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Bid Documents

For

DESIGN AND CONSTRUCTION OF CIVIL, BUILDING AND TRACK WORKS FOR DOUBLE LINE RAILWAY INVOLVING FORMATION IN EMBANKMENTS / CUTTINGS, BRIDGES, STRUCTURES (EXCLUDING CIVIL WORKS FOR BRIDGES AND FORMATION IN EMBANKMENT / CUTTING AND STRUCTURES IN APPRAOAHES FOR 150M LENGTH FROM ABUTMENTS ON BOTH SIDES OF THE BRIDGES ACROSS RIVERS MAHI AND SABARMATI), BUILDINGS, BALLAST ON FORMATION, TRACK WORK (INCLUDING BALLAST AND TRACK WORKS ON BRIDGES AND FORMATION OF APPROACHES FOR 150M LENGTH FROM ABUTMENTS ON BOTH SIDES OF THE BRIDGES ACROSS RIVERS MAHI AND SABARMATI) INCLUDING TESTING AND COMMISSIONING ON DESIGN-BUILD LUMP SUM PRICE BASIS FOR IQBALGARH - VADODARA SECTION OF WESTERN DEDICATED FREIGHT CORRIDOR

CIVIL, BUILDING AND TRACK WORKS CONTRACT
PACKAGE CT P- 3 (R)

Issued on: 03rd June, 2015

ICB No. CT P-3 (R)

VOLUME-II

EMPLOYER'S REQUIREMENTS

Employer:
DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

MINISTRY OF RAILWAYS
INDIA

DFCC NEW DELHI

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BID Documents

For

Dedicated Freight Corridor Project
(Western Corridor, Phase 1: Rewari - Vadodara)

CIVIL, BUILDING and TRACK WORKS

Contract Package 3(R)
for
ICB No. CT P-3(R): Iqbalgarh - Vadodara Section

VOLUME II Employer's Requirements
- Section 8

General
Functional
Design
Construction
Manufacturing, Installation, Testing and Commissioning
Attachments
Appendices

Employer:
Dedicated Freight Corridor Corporation of India
(A Government of India Enterprise)

NK Consortium
NK – JARTS – PBJ – NKI
Consulting Engineers

(03rd June, 2015)

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SECTION-8

EMPLOYER'S REQUIREMENTS

GENERAL

1 Introduction

1.1 The 1st phase of the Western Dedicated Freight Corridor consists of 922km of double line electrified track with 2x25 kV AC, 50 Hz. Overhead catenary system from Vadodara to Rewari running along the existing Indian Railway Tracks.

Construction of the 1st phase of the Western Dedicated Freight Corridor has been planned through nine (9) Contract Packages encompassing the following contract scopes:

CT P-1	Civil/Building/Track Works Rewari – Ajmer Section;	Combined Package
CT P-2	Civil/Building/Track Works Ajmer –Iqbalgarh Section;	
CT P-3(R)	Civil/Building/Track Works Iqbalgarh – Vadodara Section (excluding bridges across river Mahi and Sabarmati);	
CT P-3A(R)	Special Steel Bridges across rivers Mahi and Sabarmati;	
EM P-4	Electrical & Mechanical, Rewari – Vadodara Section ;	
ST P-5	Signal & Telecommunication, Rewari – Vadodara Section;	
ST P-5A	Train Protection & Warning System (TPWS) Works, Rewari- Makarpura of Phase I and Makarpura – JNPT of Phase II	
PE P-6	Plant and Equipment for Operation and Maintenance; and	
RS P-7	Rolling Stock Cum Maintenance And Depot Works.	

1.2 The 1st phase of the Western Corridor between Vadodara and Rewari for a total length of 922km is to be constructed as double line electrified track with 2 x 25 kV AC, 50 Hz, overhead catenary system, capable of operating at a maximum train speed of 100km/h with an initial axle load of 25.0 tonnes. Formation and bridge structure are to be provided for 32.5 tonnes axle load and track structure for 25 tonnes axle load.

Out of the total length of 922km, the work between Iqbalgarh and Rewari in a length of 625km has been planned under CT P-1 and CT P-2. The balance stretch of 298km between Iqbalgarh – Vadodara shall be carried out under Package CT P-3 (R), except for the work of two Special Steel Bridges across rivers Mahi and Sabarmati along with their approaches of 150m length from abutments on both sides of the bridges, which has been planned under Package CT P-3A(R).

Iqbalgarh – Vadodara Section of the alignment consists of two parts, viz. Iqbalgarh – Pansar and Pansar – Vadodara (Makarpura).

- The alignment between Iqbalgarh and Pansar (134km approximately) is located along Ikbalgarh – Palanpur - Jagudam - Pansar lines of North Western Railway. The Iqbalgarh – Jagudam section of the alignment runs on Eastern side of North Western Railway whereas the Jagudam – Pansar of the alignment runs on Western side of North Western Railway.
- The alignment between Pansar and Vadodara (Makarpura) (154 km approximately) takes detours from the existing Western Railway tracks

Construction of two special steel bridges including their approaches of 150m length from abutments on both sides of the bridges across river Mahi (at Chainage 161 / 740 Km in Sector 6, near Vadodara) and river Sabarmati (at Chainage 62 / 233 in Sector 7, near Ahmedabad) on

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the detoured alignment between Pansar and Vadodara (Makarpura) in the Iqbalgarh – Vadodara section (listed in Attachment 14) has been planned to be taken up under separate package CT P-3A (R) and is excluded from the Scope of Work of Package CT P-3 (R). However, the track work for the Package CT P-3A (R) shall be included in the Scope of Work for Package CT P-3 (R). The approximate length of the bridges across rivers Mahi and Sabarmati are 585m and 536m respectively.

The Contractor who is one of the nine contractors above and other (one to all of the) remaining contractors and referred to as the Other Contractor(s) are deemed to complete design, construction and all the way through to testing and commissioning of Dedicated Freight Corridor (Western Corridor, Phase 1). The Contractor shall undertake the design, construction, manufacture, supply, installation, testing and commissioning of the Civil, Structures, Buildings and Track works including and without limitation, the design, construction and removal of the Temporary Works as required for this Package.

1.3 The Employer's Requirements of this package are divided into six (6) sections as follows:

(1) **General**: these apply throughout the Contract;

(2) **Functional**: these include the specific requirements for the design, construction, performance and function of the Works including a general description of the Scope of Work;

(3) **Design**: these apply in respect of duties relating to the design of the Works;

(4) **Construction**: these apply in respect of the requirements relating to the construction of the Works;

(5) **Manufacturing, Installation and Testing**: these apply to the requirements relating to manufacturing, procurement and delivery of plants, equipment and manufactured items, and the requirements for testing and commissioning; and

(6) **Appendices**: these provide further requirements to the above.

2 Definitions and Interpretations

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

- **Alignment (consisting of Horizontal Alignment and Vertical Alignment) :**

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

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

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

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

- **Alignment Drawings**: mean one of the Reference Drawings (see "Reference Drawings") showing the indicative horizontal and vertical alignment for the whole main line, connecting lines including loop lines, sidings (yard layout) for each Station as developed by the Employer and collectively referred to as 'Alignment Drawings'. This forms the basis of final design of the alignment and construction by the Contractor within the available Right of Way as listed in Attachment 1A to the Scope of Work included in the Employer's Requirements - Functional.

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- **As-Built Drawings**: mean those drawings produced and endorsed by the Contractor as true records of construction of the Permanent Works. The As-Built Drawings are subject to confirmation and issue of a "Notice of No Objection by the Engineer".
- **Clear Standing Room (CSR):** The CSR for the purpose of design shall be defined as:
  - (i) Distance between the foot of the signal to the Fouling Mark in the rear on the same line in case of Main Line and Directional Loop Lines at Station Yards
  - (ii) In case of Common Loop at stations, Clear Available Length/Clear Standing Room shall be the distance between two Starter Signals of the opposite directions on the same line.
- **Construction Phase**: means the phase of the Work during which the Construction Design and Construction Technical Drawings and construction of the Permanent Works shall be undertaken by the Contractor as per the requirements of the Employer's Requirements, Specifications and other Conditions of the Contract. It has been further detailed in Clause 7 of these Employer's Requirements - General.
- **Construction Technical Drawings/ Construction Drawings**: mean those set of drawings in respect of each element of the Permanent Works prepared by the Contractor as part of the Construction Design and to be used for construction of Permanent Works and shall be derived directly from the Technical Design and Technical Drawings for which 'Notice of No Objection' has been received from the Engineer. The Construction Technical Drawings / Construction Drawings shall be used only after issue on 'Notice of No Objection' from the Engineer and endorsement of 'Good for Construction' as per the process detailed in Employer's Requirement - Design. These have been further explained in the Employer's Requirements – Design.
- **Construction Design**: means a set of design, drawings and documents in respect of each of the element of the Permanent Works, which shall be prepared by the Contractor during Construction Phase as part of the Construction Design Package based on which the Contractor shall undertake the construction of the Permanent Works. Construction Design shall be developed directly from the Technical Design and Technical Drawings for which 'Notice of No Objection' has been received from the Engineer and submit the same to the Engineer in accordance Employer's Requirements – Design.
- **Construction Design Package**: comprises the Construction Technical Drawings, Works Specification, Working Drawings and all other associated documents necessary to supplement the design covered in the Technical Design and to comply with the Contract regarding the construction of the Works such as detailed Method Statement, Safety Risk Assessment etc. The contents of the Construction Design Package are as defined in Employer's Requirements – Design.
- **Coordination Date**: means the date specified in the Appendix to Bid for the handing over/back of a working area to/from the Other Contractor for a smooth implementation of the overall construction work. The Coordination Date shall not cause a taking-over of any section or part of the Works.
- **Coordination Event:** means the event having interface with Other Contractors during the execution of the Works at Site within a specific time window defined by the Coordination Dates so as not to hinder the Other Contractor (s) form executing their works smoothly to ensure overall implementation of construction work within the stipulated time of completion.
- **Coordinated Construction Programme**: means the highest precedent programme above all sub-programmes prepared by the Contractor for execution of the Works in co-ordination with Other Contractors describing all the activities of the Works, Co-ordination Events and physical areas to which the Other Contractors shall require access within the Completion Period as specified in the Contract. Coordinated Construction Programme has been further detailed in Appendix 5 [Project Programme Requirements] to the Employers Requirements.

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- **Contractual Construction Programme**: means the highest precedent detailed programme above all sub-programmes as developed by the Contractor covering the whole scope of the Contract and based on the Bid Programme for execution of the Works within the specified completion period. Contractual Construction Programme has been further detailed in Appendix 5 [Project Programme Requirements] to the Employer's Requirements
- **Design Manual**: means the manual to be prepared and submitted by the Contractor as part of the Inception Report and as described in the Employer's Requirements - Design.
- **Design Phase**: means the phase of the Work during which the detailed design of the Permanent Works and Temporary Works shall be undertaken by the Contractor as per the Employer's Requirements, Specifications and other Conditions of the Contract. It has been further detailed in Clause 7 of the Employer's Requirements - General.

  Design Data: means the data as identified to be required by the Contractor for design of the Permanent Works
- **Reference Drawings**: express the Employer's concept and/or intent bearing function, purpose and structural form of the Permanent Works.
- **Inception Report**: means the set of drawings and documents prepared by the Contractor as one of the four major submissions during the Design Phase and Construction Phase as identified in Employer's Requirements - Design.
- **Internal Authorization Process**: means one of the core quality management systems which shall be established by the Contractor as described in Appendix 7 [Quality Assurance] to these Employer's Requirements.
- **Operation and Maintenance Manuals (O&M Manuals)**: means the manual indicating the additional provisions over and above the existing Manuals of Indian Railways for Operations and Maintenance of various assets created under this Contract and shall be prepared as part of the As-Built Documents. O&M Manuals are generally prepared for the Employer's operation and the Other Contractor's works.
- **Interfacing Parties :** includes but shall not be limited to other contractors and the designated contractors / consultants / service providers other than Other Contractors, who are engaged in part of the Works, relevant statutory authorities, relevant public utility agencies and the contractors or sub-contractors who are or may be working within or adjacent to the Site.
- **Other Contractors**: means any party or parties having a direct contract with the Employer for work on the project outside the scope of this Contract, and shall include any subcontractor of the Other Contractors.

  Railway: means Railway or any portion of a Railway for public carriage of passenger and goods as defined in the Indian Railway Act 1989.
- **Railway Envelope:** means the area within the Right of Way (ROW) as required for the safe operation of the railway.
- **Right of Way:** means the width / area of the land as required and / or acquired for the operations of the railway. Right of Way for DFC shall be as indicated in Attachment 1A to the Scope of Works included in the Employer's Requirements – Functional
- **SHE Requirements**: contain major items with respect to environmental and social considerations, and safety and health considerations for all parties involved in the Contract.
- **Site**: means the area where the Permanent Works are executed in the Right of Way (see the Work Areas).
- **Specialist Subcontractor**: means any person so named in the Prequalification Application as a Specialist Subcontractor for a part of the Works which requires highly specialized inputs

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such as mechanized track laying, specialist design consultant etc. and the legal successors in title to such person, but not any assignee of any such person.

- **Specifications**: means the detailed specifications developed by the Contractor considering the Employer's minimum and specific requirements as included in Volume III of the Bid Documents, Employer's Requirements (Volume II of the Bid Documents), requirements of Design Criteria, relevant provisions of various Codes and Standards, various Indian Railway rules, best engineering practices etc. as applicable. The specifications so formulated after considering above aspects and consented by the Engineer and approved by the Employer as part of Technical Design Package and Construction Design Package during Design Phase shall be termed as Specifications and would constitute a part of Employer's Requirements
- **Technical Design**: means a set of drawings and documents, which is submitted to the Engineer in accordance with the Employer's Requirements-Design and Specifications.
- **Technical Design Package**: Contains the "Technical Design" and its supporting documents including various reports, plans, methods and schemes, calculations, analysis, Manuals, Specifications etc. for the Permanent Works and Temporary Works submitted by the Contractor to the Engineer for his Notice of No Objection in accordance with the Employer's Requirements. The design of the Works shall be based on Design Criteria, IR Codes and Manuals, IS Codes, IRC Codes (as applicable), other International Codes (as applicable) and as referenced to in the Specifications
- **Train Vehicle Unit (TVU):** means average daily census of traffic at a level crossing considering average of the data counted for a week and calculated as the multiplication of train units and vehicles units passing through a particular level crossing. Train Motor Vehicle, Bullock Carts and Tongas being considered as one unit and Cycle rickshaw / Auto rickshaw being considered as half unit.
- **Work Areas**: comprise the Site (see "Site") and areas for the Temporary Works within and outside the Right of Way.
- **Works Segment**: means the subdivided section / stretch of the DFC Right of Way identified by the Contractor for ease of managing and optimum utilization of resources for Design and Construction of the Permanent Works. Size of the Work Segment shall be as consented by the Engineer and approved by the Employer. The Work Segment has been further explained in Appendix 14 [Requirements For Design] to the Employer's Requirements.
- **Works Programme :** means the programme showing the sequence and timing of investigations, design, execution, manufacture, installation, testing, commissioning of the Works (including Integrated Testing and Commissioning), indigenization (where applicable) and related activities in the form and content prescribed by the Employer's Requirements, or any amended or varied version thereof, as submitted by the Contractor in accordance with Appendix 5 [Project Programme Requirements] and for which the Employer/Engineer has issued a Notice of No Objection.
- **Yard / Station Yard :** Yard / Station Yards are defined by the layouts within the advance starter of UP track and advance starter of DN track
- The words "Notice to Commence" is synonymous with "Notice to Proceed" or "Order to Commence" or "Instruction to Commence"
- The words "Defects Notification Period" is synonymous with "Defects Liability Period"
- The words "Delay Damages" is synonymous with "Liquidated Damages"

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3 Relevant Documents

3.1 These document shall be read in conjunction with the General and Particular Conditions of Contract (Volume I of the Bid Documents), the Employer's Requirements (Volume II of the Bid Documents), and specifications (Volume III of the Bid Documents) and other documents forming part of the Contract.

3.2 In the event of a conflict, the order of precedence shall be as under

(a) Design Criteria (as included in the Employer's Requirements – Design)

(b) Specifications

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

3.3 The Bid Documents also include Volume IV (Data Book) and Volume V (Reference Drawings). The data provided in the Data Book and the Drawings provided in Reference Drawings, are indicative and for reference only. Employer bears no responsibility to its accuracy and adequacy.

4 Codes and Standards

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

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

4.3 The Contractor is responsible for obtaining prior Notice of No Objection from the Engineer and approval from Employer for any alternative or additional codes of practice and standards.

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

5 Reference Drawings

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

5.2 General features of those drawings are described below:

(1) Alignment Drawings

The Alignment Drawings basically contains the following contents which are further detailed in Appendix 1 [Alignment of Track-ways and Work Areas] to the Employer's Requirements. The contents of the drawings are:

(a) Indicative Horizontal and Vertical Alignment of the Track-ways for the whole Mainline, Connecting Lines, Loop Lines, Sidings (yard layout for each Station) etc. under the Contract; and

(b) Definite Right of Way (ROW) available all along the Alignment including the Junction / Crossing Stations in line with the list of ROW attached as **Attachment 1A** to the Scope of Work included in Employer's Requirements - Functional. ROW has also been physically staked all along the Alignment.

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The Alignment Drawings enclosed in the Reference Drawings are indicative and the Contractor shall be responsible for verifying their correctness and modifying them in compliance with the Design Criteria stipulated in the Employer's Requirements – Design (Volume II of the Bid Documents).

The Contractor shall ensure that his design of the Works is - consistently developed without infringing the Right of Way, the Structure Gauge and the Clearances as stipulated in the Design Criteria during the Technical Design development.

All the existing public utilities that could be identified infringing the Right of Way (ROW) have been charted including shifting of Electric Lines of 33 kV and below, other Charted Public Utilities presently existing within the Right of Way and requiring extension / temporary diversion and / or to be supported / handled / protected during construction and permanent diversion of irrigation canal. All these Public Utilities are listed in **Attachment 6, Attachment 9 and Attachment 13** respectively to the Scope of Work included in Employer's Requirements – Functional (Volume II of the Bid Documents) and also indicated on the Alignment Drawings wherever possible. Diversion of all above mentioned charted public utilities presently existing within Right of Way, are within the Scope of Works of this Contract.

All the balance Electric Lines of above 33 kV (listed in **Attachment 15**) and the other public utilities (if any) as indicated on the Alignment Drawings are for the information of the Contractor and shall be diverted by others. Their locations shall be regarded as approximate and it is the Contractor's sole responsibility to verify their precise nature and location before undertaking the Technical Design.

Handling of the existing public utilities including uncharted utilities is described in the Employer's Requirements – Construction and Appendix 15 [Requirements for Construction] to the Employer's Requirements.

(2) General Drawings – Containing the general map of the alignment route and the Site location map

(3) Civil Works Drawings – Containing the indicative General Arrangement Drawings (GADs) for bridges/ structures and level crossings (if any), standard cross sections of the formation (embankment / cut), drainage system, and existing public utility drawings etc. The General Arrangement Drawings (GADs) are a set of reference drawings which shows the Employer's concept of each Permanent Works above are indicative and for reference only and shall be further developed by the Contractor as part of Technical Design and, where relevant, coordinated with Other Contractors and Interfacing Parties.

(4) Standard Drawings of the Track Works containing Junction and Crossing Station track layout, expansion joint details, rails, prestressed concrete (PSC) sleepers, fastenings, expansion joints, turnouts, wayside signs etc.

(5) Building Works Drawings containing various buildings in the Junction / Crossing Stations, and typical layout of Junction and Crossing Stations

(6) Standard Details containing slope protection,, standard design of bridge superstructure and box culvert, steps and side drain etc.

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6 Specifications

6.1 The Specifications shall be as defined in Sub-clause 2.1 above of Employer's Requirements - General and Clause 1 – General of Volume III of the Bid Documents.

6.2 The Contract shall utilize the SI system of units, Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.

6.3 Conversion between metric units and imperial units shall be in accordance with Indian Standards.

7 Design and Construction Phases

(1) The Contractor shall execute the Works in two phases - the Design Phase and the Construction Phase.

(2) The Design Phase shall start from the Commencement Date and shall include the completion and submission of the Inception Design and the Technical Design. The requirements for the Inception Design and Technical Design are detailed in the Employer's Requirements – Design.

(3) The Design Phase shall be considered complete upon the issue of a "Notice of No Objection" in respect of the last Technical Design Submission, to be submitted not later than the Coordinating Event CT4A as described in Volume 1 of the Bid Documents and comprehensively and completely forms the Technical Design for the whole of the Works.

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

(5) The Construction Phase shall include the completion and submission of the Construction Design and the As-Built Documents. The requirements for the Construction Design and As-Built Documents are stated in the Employer's Requirements - Design.

8 Programme Requirements

(1) The Coordination Dates are defined in the Coordination Events in the Appendix to Bid in Volume I of the Bid Documents. The various stages of constructions shall be identified by the Contractor as required in Appendix 5 [Project Programme and Requirements] to these Employer's Requirements.

(2) The Contractor shall develop a detailed programme covering the whole scope of the Contract to be executed within the completion period as specified in the Contract and based on the Bid Program and submit the same to the Engineer for his consent within 28

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days after the Commencement Date. Upon consent by the Engineer to the programme, it shall be referred to as the **Contractual Construction Programme,** and become an integral part of the Contract. The Engineer shall seek the consent of the Employer before communicating the acceptance of the **Contractual Construction Programme** to the Contractor.

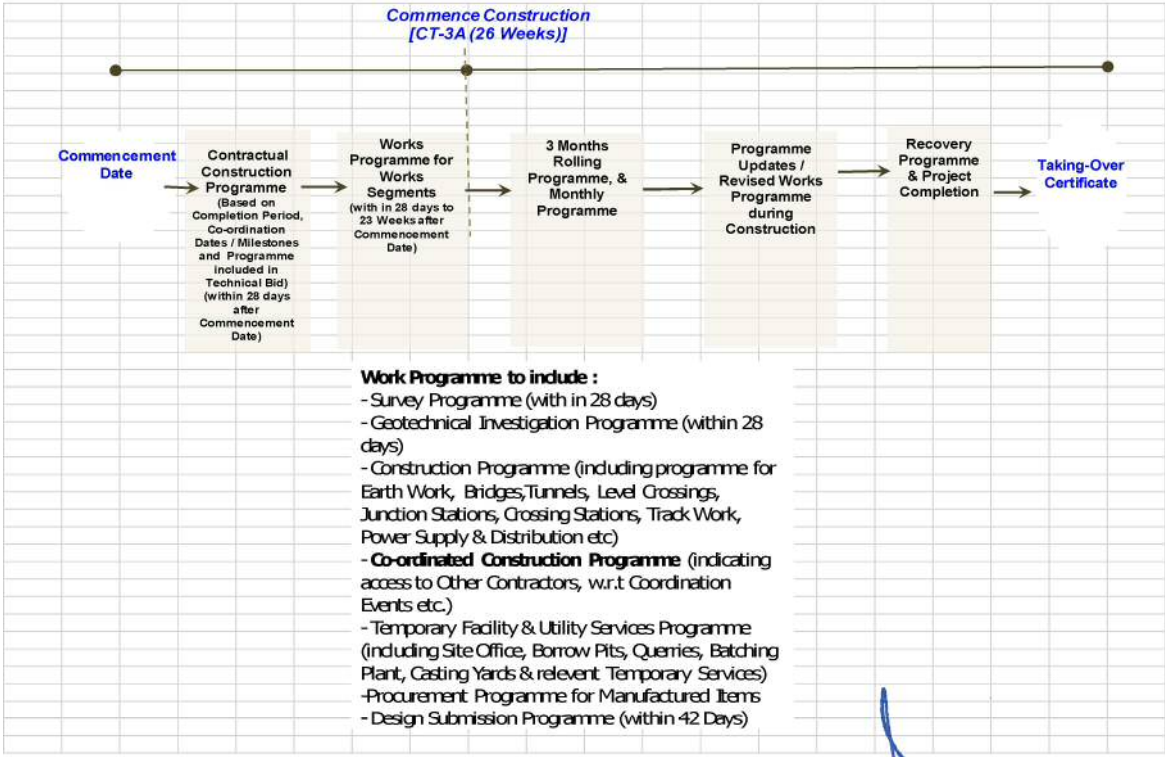
(3) Based on the Contractual Construction Programme, the Contractor shall submit sub-divided and further detailed **Works Programmes** to the Engineer for checking and monitoring the Works.

The Works Programmes for the all Works Segments as defined in Appendix 14 [Requirements for Design] produced and submitted to the Engineer shall be strictly in compliance with the Contractual Construction Programme. Requirements for the programmes are detailed in Appendix 5 [Project Programme Requirements] to the Employer's Requirements.

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

(5) The Works Programme shall take full account of the Design Submission Programme.

(6) The flow diagram for the Programme Requirements shall be as under :



9 Document Submission and Response Procedure

Within 28 days after the Commencement Date, the Contractor shall submit the Document Control Procedure to the Engineer for review, which shall comply with the detailed technical requirements as detailed in Appendix 8 [CAD and Document Standards] and also with the procedural requirements described in Appendix 13 [Document Submission and Review Procedure] in the Contract.

10 Quality Assurance Requirements

The Contractor shall establish and implement the Project Quality Assurance Plan for design and construction of the Works as described in Appendix 7 [Quality Assurance] to the Employer's Requirements. This Quality management system detailed in the plan shall be applied without prejudice to, or without in any way limiting, any quality systems that the Contractor already maintains.

11 Safety, Health and Environment (SHE) Requirements

11.1 The SHE requirements contain major items with respect to environmental and social considerations, and safety and health considerations for all parties including, people affected by the Works, Contractor's Employees, and the party involved in the Contract. Measures to the SHE requirements shall be taken by the Contractor in accordance with the requirements of various applicable Legislations, Acts, Statutes, Regulations, Rules, Codes & Standards etc. Key requirements are detailed in Clause 16 [SHE Requirements] of the specifications (Volume III of the Bid Documents).

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

11.3 The Contractor shall at all times be solely responsible for maintaining the health and safety of all his employees and safety of the general public whilst exposed to construction activities whether on or off-site. The Contractor shall at all times take all the precautions as necessary to maintain health and safety of all his employees during working hours and during hours in his employee's camp. His Employee's camp shall meet the requirements detailed in Appendix 9 [Temporary Works] to the Employer's Requirements.

11.4 Under the requirement of this Contract for CTP-3 (R), the Contractor shall strictly comply with all mandatory terms and conditions including recommendations throughout the entire construction period, as imposed by the competent authorities (i.e. Ministry of Environment, Forests & Climate Change, State and National Wild Life Board, Central Empowered Committee of the Hon'ble Supreme Court of India, State Pollution Control Board, State Forest Department etc.) via final clearance letters or any other mechanism for Forest Clearance (Stage- I & II), Balaram Ambaji Sanctuary, Thol Wildlife Sanctuary etc.

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12 Software Support, Management and Control

12.1 General

(1) The Contractor shall provide full support to the Employer and the Engineer for all computer programs provided by the Contractor under the Contract. The Contractor shall provide to the Employer and Engineer one each of the software packages with the same software products as those that the Contractor intends to use for the project, inclusive but not limited to programmes for project management, design development etc. The Contractor shall utilize a shared electronic document management system with the Engineer and the Employer which shall be web / internet based.

(2) The Contractor shall submit a software support plan at least 28 days before commencement of software installation. This plan shall require the Contractor to provide all changes, bug fixes, updates, modifications, amendments and new versions of the program as required by the Engineer.

(3) The Contractor shall provide all tools, equipment, manuals and training necessary for the Employer / Engineer to maintain and re-configure all the software provided under the Contract.

(4) The Contractor shall submit all new versions to the Engineer for review at least 2 weeks prior to their installation. New versions of any program shall not result in any non-conformance with the Employer's Requirements and Specifications, or degrade the operation of the system. The Contractor shall:

- ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.
- ensure that all new versions are fully tested and commissioned once installed on the Site; and
- deliver to the Employer/ Engineer any new version, together with the updated Operation and Maintenance Manuals.

(5) The Engineer / Employer shall not be obliged to use any new version and that shall not relieve the Contractor of any of its obligations. Any effect upon the performance or operation of the computer controlled system that may be caused by a new version shall be brought to the Engineer's attention including updating the files to suit new version.

12.2 Security Obligations

(1) Within 14 days of the application of any software into the Permanent Works by the Contractor, the Contractor shall submit to the Engineer for retention by the Employer two backup copies of the software, which shall include, without limitation

- All licenses in favour of the Employer, for his use.
- All source and executable code
- All design documentation relating to the software and
- Any specified development tools required for maintenance of the software including, but not limited to editors, compilers and linkers.

12.3 Error Correction

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

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(2) The Contractor shall provide written details as to the nature of the proposed correction to the Engineer.

(3) The Contractor shall notify the Engineer / Employer promptly of any fixes or patches that are available to correct or patch faults.

(4) The Contractor shall details any effect such fixes or patches are expected to have, upon the applications.

12.4 Training

(1) The Contractor shall provide training for the Employer / Engineer's staff to enable the Employer / Engineer to make proper use of any software and its new versions.

(2) To ensure the quality of the software development process, the Contractor shall comply with the requirements of the BS EN ISO 9000-3:1997 "Guidelines for the application of ISO 9001 to Development, Supply and Maintenance of Software – Implementation Criteria". Where the software is to be supplied by an organization other than the Contractor, the Contractor shall pass on all requirements in their entirety and without modification. The Contractor shall, however, remain responsible for the execution of the Works.

13 Contractor's Coordination with Others

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

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

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

The Contractor shall actively seek out solutions to integration issues, and to anticipate, to plan for, and to comply with the needs of these related parties, which are properly required and consistent with the obligations under the Contract. The Contractor shall comply in this respect with the requirements of Appendix 10 [Contractor's Coordination with Others] to the Employer's Requirements. Further details regarding design co-ordination with the other related entities are given in the Employer's Requirements – Design and Employer's Requirements – Construction. .

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

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

The interface Communication and Co-ordination Model is graphically shown as below:

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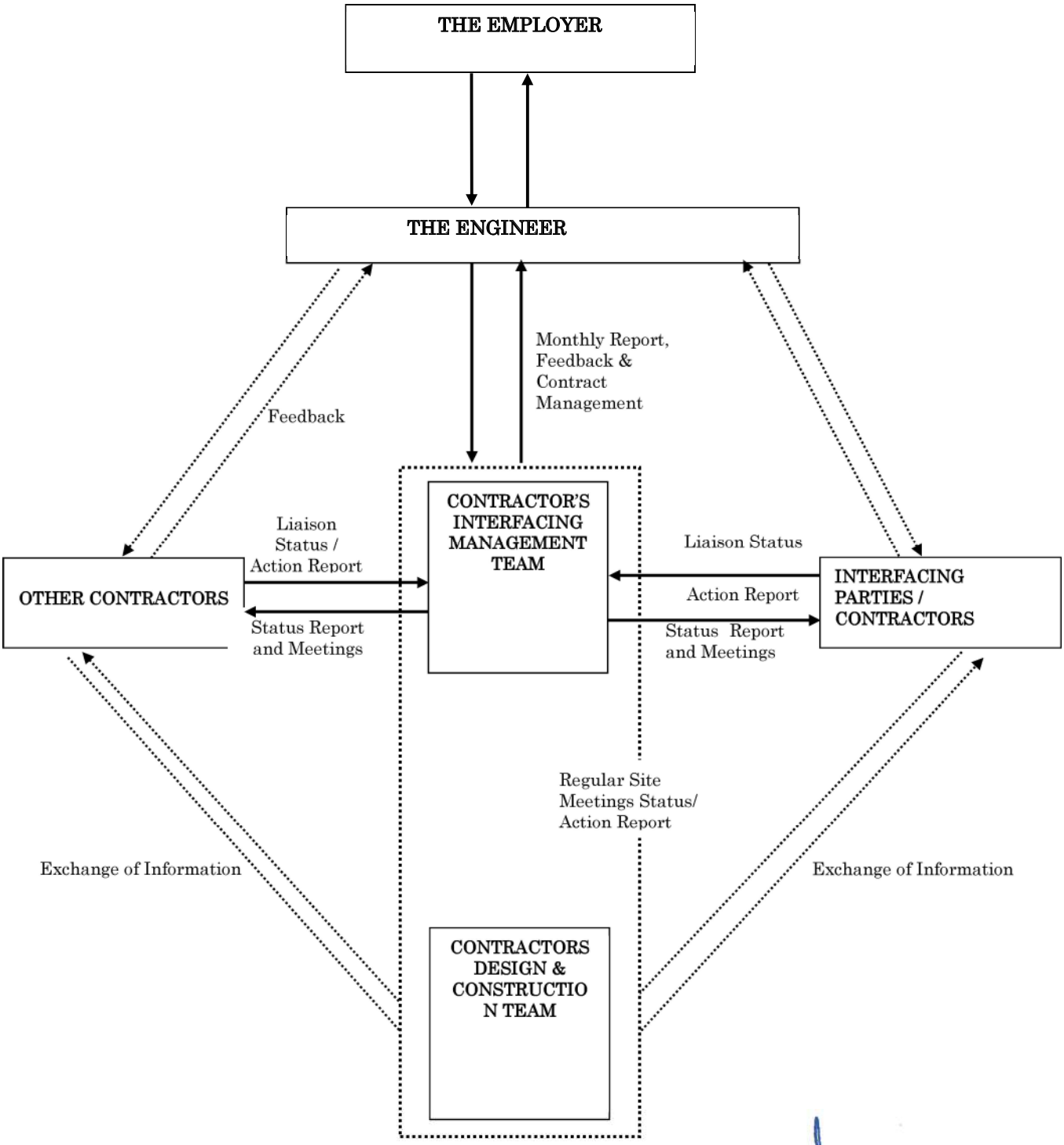

CONTRACTOR'S ORGANISATION

14 Site Installation and Demobilization

14.1 Within twenty eight days of the Commencement Date, the Contractor shall establish a temporary office at the Site duly equipped for the Contractor's Representative and his supervisory personnel. All correspondence shall continue to be addressed to the Contractor's registered head office but shall be sent to this office at the Site and shall be deemed to have been sent to the Contractor's head office.

14.2 All necessary Temporary Works regarding site installation such as Temporary Facilities and Temporary Utility Services shall be provided, equipped, and maintained by the Contractor for his own use, for his sub-contractors, for the Engineer and the Employer. The detailed requirements are described in Appendix 9 [Temporary Works] to the Employer's Requirements.

14.3 All the Temporary Facilities and Temporary Utilities Services including but not limited to those defined in Appendix 9 [Temporary Works] to the Employer's Requirements shall be provided, equipped, and maintained in good conditions and shall not be discontinued without the consent of the Engineer but not later than the issue of Taking-Over Certificate.

15 Site Surveys and Investigations

Prior to the Alignment verification and reviews of the various Reference Drawings by the Contractor, the Contractor shall carry out validation of the data as provided by the Employer and any additional surveys, if considered necessary by the Contractor, including any other geotechnical investigations to commence his design. The details are as specified in Appendix 2 [Validation of Data, Additional Survey and Setting Out].

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

The Contractor shall plan and programme those validation and additional surveys if considered necessary and investigations required to commence the design of Works and develop them to the Survey Plan and Programme as detailed in Appendix 2 [Validation of Data, Additional Survey and Setting Out], Appendix 14 [Requirements for Design] and Appendix 5 [Project Programme Requirements] to the Employer's Requirements.

The Contractor shall summarise the results of Validation of Data and Additional Survey including all the site surveys and investigations in to different reports as specified in Appendix 2 which shall form part of the Survey Report, and shall be submitted to the Engineer for his consent. The Contractor shall continue to be solely responsible for the accuracy and entirety of all the site surveys and investigations including Traverse Survey, Topographic Survey, Centre Line Survey and Geotechnical Investigations etc. throughout the Contract. . Any 'Notice of No Objection' from the Engineer does not absolve the Contractor from his responsibility for accurately designing the Alignment and setting out the Works within the available Right of Way.

15.1 Traverse Survey

The Contractor shall carry out Traverse Survey and establish the horizontal and vertical control systems at Site meeting all the requirements as specified in Appendix 2 [Validation of Data, Additional Survey and Setting Out].

As specified in Appendix 2, the Contractor shall summarize the Traverse Survey results with verification studies in the DFC Benchmark Establishing Report as required in Appendix 14 [Requirements for Design] to the Employer's Requirements.

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15.2 Topographic Survey

Upon review and 'Notice of No Objection' of the DFC Benchmark Establishing Report by the Engineer, the Contractor shall immediately carry out the validation of the data provided by the Employer including additional Topographic Survey, if considered necessary by the Contractor, and meeting all the requirements as specified in Appendix 2 [Validation of Data, Additional Survey and Setting Out] to the Employer's Requirements including verification of the Right of Way (ROW), details of which is provided by the Employer and submit the Site Location / Layout Maps and Structure Setting-out Maps etc., as detailed in Appendix 2 [Validation of Data, Additional Survey and Setting out], to the Engineer for his review and consent.

It shall be the Contractor's sole responsibility to ensure that there are no obstructions to in the Right of Way for Permanent Works based on the validation of data and additional survey carried out by the Contractor. If any obstructions such as trees, structures or charted / unchartered public utilities etc. exists, the Contractor shall locate the obstructions on the Site Location Maps or Structure Setting-out Maps with the procedure and method statement that addresses the handling of the obstructions, and submit to the Engineer for consent. Such obstructions shall be dealt with as per the provisions of the Contract.

The Contractor shall summarize the results of validation of data and topographic survey and include the same in the Survey Report as required in Appendix 14 [Requirements for Design] to the Employer's Requirements and submit to the Engineer for his consent.

15.3 Centre Line Survey

The Contractor shall design the horizontal and vertical Alignment and yard layout for each Station as per the Design Criteria specified in Employer's Requirements - Design [Volume II of the Bid Documents], and within the available ROW giving due consideration to the various obligatory points e.g. existing Bridges, Level Crossings (if any), ROBs etc.

The Contractor shall ensure that the Alignment is located adequately within the Right of Way as indicated in the Alignment Drawings. If not adequately aligned, then the Contractor shall notify the Engineer of the conflicts including descriptions on the issue and modify the same to ensure that there is no conflict with the Right of Way and in compliance with the Design Criteria as stipulated in the Employer's Requirements – Design (Volume II of the Bid Documents). The Contactor shall submit the revised Alignment Drawings (if required) to the Engineer for his review and consent of the Employer.

The Contractor shall develop the Alignment Plan and Profile Drawings in respect of the Alignment and yard layout for each Station as described in Appendix 2 [Validation of Data, Additional Survey and Setting Out] and Appendix 12 [Design Requirements] supplemented by the data derived from the validation of data and additional Topographic Survey and submit the same to the Engineer within the Coordination Date designated as "CT-3" as listed in the Appendix to Bid

The Engineer shall seek the approval of the Employer before communicating the Notice of No Objection of the Alignment Plan and Profile.

Upon Notice of No Objection to the Alignment Plan and Profile Drawings and yard layout for each Station (collectively called 'Alignment Drawings') by the Engineer, the Contractor shall immediately carry out the Centre Line Survey and staking of the Alignment at Site based on the DFC Benchmarks meeting all the requirements as specified in Appendix 2 [Validation of Data, Additional Survey and Setting Out].The Centre Line Survey shall include ROW verification / staking and Horizontal Alignment staking and shall be carried out as specified in Appendix 2 [Validation of Data, Additional Survey and Setting Out].

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15.4 Geotechnical Investigations

(1) Employer has carried out geotechnical investigation along the alignment and details of the same including the bore log data and SPT 'N' Value etc. are available in the Data Book (Volume-IV of the Bid Documents) for reference of the Contractor. The contractor shall carry out the confirmatory exploratory core boring at his own cost. The Employer shall not entertain any claim in case the contractor encounters the strata different than that indicated in the Data Book.

(2) The Contractor shall carry out the exploratory core boring for all the bridges such as the Important Bridges, the Major Bridges, the Railway Flyovers, the ROBs, RUBs and the Minor Bridges along the Alignment as well as for all the stretches on which the Embankment is to be constructed, in compliance with the following as a minimum requirement :

(a) For an n-span bridge structure, one (1) exploratory bore hole in every three (3) spans in addition to two (2) bore holes at the both longitudinal end of the structure where abutments are to be located shall be made (e.g. 2 bore holes for a 1 or a 2-span bridge and 4 bore holes for a 7-span bridge and so on);

(b) In case of an Important Bridge, the exploratory bore holes shall be made at every sub-structure location

(c) For the Minor Bridges including a culvert box or a pipe culvert, one (1) exploratory bore hole shall be made in one location of the structure; and

(d) The Contractor shall carry out the exploratory core borings for locations on which the Rail Track Formation is to be constructed (for both embankment and excavation stretches) at least one (1) exploratory bore hole in every five hundred (500) meters along the Alignment.

In case the Contractor considers that the additional geotechnical investigations are necessary for undertaking the Detailed Design work, he may make use of the geotechnical investigation data included in the Data Book (Volume IV of the Bid Documents) in case the Contractor is satisfied that the results of the exploratory core boring undertaken by him (as detailed above) are in conformity with the results of the geotechnical investigation included in the Data Book. Alternatively, the Contractor may carry out additional geotechnical investigation as planned in his Geotechnical Investigation Plan in compliance with the requirements as detailed in Appendix 14 [Requirements for Design], and the Specifications under the Contract. The amount for all the geotechnical investigation to satisfy the Contractor's requirement shall be deemed to be included in the Contract Price.

(3) The Contractor shall also carry out Plate Load Test, as required and at the locations as consented by the Engineer, to determine the bearing capacity of the soil.

(4) Based on the geotechnical investigation as above, the Contractor shall submit the Geotechnical Interpretative Report on Structure Foundation and Rail track Formation to the Engineer for review.

15.5 Field Trial Embankment

(1) The Field Trial Embankment shall be carried out to determine the following parameters for each material to be used for the objective embankment:

(a) Optimum spreading thickness of lift;

(b) Number of roller passes; and

(c) Type of compaction equipment to be used.

(2) The Contractor shall submit the Field Trial Embankment Plan to the Engineer for consent.

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at least twenty eight (28) days in advance of carrying out the Field Trial Embankment. After the Trial the Contractor shall report to the Engineer the results which shall contain the appropriate parameters above based on the tests as specified in the Specifications including in-situ and laboratory tests together with his consideration on the detailed actual implementation procedure for the embankment. The Field Trial shall be carried out for each different material which has different characteristics based on the material tests which have already carried out and consented by the Engineer as described in the Specifications. The Contractor shall include all those time factors in the Construction Programme for Stretch as specified in Appendix 5 [Project Programme Requirement] to the Employer's Requirements.

(3) The Contractor shall locate an appropriate place for the Field Trial where his proposed Trial accomplishes the objectives above. The Contractor shall select the location of the place for the Trial, subject to the Notice of No Objection by the Engineer, in the Right of Way where the Trial does not interfere with the Works during the period of the Trial including reinstatement of the area affected by the Trial.

16 Project Management Information System (PMIS)

16.1 The Contractor shall devise and utilize a PMIS such that all documents generated by the Contractor can be transmitted to the Engineer by electronic means (and vice versa) and that all documents generated by either party are electronically captured at the point of origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer Office at site and the Employer's site office and Headquarters Office by the Contractor. The documents shall comply with the standards as specified in Appendix-8 "CAD Document Standards" to the Employer's Requirements.

16.2 The Employer is in the process of implementing an Enterprise wide IT system titled "Supply & Installation of Integrated IT System" (to be done by other contractors). The objective of the IT Plan is to automate core organizational business functions / process and develop a working environment that enables higher efficiency and effectiveness, not only in internal functions but across the entire ecosystem of the Employer including Contractors. A total of eight (8) applications are envisaged for the Employer and the components of the proposed system include the following elements:

a) An ERP System for covering Finance & Accounting, HR, Project Management, General Administration to integrated management control;

b) A document Management System to ensure that all drawings / critical documents related to the construction phase are well documented and archived;

c) A Geographical Information System that shall initially have details of every asset that is created. It shall have the entire alignment geo-referenced. The monitoring of various contracts is proposed to be done through Dashboards that will have a significant component of GIS; and

d) An Enterprise Asset Management that has spatial co-ordinates of every asset.

The proposed IT System has been designed for facilitating preservation of important artifacts (plans, drawings, notes, documents, reports etc.) in a secure and manageable environment in digitized format. Appropriate triggers shall generate dashboards and management reports every time an event causes a substantial shift in the project risk or a deviation in processes is developed. The envisaged system would expedite decision making, ensure better planning and co-ordination between different functions, better data management, effective reporting, knowledge management etc. Programme management

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shall provide senior management with critical information related to various contracts, activities and funds in the form of management dashboards with inbuilt triggers to ensure timely decision making

16.3 In view of the above, the Contractor shall be required to:

a) Upload / definition of Project Plans as per the template and using software defined by the Employer

b) Maintenance and updating of uploaded Project Plans in software used by the Employer

c) Upload of drawings / designs created by the Contractor as per the classification and on the software platform defined by the Employer

d) Online measurement book entry (as required) in the Project Monitoring System, in a template defined by the Employer

e) Asset details need to be updated bin the system in the formate prescribed by the Employer

f) Geo-referencing of the alignment

g) Capture and upload of geo-referencing co-ordinates of the assets into GIS

h) Upload of digitally signed invoices for payment processing

16.4 It shall be the responsibility of the Contractor to ensure that there is interoperability between the Contractor's IT System and that being developed by the Employer so that the movement of information and data across Employer's boundaries is feasible in a seamless manner.

17 Contractor's Project Organizations

17.1 The Contractor shall have a competent team of managers, engineers, technical staff, experts and support staff etc. so as to complete the work in a satisfactory manner in compliance with Employer's Requirements and Specifications. The designations of the various project organizations team members shall be accepted by the Engineer before adoption.

17.2 The Contractor shall establish an organizational and procedural scheme which ensures all the Works are carried out strictly in compliance with the Employer's Requirements and Specifications and for the benefit of the Employer throughout the Contractor's design/ build implementation as required in Employer's Requirement – Design/ Construction and Appendix 7 [Quality Assurance] to the Employer's Requirements.

17.3 A control room with round the clock radio communication or telephone switch board links with all safety offices, Work Areas including but not limited to site offices, batching plants, casting yards workshops, fabrication yard, off site offices, Engineer's Site Office and Huts, Quarry Areas, Borrow Areas, 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 shall be on stand-by at the control room around the clock.

18 Training and Skills Transfer

The Contractor shall ensure that the Employer's personnel and all local contractors and sub-contractors engaged on the Works are given the opportunity for the necessary training and skills transfer to the extent required in the various areas of Civil, Building and Track Works such as Detailed Design, Foundation Works, Launching Works, Pre-stressing works, Track Laying, Mechanical, Electrical and Plumbing (MEP) building services, safety, quality assurance, environmental protection, installation procedures and repair and replacement of plant works, and

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any other job trainings that facilitate efficient execution of the Works.

19 Confidentiality and Public Relations

19.1 The Contractor shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out is obligations under it or to comply with applicable Laws

19.2 The Contractor shall prepare and submit Public Relations (PR) Plan to the Engineer for consent. The Contractor shall also carryout PR activities and public consultation works with the instruction and guidance of the Engineer. Further details of the Publicity and Public Relations are described in Appendix-16 [Publicity and Public Relations] to the Employer's Requirements.

19.3 The Contractor / Sub-contractors shall not publish present at seminars, forums or otherwise circulate alone or in conjunction with any other person, any articles, photographs or other materials relating to the Contract, the Site, the Works, the Project or any part thereof, nor impart to the Press, or any radio or television network any information relating thereto, nor allow any representative of the media access to the Site, Contractor's Works Areas, or off-Site place of manufacture, or storage except with the permission, in writing, of the Employer. The provisions of this Sub-Clause shall not exempt the Contractor from complying with any statutory provision in regard to the taking and publication of photographs. The Contractor shall ensure that his sub-contractors of any tier shall be bound by a like obligation and shall, if so required by the Employer, enforce the same at his own expense.

20 Monitoring of Progress

20.1 The Contractor shall submit to the Engineer 6 copies of a Monthly Progress Report (MPR), as described in Appendix-6 [Monthly Progress Report] to these Employer's Requirements, describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.

20.2 The MPR shall be divided into two sections. The first section shall cover progress and current status relating to design and the second section shall cover physical progress and current status relating to construction including co-ordination, procurement and other miscellaneous items.

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

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

20.5 **Management Meetings**

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

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

(3) The minutes of the meeting signed by the Contractor, the Employer and the Engineer shall constitute an official record of matters discussed, but shall not replace any requirement in

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the Contract for consents, approvals, instructions or decisions to be submitted in writing.

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

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

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

21 Maintenance Report

21.1 The Maintenance Report shall be submitted as part of the Technical Design and shall include full details of the long term inspection and maintenance operations for each major component including Embankment, Track Works, Bridges, Stations, ventilation equipment, non-traction power supply and distribution systems, firefighting equipment and water supply, drainage and sewerage, etc.

21.2 In addition to the various existing Codes and Manuals of Indian Railways as applicable for Operation & Maintenance of permanent Civil & Track Works and other assets, the Contractor shall provide the additional provisions (if any) to the applicable IR Manuals required for the Operation and Maintenance of various assets created as per the Contract. It shall include but shall not be limited to those identified in Clause 7 of Employer's Requirements – Manufacture, Installation, testing and Commissioning.

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

22 Intellectual Property Rights and Royalties

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

22.2 The Contractor shall be promptly notified of any claim under this Sub-Clause made against the Employer. The Contractor shall, at his cost, conduct negotiations for the settlement of such claim, and any litigation or arbitration that may arise from it. The Employer or the Engineer shall not make any admission which might be prejudicial to the Contractor, unless the Contractor has failed

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to take over the conduct of the negotiations, litigation or arbitration within a reasonable time after having been so requested. In the event of the Contractor failing to act at the Engineer's notice, the Employer, in addition to any other remedy as deemed necessary, shall be at full liberty to deduct any such amount of pending claim from any amount due to the Contractor under this Contract or any other Contract.

22.3 Subject to the provisions of Sub-clause 1.10 [Employer's Use of Contractor's Documents] of General Conditions in Volume I of the Bid Document :

a) All designs, drawings, including the computer computations undertaken, software developed by the Contractor solely for the purposes of executing the Project and fulfilling the prescribed contractual requirements of this Contract shall be taken over by the Employer.

b) Insofar as the patent, copyright or other intellectual property rights in any Plant, Design Data, plans, calculations, drawings, documents. Materials, know-how and information relating to the Works shall be vested in the Contractor, the Contractor shall grant to the Employer, his successors and assignees a royalty-free, exclusive and irrevocable license with permission to sublicense to use after completion of the Work and reproduce any of the works, designs or inventions incorporated and referred to in such Plant, documents or Materials and any such know-how and information for all purposes relating to the Works (including without limitation the design, manufacture, installation, reconstruction, testing, commissioning, completion, reinstatement, extension, repair and operation of the Works).

c) If any patent, registered design or software is developed by the Contractor specifically for the Works, the title thereto shall vest in the Contractor and the Contractor shall grant to the Employer an exclusive irrevocable and royalty-free license to use, repair, copy, modify, enhance, adapt and translate in any form such Software for internal use of the Employer.

d) If the Contractor uses proprietary software for the purpose of storing or utilizing records, the Contractor shall obtain at his own expense the grant of a license or sub-license to use such software in favour of the Employer and Engineer and shall pay such license fee or other payment as the grantor of such license may require provided that the use of such software under the license may be restricted to use relating to the design, construction, reconstruction, manufacture, completion, reinstatement, extension, repair and operation of the Works or any part thereof.

e) The Contractor's permission referred to above shall be given, inter-alia, to enable the Employer to disclose (under conditions of confidentiality satisfactory to the Contractor) programmes and documentation for a third party to undertake the performance of services for the Employer in respect of such programmes and documentation.

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

g) The Employer reserves the right to use other Software on or in connection with the Works.

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23 Acknowledgement by the Contractor

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

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

(a) Conditions bearing upon the proper transportation, disposal, handling and storage of materials (including but not limited to hazardous toxic substances and excavated materials)

(b) Availability and costs of electricity, water and gas

(c) Availability and rates of employment of skilled and unskilled manpower

(d) The character and quantum of equipment and facilities needed preliminary to and during the design, procurement, manufacture, installation, execution, testing (including Integrated Testing) and commissioning of the Works and remedying of any defect

(e) The protection of the environment and adjacent structures which shall be necessary preliminary to and during the design, procurement, manufacture, installation, execution, testing(including Integrated Testing) and commissioning of the Works and remedying of any defect

(f) The location of and the authorization required for and the means of diversion and facilities required for the purposes of the Works

24 Obligation on Engineer

24.1 It shall be obligatory on the part of the Engineer to seek the prior approval of the Employer on the certain issues specified in Sub-clause 3.1 [Engineer's Duties and Authority] of General Conditions and Sub-clause 3.1 of Particular Conditions and in Volume I of the Bid Documents including the precautions and safety measures proposed by the Contractor for working near running tracks of Indian Railways, as specified in Sub-clause 7 of Employer's Requirements – Construction, before communicating the Engineer's consent for the same to the Contractor.

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

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EMPLOYER'S REQUIREMENTS

FUNCTIONAL

(INCLUDING SCOPE OF WORK)

1 Objective

1.1 The purpose and function of the Contract and the Bid Documents is to set out the Employer's Requirements for execution of the design, construction, completion, testing and commissioning of the Works by the Contractor in the manner and time stipulated in the Contract and to achieve the standards, performance and functionality specified in the Contract.

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

1.2 The Specifications developed by the Contractor shall comply with the Employer's Requirements and specifications as specified in Clause 1 – General of Volume III of the Bid Documents.

1.3 Design of the Works shall be developed in accordance with the Employer's Requirements and Specifications under the Contract to the Contractor's Technical Design proposals, consent of which by the Engineer is deemed to be completion of the design phase. Procedure of the design development is described in Employer's Requirements – Design.

1.4 The system design and its construction/commissioning shall be carried out by Other Contractors. This includes electrification of the line, signaling systems with automatic block signaling, telecommunications and implementation of train radio and a SCADA control system with the main control centre.

1.5 Construction, installation, Testing and Commissioning shall be carried out in accordance with the Specifications and with procedures established by the Contractor through his quality management system as also developed by him meeting the requirements as detailed in Appendix 7 [Quality Assurance] and meeting the Safety, Health and Environment (SHE) requirements as detailed in Clause 16 [SHE Requirements] of the specifications (Volume III of the Bid Documents) and other requirements under this Contract and subject to consent by the Engineer.

1.6 The Contractor shall be responsible for obtaining all necessary approvals from the relevant authorities in Design, Construction and Commissioning of the Works.

1.7 In addition, the Contractor shall be responsible for rectification of the defects appearing in the Permanent Works in the manner and to the standards within the time stipulated by the Contract

1.8 A copy of all the correspondence including the communication as specified in Clause 24 [Obligations on the Engineer] of the Employer's Requirements – General, being exchanged between the Contractor and the Engineer pertaining to the Contract shall also be endorsed to the Employer for his information, by the respective parties.

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2 Contract Requirements

2.1 The design and performance of the Permanent Works shall comply with the specific requirements contained in the Contract.

2.2 The specifications included in Volume III of the Bid Documents are the minimum specific requirements for certain items. The Contractor shall further develop these specifications to the detailed specifications as described in Clause 1 – General of Volume III of the Bid Documents, The specifications so formulated shall be termed as 'Specifications' after consent of the Engineer and approval of the Employer.

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

2.3 In addition, the Contractor shall also comply with Indian Railways (IR) rules and regulations for works to be carried out within the DFC and IR Railway Envelope.

2.4 The Geotechnical Investigation data (Geotechnical Profile) along the alignment as well as other Technical Details, as available with the Employer, is included in the Data Book (Volume IV of the Bid Documents) and is only for information and reference of the Contractor and the Employer does not claim accuracy / sufficiency of the same. These shall be supplemented by verifications / additional investigations if considered necessary by the Contractor for development of his Technical Design at his own cost. No claim shall be entertained by the Employer in case the Contractor encounters the data different than that included in Data Book during the verification / additional investigation. The Contractor shall be responsible for the Geology and the Geotechnical parameters of the sub-surface strata along the alignment as required for his Technical Design submittals. No claim shall be entertained by the Employer in this regard.

3 Scope of Works

The proposed alignment of this Package CT P-3 (R) (Iqbalgarh - Vadodara Section) of Western Dedicated Freight Corridor project consists of two parts Viz.

a) Iqbalgarh – Pansar (134Km) section, located along Iqbalgarh – Palanpur - Jagudan - Pansar lines of North Western Railway and Western Railway. The Iqbalgarh – Jagudan section of the alignment runs on North Western Railway and Western Railway whereas the Jagudan – Pansar section of the alignment runs on Western side of North Western Railway; and

b) Pansar – Vadodara (Makarpura) (154Km) section takes detours from the existing North Western Railway tracks

It is intended to design and construct the system as double line electrified track with 2x25kV, 50 Hz. overhead catenary system capable of operating at a maximum train speed of 100 km/h with an initial axle load of 25.0 tonne. Formation and bridge structures are to be provided for 32.5 tonne axle load and the track structure for 25 tonne axle load.

The scope of the Works to be performed under the Contract (hereinafter referred to as "the Scope of Work") shall comprise of;

a) Design and construction of Civil, Building and Track Works. Design & construction of two special steel bridges and their approaches of 150m length from abutments on both sides of the bridges across river Mahi (at Chainage 161 / 740 Km in Sector 5, near Vadodara) and river Sabarmati (at Chainage 62 / 233 in Sector 7, near Ahmedabad) on the deloured

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alignment between Pansar and Vadodara (Makarpura) in the Iqbalgarh – Vadodara section has been planned to be taken up under separate package (Package CT P-3A (R)) and is excluded from the Scope of Work of Package 3 (R). However, the track work for the Package CT P-3A (R) shall be included in the Scope of Work for Package CT P-3 (R). The approximate length of the bridges across rivers Mahi and Sabarmati are 585m and 536m respectively

The Chainages and obligatory formation levels of the Work Areas for both the Main Line Bridges over river Mahi & river Sabarmati and their approaches are as described in the following tables

Sl. No.	**Section**	**Starting Chainage (Start of Approach on Makarpura Side)** **(Km)**	**End Chainage (End of Approach on Rewari Side)** **(Km)**	**Centre Line of Bridge Chainage** **(Km)**	**Total Length** (Col.4-Col.3) **(Km)**
Col.1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**	**Col. 6**
1.	Section-5 (Mahi River Bridge)	161/298.155	162/183.155	161 / 740.665	0.885 (Bridge Length = 585m) (Approaches = 300m)
2.	Section-6 (Sabarmati River Bridge)	61/815	62/651.250	62 / 233.125	0.83625 (Bridge Length = 536.25m) (Approaches = 300m)
Total					**1.72125 Km**

Sl. No.	**Chainage (Km)**	**Formation Level (in meters)**	**Chainage (Km)**	**Formation Level (in meters)**
	Bridge across Mahi River		**Bridge across Sabarmati River**	
1	161 Km/ 248.155	33.962	61 Km/ 706.875	41.600
2	161 Km/ 388.155	33.264	61 Km/ 906.875	41.600
3	161 Km/ 448.155	33.264	62 Km/ 443.125	41.600
4	162 Km/ 033.155	33.264	62 Km/ 560	41.600
5	162 Km/ 233.155	33.264	62 Km/ 570	41.555
6	-	-	62 Km/ 643.125	41.225

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b) Non-traction Power Supply and Distribution Work.

Scope of Work shall also include any associated works relating to manufacturing, supply, installation, testing and commissioning for electrified double line railway capable of operating at a speed of 100km/h involving design and construction of formation in embankments/ cuttings, bridges, structures, buildings, ballast on formation, track works, integration with Indian Railway System including testing and commissioning on design-build lump sum price.

For the purpose of clarity and better understanding, the entire Scope of Work, has been sub-divided in to following three sections from different perspectives.

a) Scope of Work with respect to Work Areas

b) Item-wise Scope of Work

c) Associated Works and Temporary Works

3.1 Scope of Work with respect to Work Areas

The Scope of Works shall include but shall not be limited to the following with respect to the Work Areas;

All the chainages / lengths as indicated below are indicative and approximate and shall be reviewed and firmed up by the Contractor during Technical Design and subject to 'Notice of No Objection' by the Engineer

(1) Work Areas for Main Line

The Work Areas for the Main Line (electrified double track) which are identified in terms of chainage as described in the following table shall comprise integral part of the Scope of the Work.

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Sl. No.	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km) (Col. 4-Col. 3)	Break in Continuous Chainage (Km)	Effective Total Length (Km) (Col. 5 + Col. 6)	Length of Main Line within Station (Km)	Net Length (Col 7-Col 8)
1	2	3	4	5	6	7	8	9
1.	Sec. 5 (Makarpura Side)	131/000 (Double Track)	205/334.063 (Double Track)	74/334.063 (Double Track)	Nil	74/334.063 (Double Track)	7/170 (Double Track) (3 Stations)	67/164.063 (Double Track)
2.	Sec. 6	23/785 (Double Track)	82/300 (Double Track)	58/515 (Double Track)	Nil	58/515.06 (Double Track)	4/882 (Double Track) (2 Stations)	53/633.06 (Double Track)
		82/300 (Single Track-Dn Line)	86/835.06 (95/00 of Section 7) (Single Track-Dn Line)	4/535.06 (Single Track-Dn Line)	Nil	4/535.06 (Single Track-Dn Line)	Nil	4/535.06 (Single Track-Dn Line)
		82/300 (Single Track-Up Line)	86/800.48 (95/00 of Section 7) (Single Track-UpLine)	4/500.48 (Single Track-UpLine)	Nil	4/500.48 (Single Track-Up Line)	Nil	4/500.48 (Single Track-Up Line)
3.	Sec. 7	95/000 (Double Track)	112/120 (Double Track)	17/120 (Double Track)	Nil	17/120 (Double Track)	3/165 (Double Track) (1 Station)	13/955 (Double Track)
4.	Sec. 8N	0/000 (Double Track)	116/370 (Double	116/370 (Double Track)	Nil	116/370 (Double Track)	6/966 (Double Track)	109/404 (Double

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Sl. No.	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km) (Col. 4-Col. 3)	Break in Continuous Chainage (Km)	Effective Total Length (Km) (Col. 5 + Col. 6)	Length of Main Line within Station (Km)	Net Length (Col 7-Col 8)
1	2	3	4	5	6	7	8	9
			Track)				(3 Stations)	Track)
5.	Sec. 9 (Ikbal garh Side)	8/697 (Double Track)	26/500 (Double Track)	17/803 (Double Track)	Nil	17/803 (Double Track)	3/027 (Double Track) (1 Station)	14/776 (Double Track)
	Total			**284/142.123**(Double Track) + **9/035.54** (Single Track)		**284/142.123** (Double Track) + **9/035.54** (Single Track)	**25/210** (Double Track) **(10 Stations)**	**258/932.123** (Double Track) + **9/035.54** (Single Track)

(2) **Work Areas for Connecting Lines to Existing IR Lines**

(a) The Work Areas for the Connecting Lines (single track / double track) to the existing IR Lines which are identified in terms of chainage as described in the following table shall be included in the Scope of the Work.

Sl. No.	Location	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km)
1.	Makarpura JS UP Connecting Track (DFC Makarpura Junction Station to Makarpura Station of IR)	Section 5	134/191 (Main line Chainage)	136/544.34 (Main line Chainage)	**2/353.34** (Single Track)
			0/00 (Main Line Ch. 136/544.34)	5/461.00 (IR Km 386/367.59)	5/461.00 (Single Track)
2.	Makarpura JS DN Connecting Track (DFC Makarpura Junction Station to Makarpura	Section 5	134/178.5 (Main line Chainage)	135/658.34 (Main line Chainage)	**1/479.84** (Single Track)

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Sl. No.	Location	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km)
	Station of IR)		0/00 (Main Line Ch. 135/658.34)	5/991.377 (IR Km 386/367.59)	5/991.377 (Single Track)
3.	Sabarmati South Connecting Track (DFC Sabarmati South Junction Station to Goraghuma Station of IR)	Section 6	0/610 (Main Line Ch. 82/300)	6/000	5/390 (Single Track)
4.	Sabarmati South Connecting Track (DFC Sabarmati South Junction Station to Sanand Station of IR)	Section 6	0/610 (Main Line Ch. 82/300)	2/710	2/100 **(Double Track)**
5.	Sabarmati North Connecting Track (Goraghuma Station of IR to DFC Sabarmati North Junction Station)	Section 6	0/000	6/224.95 (Main Line Ch. 95/000)	**6/224.95** (Single Track)
			95/000 (Main Line Chainage)	(Main Line Chainage)	(Single Track)
6.	Sabarmati North Connecting Track (Sanand Station of IR to DFC Sabarmati North Junction Station)	Section 6	0/000	3/113.46 (Main Line Ch. 95/000)	**3/113.46** (Single Track)
			95/000 (Main Line Chainage)	97/000 (Main Line Chainage)	**2/000** (Single Track)
7.	Mahesana Connecting Track (Mahesana IR Station to Mahesana Junction Station of DFC)	8N	0/000	6/685 (Main Line Ch. 56/300)	**6/685** (Single Track)
8.	Palanpur Connecting Track (DFC Chadotar Station to DFC Palanpur Junction Station)	Section 9	0/000	13/603	**13/603 Double Track [Net Length Excluding Chadotar Station : 11/345]**

Sl. No.	Location	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km)

Sl.	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km) (Col. 4-Col. 3)	Break in Continuous	Effective Total Length (Km) (Col. 5 + Col. 6)	Length of Main Line within Station (Km)	Net Length (Col 7-Col 8)
1	2	3	4	5	6	7	8	9
1.	Sec. 9	0/000	13/603	13/603	Nil	13/603	2/258 (1 Station)	11/345

Note : Further extension of DFC Lines towards IR Tracks (if required) beyond the above specified chainages and physical connections with IR Tracks is not in the Scope of Work of the Contractor.

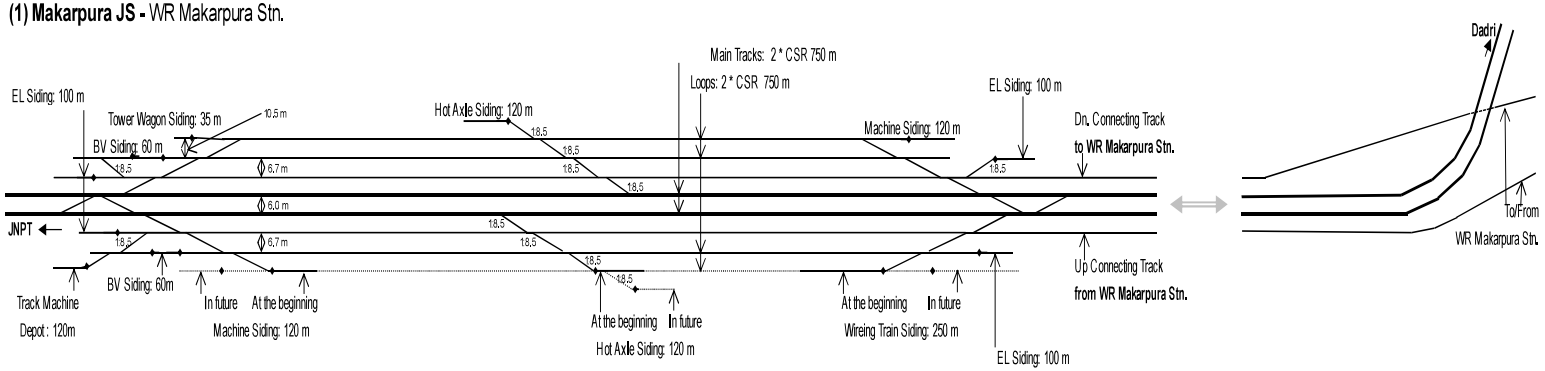
(b) The functional Line Diagram of all the above stated connections to IR tracks are as detailed below:

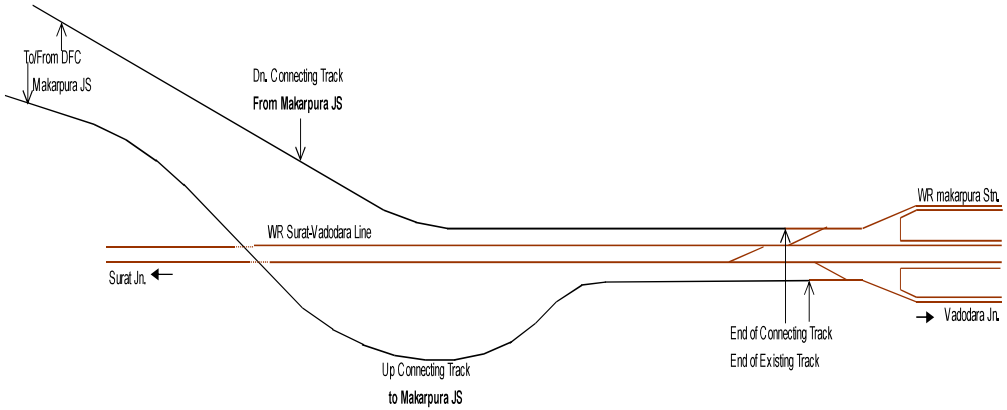
i) Functional Line Diagram for Makarpura Junction Station UP Connecting Track (connecting Makarpura Station of IR to DFC Makarpura Junction Station)

ii) Functional Line Diagram for Makarpura Junction Station DN Connecting Track (connecting DFC Makarpura Junction Station to Makarpura Station of IR)

1. Junction Station

(1) Makarpura JS - WR Makarpura Stn.





[Note] Track spacing that s not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in furure

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iii) **Functional Line Diagram for Sabarmati South Connecting Track (DFC Sabarmati South Junction Station to Goraghuma Station of IR)**

iv) **Functional Line Diagram for Sabarmati South Connecting Track (DFC Sabarmati South Junction Station to Sanand Station of IR)**

v) **Functional Line Diagram for Sabarmati North Connecting Track (Goraghuma Station of IR to DFC Sabarmati North Junction Station)**

vi) **Functional Line Diagram for Sabarmati North Connecting Track (Sanand Station of IR to DFC Sabarmati North Junction Station)**

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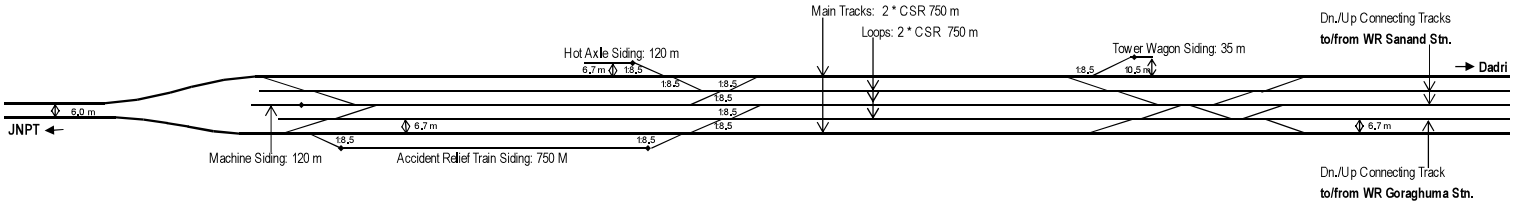
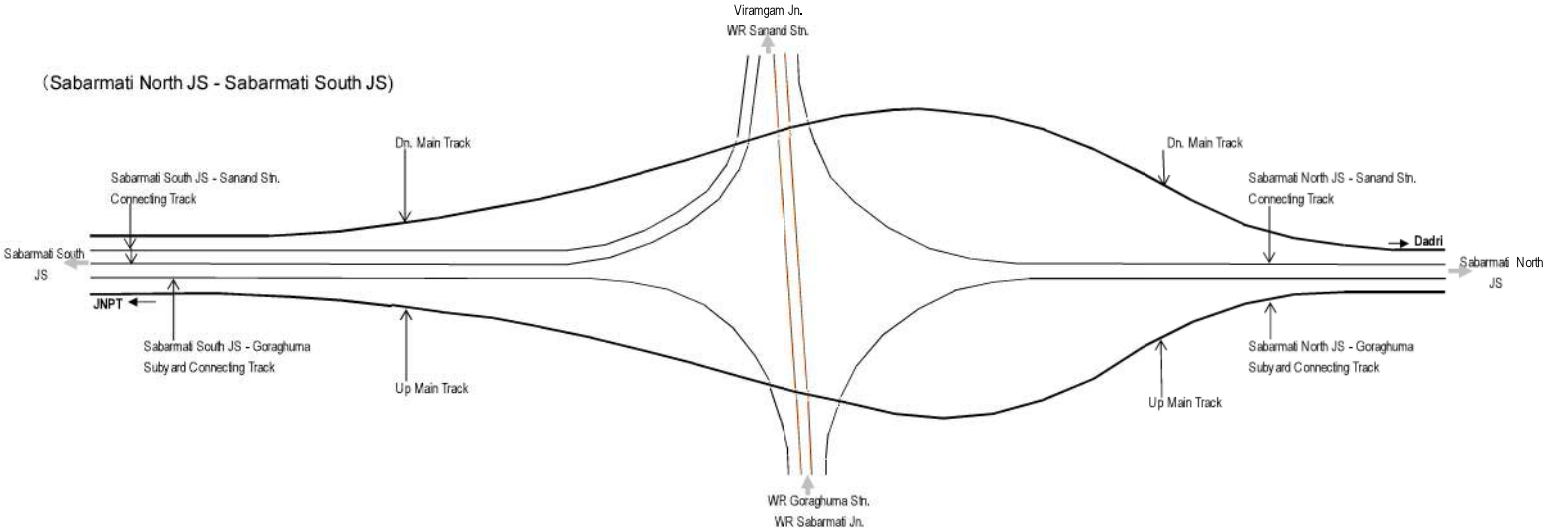
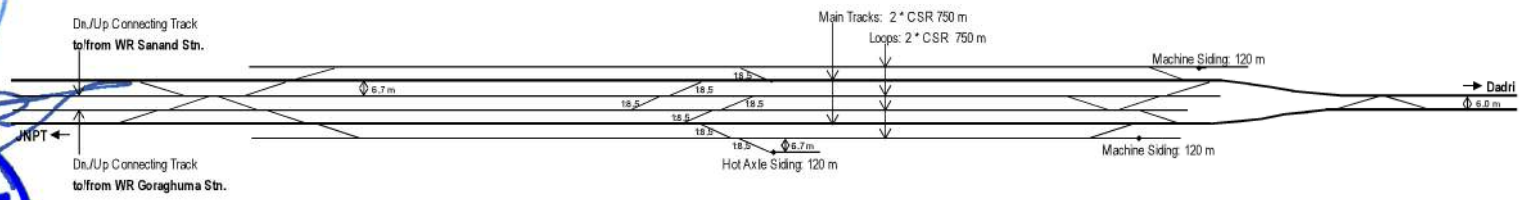
(2) Sabarmati South JS - WR Sanand Stn. /Goraghuma Stn.





(3) Sabarmati North JS - WR Sanand Stn. /Goraghuma Stn.

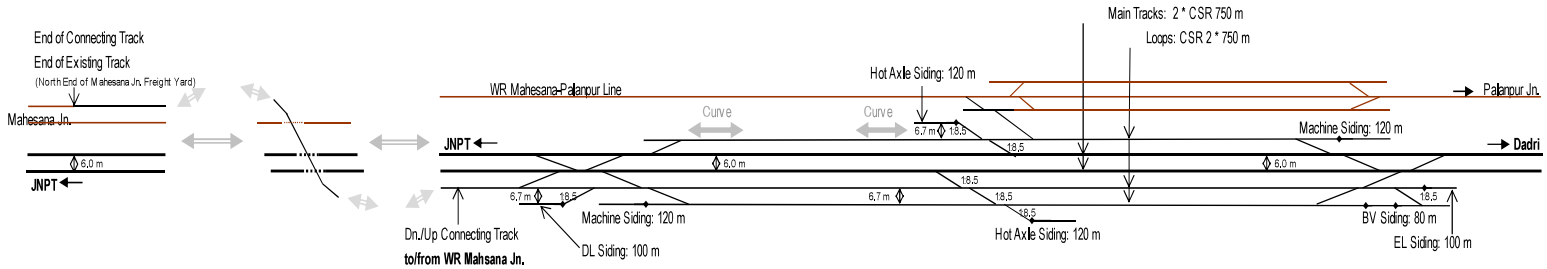


[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in future

vii) Functional Line Diagram for Mahesana Connecting Track (Mahesana IR Station to Mahesana Junction Station of DFC)

(4) Mahesana JS - WR Mahesana Stn.

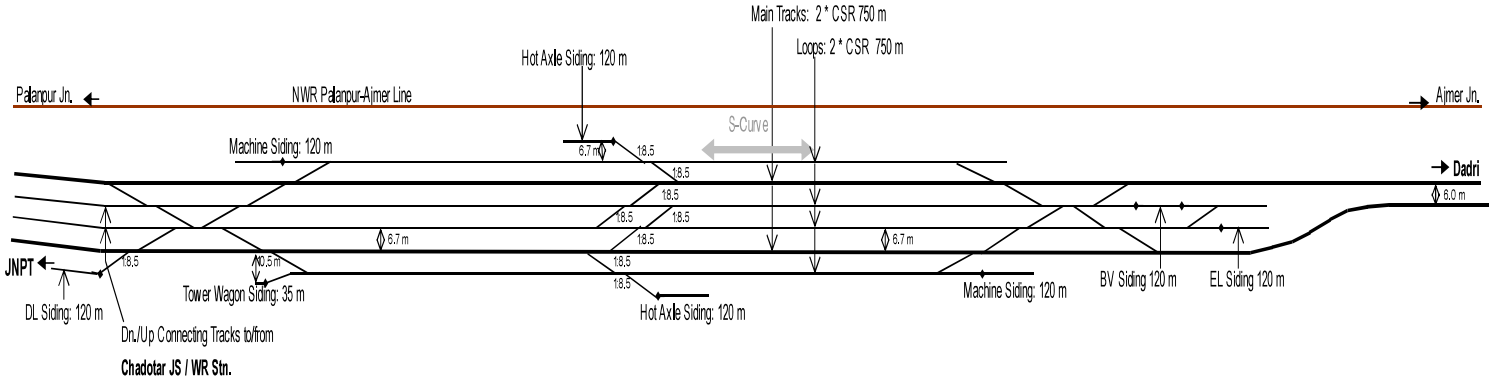


[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

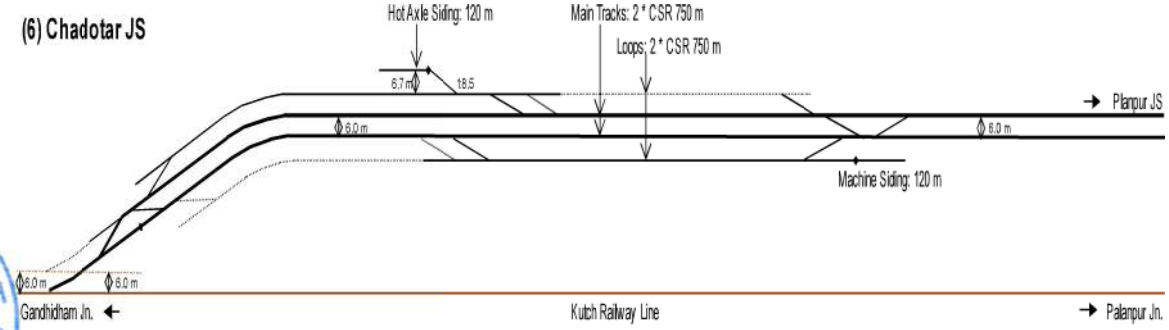
Tracks to be laid in future
Tracks to be removed in furure

viii) Functional Line Diagram for Palanpur Connecting Track (DFC Chadotar Station to DFC Palanpur Junction Station)

(5) Palanpur JS



(6) Chadotar JS



[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in future

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(3) **Work Areas for Junction/ Crossing Stations**

a) The Work Areas for the Junction/ Crossing Stations which are identified in terms of chainage from outer most facing point to outer most trailing point on either side of the Station and as described in the following table shall be included in the Scope of Work, where the Work Areas in the Junction/ Crossing Stations occupied by the Main Line shall be accounted as those of the Main Line.

Sl. No.	Station	Section	Starting Chainage (Km)	End Chainage (Km)	Total Length (Km)
1.	Makarpura Junction Station	Section 5	131/480	134/522	3/042
2.	Vasad Crossing Station	Section 5	166/998	169/450	2/452
3.	Changa Crossing Station	Section 5	195/425	197/877	2/452
4.	Timba Crossing Station	Section 6	55/705	58/210	2/505
5.	Sabarmati South Junction Station	Section 6	79/344	82/040	2/696
6.	Sabarmati North Juction Station	Section 7	97/006	100/217	3/211
7.	Ghumasan Crossing Station	Section 8 N	16/278	18/730	2/452
8.	Mahesana Junction Station	Section 8 N	56/270	58/987	2/717
9.	Malosana Crossing Station	Section 8 N	99/508	101/950	2/442
10.	Palanpur Juction Station	Section 9	10/590	13/713	3/123
11.	Chadotar Station	Section 9	0/099	2/551	2/452

b) The functional Line Diagram of all the Junction Stations Viz. Makarpura, Sabarmati South, Sabarmati North Junction Station and Palanpur Junction Stations / Chadotar Station are detailed in para 2 (b) (i) to (vi) above respectively.

The functional Line Diagram of all the other Crossing Stations are as detailed below.

The various facilities as required for Junction Stations and Crossing Stations shall be as indicated in these Functional Line Diagrams. For details and other facilities the Station Plans as included in Reference Drawings (Volume V of the Bid Documents) may be referred:

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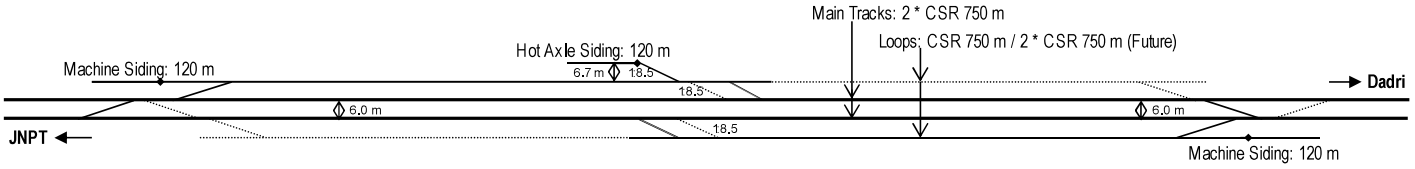
(i) Functional Line Diagram for Vasad Crossing Station of DFC

(1) Vasad CS

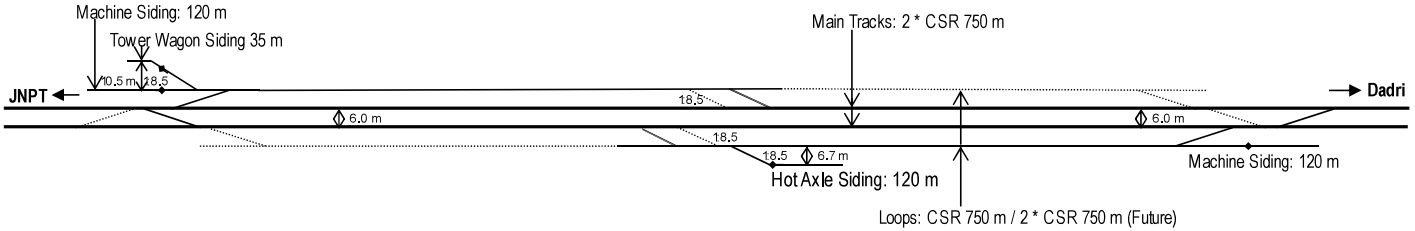


[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in furure

(ii) Functional Line Diagram for Changa Crossing Station of DFC

(2) Changa CS



[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in furure

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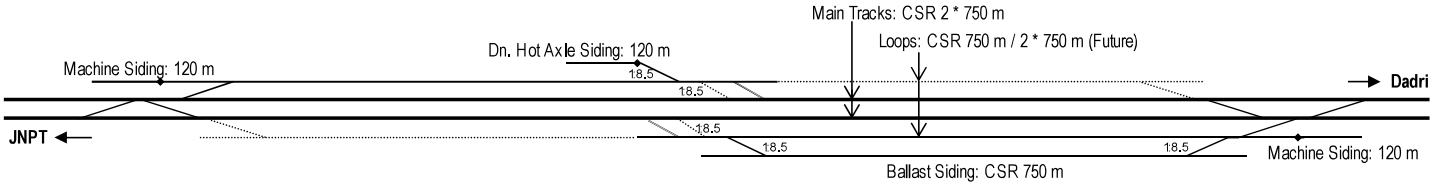
(iii) Functional Line Diagram for Timba Crossing Station of DFC

(3) Timba CS

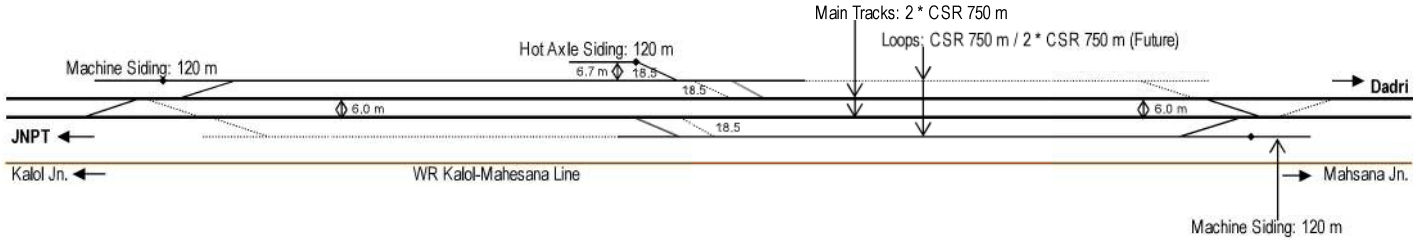


[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in furure

(iv) Functional Line Diagram for Ghumasan Crossing Station of DFC

(4) Ghumasan CS



[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in furure

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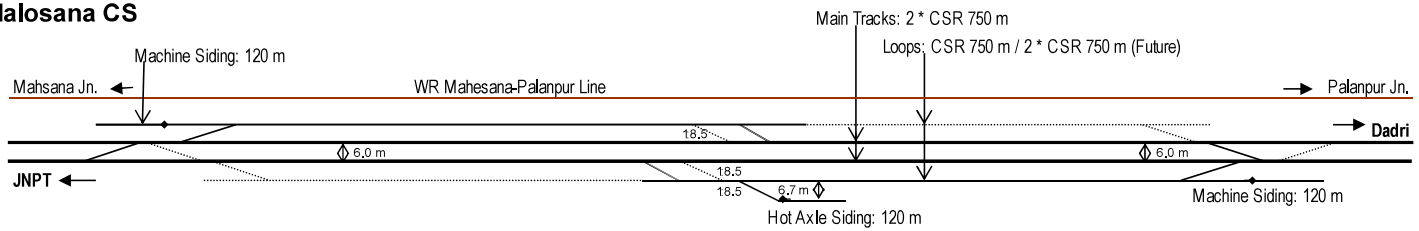
(v) Functional Line Diagram for Malosana Crossing Station of DFC

(5) Malosana CS



(Palanpur JS)

[Note] Track spacing that is not indicated: 6.25 m
Turnouts that is not indicated: "1 : 12"
Traps: Indicated as:

Tracks to be laid in future
Tracks to be removed in furure

(4) Work Areas for Temporary Works

The Work Areas for the Temporary Works as indicated in the Reference Drawings and / or as arranged by the Contractor if required.

(5) The width of the available Right of Way (ROW) for the Permanent Works at different chainages w.r.t the existing IR tracks (wherever DFC tracks are parallel to IR Tracks) and w.r.t the proposed DFC tracks (wherever the DFC tracks are on detour) shall be as per **Attachment 1A.** The said ROW boundary has also been indicated in the Alignment Drawings for reference.

(6) Employer has carried out the confirmation survey of section boundaries for about 5 Km on either side of the respective section boundary / at specific location within the Section to identify a common geodetic point within the section boundary area / at specified location within the Section and establish link between the consecutive Sections. Accordingly DGPS survey, traversing and leveling duly linked with GTS BMs (wherever GTS BMs could be located on ground) have been carried out. RCC pillars have also been provided at site as Traverse Control Points. List of Traverse Control Points, as referred above, along with the descriptions and coordinates in WGS-84 system at specified locations are attached herewith as **Attachment 1 B**. List of data includes following locations,

a) Between Chainage 186500 and Chainage 196500 (Section 5)

b) Section Boundary 6/7

c) List of GPS Control Points at Kotna side and Kanwadi side at Mahi River

d) List of GPS Control Points at Miroli side and Kasindra side at Sabarmati River

3.2 Scope of Item-Wise Works

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

(1) **[Validation of the Data and Additional Surveys]** Validation of the Data provided by the Employer including additional surveys if considered necessary by the Contractor for design of the Permanent Works and verifying the available Right of Way at Site and re-fixing the missing stakes, if any

(2) **[Geotechnical Investigations]** The Geotechnical Investigations required for Design of Permanent Works and as described in Employer's Requirement – General for design of Permanent Works..

(3) **[Review/ Modification of Alignment and Development of Yard Layout at each Station]** Review and modification of the indicative Alignment (Horizontal and Vertical) and development / layout profile (horizontal & vertical) of the schematic yard layout of each Station as shown in the Alignment Drawings included in the Reference Drawings and within available Right of Way including staking of the Alignment and yard layout at Site

(4) **[Coordination with Others]** The Coordination and Interfacing with the Other Contractors and the Interfacing Parties

(5) **[Integration with Indian Railway System]** Integration with Indian Railway Network at Junction Stations for interoperability between the two systems.

(6) **[Relevant Approvals / Clearances]** Obtaining all the necessary approvals / clearances to work, relevant Certificates and / or Clearances from Local Authorities viz. completion Certificates, Fire Clearances etc. as required. Preparing relevant documentation and assisting Engineer / Employer in getting the clearance from Commissioner of Railway

Safety (CRS) including carrying out any changes / rectifications / modifications and making good any deficiencies in the Work if required

[Civil Works]

(7) **[Bridge Structures]** Design and construction of the bridge structures grouped in to Important Bridges, Viaduct, Major Bridges, Rail Flyovers, Minor Bridges, Road Over Bridges (ROBs), Road Under Bridges (RUBs), Pedestrian Subways New Foot Over Bridges (FOBs) / Extension of Existing Foot Over Bridges (FOBs) as identified in the **Attachment 2** herewith including but not limited to:

(a) Abutments including foundation

(b) Piers including foundation

(c) Bearings including bearing inspection platform for each bearing

(d) Superstructure / deck including approach slab, wearing course, railing, ballast retainers, cable ducts, deck drainage system, expansion joints, inspection ladders

(e) Maintenance staff refuges as required (in case of Important Bridges, Viaduct and Major Bridges)

(f) Supports for locating OHE Mast for traction system (in case of Important Bridges, Viaduct and Major Bridges)

(g) Approach ramps, approach roads along with related road surfacing & bituminous work, slope protections, steps etc.

(h) River training and related protection works wherever required

(i) Curtain wall, drop wall, apron,

(j) Crash Barriers, filter beds, facia, surface drainage system, height gauges and approach roads including surfacing & bituminous work etc. as required

(k) Lighting (for the bridges in populated areas)

(l) Provision for outfall of the longitudinal side drains coming parallel to the tracks

(m) Signages as required

(n) In case of superstructure of steel truss (if required), suitable fixtures / arrangement for inspection of superstructure steel truss

(o) Other related works as considered necessary

List of **Important Bridges / Viaduct** has been included in **Attachment 2.1** herein

List of **Major Bridges** has been included in **Attachment 2.2** herein

List of **Minor Bridges** has been included in **Attachment 2.3** herein

List of **Rail Flyovers** has been included in **Attachment 2.7** herein

List of **Track Crossings** has been included in **Attachment 2.9** herein

List of **02 Nos. of Special Steel Bridges to be Constructed by Others (not in Scope of Contractor)** has been included in **Attachment 14** herein.

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List of **Public Powerlines (above 33 kV) being modified by the Employer (not in Scope of Contractor)** has been included in **Attachment 15** herein.

7.1 Road Under Bridges (RUBs)

(i) Ikbalgarh to Pansar section of the proposed Alignment (DFC tracks) is parallel to the existing IR alignment. Depending upon the density of road traffic, IR has provided number of RUBs and Level Crossings to facilitate the movement of road traffic across its existing tracks at number of locations.

(ii) In case of parallel sections:

a) RUBs has been proposed across the Alignment (DFC tracks) at the locations where RUBs already exists across IR tracks. Design and construction of the said RUBs across DFC tracks is in the Scope of Works of this Package. List of such RUBs has been included in the List of Structures in **Attachment 2** and List of RUBs (Major & Minor) in **Attachment 2.5** herein.

b) IR has also proposed the construction of RUBs replacing majority of the existing Level Crossings. The list of such works already sanctioned for construction of RUBs across IR tracks is included in the List of Structures in **Attachment 2** and List of RUBs (Major & Minor) in **Attachment 2.5** herein. Accordingly similar facility has to be constructed across the Alignment (DFC tracks) and has been included in the List of Structures / List of RUBs. Design and construction of RUBs across DFC tracks at such locations is in the Scope of Works of this Package.

(iii) In case of detour sections (including section between Pansar-Vadodara (Makarpura), RUBs has also been proposed across DFC tracks to avoid Level Crossings, Design and construction of RUBs across DFC tracks at such locations is in Scope of Work of this Package. List of such RUBs has been included in the List of Structures in **Attachment 2** and List of RUBs (Major & Minor) in **Attachment 2.5** herein

(iv) The Scope of work for RUBs across DFC tracks shall also include but not limited to design & construction of the following:

(i) Concrete approach ramp / approach road including earth retaining structures, as required on both sides of the approach road to connect RUB across DFC tracks with the existing road(s) on DFC side (in case of parallel section);

(ii) The distance between the RUB across DFC tracks and existing or proposed RUB across IR tracks (if any) shall be provided with concrete approach road including earth retaining structures, as required on both sides of the approach road and roofing on the approach road(in case of parallel section).

(iii) Concrete approach road including earth retaining structures, as required on both sides of the approach road to connect RUB across DFC tracks with the existing road(s) on both side (in case of detour section);

(iv) drainage of the RUBs across DFC tracks and approach ramps / approach roads including drainage hump at the start of the approach ramp / approach roads,

(v) Height Gauges at the start of the approach road on DFC side in case

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of parallel section

(vi) Height Gauges on both sides of the RUB across DFC tracks, in case of detour section

(vii) signages etc. as required

(viii) Lighting of RUBs for the RUBs in populated areas

(v) The design and construction of RUB across IR tracks (in case of parallel section) including its approach road to the existing road(s) on IR side shall be undertaken by IR separately and is not in the Scope of Works of the Contractor.

(vi) Right of Way as required for construction of the portion of the approach ramps beyond the DFC ROW shall also be made available by the Employer.

7.2 Pedestrian Subways: At some locations, the pedestrian subways have been proposed across the Alignment (DFC tracks) to provide access to the existing IR Stations from DFC side. The Pedestrian Subways shall be of 'U' or 'Z' or 'L' shaped depending upon the site conditions. List of such Pedestrian Subways including the indicative barrel length has been included in the List of Structures in **Attachment 2** and List of Pedestrian Subways in **Attachment 2.6** herein

The Contractor shall design such pedestrian subways across DFC tracks including its approaches to connect the existing road(s) on DFC side and approach to existing IR station area along with related road surfacing work. All the approaches of the pedestrian subways shall have concrete surfacing.

The Scope of work for Pedestrian Subways shall also include roofing on approach ramps, lighting, drainage, signages etc.

7.3 New Foot Over Bridges / Extension of Existing Foot Over Bridges (FOBs)

The Scope of Work for Foot Over Bridges shall include Design & construction of :

a) New Foot Over Bridges;

b) Extension of Foot Over Bridges presently existing across IR tracks and requiring extension to cross the DFC tracks;

c) Protective screens on parapets of FOBs with 25 kV caution boards; and

d) Roofing, lighting, drainage, signages etc. for the FOBs as per Indian Railway Standards and Works Manual

List of such Foot Over Bridges (FOBs) has been included in the List of Structures in **Attachment 2** and List of FOBs in **Attachment 2.8** herein below.

7.4 Construction of Road Over Bridges (ROBs) :

(i) Depending upon the density of road traffic, IR has provided number of ROBs to facilitate the movement of road traffic across its alignment at number of locations.

(ii) Accordingly at one location, twin ROBs presently existing across IR tracks at Chainage 112/570 (Section 8N) shall require dismantling / modification and extension to accommodate DFC tracks in addition to the existing IR Tracks.

(iii) Also due to site requirements and operational considerations, new ROBs

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also have been proposed at some locations across the :

a) Alignment (DFC tracks) and adjoining IR tracks where the proposed ROB shall be common across the Alignment (DFC tracks) and IR tracks

b) DFC tracks only (where DFC tracks are detouring from IR tracks) where the proposed ROB shall be across DFC tracks only

(iv) The location of the existing twin ROBs requiring dismantling / modification and extension and the locations of new ROBs and their Scope of Work shall be as under and also as identified in List of Structures / List of ROBs included at **Attachment 2** and **Attachment 2.4** herein below.

a) Demolition, modification and extension of the existing twin ROBs (2-Lanes each) across IR tracks at Chainage 112/570 (Section 8N) with a view to accommodating the DFC tracks. Out of these twin ROBs, ROB-1 (Single Span) is old whereas ROB-2 (two span) is newly constructed. It will require:

(i) demolition of the existing ROB-1 of single span and, reconstructing it to accommodate DFC tracks and existing IR Tracks;

(ii) dismantling the existing abutment and design & construction of one additional span of ROB-2 on Palanpur City end (East side) to accommodate DFC tracks, raising of the bridge deck along with one of the pier & abutment on the other side (Western side) including analyzing the design adequacy of the existing foundations, sub-structures and strengthening of the same as required to meet the design criteria,

(iii) re-grading of the approach ramps on both sides along with related road surfacing & bituminous work etc.

b) Design and construction of new ROBs across DFC tracks and IR tracks [at Palanpur Connecting Line Chainage 2349, Chainage 3588 and Chainage 4318] and across DFC tracks only (in case of detour section) [at Chainage 134/344.965 (Section 5), Chainage 58/072 (Section 6) and Chainage 6/490 (Section 9)] including its approach ramps on both sides and related road surfacing & bituminous work

c) Interaction with the concerned road authorities / local municipalities for approval of the layout, span arrangement / General Arrangement Drawings, designs etc. of the approaches of the ROBs

d) Design and providing the protective screens on parapets of ROBs with 25 kV caution boards

e) Lighting (in case of ROBs in populated areas), drainage, signages etc.

f) Right of Way as required for the approaches of the new ROBs shall be made available by the Employer.

(v) The specific Scope of Work in respect of modification and extension of the existing twin ROBs across IR tracks to accommodate DFC tracks at Chainage112/570 (Section 8N) shall be including but not limited to the following:

At chainage 112/570 (Section 8N), presently there exist running twin ROBs (almost abutting each other) across IR tracks having clearances with respect to IR tracks. As specified above, out of these twin ROBs, ROB-1 is old

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whereas ROB-2 is newly constructed. These twin ROBs have staggered abutments with respect to each other along with restricted lengths of approaches on East side and caters to one-way movement of the vehicular traffic across IR tracks.

DFC tracks are planned on Palanpur City end side (East side) of the twin ROBs and DFC tracks cannot be accommodated through the existing opening. The planned DFC tracks are infringed by the existing abutments and approaches on East side and shall require relocation.

With a view to accommodating DFC tracks (2 tracks), the existing twin ROBs shall have to be dismantled / modified / extended including its sub-structure, superstructure and approaches with horizontal & vertical clearances as per DFC tracks including re-grading of its approaches on both sides, related structural works and road works as per existing road specifications

The details of the existing twin ROBs and proposed dismantling / modifications / extension are explained as under:

Existing ROB No. 1 (Old):

- It has two Lanes and single span of 21.85m with approaches on both sides
- The same shall be dismantled
- Design and construction of new ROB for 2 lanes with 3 spans (1x15.0m+1x34.1m+1x24.7m) with required clearances as per Clause 16.5 (Design Criteria) of ER-Design to accommodate DFC tracks and IR Tracks. The length of the spans shall be in line with the span arrangement of ROB-2 (New) as specified below
- Re-grading / extending the approaches on both sides including related structural works and road works as per the existing road specifications

Existing ROB No. 2 (New):

- It has two lane and two spans of 34.1m and 24.71m with approaches on both sides
- One Abutment on Palanpur City end to be dismantled
- Design and construction of one Pier and one abutment along with one additional span of 15m on Palanpur City end to accommodate DFC tracks
- Existing deck of 34.1m span and 24.71m span is to be raised to provide the required clearances as per Clause 16.5 (Design Criteria) of ER-Design including raising of the existing pier and abutment on the other side, checking of the design adequacy of the existing foundation, substructure & strengthening the same as required to meet the specified Design Criteria, The scheme of raising the deck, pier and abutment shall be as consented by the Engineer
- Re-grading / extending the approaches on both sides including related structural works and road works as per the existing road specifications

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(vi) Under the policy of elimination of Level Crossings, IR has proposed the construction of ROBs replacing some of the existing Level Crossings at locations based on the predefined yard stick of train vehicle units (TVU). Such ROBs shall also be common across IR tracks and DFC tracks. List of such works already sanctioned by IR for construction of ROBs is provided in the Reference Drawings (Volume V of the Bid Documents) for information only. Design and Construction of such ROBs across IR tracks and DFC tracks shall be undertaken by IR separately and is not in the Scope of Work of the Contractor

At such locations, the Formation Level of proposed DFC tracks should not be raised above those proposed in Alignment Drawings without consent of the Engineer.

7.5 Important / Major Bridges

In respect of the following three bridges (one Important Bridge and Two Major Bridges) the conceptual drawings as included in the Reference Drawings (Volume V of the Bid Documents) specifies the PSC Box Girder superstructure. However the Contractor shall have the option of constructing these bridges superstructure with PSC Box Girder Or Under Slung Steel Composite Girder with Ballasted Deck.

a) Major Bridge No. 222 at Chainage 138/885.393 (in Section 5) having spans of 3 x 45.7m across Vishvamitry River (Non-Perennial River)

b) Important Bridge No. 133 at Chainage 39/894 (in Section 6) having spans of 7 x 45.7m across Vatrak River (Non-Perennial River)

c) Major Bridge No. 7 at Chainage 3/250 (in Section 8N) having spans of 1x6.1m + 2x45.7m + 1x6.1m across Narmada Canal (Running Canal)

7.6 Other related works as considered necessary

(8) [Earthwork for Railtrack Formation] Design and construction of the Earthworks in embankment or cutting for the Railtrack Formation for single as well as double tracks as identified above for the Main Lines, Connecting Lines for the track work within the Junction and Crossing Stations area including but not limited to

(a) Clearing & Grubbing and Striping,

(b) Excavation with or without Blasting,

(c) Embankment,

(d) Sub-Grade,

(e) Blanket Layer,

(f) Slope Protection & Erosion Control

(g) Safety refuge (in case of deep cutting areas)

(h) All other related works as considered necessary.

The Earthwork for Railtrack Formation between the following chainages is excluded from the Scope of Work for Package CT P-3 as the same is part of package CT P-3AR

i) Approach Bank for Bank for Bridge across Mahi River from Chainage 161/298.155 to 161/448.155 and from Chainage 162/033.155 to 162/183.155 in

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Section 5.

ii) Approach Bank for Bridge across Sabarmati River from Chainage 61/815 to 61/965 and Chainage 62/501.250 to 62/651.250 in Section 6.

(9) **[Drainage systems]** Design and construction of drainage system of all along the Alignment and in the Junction and Crossing Stations including all other related works as considered necessary

(10) **[Earth Retaining Structures]** Design and construction of earth retaining structures, if required, along the Alignment (Main Line, Connecting Lines) and for Stations due to site constraints only

(11) **[Earthwork other than for Railtrack Formation]** Design and construction of all the Earthworks (other than those for the Railtrack Formation hereinabove) in the Junction/ Crossing Stations areas as required including but not limited to Clearing & Grubbing, Stripping, Excavation with or without Blasting if necessary, Embankment, slope protection & erosion control and all other related works as necessary

(12) **[Level Crossing]**

(a) IR has provided number of Level Crossings at various locations to facilitate the movement of road traffic across its alignment. Under the policy of elimination of Level Crossings, IR has already sanctioned a number of RUBs / ROBs at different Level Crossings (which are at different stages of planning & construction). The RUBs / ROBs at planning stage shall also be taken up for construction by IR during currency of the Contract.

(b) Every effort shall be made by the Contractor to match the Formation Level of DFC with Formation Level of IR at all the existing Level Crossings where ROB/RUB are proposed to be constructed by IR.

(c) In case of any delay in the completion of ROB/RUB by IR at all such Level Crossings w.r.t Coordinated Construction Program of the Contractor, the provisions as specified in Clause 12 of Appendix 15 [Requirements for Construction] shall apply.

(d) In case of requirement of extension of existing Level Crossings in accordance with the provisions specified in Clause 12 of Appendix 15 [Requirements for Construction], the Work shall include design and construction of such Level Crossings across DFC tracks including:

(i) Modification / remodeling / new construction (as the case may be) of the approach ramp & approach road from the existing road on DFC side to connect with the existing Level Crossing across IR tracks along with suitable drainage arrangement

(ii) Surfacing of the area between DFC tracks and IR tracks and surfacing of the area between DFC tracks along with suitable drainage arrangement

(iii) Shifting of the existing duty huts and gate lodges (presently existing within the Right of Way and is required to be shifted due to construction of DFC tracks

(iv) Fencing on both sides of Level Crossing on DFC side

(v) Height Gauges and signages on both sides of the Level Crossing

(vi) Lighting, check rail etc.

(vii) All the temporary works including temporary diversions as required

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However the provision of new lifting barriers for the combined Level Crossings (IR & DFC) shall be carried out by Other Contractors.

(13) **[Diversion / Relocation of Public Powerline 33kV and Below]** Design and construction of the Diversion / Relocation of existing Public Powerline 33kV and Below infringing the Alignment and as identified in the List of Public Powerline 33kV and Below in **Attachment 6** herewith including coordinating with the utility owning entities.

At the locations of Electric Crossings above 33 kV (as listed in **Attachment 15**) which shall be modified by the Employer (not in Scope of Contractor), the Formation level of proposed DFC Tracks should not be raised above those proposed in Alignment Drawings without the consent of the Engineer so that the clearance between lowest point of transmission line and highest point of OHE and minimum required clearance from rail level as per SOD are respected.

(14) **[Diversion of Existing Roads and Construction of New Roads] –** Permanent diversion of existing roads and paths and construction of new link roads connecting existing roads with Junction Stations, Crossing Stations and Traction Sub-stations as identified and included in the List of New Roads to be Constructed in **Attachment 7.** The width and the type of roads to be constructed shall be as specified therein.

(15) **[Demolition and Removal of Existing Structures / Abandoned Structures Existing within Right of Way] D**emolition and removal / disposal of the existing structures / abandoned structures presently existing within the Right of Way as identified in the 'List of Existing Structures / Abandoned Structures to be Demolished and Removed' in **Attachment 8.**

(16) **[Other Charted Public Utilities, Existing within Right of Way and Requiring Extension / Temporary Diversion and / or to be Supported / Handled / Protected During Construction]** Other Charted Public Utilities as identified in **Attachment 9 -** 'List of Other Charted Public Utilities Existing within Right of Way and Requiring Extension / Temporary Diversion and / or to be Supported / Handled / Protected During Construction. These public utilities are not envisaged to be diverted permanently by the Employer.

Accordingly their extension, protection, handling, supporting and temporary diversion as required during construction including co-ordination / liaisoning with the respective utility owning entities, as required is part of the Scope of Work of this Package**.**

(17) **[Providing RCC Safety Wall / Chain Link Fencing Between DFC and Circulating Areas of IR / Habitation Area / Wild Life Habitation Area]** Design and construction of RCC safety wall between DFC and circulating areas of IR / habitation areas / Wild Life Habitation area for the length and at the locations as identified in the 'List of Locations Requiring RCC Safety Wall / Chain Link Fencing Between DFC and Circulating Areas of IR / Habitation Area / Wild Life Habitation Area' in **Attachment 11.**

(18) **[Providing Partition Wall / Gravity wall / Retaining Wall Between DFC Embankment and existing Gas / Oil Pipelines]** Design and construction of partition wall / gravity wall / retaining wall for the length and at the locations as identified in the 'List of Locations Requiring Partition Wall / Gravity wall / Retaining Wall between DFC Embankment and Existing Gas / Oil Pipelines' in **Attachment 12.**

(19) **[Diversion of Existing Irrigation Canal] –** Permanent diversion of existing Irrigation Canal as identified and included in the List of Irrigation Canal to be diverted in **Attachment 13.**

The specific Scope of Work in respect of the said Irrigation Canal presently running across the proposed Makarpura Junction Station and requiring diversion from Chainage

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131570 to 132310 shall be including but not limited to the following:

a) Excavation / Earthwork in cutting / embankments as required

b) Concrete lining as per specifications

c) The other features are as under:

(i) It is a running canal belonging to Sardar Sarover Narmada Nigam Ltd. supplying water supply from Vadasada to Gosindra area.

(ii) The size of the canal shall be trapezoidal [0.9m (bottom width) x 2.5m (Top width) x 1.1m (depth)] in line with the existing size of the canal

(iii) Right of way for the diversion of the canal shall be provided by the Employer

(20) [Cutting and disposal of trees] – Cutting & disposal of all the trees existing within the site of Works. Indicative list of trees having girth 300mm and more as collected by Employer is provided in Data Book-Volume IV of Bid Documents. Verification of same is responsibility of the Contractor and Employer bears no responsibility for variation, if any, on account of number/quantities of trees.

Cut trees shall be the property of the Contractor. Required permissions for cutting of trees and any payments/deposits to concerned authorities/Compensatory Afforestation (if required) shall be arranged by the Employer.

(21) [Uncharted Public Utilities] -Identification, of the uncharted public utilities including co-ordination with the utility owning entities

(22) [Infrastructure Works for Junction/ Crossing Stations] Design and construction of infrastructure works for the Junction / Crossing Stations including but not limited to:

(a) internal roads, pavements and footpaths,

(b) water supply system including borewells, water treatment system, storage tanks and pumping system

(c) sewage collection, treatment and disposal system including providing soak pits, septic tanks etc,

(d) storm water drainage system,

(e) rain water harvesting system,

(f) precast RCC land boundary pillars all along the boundary of Stations(except along IR side in case of parallel section) including Station entry gates,

(g) street lighting,

(h) signages

(i) all other related works and services as necessary to enable the Stations and its buildings to function properly

(23) [Miscellaneous Works] Design and construction of all the other Miscellaneous Works including but not limited to:

(a) Wayside Signs and sign boards

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(b) Interface Management and Co-ordination with Other Contractors for integrated design, testing and commissioning of Permanent Works,

(c) Testing of elements of structures for their structural conformity to the Design and Specifications (Volume III of Bid Documents);

(d) All other related works as necessary for the successful completion of the Permanent Works

[Building Works]

(24) **[Building Works]** Design and construction of various buildings in Junction/ Crossing Stations including the Key-men Quarters at the designated locations along the Alignment and as identified in the List of Buildings in Junction and Crossing Stations in **Attachment 5** herein, where the number / types of buildings, floor areas of respective buildings and relevant land areas are designated.

(1) Types of the buildings, the facilities and/or the areas included in the Building Works shall be as follows:

(i) Crew Changing Building

(ii) Integrated Maintenance Depot (IMD)

(iii) Integrated Maintenance Sub-depot (IMD Sub-depot)

(iv) Over Head Equipment (OHE) Depot

(v) Track Machine Depot

(vi) Station Building - Offices/ Resting Facilities

(vii) Service Buildings (for S & T, Electrical and Civil Departments)

(viii) Tower Wagon Shed (TWS)

(ix) Machine Maintenance Unit (MMU)

(x) Sub Depots for brake down/ emergency & day to day maintenance

(xi) Miscellaneous Works such as platforms and path way etc.

(xii) Residential Buildings Type II (45 sqm each)

(xiii) Residential Buildings Type III (56 sqm each)

(xiv) Residential Buildings Type IV (90 sqm each)

(xv) Residential Buildings Type V (160 sqm each)

(xvi) Quarters for Key-Men at IR & DFC stations (Residential Buildings Type II @ 45sqm each)

(xvii) Parking for Vehicles

(2) The building works shall include design and construction of ;

(a) Architectural and structural work including stairs, platforms, ramps, seating arrangement, landscaping etc. ,

(b) mechanical/ electrical/ plumbing (MEP) services

(c) Storm water drainage system, water supply system and sewage disposal system within the Station ROW

(d) fire detection, alarm and control system (indoor and outdoor),

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(e) air-conditioning / air-ventilation

(f) Entrance to Station

(g) Land boundary pillars all around stations

(h) Rain water harvesting system

(i) Internal roads & footpaths connecting various facilities within the Station complex

(j) all other building services & equipment including all fittings and fixtures as necessary for functioning of the Stations and buildings

(k) Signages

(25) [Providing Office Furniture, Equipment etc. Required for Integrated Maintenance Depots and Sub-depots at DFC Stations] Providing office furniture, equipment etc. required for Integrated Maintenance Depots and Sub-depots at DFC Stations(Junction Stations and Crossing Stations) as listed in **Attachment 10** for successful operation of DFC,

[Electrical Works]

(26) [Non-Traction Power Supply and Distribution] Design, manufacture / procure / supply, erection / construction, testing and commissioning of non-traction electric power supply and distribution system for all the Stations and pertaining to:

(a) various station buildings & depots / maintenance buildings,

(b) circulating areas,

(c) yards / sidings,

(d) residential buildings / staff quarters,

(e) street lighting,

(f) sub-station building,

(g) platform,

(h) level crossings including duty huts and gate lodges,

(i) Co-ordination for various installations of Traction and Signalling & Telecommunications system by Other Contractor within the Station boundary,

(j) various infrastructural facilities & services,

(k) any other installation within the station areas with all necessary equipment and installations including transmission lines and cabling,

(l) The Scope of Work shall include but not limited to the following :

(i) Design, manufacture, supply, install / erect, testing & commissioning all the equipment including spares as required

(ii) Power distribution network for all the installations & services within the Station areas and level crossings

(iii) Internal & external electrification including high mast lighting (wherever required)

(iv) Providing all electric luminaries and gadgets / equipment at Stations & residential buildings / staff quarters

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(v) DG set and Solar power panel for emergency power supply

(vi) Battery backup for emergency and security lighting

(vii) Temporary lighting arrangements with standby DG sets during non-interlocking period of signal and points (wherever required)

(viii) SCADA for auxiliary power supply

(ix) All necessary earthing, lightning protection systems for all buildings and towers, stray current control system including all other safety works to ensure that all the installations are safe

(x) Liaisoning / co-ordination with State Electricity Authorities / Local Electricity Supply Authorities for new connections / augmentation of load, applying & release of load and other related work. (Any payments / deposits to the State Electricity Authorities shall be made by the Employer)

(xi) Spares as required

[Track Works]

(27) **[Track Works]** Design, manufacture / procure / supply and construction / laying of the Track Works capable of running trains with an axle load of 25.0 tonnes operating at a maximum speed of 100 km/hr using mechanized track laying technique including but not limited to rails, sleepers, ballast, fasteners, fittings and fixtures, spares as required, welding and laying, ballast tamping, testing, de-stressing, guard rail / check rail (wherever required), turnouts, expansion joints, wayside signs, drainage including yard drainage etc. and all other related works as necessary for the following :

(a) Main Line & Connecting Line electrified track capable of operating at a maximum train speed of 100km/h

(b) Loop Line, Yards and Siding (yard layout) at each Station including but not limited to Hot Axle Siding, Machine Siding, Ballast Siding, Depot Siding, depots, Dead Ends / Buffer Stops etc. electrified track capable of operating at a maximum train speed of 50km/h.

3.3 Associated Works and Temporary Works

(1) **[Providing & Laying Double Wall Corrugated HDPE Pipes For Other Contractors]** Providing & laying Double Wall Corrugated Pipes of required dia for Other Contractors (Signalling & Telecommunication and E&M contractors) at the locations as decided by them for crossing of their cables

(2) **[Temporary Diversions and Restoration]** All the necessary temporary traffic diversions and traffic management, waterway diversions / diversion of the natural water flow etc. as required for execution of the Permanent and Temporary Works and ensuring smooth flow of the same during construction and restoration of the same on completion of the Works.

(3) The temporary barricading / fencing of the area shall be required while working in the vicinity of IR tracks, without affecting the structure gauge of the IR.

(4) **[Temporary Facilities, Temporary Utilities and Equipment for Use of Employer / Engineer]** Provision of all Temporary Facilities Viz. Provisional Site Office, Main Site Office, Site Huts, Survey Equipment and Temporary Utility Services Viz. Electricity and water supply, sanitation and sewerage, office cleaning, waste and garbage disposal etc. for the use of the Employer and the Engineer, as detailed in Appendix 9 to the Employer's Requirements

(5) All the Temporary Works associated with the Permanent Works including but not limited to:

(a) Access roads to Site as required

(b) Temporary bridges, if required

(c) Dismantling of the portion of existing structure (wherever and to the extent required) for the purpose of constructing Permanent Work adjacent to it, with the prior consent of Engineer and approval of Employer.

(d) Temporary Facilities / works and Temporary Utility Services as required by the Contractor for the safe execution of the Permanent Works

(e) Temporary signages as necessary for safe movement of public and construction machinery

(f) Any other temporary work as required for execution of the Permanent works

and removal of the same on completion of the Work

(6) **[HIV/AIDS Activities]** HIV-AIDS awareness programme as described in Sub-clause 6.7 [Health and Safety] of the General Conditions in Volume I of the Bid Documents

The attachments to the Employer's Requirements as identified above are summarized as under:

Attachment 1A Width of the available Right of Way (ROW) for the Permanent Works at different chainages

Attachment 1B List of Traverse Control Points along with the Descriptions and Co-ordinates in WGS-84 System for about 10 Kms at Specified Locations

Attachment 2 List of Structures

Attachment 2.1 List of Important Bridges / Viaducts

Attachment 2.2 List of Major Bridges

Attachment 2.3 List of Minor Bridges

Attachment 2.4 List of Road Over Bridges

Attachment 2.5 List of Road Under Bridges

Attachment 2.6 List of Pedestrian Subways

Attachment 2.7 List of Rail Flyovers

Attachment 2.8 List of New Foot Over Bridges / Extension of Existing Foot Over Bridges Requiring Extension

Attachment 2.9 List of Track Crossings

Attachment 3 List of Level Crossing

Attachment 4 List of Existing Duty Huts and Gate Lodges to be shifted

Attachment 5 List of Service Buildings and Residential Buildings in Junction and Crossing Stations

Attachment 6 List of Public Powerline 33 kV and below to be diverted

Attachment 7 List of Existing Roads to be Diverted / New Roads to be constructed

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Attachment 8	List of Existing Structures / Abandoned Structures to be Demolished and Removed
Attachment 9	List of Other Charted Public Utilities Existing within Right of Way and Requiring Extension / Temporary Diversion and / or to be Supported / Handled / Protected during Construction
Attachment 10	List of Office Furniture, Equipment etc. Required for Integrated Maintenance Depots and Sub-depots at DFC Stations
Attachment 11	List of Locations Requiring RCC Safety Wall / Chain Link Fencing Between DFC and Circulating Areas of IR / Habitation Area / Wild Life Habitation Area
Attachment 12	List of Locations Requiring Partition Wall / Gravity wall / Retaining Wall between DFC Embankment and existing Gas / Oil Pipelines
Attachment 13	List of Irrigation Canal Requiring Permanent Diversion
Attachment 14	List of 02 Nos. of Special Steel Bridges **to be Constructed by Others (Not in Scope of Contractor)**
Attachment 15	List of Public Powerlines (above 33 kV) **being modified by the Employer (Not in Scope of Contractor)**

4 Alignment of Track ways

4.1 The proposed indicative Alignment and Yard layout for each Station as developed by the Employer is enclosed in the Alignment Drawings as part in the Reference Drawings, and is further detailed in Appendix 1 [Alignment of Track ways and Work Areas] to the Employer's Requirements. The Employer has acquired the adequate Right of Way (ROW) for the same and is staked at Site. ROW offsets have been provided in Attachment 1A and have also been indicated in the Alignment drawings for reference.

4.2 The Alignment Drawings enclosed in the Reference Drawings (Volume V of the Bid Documents) are indicative and the Contractor shall be responsible for review, verifying its correctness & modifying / optimising the same with reference to the Design Criteria (as included in the Employer's Requirements – Design in Volume II of the Bid Documents) and other technical and geometrical obligatory requirements with respect to existing IR tracks. While reviewing / modifying / optimizing / developing the Alignment and yard layout for each Station (horizontal and vertical profile), the Contractor shall ensure that

(a) The minimum distance from the existing IR tracks as specified in the Design Criteria shall be maintained and the available Right of Way shall not be infringed.

(b) The other obligatory points viz. High Flood Level of the existing bridges, existing level crossings, RUBs and ROBs etc. across IR tracks (in case of parallel section) are not infringed

Prior to the Alignment verification, the Contractor shall carry out the validation of the data provided by the Employer including additional surveys and Geotechnical Investigations as considered necessary to satisfy himself.

4.3 During review of the alignment, if the Contractor notices any conflict with respect to the Right of Way, design-ability and constructability, the Contractor shall immediately notify the same to the Engineer as described in the Conditions of the Contract with supporting documents including data, calculations, maps and drawings etc.

4.4 With reference to the Alignment Drawings as described above, the Employer has developed the indicative alignment of the proposed bridges and other structures coming across the Alignment. Accordingly preliminary geotechnical investigations and river surveys have been carried out including recording of the High Flood Levels. The said data is included in the Data Book (Volume IV of the Bid Documents). Based on these data, the conceptual General Arrangement Drawings (GADs) have been developed and included in the Reference Drawings for reference only. The Contractor is expected to generally adopt the spanning arrangement as per the conceptual GADs. However the Contractor may propose different spanning arrangement subject to the condition that the span arrangement and High Flood Level of corresponding existing bridges of IR (in case of parallel section) are not obstructed. The Contractor shall prepare GADs and submit the same to the Engineer as part of the Technical Design Submittals for Notice of No Objection. The Contractor shall also assist the Engineer / Employer to take the necessary approval from Indian Railways wherever required, in case of parallel section.

5 Clearances

5.1 The Works shall not infringe the Structure Gauge as shown in the Design Criteria (included in Employer's Requirements – Design).

5.2 The Contractor shall make all provisions and considerations for the Other Contractors to install railway operating equipment without infringement of the structure Gauge.

5.3 The Contractor shall comply with the requirements of clearances, (structural and electrical) to be provided in respect of railway, roads and rivers in accordance with requirements of relevant authorities, Indian Railway Standards and Codes including Schedule of Dimensions. Indian Standard Codes and any other laws and regulations in force in India in the course of the alignment review above. For the requirement of various clearances, a reference shall be made to the Design Criteria included in the Employer's Requirements – Design (Volume II of the Bid Documents).

The Right of Way (ROW) data is included in the **Attachment 1A** to the Scope of Work above and is also indicated on the Alignment Drawings. The Contractor shall design the Works to be contained totally within the available Right of Way, respecting the relevant laws and regulations being practiced in India. Accordingly the Alignment shall be so designed that the Railtrack formation is contained within the available ROW only. However at certain locations the earth retaining structures may also be required due to obvious reasons.

6 Durability and Maintenance

6.1 The Works shall be designed and constructed such that, if maintained, in accordance with the Contractor's statements of maintainability to be contained in the Contract, they shall endure in a serviceable condition throughout their minimum design lives as described in the Design Criteria included in Employer's Requirements - Design.

6.2 The Works shall be designed and constructed so as to minimize the cost of maintenance whilst not compromising the safety or performance characteristics of the railway.

6.3 Bearings shall be replaceable with minimum disruption to rail or road traffic, as appropriate.

6.4 Movement joints shall be designed and constructed so as to be maintained and replaced with the minimum of disruption to rail or road traffic.

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6.5 Electrical and mechanical Plant & equipment where supplied including for Building Services shall be of a quality and durability fully to meet the operational requirements described in the Specifications under this Contract.

7 Interface Requirements

7.1 Traction

(1) The Other Contractor (E&M works contractor) shall be required to cross the track for passage of traction return connections at all the feeding post locations, in between AT locations and any other locations. Such locations shall be identified by the Other Contractor (E&M works contractor). At these locations return cable connection has to be to the mid point of impedance bonds to be installed by the Other Contractor. The impedance bond is likely to be located on both up and down tracks between the two rails of both the tracks. Accordingly the Contractor shall be required to co-ordinate and interface with the Other Contractors (E&M works contractor) regarding any installations to be provided by them.

(2) The Contractor shall provide and lay 100mm dia Double Wall Corrugated HDPE pipes of required dia under the track at locations including but not limited to the following to facilitate the Other Contractor (E&M contractor) for making the power supply available at both sides of the track. The exact locations of the same shall be decided by the Other Contractor (E&M Works contractor)

a) AT Locations

b) Isolator Locations

c) Level Crossing,

d) OFC Cable Hut / Telecom Tower

7.2 Traction Earthing

2 x 25 kV AT electrified railway have heavy rail currents, which may cause enhanced rail voltage. To facilitate flow of normal as well as fault current to earth on reinforced cement concrete / pre-stressed concrete bridges and viaduct structures, a well-designed earthing system shall have to be provided at the time of construction of the bridges as per the procedures stipulated in EN 50122-1.

The Other Contractor(s) (E&M Contractor and Signalling & Telecommunication contractor) shall be designing, the earthing and traction return paths including traction earthing and bonding of the RCC / PSC bridges and viaducts. The Contractor shall co-ordinate with Other Contractors (E&M Contractor and Signalling & Telecommunication Contractor) so that the earthing bars, earthing lugs are provided at the time of casting of the piers and deck girders. A typical arrangement shall be as indicated in Figure 1 & Figure 2 below. However this arrangement is only for the guidance and the final design shall be provided by Other Contractor (E&M Contractor). In case the Other Contractor(s) is not in position, the design of traction earthing and bonding of bridges shall be provided by the Employer through the Engineer. All the external connections shall be made by the Other Contractor (E&M Contractor).

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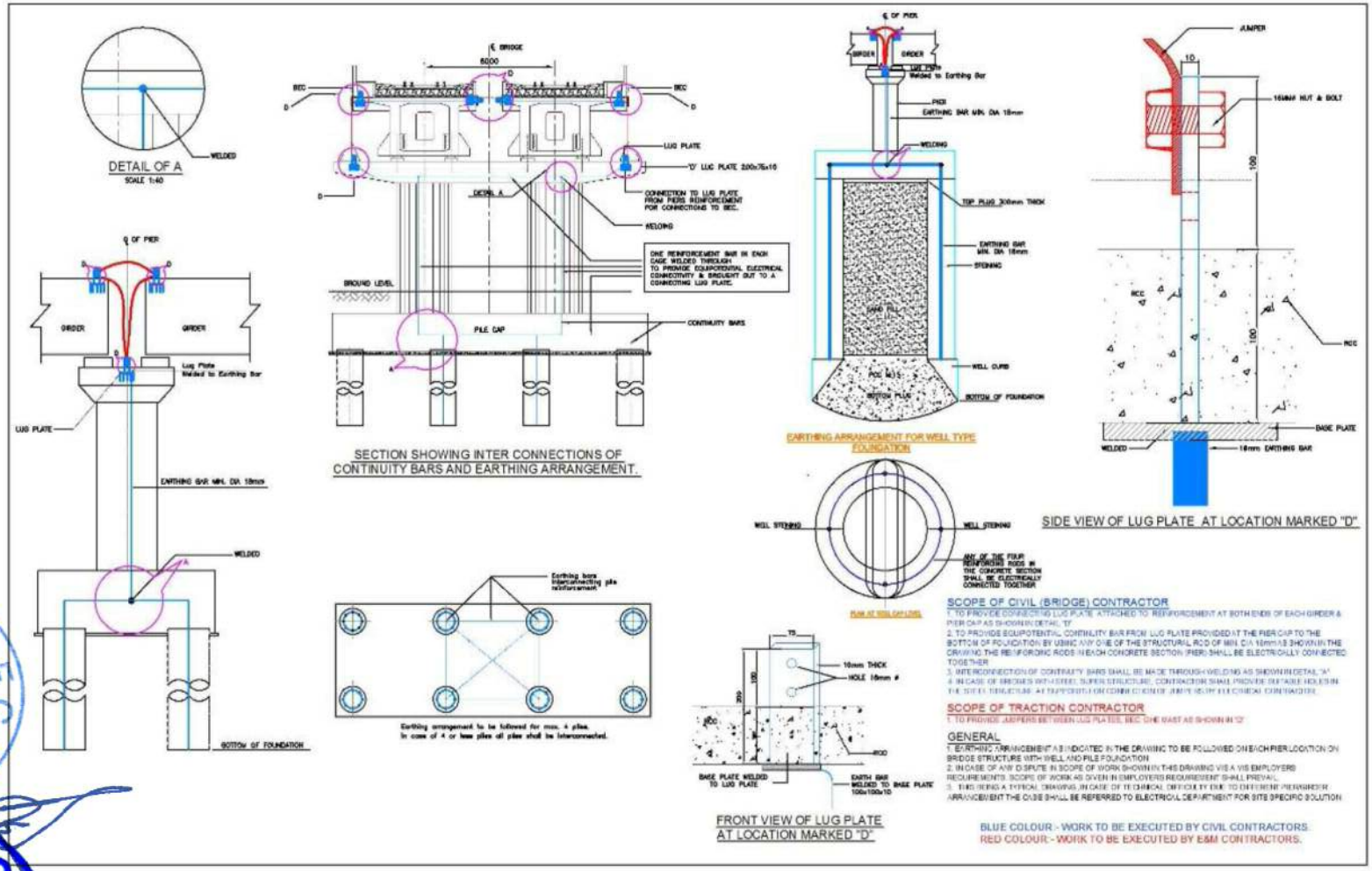
DETAIL OF A
SCALE 1:40
WELDED
SECTION SHOWING INTER CONNECTIONS OF CONTINUITY BARS AND EARTHING ARRANGEMENT.
LUG PLATE
CONTINUITY BARS
PILE CAP
GROUND LEVEL
EARTHING ARRANGEMENT FOR WELL TYPE FOUNDATION
SIDE VIEW OF LUG PLATE AT LOCATION MARKED "D"
FRONT VIEW OF LUG PLATE AT LOCATION MARKED "D"
SCOPE OF CIVIL (BRIDGE) CONTRACTOR
SCOPE OF TRACTION CONTRACTOR
GENERAL
BLUE COLOUR - WORK TO BE EXECUTED BY CIVIL CONTRACTORS.
RED COLOUR - WORK TO BE EXECUTED BY E&M CONTRACTORS.

Figure 1

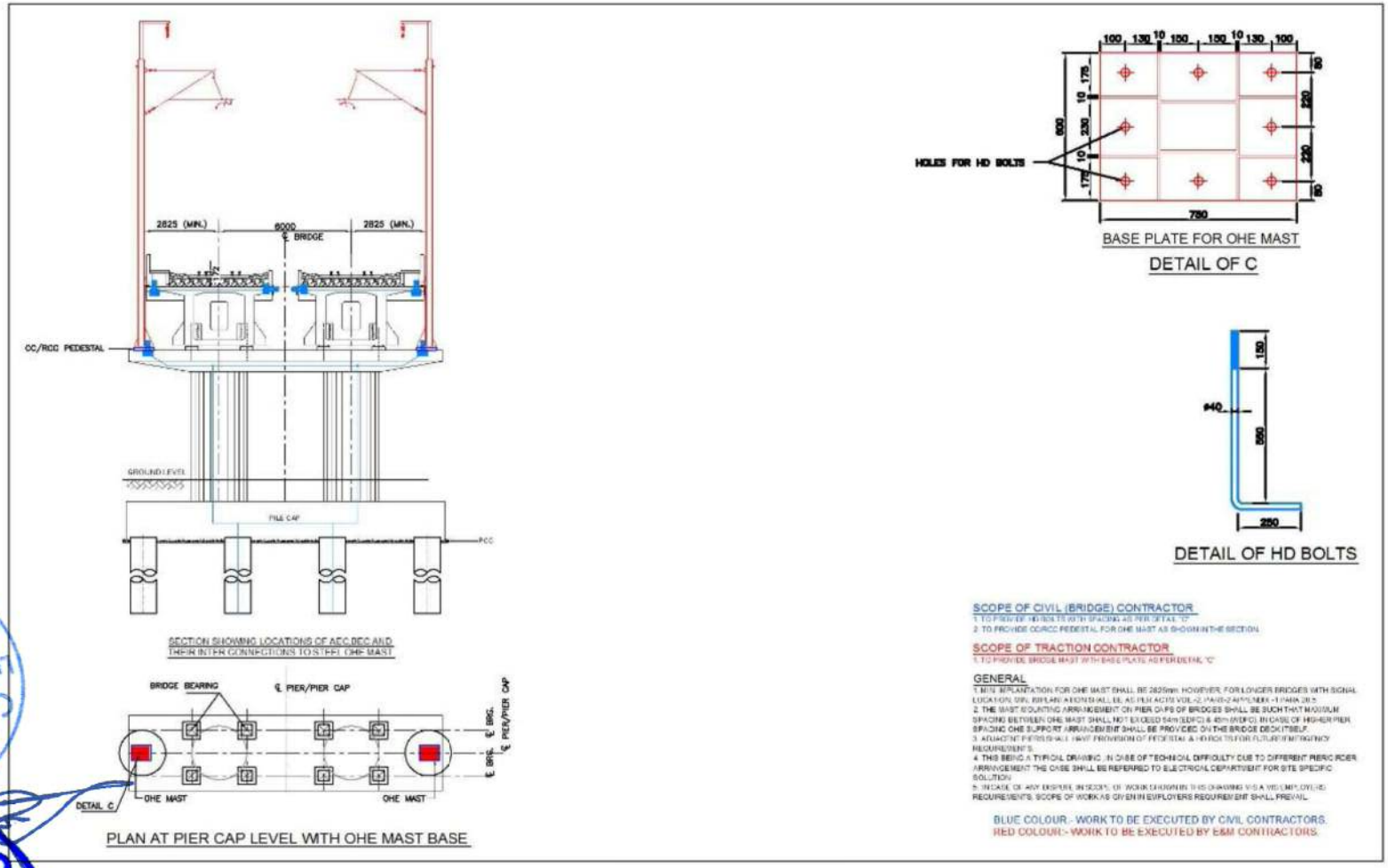
2825 (MIN.)
8000
℄ BRIDGE
2825 (MIN.)
CC/RCC PEDESTAL
GROUND LEVEL
PILE CAP
PCC
SECTION SHOWING LOCATIONS OF AEC,BEC AND THEIR INTER CONNECTIONS TO STEEL OHE MAST
BRIDGE BEARING
℄ PIER/PIER CAP
℄ BRG.
℄ PIER/PIER CAP
DETAIL C
OHE MAST
OHE MAST
PLAN AT PIER CAP LEVEL WITH OHE MAST BASE
HOLES FOR HD BOLTS
BASE PLATE FOR OHE MAST
DETAIL OF C
DETAIL OF HD BOLTS
SCOPE OF CIVIL (BRIDGE) CONTRACTOR
SCOPE OF TRACTION CONTRACTOR
GENERAL
BLUE COLOUR - WORK TO BE EXECUTED BY CIVIL CONTRACTORS.
RED COLOUR:- WORK TO BE EXECUTED BY E&M CONTRACTORS.

Figure 2

7.3 Track Crossings of cables and Space Requirements of Other Contractors

(1) The Contractor shall be required to co-ordinate and interface with the Other Contractor (E&M Works Contractor / Signalling and Telecommunication Contractor) regarding any installation to be provided by them.

(2) The Contractor shall provide and lay 100mm dia Double Wall Corrugated HDPE pipes under the track for the following and at the locations as decided by Signalling & Telecommunication contractor:

(i) track crossing of cables at 50 locations per Station considering Home to Home signal as station area and at 4 locations per Km in a block section

(ii) platform crossing from Relay Room to track side at 2 locations per Station

(iii) road crossing at 3 locations per Level Crossing

(3) Space shall be required by the Other Contractor (Signaling & Telecommunication contractor) for locating their GSM-R tower at each Station and at suitable interval in the block section. Also the space shall be required by the Signaling & Telecommunication contractor for locating Signalling huts and Telecommunication huts at suitable intervals in the block section. The Contractor shall co-ordinate with Other Contractor (Signaling & Telecommunication contractor) if the same can be accommodated within the available Right of Way.

8 Operational Requirements

8.1 The Works shall be designed and constructed to permit the railway to operate continuously and satisfactorily seven days per week, at a maximum design train speed of 100 km/hr where applicable.

8.2 The design of the works shall be such that train operations do not risk the safety of the public and railway employees including during emergency situations. Accordingly the criteria for the horizontal and vertical curvatures, criteria for Station Yard Layouts, Maximum Line Speeds for different route sections and through turnouts etc. are also specified in the Design Criteria. Also, the schematic Yard Diagram/ Layouts for different Stations are included in the Reference Drawings. In the absence of any other data as required for this propose, the Contractor shall make suitable assumptions based on his experience and propose the same as part of the Bid submission for consideration of the Employer.

8.3 In the construction of the Works, the Contractor shall, as a fundamental objective and as a priority, ensure that the public and railway employees shall, throughout the operational period of the project and within the confines thereof, be provided with as safe an environment as is reasonably possible.

8.4 Particular attention is also drawn towards the requirements of inspection by the Commissioner of Railway Safety (CRS) for safety clearance before commissioning of the Work. The Contractor shall prepare all the necessary documentation and assist the Engineer / Employer in submitting the same to the CRS. Contractor shall facilitate and assist CRS in carrying out their inspections and shall carry out any changes / rectifications / modifications and making good any deficiencies in the Work as required for obtaining the safety clearance from the CRS.

8.5 During construction the contractor shall be responsible for providing and maintaining adequate flood protection measures to ensure protection of the Works.

8.6 Particular attention shall be paid to the existing IR track ways, stations and any other related facilities (in case of parallel section) so as not to affect the railway operations. The Contractor

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shall consult with IR through Engineer and Employer with respect to this matter and shall include the agreement resulting from the consultation in his Works Programme and his Construction Method Statement and relevant drawings and documents as part of his Technical Design development. This shall include but not limited to:

(a) precautionary measures to ensure the safety of the IR moving trains;

(b) precautionary measures to existing IR railway properties including, but not limited to, rail tracks, embankment, railway structures, electrical and communication cables, and other railway operation facilities/ equipment.

(c) the works to be executed in the specified traffic block;

(d) treatment of unchartered embedded items along the existing IR embankment; and

(e) emergency procedures in case of an accident.

(f) Maintenance activities of the Indian Railways for their tracks and structures adjacent to the Work. It is a requirement that Indian Railway remains operational during the execution of the Work

9 Functional Requirements of Pumping Installations

9.1 Water pump installations shall be designed for automatic operation, controlled through liquid level controllers, capable of pumping the requisite amount of water to the ground / over head tanks.

9.2 The pumping installation shall withstand the corrosive effects of normal water supply, seepage water and sewage and serve for the anticipated life of the equipment. The discharge velocity for sewage / seepage pumping shall not be less than 0.75 l/sec.

The pipe line size shall be such that the velocity head does not exceed the normal static head except for the fire pump which is governed by separate criteria. The valve controls and regulating mechanisms shall be designed for automatic operation.

9.3 The pumps shall have 100% standby arrangement. The centrifugal pumps shall be of self-priming type. The efficiency of the pump set shall not be less than 95% of the maximum theoretical efficiency possible for that type of the pump

10 Functional requirements for Fire Protection System

Fire Protection including fire detection, alarm and fire suppression system along with complete installations shall be provided in accordance with the Specifications and National Building Code of India and shall comply with the requirements of local fire service regulations to the extent applicable

11 General Responsibilities of the Contractor

(1) The Contractor shall design, manufacture, execute, install, complete, test (including Integrated Testing) and commission the Works, including providing Construction and/or Manufacture Documents, within the Time for Completion and shall remedy any defects as per the Contract. The Contractor shall provide all superintendence, labour, Plant, Materials, Contractor's Equipment, Temporary Works and all other things, whether of a temporary or permanent nature, required in and for such design, manufacture, execution, installation

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completion, testing (including Integrated Testing) and commissioning and remedying of defects.

(2) The minimum facilities as required by the Employer at Junction Stations and Crossing Stations including but not limited to the following

a) Integrated Maintenance Depots

b) Sub-depots (CE)

c) OHE Depots

d) Ballast depots / siding

e) Track Machine Depots

f) Hot Axle Siding

g) Track Machine Siding

h) Machine Maintenance Unit (MMU)

i) Tower Wagon Shed etc.

are as specified in the Table ERD-6 of Design Criteria included in the Employer's Requirements – Design (Volume II of the Bid Documents). The Contractor shall be responsible for their adequacy, detailed design including layout, construction, manufacture, supply, installation, testing and commissioning including system sizing of the civil structures, track, buildings and building services etc.

(3) The Contractor's responsibility shall not be in any way be diminished nor shall the Contractor's design approach be limited by the Engineer's acceptance of the Contractor's guidance or recommendations as to the engineering standards and design specifications, or by the Engineer's Notice of No Objection, suggestions or recommendations or any aspect of the engineering or design.

(4) In addition to the above, the Contractor shall undertake various incidental works including but not limited to:

a) Testing of the elements of the structures for their structural conformity to the Design and Specifications, if required, and preventive as well as corrective actions,

b) traffic management around work sites,

c) reinstatement of the existing roads, utilities and services (to the extent disturbed by the Contractor),

d) Preparing work plan and methodology as required to obtain approval for traffic block or otherwise from Indian Railways through the Employer,

e) obtaining relevant certificates or clearances / acceptance from local civil authorities viz. completion certificates, fire clearances etc.

(5) During the Possession / Traffic Block of the Indian Railway Operations in respect of the existing tracks (in case of parallel section), the Contractor shall comply with the requirements as specified in Appendix 18 [Possession Management] to the Employer's Requirements

(6) Before commencing design, the Contractor shall satisfy himself regarding the Employer's Requirements and specifications. The Contractor shall give notice to Engineer of any error, fault, discrepancies or other defects in the Employer's Requirements or such items of reference within the period specified in Sub-clause 5.1 of Particular Conditions and Appendix to Bid in Volume I of the Bid Documents. After receipt of such notice, the Engineer shall determine whether Clause 13 [Variations] shall be applied.

12 Aesthetics

(1) The Permanent Works for important and major bridges shall be designed to achieve a high aesthetic character and reflecting the aesthetic character and geographic features of the location (wherever possible) including but not limited to use of common material, finishes and components subject to consent of the Engineer.

13 Planning Submissions

13.1 All the submissions for obtaining Notice of No Objection in respect of planning for the Works shall be made by the Contractor as enumerated below but not being limited to:

a) Station Areas including buildings and underpasses – Local Municipality; the Town Planning official or the Chief Architect or other appropriate local authority.

b) Water Supply and Sewerage – Local Municipality;

c) Power Supply – Power Distribution Company or Authority;

d) Road Traffic Control - Appropriate Local Authority;

e) Reconstruction of Irrigation Systems – State Irrigation Department or other appropriate local authority.

f) Reconstruction of road connections, road overpasses and underpasses – Local Public Works Department or other appropriate local authority.

g) River corrections – Appropriate Sate or Central River Authority

h) Archaeological Sites in proximity to the alignment – Appropriate State or Central Govt. Department; and

i) Connections to Industrial Areas – Through the Engineer and Employer with the plant owners

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

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

14 Traffic Management

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

The requirements for the Traffic Management and the Traffic Management Plan are fully detailed in the Clause 16 [SHE Requirements] of the specifications (Volume III of the Bid Documents) and supplemented by the Employer's Requirements - Construction and its Appendix 15 [Requirements for Construction].

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15 Standards

15.1 Equipment, materials and sub-systems (as required within the Scope of Works) shall be designed, manufactured and tested in accordance with the latest issue of consented / approved and recognized codes and standards defined and proposed by the Contractor and consented by the Engineer for the Work.

15.2 The Contractor shall submit Five original copies (latest publications in English) to the Engineer of all the Codes, Standards and Guidelines proposed to be used for the work including those listed in the specifications (Volume III of the Bid Documents) out of which Two original copies shall be retained by Engineer and Three original copies shall be forwarded to the Employer for his use.

15.3 References to "standards or to materials and equipment of a particular manufacturer" in the Bid Documents shall be regarded as followed by the words "or better".

15.4 The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified and compatible with Specifications / requirements defined under the Contract and their use shall be subject to the consent of the Engineer.

16 Office Furniture, Equipment etc. Required for Integrated Maintenance Depots and Sub-depots at DFC Stations

16.1 The Contractor shall provide the office furniture and equipment at each of the Integrated Maintenance Depot and Sub-depot at DFC Stations (Junction Station and Crossing Stations) of Iqbalgarh – Vadodara (Makarpura) Section for successful operation of DFC. The description and number of the office furniture and equipment shall be as listed in **Attachment 10** to the Scope of Work included in Employer's Requirements – Functional. and shall be of make / brand, model, type, size, capacity as approved by the Engineer / Employer. Delivery schedule of the same shall be subject to consent of the Engineer and approval of the Employer.

17 Existing IR Tracks and existing IR Station Buildings to be Shifted By IR

The proposed DFC tracks under this Package are presently infringed by the existing IR tracks and IR Station Buildings at the following locations. These tracks and buildings shall be shifted by IR before the possession of the land under these tracks and buildings is handed over to the Contractor.

Locations of Existing IR Tracks to be Shifted by IR							
Sl. No	IR Station	DFC Chainage From	DFC Chainage To	Classification	Nomenclature of Work	Action Required	Action To be Taken By
1	Unjha	72600	69100	Track	IR Main Line	IR Main Line to be shifted by 6 mts west side to accommodate DFC Track.	IR
2	Unjha	69300	67400	Track	Station Yard	Will be shifted to new location of station building	IR

Locations of Existing IR Tracks to be Shifted by IR							
Sl. No	IR Station	DFC Chainage From	DFC Chainage To	Classification	Nomenclature of Work	Action Required	Action To be Taken By
					including lines		
3	Mehsana	49600	48700	Track	MG Taranga Line of IR	MG Taranga line will be shifted more than 6 m towards East to accommodate DFC track within ROW	IR
4	Mehsana	48200	47700	Track	Salon Siding, Dead End Line and Other MG Line	Salon Siding, Dead end Line and other MG lines of MG Taranga line will be dismantled or shifted	IR
5	Mehsana	47500	46800	Track	BG Main Line	BG Main line will be shifted by 6 m towards West to accommodate DFC track within ROW	IR
6	Mehsana	47500	46800	Track	MG Line	MG Main line(ADI-MSH)will be shifted by 6 m towards West to accommodate DFC track within ROW	IR
7	Mehsana	49000	38000	Track	Taranga Line	Taranga Line will be extended from Mehsana (Ch 49000) to Jagudan (Ch 38000) after GC	IR
8	Ambliyasan	31100	30000	Track	MG Main Line	MG Main line will be dismantled to accommodate DFC Line	IR
9	Ambliyasan	31100	30000	Track	MG Loop Line	MG Loop line will be dismantled to accommodate DFC Line	IR
10	Sanand	2710 SSS		Track	SSS DN AND SSS UP	SSS DN LINE and SSS UP Line will end here and work beyond this will be done by IR	IR
11	Sanand	0 SSN		Track	SSN Connecting Line	SSN Line will end here and work beyond this point will be done by IR	IR
12	Goraghuma	6000 SSG		Track	SSG Connecting Line	SSG Line will end here and work beyond this point will be done by IR	IR
13	Goraghuma	0 GSN		Track	SSN Connecting Line	GSN Line will end here and work beyond this point will be done by IR	IR

Locations of Existing IR Station Buildings to be Shifted by IR			
S.No.	**Name of the Station**	**Action Required**	**Action To be Taken By**
1	Unjha	Existing Station Building will be shifted to 1.5 Km away towards Ahmedabad and will be constructed on west side	IR
2	Mehsana	New Station Building will be constructed on west side	IR
3	Kamli	New Station Building will be constructed on the same side nearby the existing building to accommodate DFC track	IR
4	Chappi	New Station Building will be constructed on west side opposite to the existing building	IR
5	Chadotar	New Station Building will be constructed near connectivity point of IR and DFC	IR
6	Umerdashi	New Station Building will be constructed on opposite (west side) of the existing building	IR
7	New Goraghuma	New Station Building will be constructed on north side of IR	IR

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EMPLOYER'S REQUIREMENTS

DESIGN

1 General

1.1 The Employer's Requirements - Design, specifies the requirements for the preparation and submission of the design of the Works and shall be read in conjunction with the Appendix 14 [Requirements for Design], Appendix 7 [Quality Assurance], Appendix 10 [Contractor's Co-ordination with Others] to the Employer's Requirements and other relevant Appendices as applicable. These requirements are subdivided into those that shall occur during the Design Phase, those that shall occur during the Construction Phase, and those that shall be of general application.

1.2 The Contractor shall be responsible for the design of the Works and shall ensure his design is accurate and in compliance with the Employer's Requirements and the Specifications which are deemed to be part of the Contract as defined in General Conditions and Particular Conditions in Volume I of the Bid Documents. The Contractor shall be responsible and ensure that when the Works are completed, it shall be fit for the intended purposes and as are specified in the Contract. In this context, the Contractor shall provide the Professional Indemnity Insurance as specified in Sub-clause 18.5 of Appendix to Bid and Sub-clause 18.5 of Particular Conditions in Volume I of the Bid Documents. This insurance shall be in the joint name of the Contractor, Designer and the Employer naming the Employer as the beneficiary.

1.3 The Contractor shall establish an office for his dedicated design team in the Main Site Office of the Contractor and referred to as Design Team. The Design Team shall function from this office and all meetings and discussions relating to design shall be held in this office or in the office of Engineer / Employer and / or as instructed by the Engineer. In addition to the requirements herein, the Contractor shall, whenever the Engineer so requests, provide information and participate in discussions that relate to design matters.

The members of the Design Team shall have the experience and qualification appropriate to the type and magnitude of the design involved. Full details regarding their qualifications and experience shall be submitted to the Engineer for his consent.

1.4 To clarify the responsibility and the authority, the Contractor shall also establish a Construction Team independent of the Design Team. Thereby the Contractor shall be responsible for assuring the quality of the Works governed by his ISO 9001 (design- build) – Quality Management System and his tailored quality management system specifically to the Contract and the requirements as described in Appendix 7 [Quality Assurance] to the Employer's Requirements. The integrated system thereby to assure the quality of the Works in this Contract shall be referred to as the Project Quality Assurance Plan.

1.5 The Contractor shall ensure that the Design Team continues to be represented at Site at all times by staff whose seniority and experience are to the satisfaction of the Engineer and whose representative shall be available on the Site as necessary or as required by the Engineer. As per Sub-clause 6.9 [Contractor's Personnel] of General Conditions in Volume I of the Bid Documents, if the Engineer asks (in writing) the Contractor to remove a person of his Design Team stating the reasons thereof, the Contractor shall ensure that the person leaves the Site within seven (7) days and shall have no further connection with the Works in the Contract. The Engineer shall also seek consent of the Employer in this regard

1.6 There are four Design Submissions covering the Design Phase and Construction Phase:

(i) Inception Report

(ii) Technical Design

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(iii) Construction Design

(iv) As-Built Documents

The requirements for each design stage are detailed in Appendix 14 [Requirements for Design] to the Employer's Requirements.

1.7 During the Design Phase (Technical Design Stage and Construction Design Stage), the Contractor shall comply with all the requirements pertaining to Safety, Health and Environment as specified in Clause 16 [SHE Requirements] of the specifications (Volume III of the Bid Documents)

1.8 If there are discrepancies between documents referring to the same subject, the more stringent criteria shall be followed, unless otherwise the order of precedence described in the relevant documents is not applicable

1.9 All technical solutions, schemes, structures, materials etc. shall be fully compatible with those used by the beneficiary and shall not be in conflict with the applicable rules / codes / manuals and standards as well as legislations in India.

1.10 Following the Public Consultations, as specified in Appendix 16 [Publicity and Public Relations] to the Employer's Requirements, the Contractor shall amend his design as necessary and as consented by the Engineer.

1.11 The Contractor shall submit plans, programmes, reports, manuals and drawing as specified in Appendix 12 [Requirements on Documents and Drawings] for the four design stages in accordance with the provisions herein and as further detailed in Appendix 14 [Requirements for Design] to the Engineer for consent and issue of Notices of No Objection. It shall also include the additional information as required by the Engineer and / or required for co-ordination of the design of Other Contractors

1.12 The Engineer shall review the submissions to be satisfied that the submittal covers the obligations and intended purpose of the design of the Works and fully complies with the Contract.

1.13 The Engineer shall seek the prior approval of the Employer before communicating the 'Notice of No Objection' to the Contractor in respect of the items as specified in sub-clause 3.1 of Particular Conditions in Volume I of the Bid Documents.

1.14 A conceptual flow of the Design Stages and their relationship with the Design and Construction Phases are illustrated below:

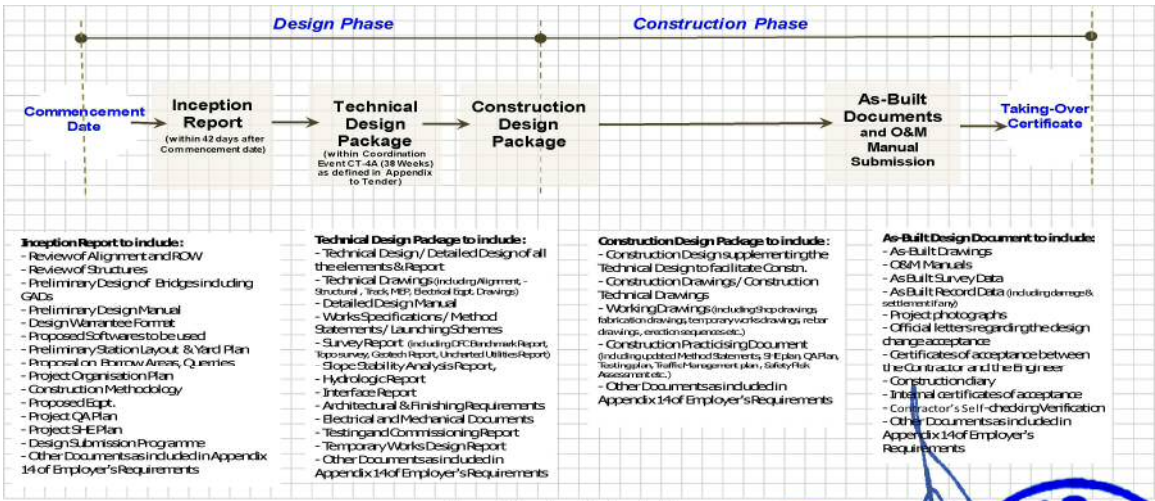

Fig – 1 Design Submissions

1.15 The designs shall be submitted within the specified dates summarized in Appendix 12 [Requirements on Documents and Drawings] to the Employer's Requirements as per the Design Submission Programme consented by the Engineer.

1.16 The design of the Works shall be carried out in accordance with the Design Criteria as included in Employer's Requirements - Design (Volume II of the Bid Documents), Project Quality Assurance Plan as described in Employer's Requirements – General and Appendix 7 [Quality Assurance] to the Employer's Requirements.

1.17 All drawings and documents shall be produced and submitted in accordance with the requirements described in Appendix 14 [Requirements for Design] to the Employer's Requirements.

1.18 Design submissions including Technical Design, Construction Design, As-Built Documents shall include a valid "Design Certificate" as specified in Appendix 7 [Quality Assurance] to the Employer's Requirements, duly signed by the Chief Design Engineer of the Contactor's Design Team and Contractor's Representative thereby demonstrating that the Contractor has carried out and fully checked the design as being compliant with the Design Criteria, all quality assurance procedures and fully compliant with the requirements of the Contract.

2 Contractor's Organization during Design Phase

2.1 Project Organization Plan

(1) The Contractor's Personnel shall be deployed maintained as described in Sub-clause 6.9 [Contractor's Personnel] and Sub-clause 6.10 [Records of Contractor's Personnel and Equipment] in the General Conditions in Volume I of the Bid Documents.

(2) Within 42 days after the Commencement Date, the Contractor shall submit the Project Organization Plan which includes complete project organization chart during the Design Phase, equipped with the functions in a manner as described in Appendix 7 [Quality Assurance] to the Employer's Requirements. The Contractor shall deploy fully qualified personnel in the Design Team with the Engineer's consent for each key personnel during the Design Phase. This plan shall be updated and resubmitted whenever there are changes to the personnel. The Plan shall show the management structure and state clearly the duties, responsibilities and authority of each key and staff member.

(3) The Contractor shall establish the Design Team in his organization independent of the Construction Team, which shall be also maintained in the construction phase to ensure that the Contractor's design development strictly complies with the Technical Design which has received 'Notice of No Objection' from Engineer and also the Employer's Requirements and Specifications without being harmed by the adverse position of the Contractor against the Employer as detailed in Appendix 7 [Quality Assurance] to the Employer's Requirements.

3 Requirements During Design Phase

3.1 Review of Indicative Design included in Reference Drawings

(1) The span arrangement / bridge length shown in the GADs (as included in the Reference Drawings) are indicative only and Contractor shall review and modify the same as per site conditions and with reference to the Design Criteria (as included in the Employer's Requirements – Design in Volume II of the Bid Documents) and subject to the review by the Engineer and approval of the Employer.

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(2) Span Arrangement of Important / Major / Minor Bridges, ROBs, RUBs, Rail Flyovers

The Contractor shall undertake the detailed review of the GADs / span arrangements and type of foundation for all the proposed Bridges viz. Important Bridges, Major Bridges, Minor Bridges, Road Over Bridges, and Road Under Bridges, Rail Flyovers and submit to the Engineer for his consent. Detailed review undertaken by the Contractor shall be in reference to the span arrangement and type of the foundations of the existing IR Bridges (in case of parallel section) for coincidence of pier locations as a first priority, as well as for the standardization of the span length and for any supplementary protection works that shall be required to avoid scour around piers of the both of existing IR bridges and the DFC bridges.

The GADs / spanning arrangement and the type of foundation for all the Bridges shall require the consent of the Engineer and approval of the Employer prior to undertaking the Technical Design.

Before communicating the Notice of No Objection for the GADS / spanning arrangement of all the Structures (viz. Major Bridges, Important Bridges, ROBs, RUBs, RFOs, Minor Bridges etc.) in parallel with existing IR line shall require approval of IR which shall be arranged by the Employer.

3.2 Inception Report

(1) Within 42 days after the Commencement Date, the Contractor shall submit the Inception Report as described herein and as further detailed in Appendix 14 [Requirements for Design] to the Employer's Requirements to the Engineer for consent and issue of a Notice of No Objection.

(2) The Inception Report shall be based on the Contractor's Bid Design and shall be sufficiently developed including the main documentation needed to prepare and to develop the Technical Design and to demonstrate compliance with design requirements, including, but not limited to, survey and investigation plans, design submission plan and programme, reviews of the Employer's Documents. The Inception Report shall sufficiently define the main structures, track alignment & track components, non-traction power supplies and building services etc. Full details of the contents of the Inception Report are given in Appendix 14 [Requirements for Design] to the Employer's Requirements and the submittals are summarized in Appendix 12 [Requirements on Documents and Drawings]

(3) In addition, general construction, manufacture, installation, testing and commissioning methodologies and documentation required to develop the Technical Design shall be submitted.

(4) Before communicating the Notice of No Objection to the Contractor, the Engineer shall seek the approval of the Employer as specified in Clause 1.13 and Clause 3.1 above

3.3 Technical Design

(1) Based on the Contractor's Bid Design and Technical proposals, and supplemented by the Inception Report as consented by the Engineer, the design of the Works shall be fully developed and detailed to the Technical Design by the Contractor. The Technical Design shall be prepared in accordance with the requirements of Specifications (as referred to in Volume III of the Bid Documents) and Design Criteria included in Employer's Requirements – Design (Volume II of the Bid Documents), therein, Codes, Standards and Manuals as applicable on Indian Railways and applicable regulations/legislation in India and existing international norms/standards wherever required. The developed and updated drawings and documents shall be submitted in the Technical Design Submission to the Engineer for consent and issue of a Notice of No Objection.

(2) During the preparation of the Technical Design, the Contractor shall in particular:

(a) complete all calculations and analysis;

(b) delineate all main and all other significant elements;

(c) complete all tests and trials and all selection of materials and equipment;

(d) assess and take full account of the effect on the Works of the proposed methods of construction, installation, testing and commissioning and temporary works.

(e) complete the validation of all the data provided by the Employer including all the additional surveys, investigations and testing as considered necessary by the Contractor to develop the Technical Design of the Works in accordance with the Contract.

(f) draw up a set of the Technical Drawings as summarized in Appendix 12 [Requirements on Documents and Drawings] to the Employer's Requirements.

(3) Engineering studies and comparative evaluations shall be performed to ensure that the designs incorporate features to achieve optimum performance of all elements.

(4) The Technical Design shall include the Technical Drawings, the Works Specification, the Technical Design Report, the Construction Method Statement and all other contents of the Technical Design Submittals as summarized in Appendix 12 [Requirements on Documents and Drawings] and detailed in Appendix 14 [Requirements for Design] to the Employer's Requirements.

(5) The Contractor shall divide the Works into Works Segments in accordance with the "Definition of Works Segments" given in Appendix 14 [Requirements for Design] to the Employer's Requirements and shall identify the Works Segments in the Works Programme and the Design Submission Programme.

(6) Upon issue of the "Notice of No Objection" in respect of the Technical Design Report, the Contractor shall complete the design in all respects and produce Technical Drawings.

(7) The Temporary Works as defined in Appendix 9 [Temporary Works] to the Employer's Requirements shall also be identified as a separate Works Segment and the design of those shall be proposed by the Contractor early enough to have sufficient discussions on engineering and procedural issues with the Engineer so as to meet the intent of the Employer's Requirements. The Contractor shall submit the agreed design of the Temporary Works as part of the Technical Design to the Engineer for consent.

(8) The Contractor shall further sub-divide the Technical Design of the Works Segment into Design Packages for submission and the sub-division shall be identified in the Design Submission Programme. The Design Packages are to relate to clearly identifiable parts and shall address the design requirements as described herein. The Design Packages shall facilitate the review and understanding of the Technical Design as a whole and shall be produced and submitted in an orderly, sequential and progressive manner to suit the construction sequence and the Works Programme.

(9) The issue of separate Notices for such sub-division shall be conditional upon the Contractor having demonstrated, to the satisfaction of the Engineer, that all loadings and load combinations including temporary loadings and the effect of each structure on other structures, public utilities, etc., and the effects of Other Contracts for the whole Works Segment has been fully accommodated in the Technical Design Package.

(10) Upon completion of Internal Authorisation Process, as specified in Appendix 7 [Quality Assurance] to the Employer's Requirements, the Contractor shall submit the Technical Design as described herein, and as detailed in Appendix 14 [Requirements for Design] to the Employer's Requirements, to the Engineer for consent and issue of a Notice of No

Objection".

(11) The Contractor shall provide to the Engineer five original full and latest editions of the publications / Technical Standards including the Codes and Standards and other documents that the Contractor propose to use for carrying out the Technical Designs, including other communications between Engineer and the Contractor relevant to this Contract as part of the Inception Report. These publications / documents shall be for the sole use of the Engineer and, upon completion of the Contract, shall become the property of the Employer.

4 Requirements During Construction Phase

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

4.1 Construction Design

(1) Upon the issue of a Notice of No Objection in respect of a Technical Design Package, the Contractor shall produce the respective Construction Design Package which shall include, but not limited to,

(a) the Technical Drawings,

(b) the updated Specifications (if any) including Method Statements/ work procedures/ construction sequences,

(c) the Working Drawings

(d) the Construction Practicing Documents including site sketches, bar bending schedules, bar reference drawings, fabrication and shop drawings, erection sequences etc. and

(e) Works Management Plans as detailed in Appendix 14 [Requirements for Design] to the Employer's Requirement.

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

(2) The Construction Design and Construction Technical Drawings including updated Specifications (if any) / Method Statements etc. shall be derived directly from the Technical Design as consented by the Engineer including changes that may be necessary to resolve the comments of the Engineer attached to the Notice of No Objection.

(3) The Working Drawings and the Construction Practicing Documents shall be prepared to facilitate construction to meet the required workmanship as well as technical requirements. The Works Management Plans shall be prepared to check and monitor the Works in terms of SHE requirements described in Clause 16 [SHE Requirements] of the specifications (Volume III of the Bid Documents) and Quality Assurance requirement described in Appendix 7 [Quality Assurance]. The submittals are summarized in Appendix 12 [Requirements on Documents and Drawings] to the Employer's Requirements.

(4) All those drawings and documents are revised, upgraded, detailed and integrated in the Construction Design Package. The Contractor shall fully verify the Construction Design Package through the Internal Authorization Process along with Design Certificate as described in Appendix 7 [Quality Assurance] by endorsing the original paper drawings and documents.

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(5) Upon the Internal Authorization Process, as specified in Appendix 7 [Quality Assurance] to the Employer's Requirements, the Contractor shall submit the Construction Design Package as the "Request for Construction" as further detailed in Appendix 14 [Requirements for Design] to the Employer's Requirements, to the Engineer for consent and issue of a Notice of No Objection.

(6) Upon receipt of the "Notice of No Objection" or "Notice of No Objection With Comments", the Contractor shall endorse the original paper drawings in respect of the Working Drawings as "Good For Construction" as per the Internal Authorisation Process as defined in the Design Quality Assurance Plan as per Appendix 7 [Quality Assurance]. If the Engineer so requires, the said endorsed original paper drawings shall be re-submitted to the Engineer, who shall, if has no objection to the contents of the re-submission, further endorse the original paper drawings by stating that he has no objection to the proposed Working Drawings. On endorsement by the Engineer, the original drawings shall forthwith be returned to the Contractor as Working Drawings to be issued to Site.

(7) The Construction Technical Drawings and the Working Drawings shall be used for construction purposes and only those drawings and documents that have been endorsed and certified through the procedure and have received "Notice of No Objection" as above or those that the Engineer has expressly stated as not requiring his endorsement shall be issued to the Site.

(8) The Construction of the Works shall be strictly in accordance with the Construction Design Package, for which "Notice of No Objection" has been issued by the Engineer and "Good For Construction" drawings has been issued as per the authorization process detailed as above.

(9) The Construction Design Package may be divided into multiple submissions for different Work Segments (as defined in Appendix 14 [Requirements for design]) and as consented by the Engineer. In such a case,

(a) Construction Design and Drawings in respect of each structure in a Work Segment shall be submitted for the entire structure

(b) submittals which are commonly applicable to the subsequent submissions shall be submitted in the initial submission and each submission shall include correlated and interdependent submittals.

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

(10) If the Contractor identifies the need for any change to the design due to site conditions or other reason, then the Contractor shall produce a Design Change Notice or Field Change Notice in accordance with procedures described in Appendix 14 [Requirements for Design] to the Employer's Requirements.

(11) The Contractor shall submit the Construction Design and Drawings for a particular work to the Engineer at least 3 months but not more than 6 months prior to the planned / scheduled date of commencement of that particular work.

5 As-Built Documents

(1) The Contractor shall maintain all records necessary for the preparation of the As-Built Documents. The Contractor shall prepare and submit the As-Built Drawings and the Records which, subject to the Engineer's agreement, shall become the contents of the As-Built Documents. The Records are defined and detailed in Appendix 15 [Requirements for

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(2) The As-Built Drawings shall be a full set of the latest revisions of the Construction Technical Drawings, which are updated to incorporate all Design Change Notices and Field Change Notices and as many Working Drawings as necessary to convey a full and true record of the as-built condition of the Works. The As-Built Drawings shall show all changes from the Construction Design, all construction deviations and all other features relevant to the future maintenance and management of the Railway and its facilities. The As-Built Drawings shall be endorsed by the Contractor as true records of the construction of the Works.

(3) The As-Built Records shall include the recorded photographs as being consistent to Sub-clause 4.21 [Progress Report] in the General Conditions in Volume I of the Bid Documents.

(4) The As-Built Records shall include survey results including geotechnical, all inspection records, and other documents as detailed in Appendix 14 [Requirement for Design] and Appendix 15 [Requirements for Construction] to the Employer's Requirements and shall be verified and endorsed by the Contractor through the Internal Authorization Process, as specified in Appendix 7 [Quality Assurance] to the Employer's Requirements, as true records of the construction of the Works.

(5) As part of the As Built Documents, the Contractor shall maintain all records necessary for the financial completion and commissioning of the project. These records shall consist of as a minimum but not limited to the following:

(a) The implemented work according to activities, places and price

(b) Used Material – type, name of manufacturers along with batch number, place and price etc.

(c) Any other record as required by the Engineer / Employer

(6) The Operation and Maintenance Manuals (O&M Manuals) shall be included as part of the As-Built Documents. O&M Manuals are generally prepared for the Employer's operation and the Other Contractor's works and shall include, but not limited to, the O&M Manual for Bridge Structures, the O&M Manual for Railtracks, the O&M Manual for Maintenance Depot Facilities, and O&M Manual for Building Mechanical/ Electrical/ Plumbing. Requirements for the Operation and Maintenance Manuals (O&M Manuals) are further detailed in the Employer's Requirements – Manufacturing, Installation, Testing and Commissioning.

(7) The As-Built Documents shall be submitted to the Engineer in the number of copies as specified in Sub-clause 5.6 of General Conditions (Volume I of the Bid Documents) along with read only electronic version of the same on CD/DVD for his consent and issue of a Notice of No Objection at no extra cost to the Employer.

(8) All the As Built Drawings and Records shall be submitted prior to the commencement of the Trial Runs. O&M Manuals shall be submitted within the period specified in the Employer's Requirements – Manufacturing, Installation, Testing and Commissioning in accordance with the Specifications and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works. The Work shall not be considered to be completed for the purposes of issue of Taking Over Certificate until these documents and manuals have been submitted and accepted by the Engineer.

6 Contractor's Coordination With Others

6.1 Other Contractors

(1) The Contractor shall fully coordinate the design of the Works with the design of the Other

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Contractors and shall follow the interfacing requirements as stipulated in Sub-clause 4.6 [Co-operation] of the General Conditions (Volume I of the Bid Documents) and as further detailed in Appendix 10 [Contractor's Coordination with Others] to the Employer's Requirements.

(2) The provision includes access to the Other Contractors including but not limited to, OHE mast foundations, Signalling & Telecommunication equipment, other embedded materials, maintenance access and delivery routes for the installation and replacement of the plant, access facilities including to and from the track way, lifting hooks and beams, and personnel access and means of escape, if appropriate.

(3) Those Works, which are necessary for Other Contractors, shall be fully coordinated and provided for throughout the Technical Design development and the results shall be recorded and summarized in the Combined Service Drawings and the Interface Report on Other Contractors as part of the Technical Design and the Construction Design.

6.2 Interfacing Parties and Related Parties

The Contractor shall fully coordinate the design of the Works with Interfacing Parties, all relevant bodies, parties and entities, in particular government authorities, departments and regulatory bodies, public utility companies, and the consultants, and contractors of adjacent projects whether ongoing or planned, as advised by the Engineer. The Contractor shall identify all such related parties, bodies and entities in his Interface Management Plan (IMP) and other relevant requirements detailed in Appendix 10 [Contractor's Coordination with Others] to the Employer's Requirements.

6.3 Co-ordination with Indian Railways

Span arrangement, type of structure and their Technical Design proposed by the Contractor in respect of all the Major / Important Bridges of DFC in parallel / vicinity of the existing structures of Indian Railways shall also require approval from Indian Railways through the Employer in addition to the consent by the Engineer.

The Contractor shall be required to submit one additional copy of all his GADs / span arrangement and Technical Design of all such structures to the Engineer for onward submission to Indian Railways. The Employer shall co-ordinate seeking the approval from Indian Railways, however, the Contractor shall facilitate the Engineer / Employer in seeking the approval from Indian Railways including but not limited to providing clarifications / additional data, attending meetings etc. as required

7 Design Review Procedures

7.1 General

(1) The designs for all four Design Stages shall be submitted for review and consent to the Engineer. The form and the procedures prepared in the Contract shall not release or remove the Contractor's responsibility for the design under the Contract as indicated in Clause 3.1 [Engineer's Responsibility and Authority] in the General Conditions and Sub-clause 3.1 of Particular Conditions (Volume I of the Bid Documents).

(2) The issue of a Notice of No Objection will be without prejudice to the issue of any future Notices.

(3) The Contractor shall, prior to the submission of the Technical Design, obtain all required and/or statutory approvals that relate to that submission and demonstrate that all required approvals have been obtained.

(4) Supplemental, supporting information to the design submission under review may be requested by the Engineer. The Contractor shall supply such information within the time specified by the Engineer.

(5) All submissions shall be accompanied by six (6) original copies of "Design Certificate" format of which is appended as "Attachment QA-1" to the Appendix 7 [Quality Assurance] to the Employer's Requirements, as part of the Internal Authorisation Process as set out in Appendix 7 [Quality Assurance].

8 Design Submissions

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

8.2 The Contractor shall submit to the Engineer all the Designs and relevant Design Data together with the Design Certificates, on or before the respective dates for submission shown on the Design Submission Programme or the Works Programme. In the event that a resubmission of Design / Design Data is required, such resubmission shall be made as soon as practicable after the receipt of the relevant statement of objections. All submissions of Design Data shall include the copies as stipulated in the Employer's Requirements.

8.3 Following receipt of a submission of Design and Design Data, the Engineer shall, within the period specified in Appendix 13 [Documents Submission and Review Procedure] to the Employer's Requirements, respond as per the procedure defined in Appendix 13 and issue "Notice of No Objection" or "Notice of No Objection with 'A' Comments" or "Notice of Objection with Comments" as the case may be. The Contractor shall comply with the requirements accordingly as specified therein

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

9 Design Submission Programme

9.1 The Contractor shall prepare the Design Submission Programme (for Design Phase and Construction Phase) which is to set out fully the Contractor's anticipated programme for the preparation, submission by the Contractor and review of the Design Packages, the issue of Notices by the Engineer for all stages of design. The Design Submission Programme shall cover all submissions during the Design Phase and the Construction Phase.

9.2 The Design Submission Programme shall:

(a) be deemed to comprise part of the Contractual Construction Programme and be in any case consistent and comply with all relevant Coordination Dates in the latest Contractual Construction Programme;

(b) identify dates and subjects by which the Engineer's response shall be made;

(c) make adequate allowance for periods of time for review by the Engineer as specified in Appendix 13 [Document Submission and Review Procedure] to the Employer's Requirements and for the review of other bodies, if necessary;

(d) clarify correlations by identifying, describing, cross-referencing and explaining the various Design Submissions including multiple submissions of the design for the different work

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(e) make adequate allowance for the design and development of the specialist works /sub-contractor works

(f) indicate the interfacing design activities in respect of each of the Other Contractor / Interfacing Parties and external related parties and

(g) Shall meet the requirements as specified in Appendix 12 [Requirements on Documents and Drawings]

9.3 The Contractor shall submit the Design Submission Programme to the Engineer within forty-two (42) days after the Commencement Date, and thereafter up-dated versions thereof at intervals of not more than one (1) month throughout the Design Phase. Such updates shall be included as an exhibit in the Contractor's Monthly Progress Report.

9.4 The Contractor shall submit complete set of documents requested by any Indian legislation, as well as consented As Built Documents and certificates for conclusion of any legislative procedures

9.5 General requirements which are applicable to the Design Submission Programme are described in Appendix 5 [Project Programme Requirements] to the Employer's Requirements.

10 Document Submission

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

(1) The Contractor shall submit drawings and documents, as required by the Contract, to the Engineer in accordance with the Design Submission Programme meeting the requirements as specified in Appendix 14 [Requirements of Design] and Appendix 12 [Requirements on Documents and Drawings]. The Construction Design submittals shall be made sufficiently before the Works are to be carried out to give the Engineer reasonable time to examine the drawings or other documents and to prepare comments within the response time as specified in Appendix 13 [Documents Submission and Review Procedure].

(2) Where the consent / Notice of No Objection from the Engineer is required, the Engineer shall notify the Contractor in writing of his decision within such period as stipulated in Appendix 13 [Documents Submission and Review Procedure].

(3) If the Engineer has reasonable cause for being dissatisfied with the submissions made by the Contractor, the Engineer shall require the Contractor in writing to make such amendments thereto as the Engineer may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended documents for Engineer's consent.

(4) Within 7 days of notification of the Engineer's consent / "Notice of No Objection" or "Notice of No Objection with Comments", the Contractor shall provide the Engineer with the type and numbers of sets of the relevant drawings and / or documents as stipulated in the Employer's Requirements for further execution of the process.

(5) Should it be found at any time after notification of consent / "Notice of No Objection" / "Notice of No objection with Comments" (as the case may be) that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Engineer has previously notified his consent / "Notice of No Objection" / "Notice of No objection with Comments" (as the case may be), the Contractor shall, at his own expense, make such alterations or additions as, in the opinion of the

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Engineer, are necessary to remedy such non-compliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Engineer.

(6) Errors, omissions, ambiguities, inconsistencies, inadequacies and other defects shall be rectified by the Contractor at his own cost and the acceptance by the Engineer of the Manufacture and construction documents shall not amount to any waiver and shall not relieve the Contractor of his obligations under the Contract.

(7) No examination by the Engineer of the drawings and / or documents submitted by the Contractor, nor any consent / "Notice of No Objection" / "Notice of No objection with Comments" (as the case may be) of the Engineer in relation to the same, with or without amendment, shall absolve the Contractor from any of his obligations under the Contract or any liability for or arising from such drawings or documents.

11 Calculations

11.1 Unless otherwise required by the Engineer, calculations shall be submitted together with the respective Design Package submissions.

11.2 A comprehensive set of calculations for the whole of the Technical Design and the Construction Design and Technical Drawings / Construction Drawings (in the form acceptable to the Engineer) shall be submitted by the Contractor to the Engineer for consent as part of the relevant submittals.

11.3 Should the design of the Works be revised thereafter and such revision render the submitted calculations superseded, then the Contractor shall prepare and submit revised calculations at the same time the revised design is submitted.

11.4 The Engineer shall require the Contractor to submit and install one copy all the applicable software as used by the Contractor for the Design, duly licensed in the name of Employer and in accordance with Clause 12 of Employer's Requirements - General including in-house software programme / worksheets developed by the Contractor, computer input and programme logic prior to the acceptance of any computer output. The Contractor shall submit the same to the Engineer without any additional cost.

11.5 The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

12 Contractor's Warranty of Design

12.1 The Contractor warrants that the Contractor's design (in accordance with General Conditions and Particular Conditions Sub-Clause 4.1, Volume I of Bid Documents) meets the Employer's Requirements and Specifications and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the Employer's Requirements and Specification or any part thereof, the Contractor's design shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost.

12.2 The Contractor shall indemnify the Employer against any damage, expense, liability, loss or claim, which the Employer might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this clause.

12.3 The Contractor further specifies and is deemed to have checked and accepted full responsibility for the Contractor's part of the design (in accordance with General Conditions and Particular Conditions Sub-Clause 4.1, Volume I of Bid Documents).

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(a) Notwithstanding that such design shall be or have been prepared, developed or issued by the Employer which has been checked by the Contractor, any of Contractor's consultants, his sub contractor's and/or his qualified personnel/persons or cause to be prepared, developed or issued by others.

(b) Notwithstanding any warranties, guaranties and/or indemnities that may be or may have been submitted by any other person.

(c) Notwithstanding that the same have been accepted by the Engineer.

12.4 The Contractor shall conform to the provision of any statute relating to the Works and regulation and bye-laws of any local authority and of any water and lighting agencies or undertakings, with whose system the work is proposed to be connected and shall before making any variation from the drawings or the specifications that shall be necessitated by so confirming give to the Engineer notice specifying the variation proposed to be made and the reason for making the variation and shall not carry out such variation until he has received instructions from the Engineer in respect thereof. The Contractor shall be bound to give all notices required by statute, regulations or bye-laws as aforesaid and shall pay all fees and taxes payable to any authority in respect thereof. Nothing shall be payable by the Employer in this regard. .

12.5 The Contractor shall ensure compliance of provision of all laws of land in force and enacted from time to time and:

(a) Ensure compliance of the regulations or bye-laws of any local body and utilities.

(b) The Contractor shall arrange necessary clearances and approvals before the work is taken up. Nothing extra will be paid by the Employer on this account.

(c) Ignorance of rules, regulations and bye-laws shall not constitute a basis for any claim at any stage of work.

12.6 The Design Warranty shall be submitted by the Contractor as part of the Inception Report and shall be as per the format included in Volume 1 of the Bid Documents.

13 Station and Integrated Maintenance Depot Planning Report

13.1 Based on the requirements for each of the facilities indicated in the Reference Drawings attached in Volume V [Reference Drawings] in this Contract Package, the Contractor shall review the contents of the Reference Drawings and outline the basic characteristics of his building planning of each Works Segment of the Building Works as specified in Design Criteria included in Employer's Requirements – Design (Volume II of the Bid Documents)

13.2 The Contractor shall submit the Station and Integrated Maintenance Depot planning Report to the Engineer for review as part of Inception Report as summarized in Appendix 12 [Requirements on Documents and Drawings] and Appendix 14 [Requirements for Design] to the Employer's Requirements.

14 Track Work Installation Planning Report

14.1 Based on the requirements described in the Track Works Drawings and Alignment Drawings included in the Reference Drawings (Volume V of the Bid Documents), the Contractor shall review the contents of the same and outline the basic characteristics of the Track Work planning including manufacturing, commissioning and testing of materials to be used and Trackwork installation procedures in the Track Work Installation Planning Report.

14.2 The Contractor shall submit the Track Work Installation Planning Report to the Engineer for review as part of Inception Report as summarized in Appendix 12 [Requirements on Documents and Drawings] and Appendix 14 [Requirements for Design] to the Employer's Requirements.

15 Document Format Requirement

Detailed requirements regarding the number of copies of drawings and documents and their standards required for submissions, the acceptable file formats and content formats are given in Appendix 8 [CAD and Document Standards] to the Employer's Requirements. After receipt of "Notice of No Objection" from the Engineer, the Contractor shall submit six (6) copies of the Design and / or Drawings for the use of the Engineer.

16 Design Criteria

16.1 General

The design of the Works shall comply with the relevant Indian Railway standards, Codes, Specifications, manuals and guidelines as published by Indian Railways / RDSO, Indian Standards, Indian Road Congress (IRC) codes and specifications and other International codes as specified in clause 2 of the specifications (Volume III of the Bid Documents) and as applicable, and with the consent of the Engineer. The precedence of the various codal provisions shall be as specified in Clause 2.2 [Relevant Standards] of the specifications (Volume III of the Bid Documents) and Employer's Requirements – General.

The Design Criteria shall be read in conjunction with the Specifications (as described in Clause 1-General of Volume III of the Bid Documents), General and Particular Conditions of Contract (Volume I of the Bid Documents) and other documents forming part of the Contract

The project entails construction of double-track electrified railway lines capable of handling 32.5 ton axle load, longer trains and double stack containers. The bridges, formation and other structures shall be designed to allow movement of 32.5 ton axle load while the track structure shall be designed for 25 ton axle load operating at maximum train speed of up to 100 Km/hr.

All levels shall be quoted in meters correct to three decimal places and shall be to Mean Sea Level Datum India. The rail level on a track shall refer to the top of the inner rail of the Down Track.

16.2 Design Principles

Indicative horizontal and vertical Alignment as developed by the Employer is given in the Alignment Drawings included in the Reference Drawings. Accordingly the required Right of Way (ROW) has been identified and acquired by the Employer. The acquired ROW is marked on the Alignment Drawings and also staked on the ground all along the proposed alignment.

With a view to optimize, the Contractor shall review the horizontal and vertical alignment and modify the same in respect of his design within the available ROW only. In case of the parallel section. the Contractor shall ensure the minimum distance to be maintained from existing IR tracks (as specified herein below) and other obligatory /control points viz. existing bridges, level crossings etc.

The Contractor shall carry out the Alignment review and Detailed Design as per the Design Criteria specified herein below as part of his Technical Design during Design Phase.

16.3 Design Life

The design life of a structure is that period for which it shall be designed to fulfill its intended function. The assumption of a design life for a structure or component does not necessarily mean

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that the structure will no longer be fit for its purpose at the end of that period.

Requirements for durability, including choice of materials and detailed requirements to achieve good durability, are given in the relevant paragraphs herein. The Design Life criteria provided herein shall be confirmed by the Contractor.

Contractor is expected to submit a report demonstrating the approach in design, construction and selection of material so as to achieve the Design Life as specified or as agreed upon.

The design life of each structure, facilities and systems are defined as follows.

(1) Structures of the Civil Works

The design life of all civil engineering structures other than those defined below is considered as minimum of 100 years unless otherwise specified in the Specifications under the Contract. In case design life of proposed structures by the Contractor seems insufficient, the Engineer shall reject the Contractor's proposal.

(2) Structures of the Building Works

The design life of all building structures of the Building Works is considered a minimum of 50 years unless otherwise specified in the Specifications under the Contract. In case design life of proposed structures by the Contractor seems insufficient, the Engineer shall reject the Contractor's proposal.

(3) Mechanical, Electrical and Plumbing (MEP)

The design life of MEP services including water supply, drainage services and fire protection services shall be considered a minimum of 20 years unless otherwise specified in the Specifications under the Contract.

(4) Heating, Ventilating and Air-conditioning (HVAC)

The design life of all HVAC facilities, systems and services shall be considered a minimum of 10 years unless otherwise specified in the Specifications under the Contract. The design life of window AC shall be considered a minimum of 5 years

(5) Railtrack Structures of the Track Works

The design life for purposes of replacement/renewal of the Track Works components are considered at minimum as follows:

i) Rails on Main Line : 800 Gross Million Tones (GMT)
ii) Rails in Depots : 50 years
iii) Pre-stressed concrete sleepers : 40 years
iv) Elastic rail fastenings : 7 years
v) Turnouts with fixed nose crossings with re-conditioning : 250 GMT
vi) Turnouts with moving nose crossing with re-conditioning : 600 GMT
vii) Turnouts Sleepers (depot) : 40years
viii) Rail Pads : 5 years

In case design life of proposed structure by the Contractor seems insufficient, the Engineer with the approval of Employer shall reject the Contractor's proposal.

16.4 Railway Design Requirements

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

16.4.1 The Contractor shall be responsible for design and construction of the Civil Works, the Building Works and the Track Works, and also responsible for coordinating and cooperating with the Other Contractors so that the design and installation of all components of the railway are compatible as a whole.

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

16.4.3 The Contractor shall design the Works taking into account of the works to be done by the Other Contractors and handover the site where the Other Contractor execute his works as planned and programmed during the design phase.

16.4.4 The extent and details of such provisions are to be determined by the Contractor(s) making due enquiries, during the design coordination period, from the Other Contractors engaged (or from the Engineer in case of absence of the Other Contractor(s)) to provide railway operating equipment as stated above.

16.4.5 The Contractor shall be responsible for coordinating his design and construction with the Other Contractors and with the Engineer / Employer and for ensuring that the design incorporates such fixings as are required in order to avoid any necessity for the Other Contractors or the Employer to drill, weld, burn or cut any part of the structure when carrying out installations

16.5 Maximum Moving Dimensions (MMD) and Structure Gauges

The Maximum Moving Dimensions, Structure Gauge and Clearances below Rail Level shall be as per Schedule of Dimensions for Dedicated Freight Corridor (Western) – January 2013.

16.5.1 The Maximum Moving Dimensions (MMD) has been calculated on the condition of wagon's static and dynamic movement for the DFC. Those dimensions are shown on the MMD and Structure Gauges Drawing as attached herein below **(Figure ERD-1).** The Contractor shall ensure that the proposed size and location of the Permanent Works and Other Contractor's works are outside the Structure Gauge through the procedure as described in Appendix 10 [Contractor's Coordination with Others] to the Employer's Requirements.

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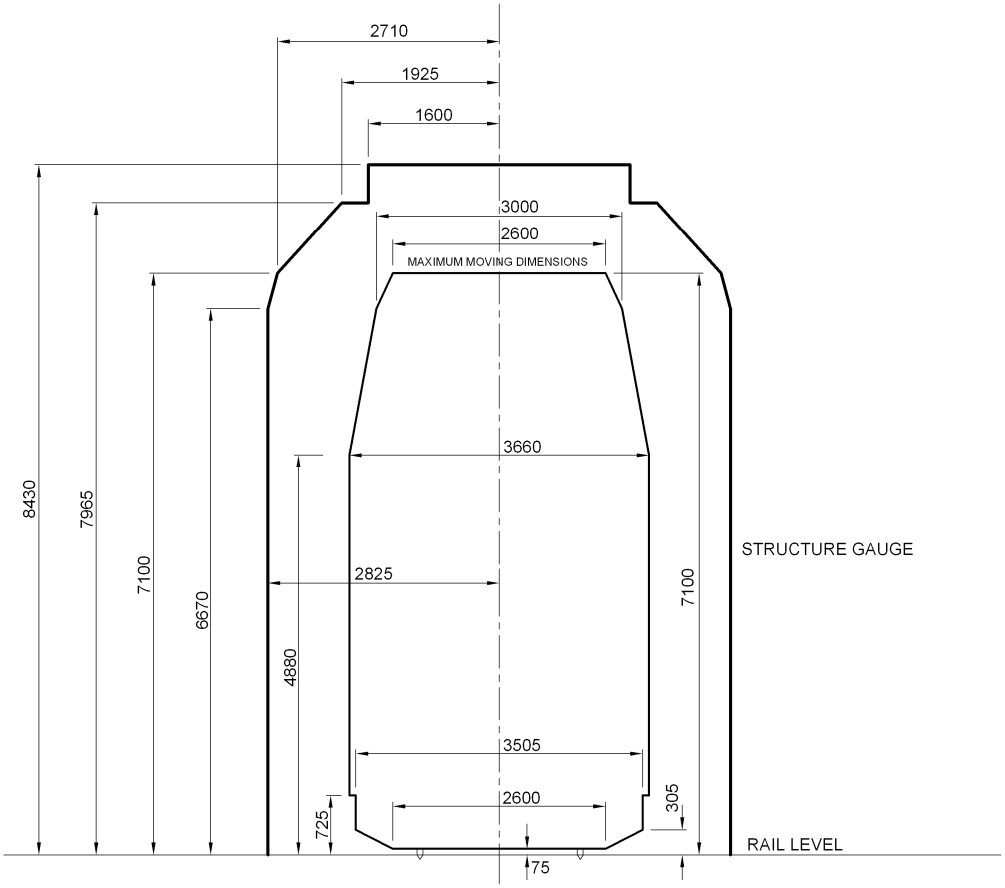
Figure- ERD-1: Maximum Moving Dimension and Structure Gauges



16.5.2 With regard to headroom clearance, the following exceptions are added to the requirements above. Minimum height above rail level for a distance of 1,600 mm on either side of the centre of the track shall be as under:

(1) When lower track line is DFC tracks

(a) Light overhead structure such as foot over bridges 8,430 mm

(b) Heavy overhead structure such as road over bridge or flyover 8,050 mm

(c) Heavy overhead structure at turnout etc. 8,430 mm

(2) When DFC tracks are crossing over IR Lines, the vertical clearances to be observed (as per IR Schedule Of Dimensions) shall be :

(a) Light overhead structure such as FOB 6250 mm

(b) Heavy overhead structure such as Flyover or ROBs 5870 mm

In case IR track is nominated for Double Stack Container (DSC), vertical clearance shall be provided as per the requirement specified in para 16.5.2 (1) above

DFC Alignment is proposed to be electrified on 25kV AC System. Necessary provision shall be made in overhead structures and overhead equipment, if necessary, by using longer traction overhead equipment masts to permit possible raising of the track by 275mm in future to cater for increased ballast cushion, larger sleeper thickness and deeper rail sections (Refer Schedule of

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Dimensions for Dedicated Freight Corridor (Western) – January 2013).

16.5.3 The Employer has identified the following locations, where DFCC and IR structures are crossing each other. The Employer (with reference to its letter no. HQ/EN/WC/E&S/5 dated September 27, 2010 and subsequent confirmation) has identified the locations where vertical clearance for Double Stack Containers (DSC) would be required to be provided as per the following Table ERD-1. In the table referred, wherever "Yes" has been mentioned under the column "Whether Vertical Clearance for DSC Required", DFC Clearances are to be followed, and wherever the word "No" is written, vertical clearances of IR are to be followed (refer Paragraph 16.5.2 (1) & (2) above)

Table ERD-1: Planned Structures for DFC over DFC Lines and Existing IR Lines

Sl. No.	Section	Location / Chainage (Km)	Upper Line	Lower Line	Note	Whether Vertical Clearance for Double Stack Container required
1	5	Makarpura JS DFC Ch. 137/800	DFC Main track	DN Connecting track to Makarpura Station	DFCC/ DFCC	Yes
2	5	Makarpura JS	Connecting track to Makarpura Station	Mumbai – Vadodara M/L		No
3	5	146/696.205	DFC Main tracks	Vishvamitri – Jambusar Rd. Line	IR Narrow Gauge	No
4	5	166/932.328	DFC Main tracks	Vasad – Kathana Line		No
5	5	184/515.417	DFC Main tracks	Anand – Khambat Line		No
6		205/334.063	DFC Main tracks	Nadiad-Bhadran Line (IR)	IR NG line	No
7	6	71/600	DFC Main tracks	Ahmedabad – Botad Line (IR)	MG Line	No
8	6	SBT JS near 84/043	DFC Dn. Main tracks	Connecting Track South Yard to Sanand Stn.	DFCC/D FCC	Yes
9	6	SBT JS near 84/120.5	DFC Dn. Main tracks	ADI-Viramgam Line		Yes
10	6	SBT JS near 84/120.5	DFC Dn. Main tracks	Connecting Track North Yard to Sanand Stn.	DFCC/D FCC	Yes
11	6	SBT JS near 84/048	DFC Up Main tracks	Connecting Track South Yard to SBT Jn. Stn.	DFCC	Yes

Sl. No.	Section	Location / Chainage (Km)	Upper Line	Lower Line	Note	Whether Vertical Clearance for Double Stack Container required
12	6	SBT JS near 84/100	DFC Up Main tracks	ADI – Viramgam line (IR)		Yes
13	6	SBT JS near 84/145	DFC Up Main tracks	Connecting track North Yard towards SBT Jn. Yard	DFCC	Yes
14	8N	8/135	DFC Main tracks	Kalol – Kotosan Rd. Line (IR MG)		No
15	8N	40/555	DFC Main Tracks	Pansar – Mahesana Line (IR)		Yes
16	8N	53/952	Connecting track from IR Mahesana Station to DFC Mahesana Jn. Station	DFC Main tracks and IR Track from Palanpur to Mahesana		Yes
17	8N	116 / 277	Palanpur Connecting Tracks	Marwar – PNU Line & DFC DN Track		Yes

16.6 Railway Alignments

16.6.1 General

(1) The Iqbalgarh – Pansar section of the proposed Alignment runs parallel to the existing alignment of Indian Railways (IR), whereas Pansar – Vadodara section takes detour. Indicative horizontal and vertical Alignment and schematic yard layout at each Station, as developed by the Employer, is given in the Alignment Drawings included in the Reference Drawings. Accordingly the required Right of Way (ROW) has been identified and acquired by the Employer. The acquired ROW is marked on the Alignment Drawings and has also been physically staked on the ground along the entire proposed DFC alignment.

(2) With a view to optimization, the Contractor shall review the horizontal and vertical alignment and modify the alignment within the ROW provided wherever required including Yards and develop the detailed yard layout at each Station within the available ROW only as part of his technical design during design phase. In case of the parallel section, the minimum distance to be maintained from existing IR tracks (as specified herein below) and other obligatory /control points viz. existing bridges, level crossings etc. are to be kept in mind.

(3) The entire Alignment contained in this Contract is divided in a Main Line, Connecting Lines, Loop Lines (in Yard) and Sidings for the clarification purpose of the design criteria.

(4) Auxiliary Main Lines: Secondary tracks leading away from the Main Lines in a Station to other facilities e.g. sidings, yards, depots / sub-depots.

(5) At Junction Stations, suitable transition length shall be provided to ensure adequate gradient for OHE as per para 5.2.8.2 (Table 8) of EN 50119-01.

16.6.2 Horizontal Alignment

(1) The minimum radius shall comply with the requirements as follows:

(i) Minimum radius for the Main Line : 700 meters (2.5 degree curve)

(ii) Minimum radius for other than Main Lines : 438 meters (4 degree curve)

Where degree of the curve is the angle subtended at the centre by a chord of 30.5m (refer Para 401 of Indian Railway Permanent Way Manual)

(2) For reverse curves, it is preferable to maintain a radius of 875 m or greater to enable application of long welded rails.

(3) The actual radius of both the tracks shall remain same. This will be achieved by shifting the centre of the curve suitably.

(4) Minimum length of straight length between adjacent curves:

(a) Desirable: 50m. In cases, where there is space constraint, both transitions can meet each other by suitable extending the lengths ensuring that rate of change of cant and versine along the two transitions so extended is kept the same.

16.6.3 Cant and Speed

The curve speed and cant relationship shall be based on the following equations:

Actual Cant $Ca = GV^2/127R$

Where Ca: Actual cant [mm]

G: Dynamic Gauge in mm i.e. 1750 [mm]

V: Equilibrium Speed in km/hr i.e. 85 [km/hr]

R: Radius of the curve [m]

The standard speed for actual cant shall be defined by considering the maximum permissible speed (100 km /hr.), speed restriction, gradient and train operation plan. The equilibrium speed of actual cant setting for general section shall be 85 km/hr. The cant computed shall be rounded off nearest 5mm. The allowable applied cant shall not be over 140 millimeters and the cant deficiency shall be limited to 75 millimeters.

Cant transition shall be straight ramp. Cant excess shall be limited to 75mm.

16.6.4 Transition Curves

(1) In general transition curves shall be provided between a circular curve and adjoining straight, and wherever possible between the different radius of a compound curve and at the adjoining ends of circular curves forming reverse curves.

(2) Transition curves shall be in the form of a cubic parabola curve in the Contract. A transition curve length shall be defined by the maximum of the following three values:

Standard Transition Curve Length (L_a, L_b and L_c):

(a) $L_a = 0.008\ Ca \times Vm$

(b) $L_b = 0.008\ Cd \times Vm$

(c) $L_c = 0.72\ Ca$

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Where L: Transition curve length [m]

Vm: Maximum permissible speed [km/hr] (= 100 km/hr)

Ca: Actual cant [mm]

Cd: Cant deficiency for Vm [mm]

Chainage of the IPs and transition curves in the Alignment Drawings are referential. The chainage on the plan and profile is for reference only.

Among the values L_a, L_b and L_c, the greatest value is provided as the Standard Transition Curve Length.

However in exceptional cases where adequate room is not available for providing sufficiently long transitions in accordance with the above, the length may be reduced to a minimum of 2/3 of the desirable length as worked out on the basis of formula (a) and (b) above or 0.36 Ca (in meters) whichever is greater.

(3) Applied transition length shall be rounded off to the nearest 5 meters.

(4) There shall be no change of grade in the transition curve.

(5) Transition curves shall not be positioned at a Level Crossing.

(6) Turnouts shall not take off from transition portion of the curve.

(7) No Transition Curve shall lie within 40 m of abutment of a Major Bridge with superstructure on Bearings

16.6.5 Vertical Alignment

(1) Vertical curve shall be provided only at the junction of two grades where the algebraic difference in change of grade is equal to or more than 0.4%.

(2) If a vertical curve is adopted, its radius shall be minimum 4000 meters.

(3) Vertical curves shall not coincide with horizontal transition curves but could be coincide with circular curves.

(4) Vertical curves shall not coincide with point and crossing work.

16.6.6 Gradients

The Ruling Gradient on the project is 1 in 200 i.e. 0.5% (Compensated).

The limits for Ruling Gradient shall be as follows:

(i) Maximum gradient for the Main Line : 1/200 i.e. 0.5% (Compensated)

(ii) The maximum gradient shall be reduced by considering the curve compensation. The curve compensation shall be defined as follows:

Curve Copmensation = 70/R [%]

Where R: Horizontal curve radius [m]

(iii) No change of Gradient in transition curve and within 30m of any points and crossings

(iv) The approaches of all "Important Bridges" shall preferably be level for 100m from the abutments. If for any constraint of unavailability of adequate space, the same can be reduced up to 50m with the consent of the Engineer.

(v) In case of other "Major bridges" there shall not be any change of gradient within 40m from either of the abutments. Only in very exceptional cases, like in flyovers, change of gradient

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on the bridge can be permitted by the Engineer with the approval of the Employer.

Station Yards

Clear Standing Room (CSR) of Loops shall be 2 x 750 m at Junction Stations and in general staggered 2 x 750m long loops at Crossing Stations. The CSR for the purposes of design shall be as defined in Clause 2.1 of ER (General).

Station Yards are defined by the layouts within the advance starter of UP track and advance starter of DN track.

Maximum gradient in Station Yard and Sidings (where wagons are stabled).

(a) Desirable - 1 in 1200

(b) Limiting Gradient – 1 in 400

Note: Gradient steeper than 1 in 400 shall be as per Correction Slip (ACS) No. 1 to SSODs for Dedicated Freight Corridor (Western Corridor) of Indian Railways, 2013.'

For design of Buffer Stops & Wheel stops, the following data may be used:

1. Number of cars per train = 140
2. Mass of Empty Train = 3000 MT
3. Mass of Loaded Train = 12000 MT
4. Speed of Train to be considered for Buffer Stops = 50 Kmph

The specified load and speed data for design of Buffer Stops & Wheel Stops is for reference.

Buffer Stops & Wheel Stops shall be provided as per the standard International practice for heavy haul traffic.

16.6.7 Levels

(1) All levels shall be quoted in meters correct to three decimal places and shall be to Mean Sea Level Datum India.

(2) For reference purpose, the down track from Vadodara to Rewari shall be the reference line and top of the inner rail of the said down track shall be considered for reference to the rail levels for the track.

16.6.8 Distance between Track Centers

(1) The distance between the track centers of two DFC Main Line tracks shall not be less than 6.0m

(2) In case of Station Yards :

a) A minimum distance of 6.25m shall be kept between Main Line to Loop Line and between two loop lines, to accommodate LED based Signalling system,

b) Since the maximum length of TRD portal is planned to be 32m, it can accommodate a maximum of 5 lines. Accordingly after every 4th line, a distance of 6.7m shall be provided to accommodate TRD portal avoiding location of such portals between two Loop / Adjacent Line.

The schematic diagrams of the track centers in the various types of Station Yards are explained below:

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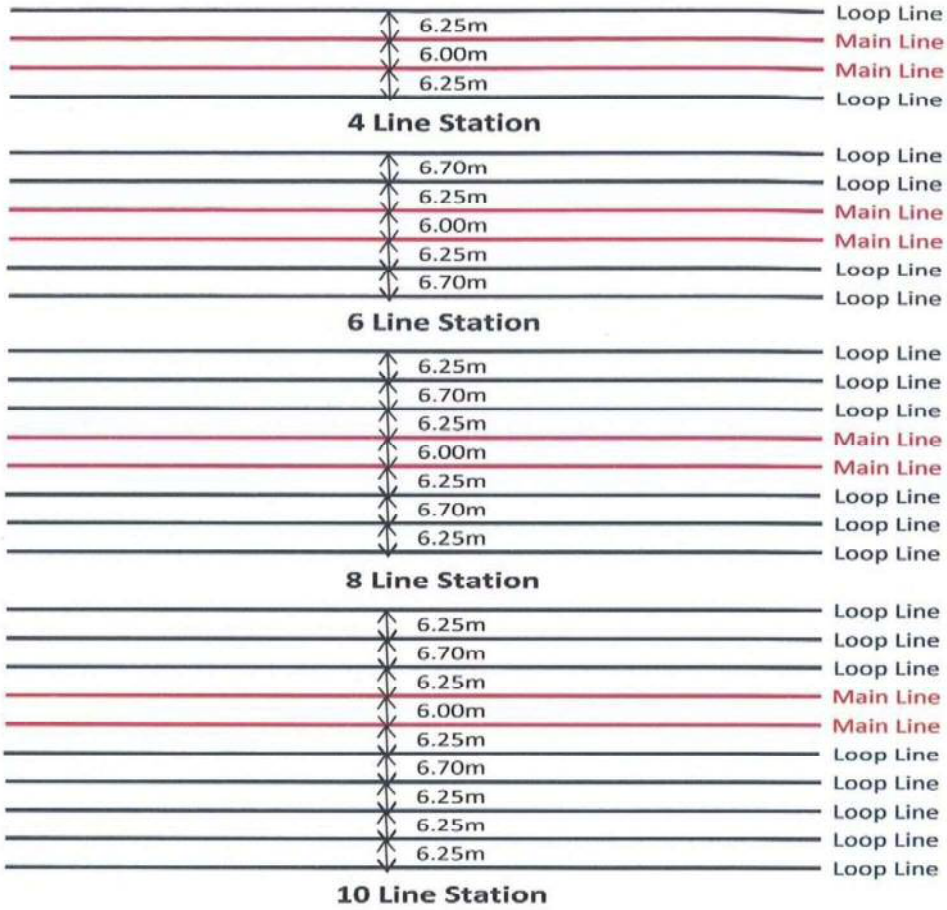

(3) Generally the distance between DFC track center (the DFC track nearest to the existing IR tracks) and the existing IR line track centre shall be 7 meters, which may be reduced to 6 meters in exceptional cases (subject to consent of Engineer and approval of Employer).

(4) Extra clearances on curves shall be as per Appendix to the Schedule of Dimensions for Dedicated Freight Corridor (Western) - January 2013. However, extra clearance upto 5 degree has been accounted for in the above spacing requirement.

16.6.9 Level Crossings

There will be no level crossings in the Yards. Wherever Alignment is parallel to the existing IR tracks and existing level crossings are being extended (wherever required, as per Clause 12 of Appendix 15 [Requirements for Construction]), depending upon the classification of the level crossing, category of the road, necessary provisions of grades, approach indicators shall be provided as per Chapter IX of the Indian Railway Permanent Way Manual.

16.7 Track Work Design

16.7.1 The track design shall be carried out by the Contractor as per the criteria specified herein and the requirements as specified in Clause 13: Track Work of the specifications (Volume III of the Bid Documents).

16.7.2 The track design shall be such so as to ensure minimum maintenance. The design of track works shall include but not limited to the following major activities and shall be read in conjunction with the other requirements as specified in Clause 13 of the specifications (Volume III of the Bid Documents):

a) Validation of the indicative designed horizontal and vertical Alignment within the available ROW;

b) Temporary Works including but not limited to base depot design (for welding of rails), material stacking & handling area, welding arrangements etc.;

c) Mechanized track laying involving laying or -laying of rail panels of 250 / 260 meters or more welded by mobile / stationary /flash butt welding plant under control conditions in depots, track linking by use of rail threader, track laying machines and use of tamping machines, dynamic track stabilizers, shoulder ballast compactors for making track fit for traffic movement for the designed permissible speed and axle load;

d) Rail welding – Flash Butt in general / Thermit welding of rail joints at special locations in exceptional cases with the consent of Engineer and approval of the Employer

e) Conversion of 250 / 260 meter or more welded rails panels in to long welded rails (LWR) / continuous welded rails (CWR) panels by deploying mobile flash butt welding plant and as per the LWR / CWR plan consented by the Engineer and approved by the Employer.

f) Ultrasonic testing of rails and welds by suitable equipment providing printed output of the test results in digital format / soft copy as well as hard copy ;

g) De-stressing of Long / Continuously welded rails using hydraulic tensors;

h) Insertion of 2 sets of Glued Joints per Station and Rail Expansion Joints as per the plan approved by Engineer / Employer;

i) Drainage;

j) Fencing at Level Crossings;

k) Provision of Permanent Markers;

l) The final track to be constructed to predefined tolerances;

m) Testing and Commissioning; and

n) Maintenance of track during the Defects Notification Period

16.7.3 Track Structure

Following technical parameters in respect of track structure corresponding to 25 tonne axle load will be adopted:

Table ERD-2: Technical Parameters of Track Structure

S. N	Technical Parameter	Value
1	Gauge	1676mm (BG)
2 (a)	Rails for Main Line and Points and crossings	UIC 60/60E1, 1080 HH Japanese Rails
2 (b)	Rails for other than Main Line and Points and Crossings	UIC60/60E1Kg - 90UTS (with specifications conforming to specifications not inferior to

S. N	Technical Parameter	Value
		IRS : T-12-2009) ie for Loop Lines, Non-running Lines, Sidings, Connecting Lines
2(c)	Guard Rail	60 Kg (2 nos. for each track) for Important Bridges, Major Bridges, RFOs, RUBS and for the tracks under ROBs
3	Points & Crossings	
3.1	Main Line and running Loops	Zu1-60, 1080 HH Rail, 1 in 12 curved thick web switches with weldable CMS Crossings on PSC Sleepers layout
3.2	Minor Loop lines and non-running lines /Sidings	Zu1-60, 1080 HH Rail, 1 in 8 1/2 curved thick web switches with weldable CMS Crossings on PSC Sleepers layout
4	Check Rail Clearances at Level Crossings	
4.1	Minimum	51 mm
4.2	Maximum	57 mm
5	Minimum depth of space for wheel flange from rail level	38 mm
6	Ballast Cushion below the bottom of the sleeper at the rail seat	
6.1	Main Line and Connecting Lines	350 mm. (minimum)
6.2	Loop Line & Sidings	250 mm (Minimum)
7	Sleeper	PSC Mono-block, 60 Kg with 1 in 20 cant for the rail seat (The rail seat of PSC Sleeper will be able to cater to 68 Kg/m and 60 Kg/m rail sections by providing suitable liners.)
8	Sleeper Density (Number of Sleepers per Km)	
8.1	Main Line and Connecting Lines	1660
8.2	Loop Line & Sidings	1540
9	Fastening	Elastic Rail Fastening
10	Formation Width	
10.1	Embankment & Cutting (excluding side drains)	a) For Double Track : 13.86 meter b) For Single Track : 7.86 meter

For Track Structure on Steel Bridges, the following additional parameters shall be adopted,

(a) Longitudinal profile of the Rails: Open web girders of 30.5m and above are provided with camber. The tracks on these girders are laid correctly following the camber of girder.

(b) Rail cant: the rails on the bridge should be laid with an inward cant of 1 in 20 by continuing the same cant as on the approaches.

(c) Guard Rails: Guard rails should be provided on all Steel Girder bridges including the bridges with ballasted deck in terms of Para 275 of IRPWM. A typical arrangement of guard rails, with important dimensions are shown in sketch below,

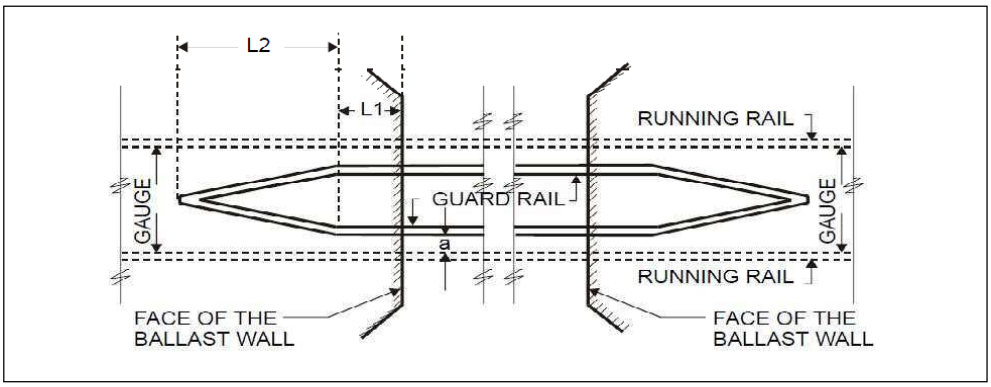

TABLE- Salient Dimensions of Guard Rail on Bridges

Particulars (*)	**Sketch Ref. Dimension**	**DFC**
Clearance between G/Rail and Running rail	"a"	250±50mm
Length of G/rail outside ballast wall	"L1"	1825mm
Length of G/rail to be bent and brought together at middle of track	"L2"	4875mm

(*) The top table of the Guard rail shall not be lower than running rail by more than 25mm.

(d) Hot dip galvanized Steel Channel sleepers suitably designed for 25 MT axle load moving at maximum speed of 100 Kmph shall be used for non-ballasted steel girders. The RDSO has designed steel channel sleepers for steel bridges for MBG loading as per RDSO Drawings No. BA-1636/1/R2 and BA-1636/R2 which may be used for guidance.

(e) The continuation of LWR/CWR over open deck steel girders shall be in accordance with Indian Railway-"Manual of Instructions on Long welded Rails (2005)" with latest correction slips. It has however to be ensured by the contractor that minimum joints/expansion joints are introduced in the rail over the Bridges and approaches.

For Track Structure on Level Crossing, the following additional parameters shall be adopted,

1. The PRC special designed sleepers (25T axle load) with arrangement for check rails (52/60 Kg/m) shall be used on the Level crossings, similar to RDSO Drg. No. RDSO/T/8225, RDSO/T/8226 and RDSO/T/8227.
2. CWR/LWR shall be continued on the Level crossings but the LC shall not be placed on the breathing length of the CWR/LWR.
3. Check rail shall be of 52 Kg / 60Kg section and no joint shall be allowed in this up to 9.0m on

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either side of the gate. RDSO Drg. No. RDSO/T/8227 is with check rail of 52Kg/m and running rail of 60Kg/m.

4. The clearances of check rail shall be as below,

Minimum horizontal clearance = 51mm
Maximum horizontal clearance =57mm
Minimum vertical clearance for wheel flange below R/R top= 38mm.

16.7.4 Rail Seat

In order to allow use of heavier 68 Kg/m rail in future during the life span of the concrete sleeper, the width of the rail seat shall be such so as to accommodate 60 Kg/m rail and 68 kg/m rails by provision of suitable liners. RDSO's indicative standard drawing for 25 tonne axle load concrete sleeper is for the track gauge of 1673 mm (RDSO drawing no. T-7008 for 136 RE Rails) and is included in the Reference Drawings (Volume V of the Bid Documents), whereas the DFC Gauge is 1676mm.However the RDSO's developed sleeper design is yet to be approved and proven. A reference shall also be made to Clause 13.5 of the specifications included in Volume III of the Bid Documents.

16.7.5 Ballast shall conform to IR specifications issued by RDSO [IRS GE;1] with latest correction slip

16.7.6 Check rail shall be installed on curve tracks with a radius < 220 meters.

16.7.7 Guard Rail shall be provided for the track on Major Bridges, Important Bridges, Rail Flyovers, RUBs and for the tracks under Road Over Bridges. For Guard Rail, 60 Kg Industrial Use (IU) Rail 880 UTS shall be permitted.

16.7.8 In depot buildings, various non-ballasted track forms will be required inside to permit rolling stock inspections and access to wheel lathes etc.

16.7.9 Performance Requirements

The main line and loop line tracks may carry 100 and 50 GMT per annum/direction respectively. The track structure shall be suitably tamped deploying appropriate tamping units (so as to ensure the track structure requires minimal intervention between the two tamping cycles) for operation of 25 tonne axle load trains operating at a maximum permissible speed of 100km/hr for the Main Line and Connecting Lines and 50km/hr for Loop Lines. The maintenance tamping cycle will be 2 years or 100 GMT of traffic; whichever is earlier.

16.7.10 Points and Crossing Work

(1) A point and a crossing shall not coincide with a vertically curved track and a horizontal transition curve.

(2) The practice of turnouts not taking off from curves shall be adopted to reduce the maintenance inputs and improve the riding quality.

(3) Turnouts shall have curved thick web switches, weldable cast manganese crossings and laid on PSC Sleepers

(4) Types of turnout shall be 1:12 and 1:8.5 curved thick web switch with weldable CMS Crossing, as per the Yard Plan provided in the Reference Drawings (Volume V of the Bid Documents)

(5) Turnouts shall not take off from transition portion of the curve

(6) There shall be no change of grades within 30m of any points and crossings

16.7.11 Sleepers

It shall be mandatory to adopt the outer profile of the PSC sleepers as indicated in the Reference Drawings (giving reference to the RDSO drawing no. RDSO / T-7008) and other requirements as

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specified in Clause 13: Track Works of the specifications (Volume III of the Bid Documents).

16.8 Earthwork Design

16.8.1 For design of the embankment / earthwork the "Guideline and Specification for Design of Formation for Heavy Axle Load, GE: 0014", issued by RDSO will be followed except the provisions contained herein below. The geometric parameters and design principles are described in terms of earthwork structure as follows:

(1) Formations comprises of granular layer (Blanket) over prepared sub-grade / Top Layer of embankment fill and embankment fill;

(2) Cross fall slope to be at least 1:30 or 3% with tolerance of 0.5%;

(3) Parameter of blanket (of thickness as specified in specifications, Volume III of the Bid Documents) are mandatory provisions to be adopted;

(4) In the case of new construction, minimum height of embankment shall not be less than one meter to ensure proper drainage, effective stress dispersal, and uniform riding qualities;

(5) Accordingly uniform total thickness of formation layers of 1.75m (the value of 2.0m as specified in RDSO Report No. RDSO/2007/GE:0014 is amended) shall be provided including blanket, prepared sub grade & top layer of embankment fill etc.;

(6) Cess width shall not be less than 900mm ;

(7) As identified in Clause 7.3 of Employer's Requirements – Functional, Signalling and Telecommunication Contractor (one of the Other Contractors) shall be providing line side signalling equipment cabinets for housing of Signalling equipment, signalling huts, telecommunication equipment cabinets, telecommunication huts for which additional earthwork above slope section on the embankment or by the side of the track shall be provided by the Contractor (in co-ordination with Signalling & Telecommunication Contractor);

(8) The construction drawings including longitudinal and cross-sections based on his final design shall be prepared by the Contractor and shall be subject to consent of the Engineer and approval of the Employer;

(9) The slope stability analysis shall generally be in accordance with Annexure-III of the Guidelines for Earthwork in Railway Projects (Guideline No. GE: G-1) by RDSO. In case of cuttings, the stability analysis and remedial methods be adopted as per RDSO guidelines for Cuttings in Railway Formations (Guidelines No. GE-2);

(10) Wherever the 'Black Cotton Soil' as described in Clause 5.9.4 (4) of the Specifications (Volume III of the Bid Documents), is encountered and ground improvement is considered necessary, the Contractor shall suggest and carry out the appropriate ground treatment measures subject to consent of the Engineer;

(11) Wherever, soft/very soft clays as defined in Clause 5.2.1 (13) of the specifications (Volume III of bid documents) is encountered, appropriate ground improvement measures shall be suggested and carried out by the Contractor subject to consent of Engineer;

(12) The Contractor shall prove using Engineering analysis and Instrumentation of the formation depth that the "residual settlement" of the Embankment and Cutting formation, at the stage of "Integrated testing and commissioning", shall not exceed the acceptable limits as per international codes, practice for heavy axle load, freight railway lines with maximum permissible speed of 100Kmph. In case of inadequate substantiation of limits from International code/practice, the limit of maximum residual settlement shall be 100mm.

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(13) It is incumbent on the Contractor to identify the soft ground/BCS sub-soil locations as a first step of starting the work and take up the earth work on priority at such locations, so that maximum settlement takes place before "Integrated testing and commissioning".

16.8.2 Geometric Parameters and Design Principles

a) The following table specifies the geometric parameters with regards to Earthwork Structure of DFC project.

Table ERD-3: Geometric Parameter of Earthwork

S. No.	Parameter	Value
1.	Formation Width (a) Embankment & Cutting	i) For Double Track : 13.86 m ii) For Single Track : 7.86 m
2.	Slope Gradient for Embankment	2H : 1V
3.	Slope Gradient for Cut	1H : 1V
4.	Thickness of Blanket	As per Guidelines and Specifications for Design of Formation for Heavy Axle Load - Report No. RDSO/2007/GE: 0014.
5.	Thickness of Prepared Subgrade	As per Guidelines and Specifications for Design of Formation for Heavy Axle Load - Report No. RDSO/2007/GE: 0014.
6.	Width of Berm	1,500mm (Minimum)
7	Width of cess (a) Embankment & Cutting	900mm (Minimum)
8.	Cross Slope at Top of Blanket	1 : 30 or 3.0% with tolerance of 0.5%
9.	Cross Slope at Top of Prepared Sub grade	1 : 30 or 3.0% with tolerance of 0.5%
10.	Cross Slope at Top of Embankment Fill	1 : 30 or 3.0% with tolerance of 0.5%
11.	Cross Slope at Berm	1 : 30 or 3.0% with tolerance of 0.5%

b) Design Principles of Earthwork

RDSO's "Guidelines and Specifications for Design of Formation for Heavy Axle Load, Report No. RDSO/2007/GE: 0014 (November 2009)" provides the parameters for design of earth work in formation. The design consists of 2 parts

i) Selection of material for formation: The soils are classified by particle size gradation

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