SECTION - 8A

EMPLOYER'S REQUIREMENT

GENERAL INFORMATION AND SCOPE OF WORK

PART-2

EMPLOYER'S REQUIREMENTS TABLE OF CONTENT

SECTION 8A - PART-2

WORKS/EMPLOYER'S REQUIREMENTS

NAME OF WORK:

Design and Construction of Elevated Viaduct of length 8.960 km and At-Grade Formation of length 37.920 km including all associated Works (excluding Station Buildings) between Heelalige and Rajanukunte of Corridor-4 of Bengaluru Suburban Railway Project (BSRP)

EMPLOYERS REQURIEMENT - 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 theWorks.
(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 theWorks.

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(8) 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 wholeor 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 ofthe Definitive Design and as described in the Employer's RequirementsDesign.

"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 Special Conditions of Contract (SCC), 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 comprehensiveand 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(6) of the Employer's Requirements - Design, the Construction Phase may commence immediately upon the issue of the Notice in respect of the Definitive Design Submission in respect of each such element subject to availability of the site in accordance with agreed programme.

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 Annexure-I to these Employer's Requirements Part-1.
(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 to these

Employer's Requirements Part-1 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

K-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 ofassets 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 tocorrect or patch faults.

(10) The Contractor shall detail any effect such fixes or patches are expected to have, upon theapplications.

(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 contractorsbefore 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-I.

(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 inaccordance 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 requiredto 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-I 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 itis 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.

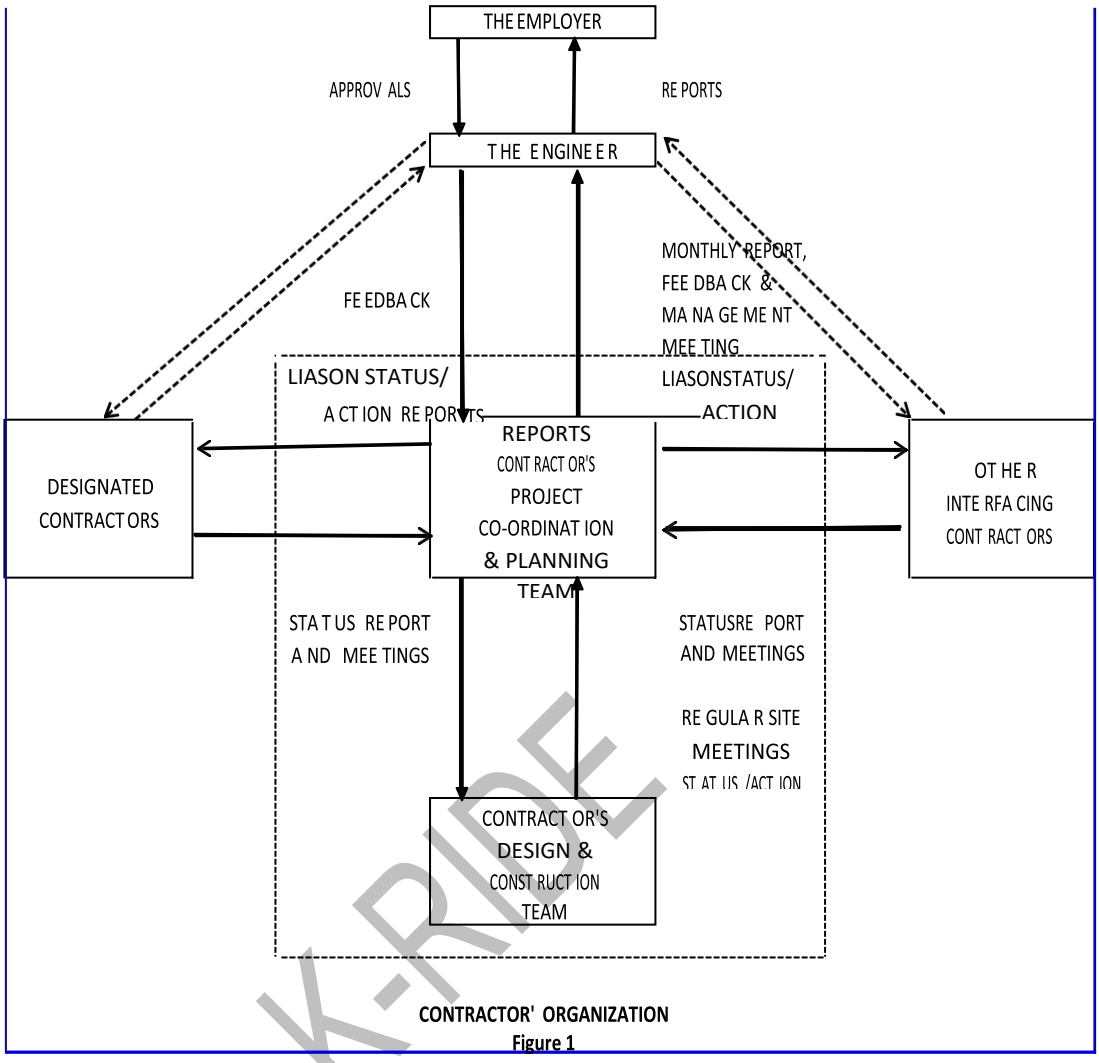
(3) The design interface is an iterative process requiring regular exchange and update of interfacing information. The Contractor shall ensure that the information he requires from the Interfacing Contractors is made known at the outset of each design interface and vice versa so that the information 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 Design reports and GFCDs to make the design interface more efficient.



CONTRACTOR' ORGANIZATION
Figure 1

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, viaduct 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 viaduct.

(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
ii. Differential movement at viaduct / station junctions or other areas identified in thedesign.
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 thereport 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, signaling, 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 from 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 K-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)

Design shall be carried out as per design basis report. Indicative parameters for designing of viaduct 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 whenthere is a structure between tracks. Ex: parapet wall, web of girder in case of trough type girder, etc. Since end evacuation is adopted in BSRP, Tenderers may note that side walkways are not a must in the viaduct and this may be taken note of while designing the girders for the viaducts".

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, totaling 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 provisionsin 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

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

2.5.2 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 forhimself 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.

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/SOR items.

The utilities are to be diverted with proper liaison and approval of the utility owning agencies. Theutilities which are not be diverted but require supporting, proper supporting is 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 K-RIDE.

(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 ofblockages and malba should not be dumped over these manholes.

(vii) Branch sewer connections which are connected with the trunk sewers should also be taken careof. 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

K-RIDE 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, K-RIDE 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/BSRP and without infringement of the Structure Gauge.

(3) Railway clearances:
Various clearances shall be provided as per the schedule of dimensions approved for the K-RIDE.

(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 BDA, BBMP, SWR, BWSSB etc., In the event that the Contractor, having used its best endeavors, 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 5 m on either side of the center line in Viaduct 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 K-RIDE.

7. DESIGN LIFE

The design life of all Permanent Works shall be 100 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, signaling 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 BSRP to operate satisfactorily at amaximum design speed as described in Design Basis Report.

(2) The vertical and horizontal alignments for the main line track work shall comply with theconditions 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 adequateflood 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-5 & 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 pedestriantraffic. 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 BSRP 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 NI 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-6 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 neededto 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 ofconstruction 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.

(8) 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 beenfully 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 Engineerto 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-1.

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) Preliminary station sizing (Wherever applicable)
l) Preliminary viaduct 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 thestructures, 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 thestructures;
(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 andequipment

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 elementsof 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 skillful, 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 upto 700 degree centigrade dry heat. 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. <u>THE MANUFACTURERS OF PROPRIETARY SYSTEMS SHALL SUPPLY THE FOLLOWING INFORMATION;</u>

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 resistance 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 beconsidered 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 informationhas 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 theProject 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 revisionsto 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 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 & Station works (Wherever required).
(b) All works related to the viaduct & At-Grade 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 28 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 . 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. 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. 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.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, andshow 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 otherreview 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 notmore than one (1) month throughout the Design Phase.

11.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.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.DOCUMENTS REQUIREMENTS

(1) Drawings shall be prepared generally to A1 size, but to ISO AO size where appropriate. Appendix-7 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-7 specifies the drawing submission requirements for CAD Media files.

14.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 anddrawings rests with the design consultants and the contractor.			
By Designer			By Contractor
Sig:	Sig:	Sig:	Sig:
Date:	Date:	Date:	Date:
Name:	Name:	Name:	Name:
Designed By	Checked by	Approved by	Accepted by

(b) 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 K-RIDE.

3. THE SITE

(1) Works Areas are those areas identified in Appendix-2A 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 /K-RIDE norms and the same will 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 groundlevels 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/ BSRP/ 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 K-RIDE drawing are required to be provided near to IR/BSRP 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, willimpose 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 BSRP 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 equipmentof 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 operationsand 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 andsubmit 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 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. He 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 FINISHEDWORKS

(10) The finished works shall be protected from any damage that could arise from any activities on theadjacent 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 whichthe 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 unable 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

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 suchremoval, 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 neighborhoods 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 thearea 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 developedwith 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 ofthe 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 theconstruction works shall be maintained or relocated to appropriate locations;
ix. Motorists, pedestrians, workmen, plant and equipment shall be protected from accidentat 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 endeavors, 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 endeavors to assist the Contractor to secure such approval but without responsibility on the partof the Employer to do so.

4. TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

1. 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.

2. 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.

3. 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 Ministryof 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.

4. Adequate number of traffic guards, supervisors and in charge shall be deployed for smooth regulation of traffic.

5. 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 publicroads 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 continuousunbroken 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 bemaintained 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 unlessprotection 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 immediatelyafter 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 to these Employer's Requirements.

(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-8 to the Employer's Requirements.

(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.

SITE UTILITIES AND ACCESS

(5) (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-12** 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 it's 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 Sub Contractor'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/ Sub Contractor 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/ Sub Contractor shall be clearly marked with the Contractor's / Sub Contractors 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 encaged 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 undertakethe 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 thefollowing 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 theworks.
(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-7 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 color 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 briefdescription 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 Section-8B of Technical Specifications. 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 contractorto 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, supplyof 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 endeavors to prevent any riotous or unlawful behavior 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 neighborhood 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 pipe lines 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 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 thatare necessary for the full development and Detailed Design of Viaduct.

OUTLINE DESIGN CRITERIA FOR VIADUCT 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 Bridgeconstruction,

latest revision.

IRS - Code of practice for the design of substructures and foundation ofbridges.

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 IRC 83: 2002	Standard Specifications and code of practice for Road Bridges, Section IX 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

IRC: SP 11	1958	Handbook of quality Control for Construction of Roads and Runways.
IRC: SP 65	2018	Guidelines for the Design and Construction of Segmental Bridges.
IRC: 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
IS 73:	1992	Paving Bitumen
IS 215:	1995	Road Tar
IS 217:	1988	Cutback Bitumen
IS 226:	1975	Structural steel (standard quality)
IS 269:	2013	Spec s for Ordinary and low heat Portland Cement
IS 278:	1978	Galvanised steel barbed wire for fencing
IS 280:	1978	Mild Steel wire for general engineering purposes
IS 281:	2009	Mild Steel siding door bolts for use with Padlocks
IS 383:	1970	Coarse and fine aggregates
IS 432:	1982	Mild steel and medium tensile steel bars and hard-drawn steel wire forconcrete reinforcement
	(Part 1)	Mild steel and medium tensile steel bars
	(Part 2)	Hard-drawn steel wire
IS 455:	1989	Portland slag cement
IS 456:	2000	Code of practice for plain and reinforced concrete
IS 457:	1957	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures
IS 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 are welding of structural steel
IS 823:	1964	Code of procedure for manual metal arc welding of mils steel
IS 875:	1987	Code of practice for design loads (other than earthquake) for buildingsand structures (Parts I, II, IV & V)
IS 875:	2015	Code of practice for design loads (other than earthquake) for buildingsand structures (Parts III)
IS 1077:	1992	Common burnt, clay building bricks
IS 1080:	1986	Design and construction of shallow foundation in soil (other than raftring 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 pipefittings
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 andstructures (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

	(Part 5)	Soundness
	(Part 6)	Measuring mortar properties of find 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 ConcreteReinforcement
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) (2013)	Load test on piles
IS 2950:	1981	Code of practice for design and construction of raft foundations.
IS 3812:	2003	Fly ash for use as pozzolona 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 forsoils
IS 5525:	1969	Recommendations for detailing of reinforcement in reinforced concreteworks
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 shallowfoundations
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 penetrationresistance
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 carbonmanganese 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 onRocks
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 SeismicForces
IS 14268:	1995	Uncoated Stress Relived 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 AnalysisASTM D-395 Compression set of vulcanized rubber
ASTM	D-412	Tension testing of vulcanized rubberASTM 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	0-3080	Method for direct shear test of soils under consolidated drainedcondition
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
AASHTOOM 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.

OTHER PUBLICATIONS

Indian Standard Hand Book 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 requirementsof NBC/NFPA 130 Standard for Fixed Guide way Systems.

3. BSRP 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, K-RIDE.

4. BSRP 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 K-RIDE. 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 railway operating equipment, including signals and signaling 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 others 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

and from the Track work DDC. Some details of the likely fixing to be provided are given below but it is stressed that this information may not be complete or comprehensive.

4.1.7 The Contractor shall be responsible for coordinating his design with other DDCs and with the Employer's Representative and for ensuring that the design incorporates such fixings as are required in order to avoid any necessity for contractors to drill, weld, burn or cut any part of a structure.

4.1.8 TELECOMMUNICATION

The Contractor shall allow for mounting plates or other agreed fixings for the line side telephones and associated cables at spacing to be determined by the system wide Contractor.

4.2 STRAY CURRENT CORROSION CONTROL

4.2.1 The Contractor shall incorporate into his design precautions as per EN 50122-2 or equivalent to minimize stray current corrosion caused by DC traction power returns through the rails. (For BSRP 25 KV AC Traction is adopted)

4.2.2 The continuous electrical path shall be provided by ensuring full and reliable electrical connection throughout the structure.

4.2.3 The electrically continuous path shall be provided through the steel reinforcement either by continuous welding of structural reinforcement or by the provision of additional welded mesh reinforcement. Where welded structural reinforcement is used to form a grid, welded cross-connections shall be at a minimum spacing of:

(a) For longitudinal bars, 600 mm measured in the transverse direction;

(b) For transverse bars, 6 m measured in the longitudinal direction.

4.2.4 The Contractor shall make provision for the monitoring of this continuous electrical path during construction and the Contractor will be required to demonstrate to the Engineer during construction that the electrical continuity between all metallic structures has been achieved.

4.2.5 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, 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.

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

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

4.2.8 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 K-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 4.3.2above

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 fulfill 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 structures shall be designed for a design life of 100 years.

5.5 BRIDGE BEARINGS AND MOVEMENTJOINTS

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 maintenancepainting 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 5to 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 blow: -

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 combinationis 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 BSRP 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)

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

a. Dead loads Super imposed Dead Load Live Loads Dynamic effects
b. Forces due to curvature or eccentricity of track
c. Temperature effects
d. Frictional resistance of expansion bearings Longitudinal forces
e. Long welded rail forces Racking forces
f. Forces on parapets Wind pressure effect
g. Forces and effect due to earthquake Erection forces and effects BuoyancyDifferential 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 EPC 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 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- 2001 and Latest RDSO guidelines for seismic design of bridges.

7.9 ERECTION FORCES AND EFFECTS (AS PER DBR)

The weight of all permanent and temporary materials together with all other forces and effect s 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.

7.11 DIFFERENTIAL SETTLEMENT: AS PER DBR

7.12 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 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 lengthsof 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. BSRP REQUIREMENTS

8.1 EMERGENCY EVACUATION

Provision for emergency evacuation shall be provided along the railway/BSRP 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 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 thecodal provision & DBR.

8.2.3 Parapets shall be provided for all transition structures to protect the guide way from intrusionby 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
iii. 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:

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 structures 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:

$L = 1.5\, h \tan(45^0 - Ø/2)$

Where h = Depth from bottom of slab to bottom of abutment (top of footing)
Ø = 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 $h \tan(45^0 - Ø/12)$ 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 inconformity 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 analyzed 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 effect a more favorable 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 COLUMN

Longitudinal sway at the top of viaduct columns due to live loads shall be restricted to amaximum of 5mm.

9.9 STRUCTURAL MEMBERS WITH BEARING

Consideration shall be given for the easy maintenance and replacement of viaduct bearings.

The minimum clearance between structural members separated by bearings shall be asfollows:

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

These are absolute minimum values and the requirement for easy maintenance andreplacement 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, 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 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 piers shall re-considered.

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

Schedule listing the performance requirements for each type of bearings for viaduct 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, 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 rotation under derailment loads shall be controlled to minimize damage to the viaduct 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 havea 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 andenable 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, utilitylines 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 DECK FURNITURE, DRAINAGE AND WATERPROOFING

Viaduct 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 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

9.16.1 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 avoidinterference with and attenuation of the signaling 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.

9.16.2 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.

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

9.16.4 Rail Structural Interaction analysis (RSI) and LWR forces: RSI analysis shall be carried out for the alignment of BSRP project so as to determine the effects of thermal interaction between the elevated viaduct (Box girder/U-Girder) and continuously welded rail (CWR/LWR). The analysis should incorporate the behavior of various elements of the structure i.e., rail fasteners, stiffness of rail, the deck, the substructure and foundations. As per DBR of K-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 K-RIDE. If required, a second opinion can be obtained from a reputed academic institution like IISc or IIT. But for guidance purpose, a load of 1.2t/m/track as used in other Metro, without dynamic augment can be used for premilitary design. The LWR forcesshown in bid documents are indicative. The Contractor needs to do detailed analysis.

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 K-RIDE are enclosed with tender. Further GT investigation details/reports as available with K-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 causedby dewatering and/or the placement of fill) is considered. The Engineer's decision is final.

10.4 In his design the Contractor shall take adequate measures to minimizethe amount of local differential settlement of road surfaces around underground works

10.5 Minimum No. of piles in a pile group is generally four.

10.6 The type of foundation shall depend on soil and site condition, and, where the K-RIDE alignment is close to the Railway line, the foundation design of the adjacent structure.

10.7 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, ROBs & 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.

TENDER DOCUMENTS

APPENDICES

EMPLOYER'S REQUIREMENTS

APPENDIX-1

DRAWING LIST

Following drawings are enclosed with tender for guidance and general information: -

General Arrangement Drawings (plan and profile)

Drawing List			
SL.No	**Description**	**Drawing No.**	**Pg.No**
1	System Map	KRIDE/BSRP/C4	901
2	Typical Cross Section, Level Sheet	KRIDE/BSRP/C4/TD/GAD/02	902-949
	Alignment Drawings		950 -961
3	L-Section	KRIDE/BSRP/C4/TD/LS/03	962-967
4	Temporary Barricading drawings.	KRIDE/BSRP/C4/TD/BD/04	968 - 969
5	Minor bridge (Slab,pipe) conceptual drawings (Plan, L section, Cross section)	KRIDE/BSRP/C4/TD/MNB/05	970 - 974
6	Drawing indicating the plan area for formation to be developed by contractor in station portion.	KRIDE/BSRP/C4/TD/CS/06	975 - 992
7	Typical road cross section	KRIDE/BSRP/C4/TD/R-CS/07	993 - 994
8	Viaduct cross sectios indicating Pile, Pile cap,Pier cap, Portal, segments, parapet etc, superstructure with single pier/portal arrangements.	KRIDE/BSRP/C4/TD/EV/T.1/08	995 - 1013
9	Typical crossection of Formation in banking and cutting	KRIDE/BSRP/C4/TD/CS-B/9	1014 - 1015
10	Ramp cross section	KRIDE/BSRP/C4/RW/10	1016
11	Retaining wall	KRIDE/BSRP/C4/TD/RW/11	1017 - 1018
12	Trolley Refuge in Banking and Cutting	KRIDE/BSRP/C4/TD/TR/12	1019 - 1020
13	RUB	KRIDE/BSRP/C4/TD/MRUB/13	1021 - 1025
14	Major Bridge	KRIDE/BSRP/C4/TD/MJB/14	1026 - 1029
15	Drain	KRIDE/BSRP/C4/TD/DN/15	1030 - 1032
16	Soil bore hole report	KRIDE/BSRP/C4	1033 - 1518
17	Utility	KRIDE/BSRP/C4	1519 - 1618

EMPLOYER'S REQUIREMENTS

APPENDIX-2A

WORK AREAS

WORK AREAS

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/ Govt. land is arranged adjacent to railway track for casting of Segmental Box Girders/U-Girders, necessary land rent /lease charges shall be levied as advised by Railway concerned/ Govt. authority norms /K-RIDE norms and the same will deducted from RA bills of the Contractor.

EMPLOYER'S REQUIREMENTS

APPENDIX-2B

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-2C

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-2D

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-3

PROJECT CALENDAR

(1) The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 00:01 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week.

(2) Requirements for the computation of Key Dates are given in Annexure-1 of Employer's Requirements.

(3) A 7-day week calendar shall be adopted for various (Work) programme schedules for scheduling purposes.

(4) For Project purposes, the presentation shall be in 'Week'" units.

EMPLOYER'S REQUIREMENTS
APPENDIX-4
PROGRAMME REQUIREMENTS

1. GENERAL

(1) Purpose of Programme

There are two primary purposes for the requirement of Programme (Scheduling)information described in this document:

a. Evaluation of Tender

b. Status Reports during Construction

To provide the Employer and the Engineer with status reports for managing, monitoring and coordinating the awarded contracts during their execution within the overall multi-contract project schedule.

The requirements are organized in two stages. The first stage is a requirement for all Tenderers and shall be submitted as part of Tender. The second stage is a requirement of the Employer and describes a series of reports to be submitted by the Contractor to the Engineer during the execution of the contract, following the award of Contract.

(2) The Tenderer/ Contractor shall programme his work at all times to meet the Key Dates stated in Annexure-1 to the Employer's Requirements and the specified interface periodsfor the installation of the Works with those of the Designated Contractors and shall during the progress of the Works constantly monitor his progress against the programmes described below.

(3) The Tenderer/ Contractor shall include in all programmes his work obligations towards shared access, shared Site areas and other coincident or adjacent Works Areas.

(4) The Works Programme, and all more detailed or revised versions, shall be submitted to the Engineer in hard copy as well as soft copy for his consent in accordance with the provisions of the GCC.

2. METHODOLOGY

(1) The computerized Critical Path Method (CPM) network using the Precedence Diagramming Method (PDM), has been selected by the Employer as the technique for contract management system and in co-coordinating the multi-contract project. This technique shall also be employed by the Tenderer in preparing their Tender submissions and by the Contractor in their Construction Stage submissions.

(2) Unless otherwise agreed by the Employer / Engineer, all programmes submitted by the Contractor shall be produced using computerized Critical Path Method (CPM) Networks developed implementing the Precedence Diagramming Method (PDM) with Cost Loaded Charts and Tables.

(3) The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, pre- construction, construction, and sub-contracts in executing the CPM scheduling by PDM. The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work remaining shall be accomplished; shall providea sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

3. PROGRAMME MANAGEMENTSOFTWARE

(1) CPM programming software used shall be Primavera Project Planning (P6) Program - Ver 2.0b or latest. Any other compatible system capable of direct file interchange capability with software program used by the Employer - Primavera (P6), Ver 2.0b can be used with Engineer's consent. Scheduling software and relevant instruction manuals, licensed for use in connection with the contract, shall be provided by the Contractor according to the Employer's specifications

(2) The Tenderer may use a system other than Primavera but will be required to demonstratethat full electronic data transfer to Primavera is available and that the various levels of reporting and coding capabilities are at least equivalent to Primavera. Compatibility and comparable performance between Primavera and the

Tenderer's proposed system shall be demonstrated in his Tender submission. Should compatibility not be demonstrated to the Employer's satisfaction the Contractor shall utilise Primavera for development, status updating and revision of all the Programmes during the duration of the Contract. Upon the Engineer's consent of a system other than Primavera, the Contractor shall supply the Engineer with an original licensed copy, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

4. (Not Used)

5. POST CONTRACT AWARD

5.1 The Contractor shall develop his Tender Programme into the Initial Works Programme including an outline Narrative Statement and submit within 15 days of the date of the Notice to Proceed and its more detailed version within sixty (60) days of receiving the Engineer's consent to theproposed Initial Works Programme.

5.2 The first Three Month Rolling Programme shall be submitted within thirty (30) days of the date of Notice to Proceed and all subsequent editions shall accompany the Monthly Progress Report. The Monthly Progress Reports shall also include a Programme Update as described below. These programmes shall subsequently be updated as described below.

5.3 Following the Contractor's Initial Works Programme submission but in any case, no later than six (6) months from the date of award of contract, the contractor shall make submissions of the detailed Works Programme suitably amended to take into account the programmes of Designated Contractors. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to review, revise and finalise his Initial Work Programme so as not to affect the progress of Works/ and or the works of the Designated Contractors. The resubmitted programme when approved by the Engineer shall form the Baseline Programme against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline programme but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.

5.4 For Initial & Detail Work Programme submission, one (1) original and six (6) copies each of the following Programmes and Reports shall be submitted to the Engineer:

a) Programme: Baseline CPM Network
b) Programme: Baseline Milestone based Cost Activity Schedule
c) Baseline Schedule Report
d) Narrative
e) Baseline physical progress's 'S' Curve
f) Baseline resource units.

5.4.1 The Engineer shall review and comment on the Contractor's programmes and information submitted under this Clause. The Engineer will confirm his consent or otherwise of the submissions within thirty (30) calendar days.

5.5 The Engineer shall require the Contractor to re-submit within thirty (30) calendar days if he is of the opinion that the programmes and information submitted by the Contractor is unlikely to meetthe Contract key dates.

5.6 If in the opinion of the Engineer, any of the Contractor's revised programmes or Baseline Schedule Report is not acceptable, it shall be construed as a failure of the Contractor to meet a Milestone.

5.7 Notwithstanding the above, the Engineer may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if statements. The initial computer-generated report after receiving the Engineer's consent will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.

5.8 Failure to include any element of work required for performance of the Contract shall not relieve

the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

6. WORKS PROGRAMME

(1) The Works Programme shall show the Contractor's plan for organising and carrying out whole of the Works.

(2) The Works Programme shall be a computerized Critical Path Method (CPM) network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly or monthly timescale.

(3) Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:

(a) Key Dates,
(b) All physical work shall be undertaken in the performance of the Contractobligations, including Temporary Works,
(c) The requested date for issue of any drawings or information by the Engineer,
(d) Incorporation of principal aspects of the Design Submission Programme,
(e) Procurement of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment,
(f) Any off-site work such as production or pre-fabrication of components,
(g) Installation of temporary construction facilities,
(h) Interface periods with Designated Contractors or utility undertakings,
(i) Design, supply and/or construction activities of sub-contractors,
(j) Any outside influence which will or may affect the Works.

(4) The Works Programme shall show achievement of all Key Dates.

(5) Activity descriptions shall be unique, describing discrete elements of work. Any activitycreating an imposed time or other constraint shall be fully defined by the Contractor.

(6) The Works Programme shall be organized in a logical work-breakdown structure includingwork stages and phases, and shall clearly indicate the critical path(s).

Each activity in the Works Programme shall be coded to indicate:

(a) Activity ID and Activity Code.

(b) The Engineer may request additional activity coding to the extent available without restraint to the Contractor's utilisation of the programme software. When requested, the Contractor shall add the required additional coding to the Programme. The Contractor shall use additional code fields as requested to comply with therequirements and for the use of the Contractor.

(7) Activity duration shall not exceed two (2) weeks, unless otherwise consented to by the Engineer, except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The Contractor shall submit a Programme/Project Calendar cross reference clearly indicating the allowance for holidays.

(8) The Works Programme, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic {3 ½" diskettes or Memory Stick) and hard copy format (time scale logic diagrams in A1 size, reports in A4 size).

(9) Activity Report shall list all activities, and events in the Works Programme, sorted by activity identification number.

The Activity Report shall include the following for each activity and event:

(a) Activity identification number and description,
(b) Duration expressed in Days,
(c) Early and Late start, & Early and Late finish dates. Planned start and finish dates,
(d) Calculated total float and free float,
(e) Predecessor and successor(s), accompanying relationships and lead/lagduration,

(f) Imposed time or date constraints,
(g) Calendar.

(10) NARRATIVE STATEMENT

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of key dates, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences and primary item of plant, Construction Equipment, Temporary Works and the like. It shall fully explain the reasons for the main logic links in the Programme and include particulars of how activity duration is established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

(11) BASELINE PHYSICAL PROGRESS 'S' CURVE

The Contractor shall also submit a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the CPM Network Logic Diagram, expressed in percentage terms. This 'S' curve shall be generated from the computerised CPM Network Logic Diagram.

(12) BASELINE RESOURCES CHARTS

The Contractor shall also submit a Resource Charts, generated from the Contractor's CPM Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project.

As an additional monitoring facility, indicator resources shall be assigned to relevant activities for the major items of work. Indicator resources shall be directly allocated for excavation (cum.), piling (no.), pile cap (no, pier & pier cap(no), viaduct (RM), parapet wall (RM) concrete (cum) for station etc. Resource indicators may be input as a daily rate, expected required rate, or as an activity total in the relevant units. These are purely indicative quantities and do not form part of contract

(13) All submissions of proposed Works Programmes subsequently, after approval of the Initial Works Programme, shall include the actual physical progress of work and forecast of the remaining work. Actual progress shall be stated in percent complete, remaining duration, and actual start and finish dates for each activity in the Works Programme.

7. INITIAL WORKS PROGRAMME

(1) The Initial Works Programme submitted as under Clause 5.1 need not include the full details given under Clause 6 above. It should be a condensed version with combined activities of longer. The outline Narrative Statement shall be in sufficient detail to clearly show the Contractor's intention.

(2) Within thirty (30) days of the Engineer's consent to the Initial Works Programme, the Contractor shall submit to the Engineer an expanded and more detailed version of the Initial Works Programme containing all of the information and detail required under Clause 5 above.

(3) Such submission shall make use of the Tender Programme submitted earlier but refined to include the best estimates of dates for the work of Designated Contracts which has impact on the Contractor's programme. Such programmes shall be amended subsequently to incorporate the actual dates/ schedule of the affecting contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to finalise the Initial Programme, without affecting progress of the work.

8. WORKS PROGRAMME REVISIONS

(1) The Contractor shall immediately notify the Engineer in writing of the need for any changes in the Works Programme, whether due to a change of intention or of circumstances or for any other reason. Where such proposed change affects timely completion of the Works or any other Key Date the Contractor shall within fourteen (14) days of the date of notifying the Engineer submit for the Engineer's consent its proposed revised Works Programme and accompanying Narrative Statement. The proposed revised Works Programme shall show the sequence of operations of any and all works related to the change

and the impact of changed work or changed conditions.

(2) If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Programme which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the Contractor within fourteen (14) days after the Engineer's instruction. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions.

(3) All activities that have negative float must be analysed by the Contractor to identify the impact on the timely completion of the Works or on the achievement of Key Dates.

9. THREE MONTH ROLLING PROGRAMME.

(1) The three-month rolling programme shall be an expansion of the current works programme covering sequential periods of three months. The Three-Month Rolling Programme shall provide more detail of the Contractor's plan, organisation and execution of the work within these periods. In particular, the Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary to a daily level of detail.

(2) The Three-Month Rolling Programme shall be developed as a Critical Path Method (CPM) network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A4 and time-scaled networks diagrams on an A1 size reproducible media. Tasks in the programme shall be derivatives of and directly related totasks in the approved Works Programme.

(3) The Contractor shall describe the discrete work elements and work element inter- relationships necessary to complete all works and any separable parts thereof including work assigned to subcontractors.

(4) Activity duration shall not exceed two (2) weeks unless otherwise consented to by the Engineer.

(5) Each activity in the Three-Month Rolling Programme shall be coded, or described so as clearly to indicate the corresponding activity in the Works Programme

10. THREE MONTH ROLLING PROGRAMME REVISIONS ANDUPDATE

(1) The Three-Month Rolling Programme shall be extended forward each month as described under Clause 5(1) above. Each submission of the Three-Month Rolling Programme shall beaccompanied by a Programme Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month period.

(2) If the Three-Month Rolling Programme is at variance with the Works Programme, the Programme Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities shall be undertaken over the three-month period, including programme assumptions and methods to be employed in achieving timely completion.

(3) The Contractor shall revise the Three-Month Rolling Programme or propose revisions of the Works Programme, or both, from time to time as may be appropriate to ensure consistency between them.

11. THREE WEEK ROLLING BAR CHART SCHEDULE

Once a week, on a day mutually agreed to by the Engineer and the Contractor, a meeting will be held to assess progress by the Contractor during the previous work week. The Contractor shall submit a construction schedule listing activities completed and in-progress from the previous week and the activities scheduled for the succeeding two weeks based on the detailed Works Programme. Copies of the schedule shall be submitted on A3 sized paper.

12. PROJECT CALENDAR

For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 5 days week -Monday through Friday, except for National (Govt, of India) Holidays. For Project purposes, a week begins at 0001 hours on a Monday and ends at 2359 hours on a Sunday. The completion of an activity or the achievement of an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered

week. An access date or activity start date when given as a week number shall be taken to mean 0001 hours on a Monday of the Numbered week.

13. PROGRAMMING PERSONNEL

The Contractor shall submit, as part of its Staff Organisation Plan, the names and required information for the staff to be employed on Works Programming. The principal Works Programmer shall hold reputable professional qualifications acceptable to the engineer including at least five (5) years relevant experience in programming civil engineering works. Others in the groups shall have at least three (3) years' experience in such works. The programmer shall be employed by the contractor full time on the contract until the completion or such earlier time the Engineer may give his consent.

14. PROGRAMME AND REPORT SUBMISSION FORMAT

The Contractor shall submit one (1) original and six (6) copies and one (1) reproducible (for Programmes) of all submissions to the Engineer. All submissions shall be in AO, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Engineer. In addition, the computerised programme and report shall be submitted in 3-1/2 inches diskettes (similarly for submissions required under Clause 5.4)

The format for all Programme and Report submissions shall be strictly in accordance with the format as stated herein or as requested by the Engineer.

15. FAILURE TO SUBMIT PROGRAMME

Failure of the Contractor to submit any programme, or any required revisions thereto within the time limits stated for acceptance by the Engineer, shall be sufficient reason for not making the relevant stage on account payment by the Engineer

The Contractor should actively participate in implementing PMIS & BIM system by K-RIDE.

EMPLOYERS REQUIREMENTS

APPENDIX-5

MONTHLY PROGRESS REPORT

GENERAL

The Contractor shall submit to the Engineer, a Monthly Progress Report. This Report shall be submitted by the end of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty-fifth (25th) day of the month of the submission. It shall be submitted in a format to which the Engineer shall have given his consent and shall contain sections /sub-sections.

1. FINANCIALSTATUS

(1) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.

(2) A spread sheet summarizing each activity, the budget, costs incurred during the period, costs to date, costs to go, cost forecast (total of costs to date and costs to go) and cost variance (difference between cost forecast and budget).

(3) A spread sheet indicating the status of all payments due and made.

(4) A report on of the status of any outstanding claims. The report shall in particular provide interim updated accounts of continuing claims.

2. PHYSICAL PROGRESS

(1) It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.

(2) It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.

3. PROGRAMME UPDATE (For Entire Project)

Programme updating shall include:

(a) the monthly Programme Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the Contractor's submittal:

(i) Early Work and Baseline Submittals - explains determination of activity duration and describes the Contractor's approach for meeting required Key Dates as specified in the Contract.

(ii) Updated Detail Programme Submittals - state in narrative the Works actually completed and reflected along critical path in terms of days ahead or behind allowable date. The requirements of the narrative are

i. If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.

ii. Identify by activity number and description, activities in progress and activities scheduled to be completed.

iii. Discuss Variation Order Work Items, if any.

(b) The Programme Status which shall:

(i) Show Works Programme status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.

(ii) Be presented as a bar-chart size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings;

(iii) The Activity Variance Analysis- which shall analyse activities planned to start prior to 01 during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works

EMPLOYER'S REQUIREMENTS

APPENDIX-6

QUALITY ASSURANCE

1. GENERAL

The Contractor shall implement a Project Quality Management Plan in accordance with ISO- 9001 "Quality System - Model for Quality Assurance in Design/Development, Production, Installation and Servicing" to ensure that all materials, workmanship, plant and equipment supplied and work done under the contract meets the requirements of the contract. This plan shall apply to all activities related to the quality of items, including designing, purchasing, inspecting, handling, assembling, testing, storing, and shipping of materials and equipment and different elements of construction work and installations of system components.

The Quality Plan shall be prepared by the Contractor and submitted to the Engineer shall follow the requirements of ISO 9000 and address each element therein.

Registration of the Contractor's organisation, or subcontractors or sub-consultants is not required for this Project but the Project Quality Management Plan as submitted shall meet the intent of the ISO 9000 requirement in that there is a comprehensive and documented approach to achieving the project quality requirements.

2. QUALITY ASSURANCE MANAGEMENT PLAN

The Project Quality Management Plan (PQMP) shall as a minimum address the quality system elements as required by ISO 9001, generally noting the applicability to the Contractor's Works Programme for the Project. Procedures or Quality Plans to be prepared by others (Suppliers, Subcontractors, and Sub-consultants) and their incorporation in the overall PQMP shall be identified.

The Contractor shall provide and maintain a Quality Assurance Plan (QA) to regulate methods, procedures, and processes to ensure compliance with the Contract requirements. The QA Plan, including QA written procedures, shall be submitted to the Engineer for his review.

Adequate records shall be maintained in a readily retrievable manner to provide documented evidence of quality monitoring and accountability. These records shall be available to Employer at all times during the term of the Contract and during the Defects Liability Period and for a five yearperiod thereafter.

The Plan shall identify:

i. Design Process: that control, check and verify the accuracy, completeness and integration of the design shall be performed by certified personnel and in accordance with documented procedure that have the written consent of the Engineer.

ii. Special Processes: that control or verify quality shall be performed by certified personnel and in accordance with documented procedures that have the written consent of the Engineer;

iii. Inspection and Test: Inspection and testing instructions shall provide for reporting non-conformances or questionable conditions to the Engineer; Inspection shall occur at appropriate points in the installation sequences to ensure compliance with drawings, test specifications, process specifications, and quality standards. The Engineer shall designate, if necessary, inspection hold points into installation or inspection planning procedures;

iv. Receiving Inspection: These procedures shall be used to preclude the use of nonconforming materials and to ensure that only correct and accepted items are used and installed;

v. Identification and Inspection Status: a system for identifying the progressive inspection status equipment, materials, components, subassemblies, and assemblies as to their acceptance, rejection, non-inspection shall be maintained;

vi. Identification and Control of Items: an item identification and traceability control shall beprovided;

vii. Handling, Storage, and Delivery: provide for adequate work, surveillance and inspection instructions.

The Plan shall ensure that conditions adverse to quality such as failures, malfunctions,

deficiencies deviations, and defects in materials and equipment shall be promptly identified andcorrected.

The Plan shall provide for establishing, and maintaining an effective and positive system for controlling non-conforming material including procedures for the identification, segregation, and disposal of all non-conforming material. Dispositions for the use or repair of non-conforming materials shall require the Engineer's consent.

3. PLAN IMPLEMENTATION AND VERIFICATION

The Plan shall clearly define the QA Organisation. Management responsibility for the QA shall be set forth on the Contractor's policy and organisation chart. The Plan shall define the requirementsfor QA/ personnel, their skills and training. Records of personnel certifications shall be maintained and monitored by the QA personnel. These records shall be made available to the Engineer for review, upon request.

The QA operations shall be subject to the Engineer's or Employer's authorised representative's verification at any time, including: surveillance of the operations to determine that practices, methods and procedures of the plan are being properly applied; inspection to measure quality of items to be offered for acceptance; and audits to ensure compliance with the Contract documents.

The contractor's Quality Audit Schedule shall be submitted to the Employer and the Engineer for consent of the Employer every three months or more frequently as required and as advised by the Employer.

The results of Quality Audits shall be summarised in the Contractor's monthly reports.

The Contractor shall provide all necessary access, assistance and facilities to enable the Employer / Engineer to carry out on-site and off-site surveillance of Quality Assurance Audits to verify that the quality system which has the consent of the Employer / Engineer is being implemented fully and properly.

EMPLOYER'S REQUIREMENTS

APPENDIX-7

DRAFTING AND CAD STANDARDS

1. INTRODUCTION

(1) The purpose of this document is to define the minimum Drafting and CAD standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the Works.

(2) By defining a common format for the presentations of drawings and CAD files, the exchange of drawn information is improved and will maximize the use of CAD in the co-ordination process.

(3) All submissions shall be made to the Employer's Requirement in a format reviewed without objection by the Employer's Requirement and in accordance with the requirements in and as approved by the Employer:

(a) the Contract;

(b) the Document Submittal Instructions to Consultants and Contractors.

(4) Paper and drawing sizes shall be "A" series sheets as specified in BS3429.

(5) The following software latest and update version compatible for use with Mac / Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissionsrequired:

Document Type	Electronic Document Format
Text Documents	MS Word,
Spread Sheets	MS Excel,
Data Base Files	MS Access,
Presentation Files	MS PowerPoint or Keynote (Mac) or any other approved by the Employer,
Programmes Ver2.0a	Primavera for Windows or any other approved PIMS, Sure trackAutoCAD Graphics CorelDraw / AutoCAD
Photographic	Adobe Photoshop,
Desktop Publishing	Page Maker
CADD Drawings	AutoCAD

(6) Media for Electronic File Submission

One copy shall be submitted unless otherwise stated in Memory Device.

(7) Internet File Formats/Standards

(a) The following guidelines shall be followed when the Contractor uses the Internet browser asthe communication media to share information with the Employer.

(b) All the data formats or standards must be supported by Microsoft Internet Explorer version 3 or above running on Windows NT and Windows 10 or the latest.

(c) The following lists the file types and the corresponding data formats to be used on Internet.

The Contractor shall comply with them unless prior consent is obtained from the Employer'sRequirement for a different Data format:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF or JPEG
Computer Aid Design files(CAD)	Computer Graphics Metafile (CGM)
Video	Window video (.avi)

Sound	Wave file (.wav)

(8) The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different standard:

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Markup Language (HTML)

The hard copy of all documents shall be the contractual copy.

2. GENERAL REQUIREMENTS

1.GENERAL

(1) The Contractor shall adopt a title block similar to that used in the Drawings for all drawings prepared under the Contract. It shall be approved by the Employer.

(2) Each drawing shall be uniquely referenced by a drawing number and shall define both thecurrent status and revision of the drawing.

(3) The current status of each drawing shall be clearly defined by the use of a single letter code as follows:

P - Preliminary Design Drawing
D - Definitive Design Drawing
C - Construction Reference Drawing
W - Working Drawing
B - As-Built Drawing
M - As Manufactured Drawing
E - Employer's Drawing

2. TYPES OF DRAWING

1) 'Design drawings' mean all drawings except shop drawings and as-built drawings.

2) Working drawings are design drawing of sufficient detail to fully describe the works and adequate to use for construction or installation.

3) Site drawings and sketches are drawings, often in sketch form, prepared on site to describe modifications of the Working drawings where site conditions warrant changes that do not invalidate the design.

4) 'Shop drawings' are special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.

5) 'As-built drawings' show the Works exactly as constructed or installed. They are usually prepared by amending the working drawings to take into account changes necessitated by site conditions and described in Site drawings. These drawings shall be completed on a regular basisas the works progress, and shall not be left until completion of the entire works.

3. COMPUTER AIDED DESIGN & DRAFTING (CAD)STANDARDS

3.1 INTRODUCTION

SCOPE OF USE

Data input procedures between the Employer / Engineer and contractors must be coordinated, and the key parameters used to form CAD data files must be standardised. The production of all CAD data filesshall comply with the following requirements.

3.2 OBJECTIVES

The main objectives of the CAD standards are as follows:

(a) To ensure that the CAD data files produced for Project are co-ordinated and referencedin a consistent manner.

(b) To provide the information and procedures necessary for a CAD user from one discipline or external organisation to access (and use as background reference), information from a CAD data file prepared by another discipline or external organisation.

(c) To standardise the information contained within CAD data files which may be commonto more than one discipline such as drawing borders, title boxes, grid lines etc.

(d) To establish procedures necessary for the management of CAD datafiles.

(e) To ensure all contractors use 'Model space' and 'Paper space' in the production of theirCAD files.

3.3 GENERAL

(1) To facilitate co-ordination between contractors, it is a requirement that all drawings issued by contractors for co-ordination or record purposes shall be produced using CAD methods. Drawings shall be issued in digital format in addition to the paper copies.

(2) The intent of the issue of digital information is to aid the related design by others. The definitive version of all drawings shall always be the paper or polyester film copies which have been issued by the contractor or organisation originating the drawing.

(3) Drawings and drawing packages issued for co-ordination, record purposes or for acceptance shall be accompanied by a complete set of the corresponding CAD datafiles.

(4) Any contractor or organization making use of the CAD data from others shall be responsible for satisfying him that such data is producing an accurate representation of the information on the corresponding paper drawing which is satisfactory for the purpose for which he is using it. Provided the general principles of this section have been achieved by the originator of the CAD data, contractors making use of the CAD data from others shall not be entitled to require alterations in the manner in which such CAD data is being presented to them.

(5) In particular, automatic determination of physical dimensions from the data file shall always be verified against the figured dimensions on the paper or polyester drawings. Figured dimensions shall always be taken as correct where discrepancies occur.

3.4 TERMINOLOGY & ASSOCIATED STANDARDS/GUIDELINES

Any terminology used within this section that is ambiguous to the user shall be clarified with the Employer's Requirement. British Standard BS1192 is used in principle as a guide for drawing practice, convention, CAD data structure and translation.

3.5 PAPER DRAWINGS

(1) For the Project "Paper" drawings are considered to be the main vehicle for the receipt and transmittal of design and production information, typically plans, elevations and sections.

(2) The Project wide accepted media for the receipt and transmittal of "Paper" drawings will be paper and polyester film of various standard ISO 'A' sizes. The composition of this information shall be derived from a CAD "Model".

(3) The CAD derived "Paper" drawing composition will reflect a window of information contained within a CAD "Model Space' file together with a selection of information contained within the associated CAD "Paper Space" file.

3.6 CAD DATA CREATION, CONTENT & PRESENTATION

A consistent method of CAD data creation, together with content and presentation is essential.The method of CAD "Model Space and Paper Space" creation is as follows:

(1) Model Space Files

(a) Typically, CAD "Model Space" files are required for general arrangement and location plans and will consist of a series of other "Model Space" referenced CAD files covering the total design extents at a defined building level (the number of referenced files should be kept to an absolute minimum). Data contained within a CAD "Model Space" file is drawn at full size (1:1) and located at the correct global position and orientationon the Project Grid / or defined reference points.

(b) Each CAD "Model Space" file will relate to an individual discipline. Drawing border / text, match / section lines or detailed notation shall NOT be included within a CAD "Model Space" file. Dimensions shall be included within a CAD "Model Space" but located on a dedicated layer. Elevations, Long Sections and Cross Sections shall also be presented in CAD "Model Space" as defined above, but do not need to be positioned and orientated on the Project Grid.

(2) Paper Space CAD Files

(a) Paper Space" CAD files are utilized to aid the process of plotting "Paper" drawings and are primarily a window of the CAD "Model Space" file. A "Paper Space" CAD file will typically contain drawing borders, text, match or section lines & detailed notation. Once these files are initially set up and positioned the majority of "Paper Drawing" plots at various approved scales re efficiently and consistently generated by displaying different combinations of element verse and symbology contained within the "Paper Space" file and the referenced "Model pace" files.

(b) The purpose is to ensure that total co-ordination is achieved between the CAD "Model Space" file and the "Paper Drawing" output during the revision cycle of the design and production process. Duplicated data in "Model and paper Space" files will not be acceptable unless an automatic update link exists between the two data sets. "Paper Space" files are not typically required as part of the CAD Media Receipt from contractors, unless specifically requested.

3.7 CAD QUALITY CONTROL CHECKS

(1) Random CAD Quality Control Audits will be carried out by Engineer on all CAD media received and transmitted.

(2) These checks DO NOT verify the technical content of the CAD data received or transmitted (as this is the responsibility of the originating organization), however compliance with Project CAD and Droughting Standards shall be checked.

(3) In addition, all contractors who transmit and receive CAD data from the Project shall haveCAD quality control procedures in place. A typical quality control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

3.8 CAD DATA TRANSFER MEDIA AND FORMAT

When CAD data is received & transmittal between Engineer and the Contractor, the media shallbe as follows:

(a) Data Exchange Format - AutoCAD Release 14 (.DWG) or latest version

(b) Operating System -windows Latest version

(c) Data Transfer Media: Memory Stick/ RW of adequate capacity

(d) All CDs must be labeled on the data shield with:

(i) Name of Company
(ii) Project Title
(iii) Drawing Filenames (for diskettes only)
(iv) CD no.

(e) All media shall be submitted with a completed Form

(f) The Contractor must ensure the supplied media is free from virus. SUB-directories on tapes or disks are not permitted. If CAD Data is created using UNIX, archive commands must be unrooted.

3.9 CAD MEDIA RECEIPT & TRANSMITTAL

(1) CAD Media Transmittal (from the Contractor to Engineer) - this will consist of the following:

(a) CAD Digital Media
(b) CAD data sheet
(c) CAD issue / revision sheet
(d) CAD Quality Checklist confirming compliance.
(e) Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).

(2) The above CAD media will be collectively known as "CAD Media Transmittal Set". The CADdata file transmittal format required by Employer 's Representative from all contractors shall be in AutoCAD (Latest version)

(3) All CAD media received from contractors will be retained by Engineer except for SCSIdisk (if used) as an audit trail / archive of a specific contractor's design evolution.

(4) CAD Media Receipt (from Engineer to the Contractor)

(a) CAD media should normally be obtained from the respective interfacingcontractor(s), but should Engineer issue CAD media it will consist of the following:

(i) CAD Digital Media typically contain only CAD "Model Space" files.
(ii) CAD data sheet.
(iii) CAD issue / revision sheet

(b) The above CAD media will be collectively known as the "CAD Media Receipt Set". The CAD data file transmittal format used by Engineer to all contractors will be in AutoCAD (version 14)

(c) Each CAD transmittal CD will be labeled with proper disk label as approved by the Engineer/ Any CAD data transmitted without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.

3.10 REVISIONS

(1) All 'Revisions', 'In Abeyance' and 'Deletions' shall be located on a common layer. This layer can be turned on or off for plotting purposes.

(2) The following example text indicates the current CAD file revision, i.e., 'Revision [A]'. This shall be allocated to a defined layer on all CAD "Model Space" files, in text of a size that will be readable when the CAD "Model Space" file is fitted to the screen, with all levels on.

3.11 BLOCK LIBRARIES, BLOCKS, & BLOCK NAMES

(1) All Construction Industry symbols produced as CAD Cells shall typically conform to BritishStandard BS1192 - part 3.

(2) All Blocks created shall be Primitive (i.e., NOT Complex) and shall be placed Absolute (i.e. NOT Relative).

(3) The Contractor's specific block libraries shall be transmitted to Engineer together with an associated block library list containing the filename (max. 6 characters) and block description. The Contractor shall ensure that the library is regularly updated and circulated to all other users, together with the associated library listing.

(4) All Blocks of a common type, symbols or details should initially be created within a CAD "Model Space File" specifically utilized for that purpose. These files will be made available on request by Employer's Representative.

(5) Blocks created will typically be 2D unless 3D is specifically requested. In both instances they shall have an origin at a logical point located within the extents of each Block's masked area or volume.

3.12 CAD DIMENSIONING

Automatic CAD Dimensioning will be used at all times. Any dimensional change must involve the necessary revision to the model space file. If the CAD Quality Control Checks find that the revisions have not been correctly carried out, the rejection of the entire CAD submission will result.

3.13 CAD LAYERING

All CAD elements shall be placed on the layers allocated for each different discipline. The layer naming convention to be adopted by the Contractor shall be submitted for acceptance and inclusion within these standards.

3.14 GLOBAL ORIGIN, LOCATION & ORIENTATION ON THE ALIGNMENT DRAWING.

(1) Location or Plan information in "Model Space" files shall coincide with the correct location and orientation on the Project grid for each specific contract.

(2) Location plans shall have at least three setting out points shown on each CAD "Model Space" file. Each setting out point shall be indicated by a simple cross-hair together with related Eastings and Northings co-ordinates. The Contractor(s) shall establish the 3 D co-ordinates for their respective works, which will then be used by all other contractors including the Contractor.

3.15 LINE THICKNESS AND COLOUR

To assist plotting by other users, the following colour codes will be assigned to the following linethickness / pen sizes.

Colour	Code No	Line Thickness
Red	10	0.18
White	7	0.25
Yellow	2	0.35
Brown	34	0.5
Blue	130	0.7
Orange	30	1.0
Green	3	1.4
Grey	253	2.0

3.16 CAD UTILIZATION OF 2D & 3DFILES

Although the project standard is 2D CAD files, certain disciplines and contractors may use 3D CAD files for specific applications or where the isolated use of 3D aids the design and visualization process (i.e., Architecture, Survey and Utilities). In these specific instances 3D CAD data will only be transmitted if all other users can use this data. If this is not the case, 3D to 2D translation shall be processed by the creator prior to issue.

3.17 CAD FILE NUMBERING

(1) Contractors CAD File Numbering shall be described in 2.2above.

(2) Employer CAD File numbering unlike most of the contractors, Employer will not be required to produce numerous CAD files. This will follow the numbering system Except that the status of the drawing in 2.1(3) shall be "E".

3.18 CAD FILE NAMING CONVENTION - GENERAL

CAD "Model Space" files shall be named in accordance with general drawing conventions.Note: The CAD standards shall be compatible with BIM platform of K-RIDE.

3.19 ERP, OSO AND 3D BIM PLATFORM

The Contractor shall utilise a PMIS integrating with BIM software such that all documents generated by the Contractor can be transmitted to the Employer and the Engineer by electronic means (and vice versa) and

that all documents generated by either party are electronically captured at the point of origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer office at site and the Employer's Office by the Contractor.

EMPLOYER'S REQUIREMENTS

APPENDIX-8

WORKS AREAS & TEMPORARY POWERSUPPLY

1. INTRODUCTION

(1) The Contractor shall provide within the designated principal Works Areas, at locations agreed with the Employer / Engineer, the compounds and facilities for the Employer and the Engineer and other contractors of the Employer defined under Clause 2 of this Appendix.

(2) The standard conditions applying to the use of any Works Area by the Contractor for itssite facilities are given under Clause 2 of this Appendix.

(3) The Conditions for supply of electricity by the Contractor to Designated Contractors aregiven under Clause 3 of this Appendix.

2. STANDARD ENGINEERING CONDITIOMS

The following standard engineering conditions apply to all Works Areas:

(1) Formation

(a) The Works Areas shall be formed to the levels that the Employer / Engineer has given his consent. No levels shall be amended without prior consent of the Employer / Engineer.

(b) The Works Areas shall be surfaced in a manner agreed with the Employer / Engineer, compatible with their intended use, and, in particular, footpaths and roadways connecting facilities shall be clearly defined. Measures shall be taken to the satisfaction of the Employer / Engineer to ensure all areas are properly drained and kept free of static water.

(c) The removal, diversion or reinstatement elsewhere as may be required of any existing works or installation whatsoever within the Works Areas shall be carried out to the satisfaction of the Employer.

(2) Roads & Parking

(a) Space shall be provided within the Works Areas for parking, loading/unloading andmaneuvering of motor vehicles.

(b) Any damage done to the adjoining public roads and fixtures and properties (public orprivate) shall be made good to the satisfaction of the Employer.

(3) Drainage & Sewerage

(a) All storm or rainwater from the Work Areas including any access roads thereto shall beconveyed to the nearest stream course, catch-pit, channel or storm water drain as required by the Engineer. All temporary and permanent works shall be carried out in such a manner that no damage or nuisance are caused by storm water or rain water to the adjacent property.

(b) No drain or watercourse shall be used without consent of the Employer.

(c) Damages or obstructions caused to any watercourse, drain, water-main or other installation within or adjoining the Works areas shall be made good to the satisfactionof the Employer.

(d) Treatment and disposal of sewage and waste water from the works areas shall be provided to the satisfaction of the Employer.

(4) Buildings

(a) No permanent structures other than those required for the Permanent Works shall beTemporary permitted on the Works Areas.

(b) Electricity, water, telephone and sewerage shall be provided by the Contractor, asrequired, for all temporary buildings.

(c) No potable water obtained from the Govt. sources shall be used for heating, cooling and humidification purposes, or vehicle washing without the written consent of theEngineer.

(5) Pedestrian Access

Every existing pedestrian access throughout the Works Areas shall be maintained in a usable condition at all times to the satisfaction of the Engineer including lighting, signing and guarding.

(6) Fencing

The Works Areas shall be secured against unauthorised access at all times. In particular fencing or the like shall be maintained, removed and re-erected in the new location wherever and whenever a Works Area is relinquished in stages.

3. APPLICABILITY

(1) Where the Contractor is required to provide temporary electrical supplies, or to use, extendor expand on temporary supplies installed by others, all such activity shall be executed in accordance with Paragraphs of this Appendix.

(2) When the Contractor makes use of temporary electrical supplies provided by others he will observe and comply with the requirements of this Appendix.

4. WORK ON SITE

(1) The contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Employer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring all the necessary equipment on site. The contractor shall not install or operate any temporary site electrical systems until his representative is appointed and has commenced duties.

(2) The name and contact telephone number of the representative having been reviewed without objection by the Employer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.

(3) Schematic diagrams and the details of the equipment for all temporary electrical installations shall be submitted by the Contractor, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for his consent.

(4) All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorized electricians, who are registered as such under the Electricity Ordinance 1990/Electricity (Registration) Regulations1990.

5. ELECTRICAL GENERAL

Temporary electrical Site installations and distribution systems shall be in accordance with: -

(1) Indian Electricity Rules
(2) The Power Companies' Supply Rules;
(3) Electricity and its subsidiary Regulations;
(4) IEE Wiring Regulations (16th Edition);
(5) BS 7375 Distribution of Electricity on Construction and Building Sites;
(6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and BuildingSites; and
(7) BS 6164 Safety in Tunneling in the Construction Industry.
(8) Any other applicable national standards

6. MATERIALS, APPLIANCES AND COMPONENTS

All materials, appliances and components used within the distribution system shall comply withBS 4363 and BS 7375 Appendix A.

7. DESIGN CONSIDERATIONS

(1) Distribution equipment utilized within the temporary electrical distribution system shallincorporate the following features:-

(a) Flexibility in application for repeated use;
(b) Suitability for transport and storage;

(c) Robust construction to resist moisture and damage; and
(d) Safety in use.

(2) All cabling shall be run at high level whenever possible and firmly secured to ensure theydo not present a hazard or obstruction to people and equipment.

(3) The installation on Site shall allow convenient access to authorized and competent operators to work on the apparatus contained within.

8. MAINS VOLTAGE

(1) The site mains voltage shall be as per the electricity authority, 415V/3 phase 4 wiresystem.

(a) single phase voltage shall be as per the electricity authority, 230V supply.

(b) Reduced voltages shall conform to BS 7375.

(2) Types of Distribution Supply

The following voltages shall be adhered to for typical applications throughout thedistribution systems:

(a) fixed plant - 415V/ 3 phase;
(b) movable plant fed by trailing cable - 415V /3phase;
(c) installations in Site buildings - 230V /1phase;
(d) fixed flood lighting - 230V/1phase;
(e) portable and hand held tools -115V /1phase;
(f) Site lighting (other than flood lighting) -115V /1 phase; and
(g) Portable hand-lamps (general use) -115V /1phase.

(3) When the low voltage supply is energized via the Employer's transformer, any power utilized from that source shall be- cither 415 V. 3 phase or 230 V. 1 phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.

(4) Protection of Circuits

(a) Protection shall be provided for all main and sub-circuits against excess current, underand over voltage, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.

(b) Discrimination between circuit breakers, circuit breakers and fuses shall be inaccordance with: -

(i) BS 88;
(ii) BS EN 60898; and
(iii) BS 7375;
(iv) Any other appropriate Indian Standards.

9. EARTHING

(1) Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.

(2) Earthing systems shall conform to the following standards: -

(a) IEE Wiring Regulations (16th Edition);
(b) BS 7430;
(c) BS 7375; and
(d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

10. PLUGS, SOCKET OUTLETS AND COUPLERS

Low voltage plugs, sockets and couplers shall be color coded in accordance with BS 7375, and constructed to confirm BS EN 63809 high voltage couplers and 'T' connections shall be in accordance with BS 3905.

11. CABLES

(1) Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.

(2) For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following specificationsappropriate to the duties imposed on it:

(a) BS 6708 flexible cables for use at mines and quarries;
(b) BS 6007 rubber insulated cables for electric power and lighting; and
(c) BS 6500 insulated flexible cords and cables.

(3) Where low voltage cables are to be used, reference shall be made to BS 7375. Thefollowing specifications shall also be referred to particularly for under ground cables:-

(a) BS 6346 for armored PVC insulated cables; and
(b) BS 6708 Flexible cables for use at mines and quarries.

(4) All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.

(5) Armoured cables having an over sheath of polyvinyl chloride (PVC) or an oil resisting and flame retardant compound shall be used whenever there is a risk of mechanical damage occurring.

(6) For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.

(7) Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be of a type insulated and sheathed with a general purpose or heat resisting elastomer.

(8) All cables which are likely to be frequently moved in normal use shall be flexible cables. Flexible cables shall be in accordance with BS 6500 and BS 7375.

12. LIGHTING INSTALLATION

(1) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be accordance with BS 7375 and BS4363.

(2) Voltage shall not exceed 55 V to earth except when the supply is to a fixed point andwhere the lighting fixture is fixed in position.

(3) Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degreeof protection to IP 65 shall be employed.

(4) The Contractor shall upgrade the lighting level to a minimum of 200 lux by localized lighting in all areas where required by the Engineer.

(5) Mechanical protection of luminaries against damage by impact shall be provided by useof wire guards or other such devices whenever risk of damage occurs.

13. ELECTRICAL MOTORS

(1) Totally enclosed fan cooled motors to BS 4999: Part 105 shall be used.

(2) Motor control and protection circuits shall be as stipulated in BS 6164. The emergencystops for machinery shall be provided

14. INSPECTION AND TESTING.

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the I EE Wiring Regulations (16th Edition).

15. IDENTIFICATION

Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

16. MAINTENANCE:

(1) Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.

(2) All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.

17. METERING

The Contractor shall install a separately metered and invoiced supply or supplies of electricity for: -

(a) Site fabrication facilities;
(b) Site workshops and work yards; and
(c) Site offices and stores.

EMPLOYER'S REQUIREMENTS

APPENDIX-9

RAILWAY ENVELOPE: DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-10

APPROVED MANUFACTURERS /SUPPLIERS

Refer Annexure to Technical Specification

EMPLOYER'S REQUIREMENTS

APPENDIX-11

CURVE AND GRADIENT DETAILS

BSRP CORRIDOR

HORIZONTAL AND VERTICAL ALIGNMENT

All tentative details with regard to the Horizontal and Vertical Alignment are shown on the plan & profile sheets of the drawings provided in tender document. It is indictive for guidance purpose only for the contractor to develop further design process of optimization to achieve improved operational efficiency duly complying with various technical requirements and codes, Railway/ BSRP practices, Railway/BSRP guidelines and standards.

EMPLOYER'S REQUIREMENTS

APPENDIX-12

UTILITIES

UTILITIES

DEFINITIONS

1. UTILITIES:

Utilities are defined as public utilities above or below ground and include all live water mains, sewer mains, water wells, power cables, streetlights, transformers, pillar boxes, telephone posts, telecommunication cables, gravity sewers, storm water drains, gas lines which are either shown on the Employer's Drawings (chartered) or identified on site by the Contractor (uncharted).

1.1 Charted Utilities:
Charted Utilities are the utilities (as defined above) which are shown on the Employer's Tender Drawings.

1.2 Uncharted Utilities:
Uncharted Utilities are the utilities (as defined above) which are not shown on the Employer's Tender Drawings.

1.3 Responsibility of the Contractor.

1.3.1 The Contractor shall make his own enquiries and investigations, including excavating trial holes/pits, to ascertain the existence, nature, location, and size of utilities. A schedule of utility diversions and utilities to remain but to be supported / protected (the utility diversion plan) shall be prepared by the Contractor and submitted.

The schedule will list out utilities that:

i. will be diverted by the Contractor during the course of the Works, and
ii. will remain in place and require the use of specific construction protection methods to complete the underground structures around and below the utilities including support of the utilities during construction by the Contractor.

1.3.2 The Contractor shall take into consideration the time required for utility diversions into the overall Works Programme for the Contract. However, efforts shall be made to avoid diverting/disturbance of any utility and continue the Works by supporting the same but the required services being provided by these utilities shall be maintained at all the times by the Contractor. Any delay to construction works due to delay in Utility diversion work will be responsibility of contractor, no claims shall be entertained in this regard.

1.3.3 The diversion work shall be undertaken by the Contractor as per the approval of the Utility owning Agencies and a notice from the Engineer. Temporary supports and protection by methods proposed by the Contractor and agreed by the Utility Agency shall be provided to the utilities. Permanent supports and protection shall be provided wherever required for the safety and security of the utility service.

1.3.4 The Contractor shall immediately inform the Engineer and the Utility Agencies of any

(a) damage to utilities.

(b) leakage of utilities.

(c) discovery of utilities not previously identified.

1.3.5 When diverting and/or protecting sewerage and storm water lines the Contractor shall ensure that drainage to the site and adjacent areas is maintained at all times and that at no times flooding/overflow or other nuisance occurs.

1.3.6 The Contractor shall inform the Employer/Engineer of the programme of all works of utility diversion/ protection works and shall take all steps to enable the utility diversions to proceed in accordance with the programme. The Contractor shall maintain close liaison with the Utility Agencies. The Contractor shall set up and manage a Utility Liaison Group of experienced personnel for the duration of the Contract.

1.3.7 Records of the existing utilities encountered shall be kept by the Contractor on the Site and a copy provided for the Employer/Engineer. The records shall contain the following details:

(a) location of utility.
(b) date on which the utilities were encountered.
(c) nature and sizes of the utilities.
(d) condition of utility.
(e) temporary or permanent supports provided, and
(f) Diversions made –Temporary or permanent

1.3.8 The Contractor shall include the details (plan, location, ownership, size, and material) of all such utilities on the As Built Drawings.

1.3.9 The diversion/protection of utilities (Charted/Uncharted) shall be covered under the provisional sum given in the Pricing Summary under schedule-C. The Contractor shall be paid as per the current Schedule of Rates of the respective departments (KPWD, IR-USSOR, BWSSB, BESCOM, BSNL, or any other Govt agency etc.) plus 10% for overhead and profit. The priority of reference for deriving rate shall be in the same order as stated above. Until such time as such rate(s) are agreed or fixed, the Engineer, after consultation with the Employer, shall determine the provisional rate(s) to enable IPC to be issued by the Engineer.

1.3.10 Temporary diversion of each utility is allowed for one time. If the utility is to be restored, permanent restoration shall be considered in addition to the temporary diversion.

1.3.11 NOC & Approval of schemes for Diversion of Utilities from the concerned regulatory /statutory/Local Authority is the responsibility of the Contractor in coordination with Employer, Employer will only assist in getting permission and nothing extra is payable on this account. Similarly, necessary precautions which are specified from time to time by the utility owning agencies shall be followed. Contractor should make his own survey for identification of underground/above ground utilities.

2. DIVERSION AND PROTECTION OF UNDERGROUND/OVERHEAD UTILITY LINES

2.1 The work comprises of replacement, relocation, diversion and protection of existing subsurface, surface and overhead public utilities viz. sewer mains, water lines, water wells, storm water drains, gully pits including connection pipes, house drains, gas pipe lines, electric and telephone cables, optical fibre cables including their appurtenance structure, O.H. electrical transmission line, electric poles, traffic signals, etc. which will be disturbed due to construction of the metro stations, where applicable.

2.2 The Contractor shall effectively protect all public utilities falling within the stations, station entry & exit locations and their immediate adjoining areas or which are likely to be exposed, disturbed or damaged during the execution of the work or in consequence thereof, in such a manner and using such materials as required or specified by the concerned public Utility Agencies and as per instruction of the Engineer, and hold them in proper position without any damage being caused to them during execution of work. Where adequate spaces are not available adjacent and outside the stations, the utilities may have to be hanged within the station-box itself to facilitate the construction work.

2.3 The contractor shall provide and lay pipes, water wells, gas mains/gully pit connections/house drains and other electric, telephones, copper telecom cable, optical fibre cables and other cables or any other underground structures or services falling within the station and their immediate adjoining areas which may be found to have been disturbed or damaged due to the Contractor's fault and/or defective and careless workmanship. The decision of the Engineer in this respect shall be binding and final and all costs of rebuilding

or repairing of such damaged services or structures as foresaid shall be deducted from the Contractor, if the same is not taken care of within a reasonable time frame, mutually agreed between the Engineer and the Contractor. The claim or penalty imposed by the concerned utility department for the damage of utilities done by the contractor shall be recovered from the Contractor.

2.4 The Contractor shall enquire of and collect information from all concerned public Utility agencies, owners, Government Departments and local bodies in connection with the sewer lines, water mains, water wells, cables, wires and any other obstruction either overhead or on ground or underground which may be encountered in the course of execution of the work and which are likely to affect the progress of the work, at his own cost and risk. No idle labour charge will be admissible on account of delay in collecting the above-mentioned information.

2.5 The Contractor shall have to excavate trial trenches of suitable sizes for satisfactorily exploring all the underground utilities as required and as instructed by the Engineer before commencement of any permanent work below ground level. All works related to utility identification and preparation of drawings obtaining stake holders approval shall be included in the Contractors quoted price. The time of completion for the project is inclusive of diverting and/or protection (temporary as well permanent) of utilities.

3. ADDITIONAL CONDITIONS FOR DIVERSION/PROTECTION OF BWSSB UTILITIES

3.1 It is the responsibility of the Contractor to get the approval of the proposed water/sewer/storm water/ pipeline etc., diversion/shifting from the concerned Agency/Authority. However, Engineer / Employer may facilitate the co-ordination work with concerned agency for getting the necessary approval.

3.2 In case the concerned utility agency/authority maintains a list of registered/approved contractors for undertaking such works and desires such shifting/diversion of pipeline/utility etc. work to be undertaken by such registered/approved contractors, then such shifting/diversion of pipeline/utility etc., shall be carried out by engaging the registered/approved contractors.

3.3 In case the Engineers of concerned utility agency intend to supervise the work, the Contractor (or sub-contractors engaged by the Contractor) have to carry out the work as per the instruction of the utility agency during diversion work by the Contractor.

3.4 In case of permanent diversion of water/sewer/storm water/pipelines etc., it is the responsibility of the Contractor to carry out such work without affecting water supply/without affecting sewage disposal etc. If required alternative temporary arrangement shall be made by the Contractor without any additional cost.

3.5 In case of temporary water pipe/sewer pumping mains (without manholes) diversion (which means divert the pipeline temporary away from station box and brought back to the original position after completion of station work), it is the responsibility of the Contractor either to use the retrieved diverted pipes or new pipes to restore back the original place without affecting the water supply/utility service.

3.6 In case of temporary diversion of gravity sewer pipelines with manholes are required, the Contractor, initially before taking up the station work has to ensure that the flow is diverted by laying sewer pipeline and constructing manholes away from the station box and then only divert the flow. After completion of station work, the Contractor shall have to lay again another sewer pipelines and again construct new manholes for restoring back to the original place.

3.7 In case of temporary supporting of water/sewer pipelines, if any damages occur during construction period it is the responsibility of the Contractor to rectify the damages to the satisfaction of concerned agency. The cost of the rectification works shall be borne by the Contractor.

3.8 It is the responsibility of the Contractor to obtain completion certificate from concerned utility agency for each diversion work. The payment for such diversion work will be made to the Contractor after obtaining completion certificate from concerned utility agency.

3.9 The Contractor shall handover all the retrieved material to the stores of the concerned utility agency/concerned department at the Contractor's cost and submit the proof of handing over.

4. ELECTRICAL UTILITIES (BESCOM/KPTCL)

4.1 The Contractor shall submit the utility diversion programme to Engineer / Employer with diversion justification based on trial pit information.

4.2 The Contractor shall submit the diversion plan to Engineer at least 60 (sixty) days in advance of work commencing to obtain approval from Electrical utility agencies. For utility diversion proposals of BESCOM / KPTCL, the Contractor shall submit diversion justification with trail pit information and drawing(s) with the proposed diversion route(s).

4.3 The Contractor would submit application of diversion works to electrical utility agencies with diversion plans. The Contractor shall render necessary assistance.

4.4 The Contractor shall coordinate with the local officials to assess quantities and specifications of materials required for diversion works. Necessary assistance would be provided by the Employer and the Engineer.

4.5 The Contractor shall obtain necessary permission from the concerned departments/agencies to carry out the diversion/shifting works and get necessary permission from Traffic Police Department.

4.6 Wherever possible, horizontal directional drilling method shall be adopted at location where utility diversion works crosses roadways and require lane closures for excavation to avoid inconvenience to the traffic.

4.7 The electrical utilities diversion/ shifting should be carried out by the Contractors/agencies registered with the electrical utility agencies / KPWD and have the required grade license from the Chief Electrical Inspector to Government. The Contractor should be well acquainted with electrical works so as to maintain the standard. The Contractor shall inform the same to Employer/Engineer for getting consent from the concerned electrical utility agency.

4.8 The Contractor shall identify the quantity of materials required for the contract such that the material can be procured by the Contractor in bulk and in advance to the implementation of the utility diversion works. The quality of materials to be procured shall be approved by the concerned utility agency. Materials used for diversion/ shifting shall be of quality conforming to the applicable standard of the electrical utility agency and as per relevant BIS.

4.9 The source of materials and the guarantee for the materials to be used shall be submitted to Engineer for obtaining approval from the concerned utility agency. Any failure of the material within the guarantee period shall be replaced and installed free of cost by the Contractor.

4.10 Contractor shall inform the local officers/officials of the concerned utility agency about the diversion works at least 15 (fifteen) days before the execution of diversion.

4.11 The diversion / shifting utility work shall be carried out under the direct supervision of officials and the utility agency decision shall be final in this regard. The Contractor shall provide free access to officers/ officials / workman for the purpose of inspection/supervision.

4.12 After restoration of regular service completion certificate shall be obtained from the concerned departments/agencies. The regulations for working with utility agencies shall be as follows.

a. The diversion/shifting utility work should be carried out without causing any inconvenience to the operation and maintenance of Sub-Station and other departmental works of the concerned utility agency.

b. The Contractor shall execute and complete the work strictly in adherence to the time schedule and to the satisfaction of the engineers and adhere strictly the direction of the utility agency in any matter.

c. The Contractor shall be responsible to protect the public and the employees of the utility agency against any accident that may arise during the execution of diversion/shifting utility works. The Contractor shall indemnify the Employer for any claims for damages/injuries to the person/property resulting from any such accident. The Contractor shall Compensation Act by the way of obtaining an accident risk type insurance to meet all purpose of relief, failing which or otherwise the Contractor shall be solely responsible for meeting the compensation awarded under the said Act.

d. The Contractor shall undertake to ensure free flow of traffic during execution of the diversion/shifting works and shall be responsible for any accident/loss of lives/property. Damage to the other existing utilities during diversion shall be rectified by the Contractor at his own cost.

e. The Contractor shall employ qualified technical personnel to carry out the diversion/shifting of utility works.

f. The Contractor shall apply well in advance for Line Clearance (LC) for carrying out the joint works/shifting works. Employer would authorise the Contractor to take LC from the concerned utility agency. If needed, Employer would provide assistance to the Contractor to get the LC. LC will be given by the concerned utility agency depending upon exigencies, which have to be strictly adhered to.

g. The Contractor shall handover all the retrieved / unused material to the stores of the concerned utility agency /concerned department at the Contractor's cost.

h. Contractor to pay the penalty/charges imposed by the utility agency for damage to the utilities on their own.

i. The Contractor shall undertake not to revoke the above conditions until the completion of diversion/shifting works.

5. **BBMP UTILITIES DIVERSION**

5.1 Diversion of Storm water drain shall be carried out as per the design, standard and general specifications of BBMP /PWD/concerned Highways Department.

5.2 The diversion route for storm water drain shall be approved by BBMP /concerned PWD/ Highways Department.

5.3 The invert level of diverting drain shall be maintained on par with upstream/downstream of connecting drains.

5.4 The Contractor shall make alternate arrangements to divert and ensure smooth flow of water from upstream side during construction.

5.5 The Contractor shall provide the adequate sizes of drain or follow the existing sizes as agreed by the concerned agency.

5.6 Diversion of storm water drain shall be carried out through the registered Contractors of BBMP/PWD/Highways Department (if such a list of approved/registered contractors is maintained by the utility agency).

5.7 Streetlights shifting shall be carried out as per the specification of BBMP.

6. BSNL UTILITIES DIVERSION:

BSNL utilities such as copper cable and OFC cables which are likely to be affected to be identified based on trial pit information. Contractor to prepare the diversion plan in coordination with the BSNL utilities agencies and get approval for the diversion plan. Employer/Engineer may provide assistance in this regard. Contractor to assess the required quantities based on the diversion plan. Cables procured to be Quality control checked by the concern wing of BSNL. Contractor to coordinate and arrange for the Quality control check by BSNL Diversion of BSNL utilities to be done by the BSNL approved subcontractors and the completion certificate to be obtained from BSNL for the utility's diversion done.

7. Private Telecom/OFC/Other cable Contractor to manage the existing private telecom and OFC cables.

8. ADD NEW ADDITIONS – GAIL etc.

General:

The Contractor shall provide 6 months rolling programme every 3 month.

EMPLOYER'S REQUIREMENTS

APPENDIX-13

DELETED

EMPLOYER'S REQUIREMENTSAPPENDIX-14

CONTRACTOR'S SITE LABORATORY

1. SITE LABORATORY

(1) The Site Laboratory shall be approximately 250 sqm in area. It shall consist of thefollowing accommodation:

1 concrete laboratory	60 sqm floor area
1 Soil laboratory	30 sqm floor area
2 office	each 15 sqm floor area
1 store room	10 sqm floor area
1 kitchen	10 sqm floor area
Male toilets, changing room & shower	sufficient for 6 persons

(2) The remainder of the 250 sqm shall consist of storage area for concrete cube curing tanks. The laboratory, office etc. shall be in one building; the curing tank storage building may be ina separate building. If in separate building, it shall be adjacent to the laboratory building & connected to itby a level, weatherproof passageway. In addition, an area of covered hard standing of 50 sqm for motor vehicles shall be provided adjacent to the laboratory.

2. STANDARD OF CONSTRUCTION

(1) The laboratory shall be constructed to the best Engineering practice and as approved by the Employer / Engineer. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be located in areas as approved by the Employer / Engineer.

(2) A water tank with minimum capacity of 2000 litres shall be installed. Constant waterpressure of 15 KPa minimum shall be ensured in each laboratory.

(3) In the case of sinks used for washing samples, adequate trapping and/or separating devices shall be provided to ensure the proper functioning of the facility.

3. FURNISHINGS AND FIXTURES

The contractor's site laboratory shall be provided with required furnishings and fixtures.

4. LABORATORY EQUIPMENT

(1) The laboratory equipment, as listed below, shall be approved by the Engineer. The Contractor shall submit for the Engineer's approval within 2 weeks of the order to commence work the name of the supplier it intends to use for each piece of apparatus together with therelevant catalogue number.

(2) The layout of the equipment in the testing laboratory shall be as instructed by the Employer / Engineer. The equipment shall be maintained to accuracy appropriate to the required testing methods with routine calibration by an accredited organisation as recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.

(3) The Contractor's site laboratory shall be equipped with the following material testing equipment as a minimum. The nature and quality of equipment required for pre-stressing may be varied by the Engineer depending on the detail of the Contractor's Design and Construction methods or for any other reason which he deems to be valid and necessary for the proper control of quality:

Liquid limit device (Casagrande type)	1 set
Grooving tools	1 No
Evaporating dish	1 No
Spatula 100mm blade	1 No
Laboratory balance, capacity 500 gm, (Sensitivity 0.01 gms.)	1 No
Wash bottle, capacity 500 ml.	1 No
Moisture cans capacity 50 ml.	24 No
Determining Plastic Limit (1 complete set)	
Evaporating dish	1 No
Spatula 100mm blade	1 No
Glass plate 250mmx250mmx12mm	2 No
Moisture cans capacity 50 ml.	12 No
Stainless steel rods, 3 mm dia.	2 No
Determining Moisture Content (1 complete set)	
Micro Oven, capacity 35 liters, control temperature up to	200 °c
1 No weighing machine, capacity 200 gm., sensitivity 0.01 gm.	1 No
Lab. Toungs	1 No
Moisture cans 75ml. with lid	36 No
Compaction Characteristics (1 complete set)	
Standard compaction mould 100mm dia.	1 No
Modified compaction mould 150mm dia.	1 No
Standard compaction Rammer, 2.5 kg.	1 No
Modified compaction Rammer, 4.5kg.	1 No
Straight edge 300mm long	1 No
Sample ejector for 100mm and 150mm	1 No
mould Sample tray 60 x 60 x 8 cm	3 No
Wash bottle, 500 ml.	2 No
Moisture cans 250 ml	24 No
Density of soil in-place by sand core method	(2 complete set)
Sand density cone apparatus 150ml	2 No
Plate, 300mm X 300mm	2 No
Chisel 25mmX 150mm	2 No
Hammer 2 No	
One gallons field cans	24 No
Sampling spoons	2 No
Soft hair brush	2 No
Moisture cans 250ml	48 No
Sieve Analysis	
Sieve shaker (portable)	1 unit
Coarse sieves in sizes from 100mm to 10mm (1set Fine sieves #4, #8, #16, #30, #40, #50, #100, #200 each)	
Pans & covers	
Specific gravity and absorption of coarse aggregate	
Wire basket, 200mm dia Heavy duty suspension balance, 20kg X 1gm with accessory for weight in water	1set
Suitable water container	1 No.
Unit wt. of aggregate	
Balance, 100Kg cap. With 10gm precision	1No
Tamping rod 16mm diaX600mm long	1No
Measuring containers (3, 10,15,30 ltrs)	1 each
Flakiness & Elongation	
Flakiness gauge, Elongation Index	1 set
Soundness Test	
Sodium Sulphate	25 Kg

Soaking Tank	1 no
Balance, Cap. 3Kg, sensitivity 0.1gm	1 set
Sieves: coarse, Fine	1 set
Concrete	
Bickets for concrete sampling	12 Nos.
Slump Cone	12 Nos.
Tamping rod	12 Nos.
Base plate	12 Nos.
Mixing pan for concrete	2 Nos.
Scoop for general purpose	2 Nos.
Concrete thermometer	2 Nos.
Concrete cylinder mould, 150 mm * 300mm;	
100 mm* 300 mm	10 each
Concrete cube mould, 100 mm cube & 150 mm cube	10 each
Adjustable spanners for Dismantling cube moulds	6 Nos.
Capping set	2 Nos.
Capping compound	
Concrete curing tank with capacity for 270 cubes, temperature controlled,	
with circulation system drain and lockable cover	5 Nos.
Schmidt test hammer	1 No.
Compression testing machine (simple hand operated)	1 No.
Mould oil Temperature chart recorder	1 No.
Miscellaneous	
Vernier callipers to measure up to 200mm, with elongated jaws	5 Nos.
Steel rule, 300 mm long graduated	2 Nos.
Rubber gloves	10 Pair
Cotton working gloves	20 Pair
First aid kit	1 set
Wire brush	6 Nos.
Steel tape, 3m, 5m, 30m	3 each
Ball peen hammer, 1 kg	2 Nos.
Paint scraper. Approx. 100mm wide	8 Nos.
Float, steel Approx.280 x 120 mm	8 Nos.
Sack barrow	1 No
Shovel: Square Mouthed	2 Nos.
Round Mouthed	2 Nos.
24-wheel trolley, heavy duty, approx. 0.7m X 1.0m long Pneumatic tyred type	1 No
Wheel barrow, rubber tyred	
Comprehensive tool kit	1 No
claw hammer, multi-grips, spanners (adjustable)	1 No
Type NR Schmidt Hammer and tester with recording device	1 No
Testing Anvil for Schmidt Hammer test (SHT)	1 No
Chart recording paper for SHT	10 Pkts
Cover meter for detecting metal objects to depth of	100 mm
below the surface of non-magnetic objects	3 Nos.
Noise meter	1 No
RCPT Testing Machine	1 No
Permeability Testing Machine	1 No

EMPLOYER'S REQUIREMENTS

APPENDIX-15

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-16

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-17

DELETED

EMPLOYER'S REQUIREMENTS

APPENDIX-18

DELETED

SCHEDULES

SITE OF THE PROJECT

1 THE SITE

1. Site of the BSRP includes the land, buildings, structures as described.
2. Access and RUC shall be arranged progressively, as per 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 BSRP are specified in Tender Drawings.
5. The status of the environment clearances and forest clearances obtained or awaited is given in Annexure 4.

ANNEXURE- I

SITE

1. SITE

The Site of the BSRP comprises the section commencing from km (-) 0.635 to km 46.985 i.e., the Heelalige - Rajanukunte section excluding alignment for 740 m at Benniganahalli station from CH: 21.925 km to CH: 22.665 in Bengaluru. The land and other structures comprising the Site are described below:

2. ROUTE LENGTH

The route length of Corridor-4 of BSRP 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	Heelalige	Rajanukunte	(-) 0.635	46.985	46.880	(Excluding CH: 21.925 – CH: 22.665 of Benniganahalli) including Viaduct and At Grade Section
2	AT-Grade section	-	-	-	37.920	Details are in GAD
3	Viaduct section	-	-	-	8.960	

3. ALIGNMENT AND LAND PLAN:

The tentative land plan and alignment plan are attached.

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

4.1 MAJOR BRIDGES:

The Site includes the following Major Bridges:

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.513@ 14.350	Pile Foundation	RCC Abutment	PSC Slab	2x12.2 (2 Span, 2 Track for BSRP)
2	Bridge No 519A @Ch: 17.95	Pile Foundation	RCC abutment	Composite Steel Girder	2X41m (2 Span, 2 Track for BSRP)
3	Bridge No.537 @ 28.519	Pile Foundation	RCC Abutment	PSC U-girder	1x12.2 (1 Span, 2 Track for BSRP)
4	Bridge No 520 @ 34.089	Pile Foundation	RCC abutment	PSC U-girder	1X22m (1 Span, 2 Track for BSRP)

4.2 MINOR BRIDGES

The Site includes the following Minor Bridges:

Sl. No.	Existing		Proposed (Tentative)		Barrel Length (m)
	Chainage (km)	Bridge No.	Type of Structure	Size (m)	
1	-0.054	476	RCC Box	2.00x1.20	30.50
2	0.928	477	RCC Box	2.16x1.35	14.00
3	1.344	478	RCC Box	1.20X1.35	26.00
4	1.355	479	RCC Box	1.90 x 1.65	22.00
5	2.447	480	RCC Box	3.66 x 4.10	15.00
6	2.691	481	RCC Box	3.65x3.85	15.50
7	3.023	482	RCC Box	3.05x2.95	27.50

8	3.617	483	RCC Box	1.20x1.35	16.00
9	3.738	484	RCC Box	6.00x3.71	15.00
10	3.887	485	RCC Box	1.20x1.35	15.50
11	3.920	486	RCC Box	1.20 x 1.35	14.50
12	4.137	487	RCC Box	1.20 x 1.35	15.00
13	4.537	488	RCC Box	3.36 x 1.35	13.00
14	5.069	489	RCC Box	3.66 x 2.31	68.50
15	5.412	490	RCC Box	1.20 x 1.35	47.50
16	5.790	491	RCC Box	1.20 x 1.35	23.00
17	5.955	492	RCC Box	3.66 x 2.10	16.50
18	6.092	493	RCC Box	4.57 x 2.05	16.00
19	6.387	494	RCC Box	1.20 x 1.35	15.50
20	6.768	495	RCC Box	1.20 x 1.35	14.00
21	7.092	496	RCC Box	3.00 x 2.85	15.00
22	7.293	497	RCC Box	1.20 x 1.35	14.50
23	8.267	498	RCC Box	3.66 x 3.60	15.00
24	8.408	499	RCC Box	1.20 x 1.35	15.50
25	9.072	500	RCC Box	1.20 x 1.35	14.00
26	9.483	501	RCC Box	1.20 x 1.35	15.00
27	10.008	502	RCC Box	1.22 x 1.35	17.50
28	10.198	503	RCC Box	2.10 x 1.35	18.00
29	11.245	504	RCC Box	1.20 x 1.35	14.50
30	11.888	505	RCC Box	2.10 x 1.35	13.00
31	12.663	506	RCC Box	1.83 x 3.65	15.50
32	13.245	507	RCC Box	3.66 x 3.53	25.00
33	13.278	508	RCC Box	1.20 x 1.35	26.50
34	13.392	509	RCC Box	1.20 x 1.35	34.50
35	13.595	510	RCC Box	1.20 x 1.35	36.50
36	14.101	512A	RCC Box	3.66 x 3.20	24.00
37	14.654	514	RCC Box	6.00 x 5.15	26.00
38	17.856	519	RCC Box	3.50 x 1.35	20.00

39	18.685	520	RCC Box	6.10 x 5.02	20.00
40	19.256	521	RCC Box	3.05 x 3.50	31.50
41	19.607	522	RCC Box	3.50 x 1.35	30.50
42	20.332	524	RCC Box	3.66 x 2.10	16.50
43	21.812	528	RCC Box	4.00 x 3.66	16.50
44	23.905	548	RCC Box	2.0 x 2.50	12.50
45	24.884	546	RCC Box	1 x 4.60 x 3.15	13.00
46	24.934	545	RCC Box	1 x 2.00 x 2.55	11.50
47	25.033	544	RCC Box	1 x 3.05 x 1.665	10.00
48	25.627	543	RCC Box	1 x 2.00 x 2.70	14.50
49	25.792	542	RCC Box	1 x 2.70 x 1.50	14.50
50	25.923	541	RCC Box	1 x 3.50 x1.65	15.00
51	26.685	540	RCC Box	1 x 4.57 x 3.05	22.50
52	26.885	539	RCC Box	1 x 1.50 x 1.65	20.50
53	28.587	536	RCC Box	1 x 3.50 x 1.65	14.50
54	29.114	534	RCC Box	1 x 1.50 x 1.65	18.50
55	30.760	533	RCC Box	1 x 1.50 x 1.65	14.00
56	31.496	531	RCC Box	1 x 1.50 x 1.65	14.50
57	31.582	530	RCC Box	1 x 1.50 x 1.65	14.50
58	32.330	529	RCC Box	1 x 2.00 x 1.65	33.00
59	32.338	528	RCC Box	1 x 1.50 x 1.65	39.50
60	32.622	527	RCC Box	1 x 1.50 x 1.65	14.00
61	33.480	526	RCC Box	1 x 1.50 x 1.65	14.50
62	33.545	525	RCC Box	1 x 1.50 x 1.65	17.50
63	33.673	524	RCC Box	1 x 1.50 x 1.65	16.00
64	33.720	523	RCC Box	1 x 1.83 x 2.45	20.50
65	33.763	522	RCC Box	1 x 1.50 x 1.65	23.50
66	34.022	521	RCC Box	1 x 1.50 x 1.65	23.00
67	40.550	513	RCC Box	1 x 1.50 x 1.55	14.00
68	40.690	512	RCC Box	1 x 1.50 x 1.55	11.50
69	40.950	511	RCC Box	1 x 1.50 x 1.70	12.00

70	41.008	510	RCC Box	1 x 1.50 x 1.65	13.00
71	41.461	509	RCC Box	1 x 1.50 x 1.90	14.00
72	41.763	508	RCC Box	1 x 1.50 x 2.00	13.00
73	41.935	507	RCC Box	1 x 3.00 x 1.65	14.50
74	42.223	506	RCC Box	1 x 1.50 x 2.15	15.00
75	42.303	505	RCC Box	1 x 1.50 x 2.15	14.50
76	42.850	504	RCC Box	1 x 1.50 x 1.75	13.50
77	43.186	503	RCC Box	1 x 1.50 x 1.55	13.50
78	43.600	502	RCC Box	1 x 1.50 x 1.85	13.00
79	44.097	501	RCC Box	1 x 1.50 x 1.65	13.00
80	44.641	500	RCC Box	1 x 4.57 x 2.15	14.00
81	45.404	499	RCC Box	1 x 1.50 x 1.65	14.50
82	45.726	498	RCC Box	1 x 6.00 x 1.75	15.00
83	46.310	497	RCC Box	1 x 5.00 x 1.35	16.50

4.3 ROAD UNDER BRIDGES (RUB) / ROAD OVER BRIDGES (ROB)

The Site includes the following RUB (Road Under Railway line)/ ROB (Road Over Railway line):

Sl. No	Existing		Proposed				
	Chainage (km)	Bridge No.	Type of Structure	Span (Nos × length)	RUB/ ROB	Barrel Length (m)	Remarks
1	(-)0.398	475A	RCC Box	2 x 6.0 x 5.0	RUB	15.00	Extension of existing ROBs/RUBs for BSRP
2	0.664	476A	RCC Box	1 x 11.00 x 7.00	ROB	15.00	
3	1.239	477A	RCC Box	1 x 4.00 x 3.60	RUB	15.00	
4	2.557	480A	RCC Box	1 x 4.00 x 4.00	RUB	13.00	
5	5.728	490A	RCC Box	1 x 4.00 x 4.00	RUB	12.00	
6	7.404	497A	RCC Box	1 x 4.00 x 3.75	RUB	24.00	
7	13.665	511	RCC Box	2 x 9.00 x 5.00	RUB	17.00	
8	13.678	511A	RCC Box	1 x 6.00 x 5.00	RUB	23.00	
9	18.589	519B	RCC Box	1 x 4.00 x 3.90	RUB	13.00	Extension of existing RUBs for BSRP
10	25.949	541 (539A)	RCC Box	2 x 7.50 x 5.50	RUB	17.00	
11	27.875	538A	RCC Box	1 x 6.00 x 6.00	ROB	15.00	
12	28.770	535	Composite steel	1 x 20.78 x 5.50	RUB	NA	
13	30.791	532	PSC U-Girder	1 x 25.0 x 5.00	RUB	15.00	
14	31.630	530 (529A)	RCC Box	1 x 5.00 x 4.15	RUB	13.00	
15	32.535	528A	RCC Box	2 x 8.75 x 5.50	RUB	14.00	

16	36.192	516B	RCC Box+ Composite Steel Girder+ RCC Box	1 x 8.00 x 5.50 + 2 x 41.00 x 5.50 + 1 x 8.00 x 5.50	RUB	16.00	

4.4 BSRP/RAILWAY STATIONS

The Site includes the following BSRP/Railway stations of corridor - 4. The Proposed Station locations may change as per the site conditions, availability of land etc., during finalisation of GAD after awarding the work. Nothing will be paid extra for the change/cancellation of station locations or introduction of new stations.

Sl. No.	Station	Chainage (km)	Station Formation Area (Approx.)	Nos of P.F. & Length	Remarks (Whether Jn. Station)
1	Heelalige	0.000	25x205	2 X 205	Jn For BSRP & Railway
2	Bommasandra	1.480	25 X 205	1 X 205	**Future station.** The earthwork and structures to be constructed up to formation level.
3	Singena Agrahara	3.000	25 X 205	1 X 205	**Future station.** The earthwork and structures to be constructed up to formation level.
4	Huskur	5.068	25 X 205	2 X 205	New BSRP Station
5	Ambedkarnagar	7.95	25 X 205	1 x 205	New BSRP Station
6	Karmelaram	9.626	25 X 205	1 X 205	Jn. For BSRP & Railway
7	Bellandur	13.813	25 X 205	1 X 205	Jn. For BSRP & Railway
8	Marathahalli	15.860	25 X 205	1 X 205	New Elevated BSRP Station
9	Doddanekundi	18.261	25 X 205	1 x 205	New BSRP Station
10	Kaggadasapura	20.700	20 X 205	1 x 205	New BSRP Station

11	Channasandra	24.105	25x205	1 x 205	New BSRP Station
12	Horamavu	26.070	25x205	2 X 205	New BSRP Station
13	Hennur	27.590	25 X 205	1 X 205	New BSRP Station
14	Thanisandra	30.925	25 X 205	1 X 205	New BSRP Station
15	Hegde Nagar	32.420	25 X 205	2 X 205	New BSRP Station
16	Jakkur	33.930	25 X 205	1x205	New BSRP Station
17	Yelahanka	37.152	25 X 205	1 X 205	Jn. For BSRP & Railway -Elevated
18	Muddanahalli	42.275	25 X 205	1 X 205	New BSRP Station
19	Rajanukunte	46.285	25 X 205	1 X 205	Jn. For BSRP & Railway

4.5 BSRP/RAILWAY YARDS

The Site includes the following BSRP/Railway yards:

Sl. No.	Name of Yard	Number of Lines	Remarks
1	Heelalige	4Lines	Jn. For BSRP & Railway
2	Karmelaram	2Lines	Jn. For BSRP & Railway
3	Bellandur	4 Lines	Jn. For BSRP & Railway
4	Channasandra	4 Lines	Railway junction for three directions(YNK, BYPL,KJM) and BSRP
5	Yelahanka	6 Lines	Railway junction for four directions(RNN, CBP, YPR,CSDR) and two corridors of BSRP

6	Rajanukunte	4Lines	Jn. For BSRP & Railway

4.7 TRANSMISSION LINES CROSSING THE RIGHT OF ACCESS

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

Sl. No.	Section	IR Chainage	HT/LT	OH/UG	Height above IR RL/ Depth below RL (m) Tentatively
1	Ambedkarnagar – Karmelaram	190/850	High tension line-220KV	OH	12.525
2	Ambedkarnagar – Karmelaram	191/600-700	High tension line-66KV	OH	15.484
3	Karmelaram-Bellandur	193/800-900	High tension line-132KV	OH	10.5
4	Karmelaram – Bellandur	195/400-500	High tension line-132KV	OH	12.500
5	Doddanekundi – Kaggadasapura	203/300-400	High tension line-132KV	OH	9.224
6	At Huskur	187/720	Low Tension Line 2-Pole Structure	OH	Parallel to the alignment
7	Huskur – Ambedkarnagar	187/100-200	Low Tension Line	OH	Parallel to alignment
8	Ambedkarnagar – Karmelaram	191/600-700	Low Tension Line	OH	Parallel to alignment
9	Ambedkarnagar - Karmelaram	192/600-800	Low Tension Line	OH	Parallel to alignment
10	Karmelaram Station Location	193/300-500	Low Tension Line	OH	Parallel to alignment
11	Karmelaram to Bellandur	194/400-500	Low Tension Line	OH	Parallel to alignment
12	Hennur - Thanisandra	03/800-900	High tension line	OH	8.234
13	Hennur - Thanisandra	07/800-900	High tension line-66KV	OH	12.226
14	Hennur - Thanisandra	08/200-300	High tension line-220KV	OH	11.029

15	Thanisandra – Hegde Nagar	10/200-300	SSP	OH	9.414

4.8 GAIL (Gas Authority of India Limited) pipe line details (tentative) are in the tender drawings.

4.9 GPR report (Ground Penetration Radar) is attached with the bid document for the following locations for indicative purpose (The contractors shall conduct their own tests for confirmation).

Yelahanka (Platform-1)	625 m	2416.45 Sqm
In- Front of Yelahanka Station Building	650 m	2636.15 Sqm
Rajanukunte (At station Building)	25 m	354.25 Sqm
Rajanukunte (Platform-1)	435 m	1669.43 Sqm
Bellandur Road Railway station	52 m	260.00 Sqm
Karmelaram Railway station	160 m	1020.20 Sqm

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. The remaining land or portion of land near to the Railway boundary is under acquisition and is expected to be acquired soon.

A majority of railway land will be handed over progressively within 4 months (tentative) from the date of LOA, generally to match with the approved programme of work. The access to a majority of private land and a majority of other Govt lands will be made available within 8 months (tentative) from date of LOA, generally to match with the approved programme of work.

If any delay in access to, and possession of the site, the extension of time as per relevant clause of contract shall be given for the delay of affected portion of the works.

The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which he may require, including those for access to the Site. The Contractor shall also indicate extra railway land or Govt land or private land, if any required, beyond what is shown in the tentative tender drawing with the view to achieve best fit alignment for improved operational efficiency. On review by Engineer and Employer, the Contractor will be advised with the approved Horizontal/Vertical alignment for permanent works. Additional land, if needed by the Contractor beyond the Right of Access for movement of machinery etc., shall have to be arranged by the contractor at his own cost.

In case any operation connected with traffic necessitates diversion, obstruction or closure of any road, railway or any other Right of Access, the proposal shall be developed by the contractor for review for the approval of the Engineer/Employer and the consents and approval of the concerned authorities shall be obtained well in advance by the Contractor.

Provided that if it is found necessary for the Contractor to move one or more loads of heavy constructional plants and equipment, materials or Pre-constructed units or parts of units of work over roads, highways, bridges on which such oversized and overweight items that are not normally to be moved, the contractor shall obtain prior permission from the concerned authorities.

Payments for complying with the requirements, if any, for protection or strengthening of the roads, highways or bridges shall be made by the contractor and such expenses shall be deemed to be included in his quoted contract price.

Further Refer to Section 7, Clause 4.31 of PCC for details.

ANNEXURE - 3

ALIGNMENT PLANS (GAD)

The proposed tentative alignment plan of the BSRP line is attached, for reference and guidance. This is based on survey conducted by the Authority. The Contractor is required to validate and modify the plan and profile of the alignment so as to get the best fit designed alignment to achieve improved operational efficiency as per SOD within the Right of Access boundaries, with the approval of Engineer/Employer.

The impact and requirement of additional railway land or private land, if needed, to improve the alignment to achieve maximum design speed shall be explored in detail and communicated to the Employer.

In addition, the possibility of reducing BSRP corridors to the extent SOD permits also shall be explored to optimize the land requirement.

ANNEXURE - 4

TREE CUTTING AND FOREST CLEARANCES – IN PROCESS

Forest clearances: The permission for obtaining tree cutting/translocation is in progress with BBMP and Forest Department. The tree enumeration list and joint inspection with Forest officers/BBMP/TEC is in progress.

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 is included in the scope of work. 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) plus FDT (Forest Development Tax) to KRIDE for onward transmission 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/K-RIDE Review with time limit
1.	Alignment Design Report	Contractor	45 Days
2.	L-Section	Contractor	30 Days
3.	GAD of major and minor bridges.	Contractor	30 Days
4.	Structural drawings of major bridges	Contractor	30 Days
5.	Structural drawings of minor bridges	Contractor	30 Days
6.	GADs of ROBs/ RUBs	Contractor	30 Days
7.	Structural Drawings of ROBs/RUBs	Contractor	30 Days
8.	Drainage Plans	Contractor	15 Days
9.	Protection Work Design and Drawings	Contractor	15 Days
10.	Viaduct portion	Contractor	
	a) Test Pile drawing	Contractor	15 Days
	b) Segment drawing	Contractor	15 Days
	c) Working pile drawings	Contractor	15 Days
	d) Pile cap drawings	Contractor	30 Days
	e) Pier and pier cap/Portal- drawings	Contractor	30 Days
	f) Bearing drawings	Contractor	30 Days
	g) Superstructure and parapet drawings	Contractor	30 Days
11.	Earthwork in Embankment and Cutting drawings, retaining wall, Drain at Ramps etc.,	Contractor	15 Days
12.	Temporary structures design	Contractor	30 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.

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 .....- ..... BSRP (the "**BSRP Project**") on Engineering, Procurement and Construction (EPC) basis through …… (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been undertaken to determine compliance of the BSRP 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 BSRP 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 BSRP 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 BSRP Project is hereby provisionally declared fit for entry into operation on this the …… day of …….. 20…...

ACCEPTED, SIGNED, SEALED	SIGNED, SEALED AND
AND DELIVERED	DELIVERED
For and on behalf of	For and on behalf of
CONTRACTOR by:	AUTHORITY's ENGINEER by:
(Signature)	(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 the .....section (km ..... to km .....) of …… in the State of ..... in .....- ..... BSRP (the "**BSRP Project**") on Engineering, Procurement and Construction (EPC) basis through ……. (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been successfully undertaken to determine compliance of the BSRP 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 BSRP 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 Cl.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)