	20	3.5									8

133	2	8140	8160	20	3.5									8
134	2	8160	8180	20										
135	2	8180	8200	20										
136	2	8200	8220	20										
137	2	8220	8240	20										
138	2	8240	8260	20										
139	2	8260	8280	20										
140	2	8280	8300	20										
141	2	8300	8320	20										
142	2	8320	8340	20										
143	2	8340	8360	20										
144	2	8360	8380	20										
145	2	8380	8400	20										
146	2	8400	8420	20	3.2									8
147	2	8420	8440	20	2.7	1	1	1	1	1	1	1	1	8
148	2	8440	8460	20	2.2	1	1	1	1	1	1	1	1	8
149	2	8460	8480	20	1.6	1	1	1	1	1	1	1	1	8
150	2	8780	8800	20	1.5	1	1	1	1	1	1	1	1	8
151	2	8800	8820	20	1.8	1	1	1	1	1	1	1	1	8
152	2	8820	8840	20	2.2	1	1	1	1	1	1	1	1	8
153	2	8840	8860	20										
154	2	8860	8880	20										
155	2	8880	8900	20										
156	2	8900	8920	20										
157	2	8920	8940	20										

158	2	8940	8960	20										
159	2	8960	8980	20										
160	2	8980	9000	20										
161	2	9000	9020	20										
162	2	9020	9040	20										
163	2	9040	9060	20										
164	2	9060	9080	20										
165	2	9080	9100	20										
166	2	9100	9120	20										
167	2	9120	9140	20										
168	2	9140	9160	20										
169	2	9160	9180	20										
170	2	9180	9200	20										
171	2	9200	9220	20										
172	2	9220	9240	20	3.4									8
173	2	9240	9260	20	3.1									8
174	2	9260	9280	20	2.9	1	1	1	1	1	1	1	1	8
175	2	9280	9300	20	2.8	1	1	1	1	1	1	1	1	8
176	2	9300	9320	20	2.6	1	1	1	1	1	1	1	1	8
177	2	9320	9340	20	2.6	1	1	1	1	1	1	1	1	8
178	2	9340	9360	20	2.8	1	1	1	1	1	1	1	1	8
179	2	9360	9380	20	2.9	1	1	1	1	1	1	1	1	8
180	2	9380	9400	20	2.9	1	1	1	1	1	1	1	1	8
181	2	9400	9420	20	2.8	1	1	1	1	1	1	1	1	8
182	2	9420	9440	20	2.8	1	1	1	1	1	1	1	1	8

183	2	9440	9460	20	2.7	1	1	1	1	1	1	1	1	8
184	2	9460	9480	20	2.7	1	1	1	1	1	1	1	1	8
185	2	9480	9500	20	2.6	1	1	1	1	1	1	1	1	8
186	2	9500	9520	20	2.6	1	1	1	1	1	1	1	1	8
187	2	9520	9540	20	2.5	1	1	1	1	1	1	1	1	8
188	2	9540	9560	20	2.5	1	1	1	1	1	1	1	1	8
189	2	9560	9580	20	2.5	1	1	1	1	1	1	1	1	8
190	2	9580	9600	20	2.5	1	1	1	1	1	1	1	1	8
191	2	9600	9620	20	2.5	1	1	1						3
192	2	9620	9640	20	2.6	1	1	1	1	1	1	1	1	8
193	2	9640	9660	20	2.6	1	1	1	1	1	1	1	1	8
194	2	9660	9680	20	2.6	1	1	1	1	1	1	1	1	8
195	2	9680	9700	20	2.7	1	1							8
196	2	9700	9720	20	2.7									8
197	2	9720	9740	20	2.7									8
198	2	9740	9760	20	2.7									8
199	2	9760	9780	20	2.7									8
200	2	9780	9800	20	2.7									8
201	2	9800	9820	20	2.7									8
202	2	9820	9840	20	2.6									8
203	2	9840	9860	20	2.5									8
204	2	9860	9880	20	2.3									8
205	2	9880	9900	20	2.2									8
206	2	9900	9920	20	1.9	1	1	1	1	1	1	1	1	8
207	2	9920	9940	20	1.8	1	1	1	1	1	1	1	1	8

208	2	9940	9960	20	1.7	1	1	1	1	1	1	1	1	8
209	2	9960	9980	20	1.7	1	1	1	1	1	1	1	1	8
210	2	9980	10000	20	1.8	1	1	1	1	1	1	1	1	8
211	2	10000	10020	20	1.8	1	1	1	1	1	1	1	1	8
212	2	10020	10040	20	1.7	1	1	1	1	1	1	1	1	8
213	2	10040	10060	20	1.7	1	1	1	1	1	1	1	1	8
214	2	10060	10080	20	1.7	1	1	1	1	1	1	1	1	8
215	2	10080	10100	20	1.7	1	1	1	1	1	1	1	1	8
216	2	10100	10120	20	1.5	1	1	1	1	1	1	1	1	8
217	2	10120	10140	20	1.3	1	1	1	1	1	1	1	1	8
218	2	10140	10160	20	1.1	1	1	1	1	1	1	1	1	8
					4540									

	<u>Legends:</u>	<u>Description</u>
		Cast in situ Sacrificial Wall
		Sacrificial Pre cast yet to be casted
		Station Area
		Pre cast Sacrificial Completed
		No Sacrificial wall required

Statement of Part Works executed by earlier Contractor in Corridor-2 Details of Sacrificial wall Cast in situ done by other agency as per site									
SI No	Structure	BSTP Chainage		Length (M)	Cast in suit Sacrificial wall				
		From	To		SRW Wall height from founding level (M)	Executed height of SRW Wall by other agency (M)	Remaining ERS Wall height (M)	UOM	Total Quantity of reinforcement available at site
1	SRW	7760	7780	20	3	1.25	1.6	Kgs	235.78
2	SRW	7780	7800	20					Completed
3	SRW	7800	7820	20					Completed
4	SRW	7820	7840	20					Completed
5	SRW	7840	7860	20					Completed
6	SRW	7860	7880	20					Completed
7	SRW	7880	7900	20					235.78
8	SRW	7900	7920	20	3	1.25	1.6	Kgs	235.78
9	SRW	7920	7940	20					Completed
10		7940	7960	20	3	1.25	1.6	Kgs	235.78
11	SRW	7960	7980	20	3	1.25	1.6	Kgs	Completed
12		7980	8000	20					Raft completed
13	SRW	8000	8020	20	3	0	2.85	Kgs	388.46

14	SRW	8020	8040	20	3	1.25	1.6	Kgs	235.78
15	SRW	8040	8060	20	3	1.25	1.6	Kgs	235.78
16	SRW	8060	8080	20	3	1.25	1.6	Kgs	235.78
17	SRW	8080	8100	20	3	0	2.85	Kgs	388.46
18	SRW	8840	8860	20	3.5	1.8	1.45	Kgs	200.96
19	SRW	8860	8880	20	3.5	1.8	1.45	Kgs	200.96
20	SRW	8880	8900	20	3.5	1.8	1.45	Kgs	200.96
21	SRW	8900	8920	20	3.5	1.8	1.45	Kgs	200.96
22	SRW	8920	8940	20	3.5	1.8	1.45	Kgs	1st lift (Steel cut)
23	SRW	8940	8960	20					PCC (Excluding Key)
24	SRW	8960	8980	20					PCC (Excluding Key)
25	SRW	8980	9000	20					PCC (Excluding Key)
26	SRW	9000	9020	20					PCC (Excluding Key)
27	SRW	9020	9040	20					PCC (Excluding Key)
				540			Total	Kg	3231.21

ANNEXURE - 2
RIGHT OF ACCESS TO THE SITE

TIME FOR ACCESS TO THE SITE

Access to site and RUC will be given progressively, generally taking into account the approved programme of works.

A major portion of the land required for execution of works is Railway land and the same is available along the alignment.

Refer S.No 21 of part-A Contract data

ANNEXURE - 3
ALIGNMENT PLANS (GAD)

The proposed final alignment plan of the BSTP line is attached, for reference and guidance. This is based on survey conducted by the Authority.

ANNEXURE – 4**TREE CUTTING AND FOREST CLEARANCES**

Tree cutting, preservation and disposal (or) Translocation along the alignment for cutting/disposal/translocation/afforestation (as per the norms of Forest Department) in lieu of cutting/ translocation to be arranged by Contractor at her/his own cost. The applicable permits/ permissions for felling of tress / Translocation shall be arranged by Employer. The tree cutting and disposal shall be arranged by the contractor and the scope is inclusive of the same. The applicable permits / permissions for felling of tress / Translocation shall be arranged by Employer. The cut trees will be the property of the Contractor. However, the contractor shall deposit an amount not less than Reserve Price of the trees (as fixed by Forest Department / BBMP/Railways) plus FDT (Forest Development Tax) to Bi-RIDE for onward communication to Railways / BBMP / Forest Department, as the case may be.

ANNEXURE - 5**TIME SCHEDULE FOR REVIEW OF DRAWINGS BY THE AUTHORITY**

Sl. No.	Item	Preparation	GC Review with time limit (NO NO) days from Contractor submission	Bi-RIDE Review for GC approval with time limit (GFC)
1)	Alignment Design Report	Contractor	15 Days	7 days
2)	L-Section	Contractor	15 Days	7 days
3)	GAD of ROB and minor bridges.	Contractor	15 Days	7 days
4)	Structural drawings of ROB	Contractor	15 Days	7 days
5)	Structural drawings of Minor bridges	Contractor	15 Days	7 days
6)	GADs of RUBs	Contractor	15 Days	7 days
7)	Structural Drawings of RUBs	Contractor	15 Days	7 days
8)	Drainage Plans	Contractor	15 Days	7 days
9)	Protection Work Design and Drawings	Contractor	15 Days	7 days
10)	Earth Retaining Structure Structural drawing	Contractor	15 Days	7 days
11)	a) Test Pile drawing	Contractor	15 Days	7 days
12)	b) Segment drawing	Contractor	15 Days	7 days
13)	c) Working pile drawings	Contractor	15 Days	7 days
14)	d) Pile cap drawings	Contractor	15 Days	7 days
15)	e) Pier and pier cap/Portal-drawings	Contractor	30 Days	7 days
16)	f) Bearing drawings	Contractor	15 Days	7 days
17)	g) Superstructure and parapet drawings	Contractor	15 Days	7 days

18)	Earthwork in Embankment and Cutting drawings, retaining wall, Drain at Ramps etc.,	Contractor	15 Days	7 days
19)	Temporary structures design	Contractor	15 Days	7 days
20)	GAD of Station Box of Nagavara & Kanakanagar	Contractor	15 Days	7 days
21)	Structural Drawings of Station Box of Nagavara & Kanakanagar	Contractors	15 Days	7 days

ANNEXURE - 6
APPLICABLE PERMITS

1 APPLICABLE PERMITS

- 1.1 The Contractor shall obtain, as required under Applicable Laws, the following Applicable Permits:
- (a) Permission of the State Government for extraction of boulders from quarry;
 - (b) Permission of Village Panchayats and Pollution Control Board for installation of crushers;
 - (c) Licence for use of explosives;
 - (d) Permission of the State Government for drawing water from river/reservoir;
 - (e) Licence from inspector of factories or other competent Authority for setting up batching plant;
 - (f) Clearance of Pollution Control Board for setting up batching plant;
 - (g) Clearance of Village Panchayats and Pollution Control Board for setting up asphalt plant;
 - (h) Permission of Village Panchayats and State Government for borrow earth; and
 - (i) Any other permits or clearances required under Applicable Laws.
 - (j) Fire NOC from Karnataka State Fire and Emergency Services Department
 - (k) Traffic Diversion NOC/permission from Bangalore police commissioner /Deputy commissioner Traffic Police

ANNEXURE – 7**PROVISIONAL CERTIFICATE**

- 1 I/We, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for construction of the section (km to km) in the State of in- BSTP (the "**BSTP Project**") on Design and Construction basis through (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been undertaken to determine compliance of the BSTP Project with the provisions of the Agreement.
- 2 Certain minor works are incomplete, and these are not likely to cause material inconvenience to the Users of the BSTP Project or affect their safety or the movement of rail traffic in any manner. These works have been specified in the Punch List appended hereto, and the Contractors have agreed and accepted that they will complete all such works in the time and manner set forth in the Agreement.
- 3 In view of the foregoing, I/We am/are satisfied that the BSTP Project from km to km can be safely and reliably placed in service of the Authority for railway freight and passenger traffic, subject to authorisation by the Commissioner of Railway Safety in accordance with Applicable Laws. In terms of the Agreement, the BSTP Project is hereby provisionally declared fit for entry into operation on this the day of 20.....

ACCEPTED, SIGNED, SEALED

AND DELIVERED

For and on behalf of

CONTRACTOR by:

(Signature)

SIGNED, SEALED AND

DELIVERED

For and on behalf of

AUTHORITY's ENGINEER by:

(Signature)

ANNEXURE - 8

COMPLETION CERTIFICATE

1 I/We, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for construction of thesection (km to km) of in the State of in- BSTP (the "**BSTP Project**") on Design and Construction basis through (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been successfully undertaken to determine compliance of the BSTP Project with the provisions of the Agreement, and the authorisation by the Commissioner for Railway Safety under Applicable Laws has been obtained.

2 It is certified that, in terms of the aforesaid Agreement, all works forming part of Railway Project have been completed, and the BSTP Project is hereby declared fit for entry into operation on this the day of 20.....

- i) The test on completion of civil works shall also include the integrated testing. The objective of the contract is the Design and construction, testing and commissioning of the permanent works, construction and removal of the Temporary Works and the rectification of defects appearing in Permanent Works by the contractor in the manner stipulated by the Contract.
- ii) The completion certificate is as per railway standard format. Please refer CI.30.6 at page 161, para 12 and para 2.

The format can be altered as per the contract conditions. The tender conditions prevail.

SIGNED, SEALED AND DELIVERED

For and on behalf of the Authority's Engineer by:

(Signature)

(Name)

(Designation)

(Address)