
Annexure – 2 of Addendum no. 2

**TENDER NOTIFICATION NO.
GMRC/DDC/ELEV-VDCT+STNS & DEPOT/PH-3B/2026**

“DETAILED DESIGN CONSULTANCY SERVICES FOR “METRO CORRIDOR FROM SHILAJ CIRCLE TO BADRABAD METRO STATION, ELEVATED VIADUCT (12.527KM), ELEVATED STATION (7 STATIONS) INCLUDING VIADUCT PORTION WITHIN THE STATIONS AND TRANSITION SPANS ON EITHER SIDE OF THE STATIONS, 2 NOS. OF DEPOT CUM WORKSHOP” AND STAFF QUARTER (PHASE –3B)” IN CONNECTION WITH AHMEDABAD METRO RAIL PROJECT, PHASE –3

**TENDER NO.:
GMRC/DDC/ELEV-VDCT+STNS & DEPOT /PH-3B/2026**

VOLUME - II

Revised _ Scope of Work

Gujarat Metro Rail Corporation (GMRC) Limited

(SPV of Govt. of Gujarat and Govt. of India)

Formerly known as Metro Link Express for Gandhinagar and Ahmedabad (MEGA) Co. Ltd.

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Corporate Identification No (CIN): U60200GJ2010SGC059407

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SCOPE OF WORK

1. INTRODUCTION

Ahmedabad also known as Amdavad in Gujarati pronunciation, is the largest city and former capital of Gujarat. It is the administrative headquarters of the Ahmedabad district and the seat of the Gujarat High Court. It is the sixth largest city and seventh largest metropolitan area of India, with a population of more than 6.3 million and an extended population of 7.8 million. Ahmedabad is located on the banks of the Sabarmati River. It is located 30 km from the state capital Gandhinagar, which is its twin city.

Ahmedabad has emerged as an important economic and industrial hub in India. It is the second largest producer of cotton in India, and its stock exchange is the country's second oldest. Cricket is a popular sport in Ahmedabad, a newly built stadium, called Narendra Modi Stadium, at Motera can accommodate 132,000 spectators, making it the largest stadium in the world. The world-class Sardar Vallabhbhai Patel

Sports Enclave is currently under construction and once complete, it will be one of the biggest sports centers (Sports City) in India. The effects of liberalization of the Indian economy have energized the city's economy towards tertiary sector activities such as commerce, communication and construction. Ahmedabad's increasing population has resulted in an increase in the construction and housing industries resulting in recent development of skyscrapers.

A Detailed Project Report, to cope-up with the rising demand of transport by a metro rail system, prepared by Delhi Metro Rail Corporation (DMRC). Gujarat Metro Rail Corporation (GMRC) Limited, a special purpose vehicle of the Government of Gujarat, has been set up to implement the project.

This corridor is a spur line of E-W corridor (Thaltej Gam to Vastrapur Gam) of Ahmedabad Metro Phase I".

Providing Metro will not only provide seamless metro connectivity to other parts of city and Gandhinagar, but will also save travel time to upcoming Common Wealth Games 2030 venue, proposed near Godhavi.

A route map of the project is given in Figure 1.1 and salient technical features of the project are given in Table 1.1 below:-

Table 1.1: Salient technical features of the project

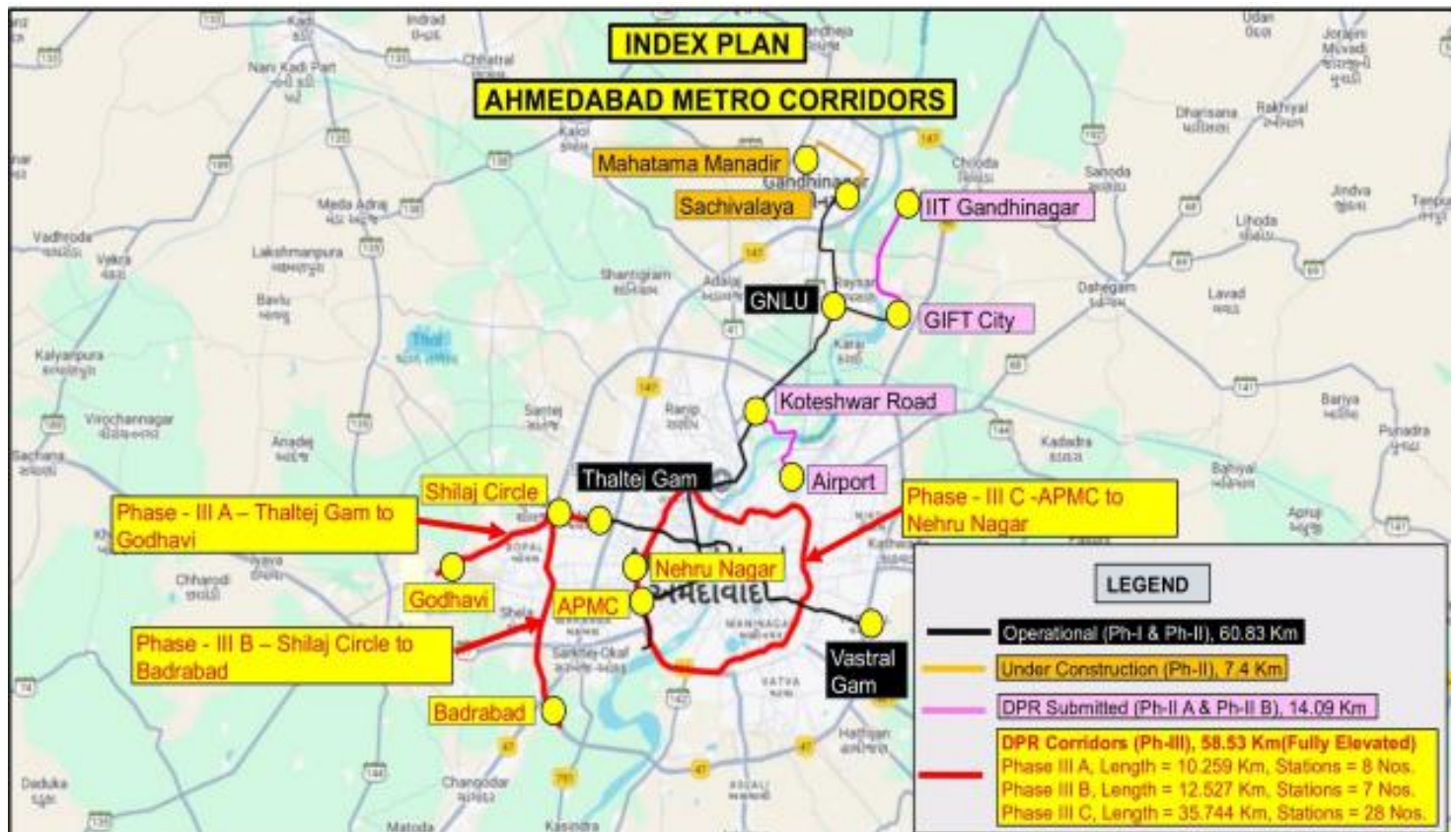
Sl. No.	Item Description	Particulars
1.	Gauge	Standard Gauge (1435 mm)
2.	Rails	60 kg UIC
3.	Track Structure	Ballastless (Mainline) Ballasted with PRC Sleepers (Depot lines)
4.	Traction & Power Supply	Voltage 750V DC with SCADA system
5.	Signalling & Train Control	GoA 3 with CBTC and with PSD
6.	Telecommunication	i) Fiber Optic System (FOTS), SCADA, Train Radio, PA system etc. ii) Train information system, Control telephones and Centralized Clock System.

Sl. No.	Item Description	Particulars
7.	AFC	Automatic Fare Collection System with TIM and Smart card
8.	Speed	Designed Speed – 90 kmph
9.	Axle Load	16 T
10.	Car size	2.9 m wide modern rolling stock with stainless steel body
11.	Train Composition & Capacity	3 coach unit: DMC + TC + DMC
12.	Train Capacity	Normal - 764 Passenger Crush - 972 Passengers

1.1.1 Expected date for revenue operation is September 2030.

1.2 This tender is for the engagement of a Detail Design Consultant (DDC) for Civil, Architectural, E&M and Building Services Works from **Shilaj Circle to Badrabad** station, 2 nos. of Depot cum Workshop and Staff quarter.

Figure 1.1



2. EXTENT OF SERVICES

2.1 Services to be provided

The DDC shall deliver sufficient designs, drawings and documents for the construction of viaducts, stations, Depot cum workshop and Staff quarter that conform to the Metro corridor. The approximate length of viaducts, no. of stations and details of stations involved are given in Table 2.1 and 2.2 below:-

Table 2.1: Length of viaducts and no. of stations

Sl. No.	Description	Elevated Viaducts (Km)	No. of Stations (Elevated)
1.	Shilaj Circle to Badrabad	12.527	7
	Total	12.527 Kms	7 nos.

Table 2.2: Details of stations, Phase 3B-2

Sl. No.	Station Name	Chainage (m)	Inter Station Distance (m)	Remarks
1.	Start of DDC work	0		-
2.	Turquoise Dreamz	1050.295	1205.569 (Inter station distance from Shilaj Circle station)	Elevated
3.	Vakil Bridge	2951.354	1901.059	Elevated
4.	South Bopal	4528.657	1577.303	Elevated
5.	Sarkhej- Okaf	5989.467	1460.81	Elevated
6.	Shela	7566.598	1577.131	Elevated
7.	Sanathal	10223.734	2657.136	Elevated
8.	Badrabad	11799.985	1576.251	Elevated
9.	Dead End	12526.74	726.755	

2.1.1 These Services generally include, but are not limited to:

- Review of DPR for basic requirements;
- Producing concept planning and design alternatives of elevated viaduct including viaduct of

- Depot entry upto 1km length, typical, non-typical & interchange stations, Depot cum workshop and Staff quarter for GMRC's review;
- c) Review of alignment in general and station locations in particular with a view of optimization of neighborhood connectivity and MMI integration;
 - d) Modifications to the preliminary alignment given in DPR, on the basis of detailed topographical survey data (to be provided by GMRC), and preparation of final Metro rail alignment and center line pegging for construction including re-designing / refining the alignment during the whole duration of the project, as and when required, based on site conditions & other interface requirements, support during construction etc.
 - e) Perform cost effective detailed designs of Architectural, Structural (including track supporting structure), Building Electrical and Mechanical services;
 - f) Manage the design task for cost, schedule and performance compliance;
 - g) Primary design of various structural components of Depot cum workshop, Staff quarter, elevated stations like foundations and superstructure, entries, exits etc. and viaduct including pocket track;
 - h) Perform detailed designs of viaduct including pocket track and entry to the depot, specialized structures, Staff quarter, stations including sub-structure and other building works, the fitting out of stations with architectural finishes and services including FOB of completed length for MMI purpose, illuminations, lifts, escalators, water supply, drainage, power supply and other passenger amenities including any special span;
 - i) Proof checking of temporary works, shop drawings and scheme of construction suggested by the Civil Contractors for the work;
 - j) Perform detailed designs for multi-modal transfer facilities for road and pedestrian traffic, landscaping, traffic management and road and station interfaces for the surrounding roads and neighborhood;
 - k) Preliminary & detailed design of Depot-cum-Workshop and staff quarter;
 - l) Identification of utilities and review of alignment plan duly marked with utilities;
 - m) Review and suggest changes as necessary in the detailed designs done by Civil Contractors for viaduct & Station works for temporary and permanent diversion works for all utilities affected by the station works / viaducts identified by contractors during execution and design structures accordingly. Provide items in the Construct Contract BOQ for diversion of these utilities;
 - n) Co-ordinate and integrate designs and details with contractors and consultants employed by GMRC working on contracts pertaining/relevant to the site of works for this contract regarding DDC's drawings;
 - o) Integration of Building Services with the existing M&E systems at interchange stations

- including fire compartmentation;
- p) Prepare and update during construction Combined Services Drawings (CSD), Structural-Electrical-Mechanical Opening Drawings (SEM) and identify embedded items/openings indicating system wide information for the purpose of E & M co-ordination and civil construction interfaces;
 - q) Prepare BOQs, Technical specifications, scope of work, construction cost estimates for the associated construction contract, interface matrix for tendering by GMRC and modify the cost estimate before the contract is awarded. The BOQs, special specifications, construction cost estimate is to be prepared separately for Depot cum workshop, Staff quarter and stations in a number of packages as decided by GMRC so as to facilitate GMRC to call construct only tenders in different contract packages;
 - r) Incorporate and co-ordinate changes in design due to system wide interfacing with other DDCs/ Contractors/ GMRC;
 - s) Incorporate changes in design resulting from GMRC's design reviews;
 - t) Consult and co-ordinate with various City and Government authorities (in Ahmedabad as well as outside Ahmedabad) that interface with the project. GMRC will assist with the co-ordination;
 - u) Prepare necessary documentation and obtain necessary planning and other required approvals for Depot-cum-Workshop Staff quarter, the integrated complex consisting of Station designs, Station layouts, track supporting structures including E&M facilities and fire detection/suppression system, conceptual layouts and drawings for property development, if any, from the relevant approving authorities;
 - v) Plan, design, detail, control, co-ordinate, and execute the design phase of the Works for production of drawings, documents and reports to meet the key schedule dates included in the Special condition of contract and as directed by GMRC;
 - w) Maintain a Quality Control activity and an effective internal procedure for checking the accuracy of Work and assuring compliance with contract requirements;
 - x) Attend meetings connected with the Work whenever required; and
 - y) Make available their services as and when required during the construction contract, to modify existing designs or drawings as necessary, to incorporate site conditions and unforeseen conditions, to assist GMRC's site supervision staff in clarification of queries resulting from the design, to review and confirm civil Contractor's prepared As Built' drawings;
 - z) DDC shall be responsible for the preparation of various Minutes of Meetings, as directed by GMRC;
 - aa) DDC shall submit document control index sheet with total no of drawings needed to be submitted for final approval. DDC shall submit Project Program including complete list of Deliverables, Schedule of Delivery & Mobilization Schedule of Expatriate Consultants and

- three months rolling programme for design submissions;
- bb) There shall be revision A,B,C.... drawings for design / drawing review. After GMRC's approval, Revision 0 drawing will be prepared on A1 size 7 sets as GFC and issued to site. One copy of tracing sheets of GFC drwgs shall be submitted to GMRC;
 - cc) GMRC's comment sheet and its compliance by DDC shall be documented in the design note forwarded for GMRC's approval;
 - dd) Clouding needs to be shown in the drawing, with a note clearly stating the changes made in drawing after GMRC comments;
 - ee) All STAAD input files, Excel files used in the design calculation, Autocad file for drawings and pdf files for both design document and drawing and comment compliance sheet in word format shall be submitted with CD. The same CD details shall be mentioned in the transmittal letter forwarded to GMRC for approval;
 - ff) The DDC should supply all the software used for analysis and structural design, for architectural design, for building services design and for E&M design. The software should be for four users in case of structural design, two users in case of Architecture design , 2 user in-case of E&M design and one user in other cases. The licenses should be valid for complete duration for the DDC contract including extension, if any and should be upgraded as and when such upgradation is issued by software owning agency. Fixing arrangements with member sizes for Architectural Finishes/ any other item to be provided by DDC. In case, DDC uses uncertified software for design or analysis of any member, the excel sheet along with the formula will be shared in dot excel format (editable copy) and a sample manual copy of design calculation duly certified. The pdf copy of design alone will not be acceptable. All designs should be submitted along with the version of software in which analysis or design is done or in dot excel format (editable copy) as the case may be, in addition to pdf copy.
 - gg) Excel sheet if used in design shall be submitted with unlock password with all macros enabled along with all linked .xla files. The design formulae's, methodology, need to be submitted in a manual, explaining the working of excel sheet. There shall be no proprietary item in design note which DDC can claim. GMRC owns all the working excel sheets, input files, output files, design data and DDC shall not use this design data for other projects;
 - hh) After GMRC's comments, drawing/design shall be submitted along with compliance sheet for GMRC's approval within 10 days;
 - ii) The structural drawing shall have architectural drawing reference no. with revision no. used while preparing the design document. If there are any changes in architectural no., same has to be updated in structuring drawing as well;
 - jj) All structural drawings shall have design document no. mentioned under general notes;
 - kk) If there is any repetition of drawings because of similar station structural configuration, then original reference structural design / drawing shall be mentioned in the drawing;
 - ll) GMRC will provide access to EDMS server to upload all the design documents / drawings on the server.
 - mm) Rail structure interaction analysis shall be carried by DDC for the project to determine LWR

forces due to continuous welded rails. RDSO's guidelines for RSI analysis and UIC code need to be followed. Forces on piers for viaduct, station, curves at different heights and corresponding stress in rails shall be mentioned in the RSI report;

- nn) The Consultant shall prioritise and deliver all Standard Design and Drawings for Superstructures and Substructures as listed in **Annexure I** – Standard Design & Drawing Required from Consultant at the commencement of the project, and in any case no later than D+4 months from the Date of LOA unless the Client grants a written extension. Such early delivery of Standard Designs shall be treated as a contractual obligation and a pre-condition for the Consultant's efficient deployment of resources on: i) Non Standard Design components and ii) Foundation design for all structures under the scope of this contract.
- oo) The Consultant acknowledges that the Standard Designs referred to in **Annexure I** are fully within the priced and accepted scope of this Contract, and that their early preparation places no additional burden beyond what has already been priced in the Financial Proposal.

2.1.2 Implementation of BIM System for DDC Services

DDC shall implement BIM system for executing and delivering the services set out in this Agreement.

Building Information Modelling (BIM) uses computing power and systems to create 3D models of all kind of buildings and infrastructure, with information about its design, operation and current condition. At the planning and design stage it enables designers, owners and users to work together to produce the best possible designs and to test them virtually before they are constructed. During construction, it enables GMRCs, contractors and suppliers to integrate all components cutting out waste and reducing the risk of errors. In operation it provides users with real-time information about available services and facility managers with accurate assessments of the condition of assets.

All station designs (including architectural design, structure design, E&M services design, interior fit outs, plumbing design etc.) and viaduct designs/proof checking shall be done using BIM modelling. DDC shall implement and maintain, for entire duration of the project, necessary hardware, software and human resources towards this end in their office and provide same software with subscription support/upgrade up to project duration for 5 users for use of GMRC personnel and shall arrange training for 10 personnel of GMRC including 5 from E&M and L&E. DDC shall be required to produce, update and present to GMRC on a fortnightly basis an integrated 3D BIM model incorporating rail track, topography, architecture, structure, plumbing and all other building services and system wide requirements in design review meetings. These models shall be 3D rendered and shall help in design visualization and clash detection of elements as well as finalization of design.

In addition, DDC shall also provide following individual models: -

1. Station Architecture Modelling
2. Station Mechanical Modelling

3. Station Electrical Modelling including BMS
4. Station Plumbing Modelling
5. Station HVAC Modelling
6. Rail Track Modelling
7. Terrain modelling
8. Clash Detection
9. Quantity takeoff from BIM model
10. Visualization and Animated Walkthroughs for each type of station.
11. Updation of system departments inputs in BIM models.

Final coordinated drawings (at each stage of submission) of all disciplines shall only be generated from the BIM model. Detailed cost estimates shall also be prepared only on the basis of approved 3D BIM model.

3D BIM Implementation is required. BIM Execution plan to be provided. Federated model to be submitted at each stage including Revit/BIM Model on ACC platforms (Autodesk Forma) for required review of stakeholders and client. At each stage, DDC to carry out clash detection with all services.

DDC need to incorporate the requirements of all System stakeholders into its BIM design during each design stage. The BIM shall be developed to the following LOD specifications:

- a) LOD 100 - Concept Design Drawings Submission
- b) LOD 200 - Preliminary Design Drawings & Tender Drawings Submission
- c) LOD 300 - Final Design & Drawings (GAD) Submission inclusive of Land Plans & MMI
- d) LOD 400- GFC (Good for Construction) Drawings & Details Submission inclusive of MMI

2.2 Contracting strategy for construction

2.2.1 Elevated packages – Civil Works

The construction tenders will be launched on the basis of a Preliminary design prepared by the DDC.

The performed Preliminary design should allow reasonable accuracy, estimating the construction costs within a margin of error in a range of $\pm 10\%$ of the contract value, and providing the tenderer with all the elements necessary to prepare their offers.

The detailed design of the substructures & Super structure would be done by the DDC based on the GMRC's approval on preliminary designs.

Following the award of the construction contracts, the proof checking of detailed design of Temporary structures etc. will be performed by the DDC including but not limited to Radio Tower , RSS building, pocket track , buffer stop line if any.

2.2.2 Elevated packages – Building Services

The DDC shall prepare the preliminary/definitive design for the Elevated Stations & Viaduct. Based on the design, tender documents for Elevated stations & Viaduct will be prepared and the tenders will be floated accordingly. The design shall finalize the major equipment capacities and the quantities of the miscellaneous items.

The detail design consultant will however perform Detailed design of BMS, and E&M for all stations and viaduct as well as incorporate requirements of Signalling, Telecom, AFC, Traction, Rolling Stock, Track, Lifts, Escalator, Travelators ,PSG and all other system wide contractors design and drawings.

2.3 Duties and Responsibilities of the DDC

The DDC shall initiate, and actively pursue and involve itself in all investigations and enquiries, consultations, studies, collection and compliance with pertinent information and data, convening of and attendance at meetings, and in any other activities as are or may be necessary for producing the detailed design, drawings and documents to the specified requirements.

The DDC shall carry out the Services in accordance with its own methods, in compliance with the provisions of the Agreement. Any and all changes necessary to ensure that the DDC's design, BIM models, drawings and documents conform to the intent and purpose set out in the Agreement, shall be made at the DDC's own expense.

DDC shall collect and study the flood/hydrological data of city, river and drains, analyse them and submit a report, recommending HFLs and protection measures to be adopted for design of bridges, viaducts, stations, Depot and staff quarter. DDC shall also coordinate with the consultant, appointed by GMRC, to study the effect of climate change and take necessary inputs in its designs.

The DDC represents it as a professional and experienced consultant providing full consultancy services, and hereby agrees to bear full responsibility for the correctness and technical merit of the services performed.

The DDC shall obtain the necessary design and regulatory approvals from the appropriate authorities including Railways/N.H/Irrigation/Canal/ Local Urban body/ Municipal Corporation etc. for the stations, station areas, Depot , staff quarters, specialized structures and any associated joint developments. GMRC will provide co-ordination for this process.

DDC shall prepare 3D views and Walkthrough for stations Depot and staff quarters. 3D and walkthrough to be prepared for typical, all non-typical station and iconic station.

DDC shall take approvals of designs and dwgs from all government authorities as instructed by GMRC.

DDC shall do utility investigation by using ground probing radars, utility trenching if required.

DDC shall prepare land plans.

DDC shall prepare multimodal traffic integration plans and detailed designs of FOB (complete length including beyond the station footprint area), skywalks, underpasses or similar structures.

DDC shall coordinate and interface with various consultants appointed by GMRC and provide /incorporate the inputs wherever applicable.

DDC shall also take into cognizance for the provision of safe access equipment pathway's for shifting & maintenance of traction and E&M equipment from ASS-TSS room in coordination with Civil

DDC shall prepare the integrated interface schedule and regularly updated as per actual position in project

DDC shall incorporate the Traction Earthing and Bonding requirement in civil GFC drawings of viaduct, station, Depot , staff quarters etc

DDC shall prepare drawings for submission to Fire authority, AMC, revenue departments or any departments related to metro rail.

DDC shall prepare all documents and obtain approvals from Fire authority, AMC, revenue departments, RDSO or any departments related to metro rail.

Design of ancillary buildings or any building related to metro rail project.

2.4 Basis of Detailed Design

The detailed design, drawings and documents shall be developed by the DDC from the design criteria, outline specifications and other information to be issued to or gathered by the DDC and as approved by GMRC In order to ensure uniformity of all Design Contracts. compliance with the requirements specified therein shall be mandatory unless prior agreement in writing for any changes has been obtained from GMRC. If there are any points of disagreement or inconsistency, the DDC shall immediately refer these, giving reasons for the disagreement, in writing to GMRC for a ruling.

The DDC shall comply in producing its detailed design and drawings in accordance with the checking requirements specified in Section 7 of this document.

The details of property development, including the floor area, number of stories shall be worked out by the DDC on the basis of market potential and building rules, if applicable.

Though only conceptual design and drawings are to be made for the property development, the **lighting, circulation, staircases and other services required for the property development area, though required later are to be planned for.**

2.5 Input for interface

DDC shall be responsible to carry out all interface activities with the consultants/contractors of systemwide works and shall ensure that all their requirements are incorporated in their designs.

3 SERVICES TO BE PERFORMED BY THE DDC PRIOR TO THE AWARD OF CONSTRUCTION CONTRACTS

3.1 Available Information

The DDC shall study all the available information and conceptual drawings issued (if any) or made available to it in the Scope of Services, carry out all necessary analyses, and request any further information or data which is necessary for its design development from GMRC which will be provided, if available.

3.2 Additional Information

The DDC, shall, if so required, carry out additional field surveys, which will be paid extra at a mutually agreed rate.

DDC shall use the approved Outline Design Criteria and any other approved design specifications as provided by GMRC as the basis for developing the full design, Construction reference Drawings, Cost Estimates and BOQs for all Architecture, Structure and E&M works including L&E.

3.2.1 Systems shall comply with the following codes of practice, standards, specifications and manuals wherever specified.

National Building Construction Standards 2026

The Guides of the Chartered Institution of Building Services Engineers

Acceptable Internationally recognised standards for this Contract are:

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	British Standards
BIS	Bureau of Indian Standards
DIN	Deutsche Industrie Normen
IEC	International Electro technical Commission
IEEMA	Indian Electrical and Electronics Manufacturers Association
JIS	Japanese Industrial Standards
NEC	National Electrical Code (NFPA 70)
NEC	National Electrical Code (Indian)

NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
VDE	Verband Deutsche Elektrotechniker
GDCR	Gujarat Development Control Regulation (Latest)

BS 7671: 1992 "Requirements for Electrical Installations"

In case, standards and Codes for any specific element are not defined in documents referred to above, DDC may use applicable Standard or Code from the above list with the approval of GMRC.

3.2.2 Unless otherwise stated, the E & M System design and execution shall comply with all applicable local regulations issued by the agencies listed below:

- Indian Electricity Rules
- Indian Electricity Act
- National Building Code
- Chief Inspector (Electrical), Govt. of Gujarat,
- Central Pollution Control Board
- Ahmedabad Fire Services
- Public Works Department of Ahmedabad
- Central Public Works Department
- Ahmedabad & State Power Supply Utilities
- Ahmedabad & State Administration
- Municipal Corporations of Ahmedabad
- National Safety Council
- Gujarat LIFT and escalator act 2001 and/or latest amendment.

3.2.3 Any additional requirements imposed by local agencies not listed above shall be incorporated into the designs. Local codes, regulations and standards shall take precedence where their standards or requirements are more onerous than other International standards.

The design of any one system shall be to a single code or specification. Parallel use of different codes for one particular item or component shall not be allowed.

Should the DDC propose to use alternative Standards or Codes of Practice, they shall submit two copies of these with justification for their use to GMRC for review and acceptance within 2 weeks from the Issue of Letter of acceptance.

3.3 Design Alternatives

The DDC shall perform Design Alternatives as per the conditions of the Contract and as per the requirements of site conditions. The DDC shall develop architecture alternative layouts of the elevated stations, Staff quarter & Depot and designs for the substructure, superstructure of Viaduct & elevated stations within the overall design parameters defined in the Agreement. The DDC shall perform proof checking of structural design and scheme of construction suggested by the Contractor for Staff quarter, Depot, Viaduct & elevated stations, the objective of which will be to reduce construction cost without adversely affecting the required transit system functions such as capacity, service life, reliability, economy of operation or ease of maintenance and which shall not require any extension of design or construction time.

The DDC shall offer state of the art design for the Building Services and the alternative designs shall also be offered for E & M services.

Min. 3 nos. of alternatives will be required.

Several design alternatives may be required as per the site conditions or any other specific requirement of the project.

Each design alternative shall be presented in sufficient detail to clearly define the proposed design alternative including:

- A description of the difference between each proposed design alternative and the comparative advantages and disadvantages of each. Clearly illustrated sketches, drawings, diagrams, calculations, published reports or other means that allows evaluation shall accompany the written description.
- A detailed estimate of the amount of savings in construction cost.
- All further work of preparing tender documents, detailed design, drawings, etc. will be done as per the alternatives approved by GMRC. Different alternatives may be approved for different locations.
- All costs associated with this shall be included in the Lump Sum price.

3.4 Detailed Design

The DDC shall prepare detailed designs based on the requirements provided in the drawings and documents issued to it. If the DDC disagrees with the design requirements of the specified works, it shall propose alternative designs to GMRC for approval. Upon approval, the DDC shall completely design and detail the Works, provide Tender and Contract Drawings and other documents for the construction contract and be fully responsible for such design and detailing.

The detailed design of the specified works and the incorporation of all systemwide requirements are the responsibility of the DDC. The design shall be developed from the conceptual drawings, outline specifications and design criteria prepared and issued to the DDC by GMRC. Any critical

difficulty identified shall be immediately drawn to the attention of GMRC, but not withstanding that, the DDC shall remain totally committed to the overall integrity of the design, if necessary actively seeking advice, information and clarification so as to avoid abortive work.

The DDC shall incorporate in its design, the relevant seismic criteria and earthquake design, as required by the design criteria.

The DDC's design shall take into account the installation requirements of the system wide information listed in Section 3.6 of this Document, which will include the provision of openings, conduits, fixings, bases, plinths and loadings. Provision of earth electrodes, Earthing arrangement to steel reinforcement. The DDC shall make provision in its design programme for the inclusion of these requirements at a later date as they cannot be finally determined until after the award of the systemwide contracts. The DDC shall incorporate the requirements of the systemwide contractors into its design as appropriate and as they become available.

The design of Lifts and Escalators will be carried out by others under a separate systemwide contract.

3.5 Requirements for Earthing, Bonding and Corrosion Protection

The DDC shall incorporate the relevant requirements of design criteria in its design.

3.6 Systemwide Information

The DDC shall incorporate all the relevant information made available to it regarding the systemwide works in its design and other documents including, but not limited to:

- Rolling Stock;
- Track Work;
- Electrification;
- Signalling;
- Communications including Closed Circuit Television (CCTV), Public Address (PA), and SCADA Systems;
- Traction Power, Power Supply and Emergency Power Supply Equipment;
- Automatic Fare Collection System;
- Lifts and Escalators; Travelators and
- Platform Screen Gates
- Signage.

3.7 Systemwide Requirements

Systemwide requirements in the form of preliminary Systems information, as indicated in section 3.6 above, will be provided by GMRC for the purpose of preparation of the CSD and SEM drawings by the DDC.

The general arrangement of the station, the major equipment locations and major services routes,

and the cable routes are to be shown on the CSD drawings. The major equipment loads pressure rating of air plenum, major openings and major embedded items and other similar interface are also to be shown on these drawings.

During the detailed design phase and continuing through the construction phase, the DDC shall co-ordinate with GMRC, and other system wide DDCs to obtain systemwide requirements such as embedded conduits, floor trunking, wall and floor openings, equipment concrete plinths, air conditioning equipment space, sleeves, hoisting hooks, earthing, lightning arresters etc., and incorporate into the architectural drawings for construction contracts.

The layouts for the stations and other buildings shall be co-ordinated by compatibility review meetings chaired by the DDC, which GMRC will attend, during the design stage.

DDC shall be responsible for Preparation of Minutes of Meeting and its issue.

At the final submission stage, detailed layouts shall be co-ordinated and drawn by the DDC on one set of CSD drawings. These drawings serve to co-ordinate major routings of all services. It is an information drawing and is not used for construction. It directs the systemwide

DDCs and contractors to prepare their respective shop drawings in accordance with the routings shown on them. These drawings shall be included in the Contract Documents as information drawings. During design and continuing through the construction phase, the DDC shall revise completed or partially completed SEM opening drawings and architecture drawings to incorporate the additional systemwide requirements defined by the systemwide CSDs.

Additional layout details and systemwide requirements requested by systems and E & M Contractors during construction shall be incorporated into the CSD, SEM opening drawings and architecture drawings. Sub-Section 4.2 describes construction stage services regarding final CSD and systemwide requirements. DDC shall make available the BIM models and CAD electronic data to the System and E&M Contractors who will incorporate these additional details in the design.

DDC will review and incorporate the modified design. However, DDC will repeatedly interface with System Contractors / other DDCs to ensure compatible complete design.

The DDC shall submit a Design Brief describing in words, diagrams and graphics.

It is of utmost concern that the design of the station shall be safe in the event of a fire. In this respect, it is essential that the suitable necessary details be incorporated into the design as per prevalent rules, regulations, code and practice.

3.8 Architecture Design Services

The Architecture services shall include the detailed design of all Architecture and landscaping works, preparation of drawings, specifications, cost estimates and other documents, as required, in order to obtain tenders and to construct the works, together with such other services as are set

out and referred to in this General Scope of Services. The works specifically include obtaining the necessary approvals from the concerned Civic Authorities.

The DDC shall prepare drawings with sufficient detail to fully describe the architecture design of the Staff quarter, Depot, stations, ancillary facilities, and property development, including mechanical and electrical equipment and any structures visible to the public. These drawings shall address at a minimum such issues as:

- Staff quarter, Depot, Station and ancillary buildings architecture design
- Site design, landscape design and urban design.
- Existing site characteristics.
- Proposed land uses and relationships to surrounding properties.
- Visual corridors to and from proposed property development.
- Pedestrian paths and vehicular links.
- Hierarchies of public and private spaces.
- General concepts of building massing.
- Integration with existing and proposed property development.
- Floor and ceiling finishes having good light dispersing properties to enhance illumination.
- The DDC shall prepare design solutions responding to requirements for public and private transportation facilities and open space provisions within the proposed property development sites. The DDC shall prepare all the conceptual designs and drawings for Property Development keeping in view the prevailing building rules and it shall not be required to prepare detailed drawings. The DDC shall make necessary presentation at various stages of scope of work as mentioned above as per directions & requirement of GMRC.
- DDC to submit drawings on ACC BIM Platform along with 2D AutoCAD files and 3D model. 3D & 2D software licenses (Auto Cad, Revit) to be arranged by DDC and to be made available to client as per tender conditions for minimum no of users.
- Entry Exit Drawings shall be finalized only after utility and other services verified by site Civil team. DDC shall provide options based on site conditions. No cost variation shall be acceptable towards preparation of options and related land requirement plans.
- Payment Shall be granted only after finalization of Entry Exit GFC Drawings.
- DDC shall attend inspection site visit as and when required.

Stage-1: Submission of Project Program including complete list of Deliverables, Schedule of Delivery, Mobilization Schedule of Expatriate Consultants and key persons. *

Stage-2: Submission of concept design drawings and Design alternatives along with concept design report.

The DDC shall prepare Concept Design with all measurements. Transition from Concept to schematic design should be sufficient to fully describe the design by incorporating various inputs given by GMRC. Impact of inputs from GMRC on the "saving in Cost" should be justifiable.

Views of the Planning Division of GMRC shall also be taken on the concept design before approval is given. Variation can occur between "Approval given to concept design" and the schematic design. DDC should make design presentation at each stage for in-principle approval from GMRC and other stakeholders. One of the outputs of the concept design stage is to produce a report which records the design concepts for major aspects of the project that might be worth developing as detailed designs. The report also identifies instructions required from the GMRC.

The concept design may include:

- A summary of the design brief.
- Identification of constraints, including local context right of way (ROW), site levels, access, build-ability, manufacturing, financial and local authority planning and building regulations, land-plan issues, etc.
- Statement of how the design meets the client's needs.
- Site plan.
- Layout plans of each level (typical & non-typical stations).
- Natural ventilation/Lighting strategies.
- Landscape strategy (in a general level).
- Conceptual Sections.
- Conceptual Elevations.
- Comparative studies of completed projects. (3D views of proposed and completed projects)
- DDC to submit drawings on ACC BIM Platform along with 2D & 3D Revit model & Auto Cad Files

Stage-3: Approval of concept design drawings and concept design report.

After submission of concept design report, approval of concept design has to be taken from GMRC to proceed for next stage.

Stage-4: Submission of preliminary design drawings including interchange scheme based on approved Concept design drawings, including modifications if any.

The preliminary design of the specified work shall be developed from the approved concept drawings, specifications and design criteria mentioned in the Detailed Project Report (DPR) prepared by DMRC. Any critical difficulty identified shall be immediately drawn to the attention of GMRC, but not withstanding that, the DDC shall remain totally committed to the overall integrity of the design, if necessary, actively seeking advice, information and clarification to avoid abortive work.

The preliminary design may include:

- Design calculations to reflect the scope of the work to be executed.
- Preparation of preliminary strategies for Staff quarter, Depot, stations including commercial & retail development and optimizing retail area and revenue enhancement opportunities in the stations.
- Drawings based on approved Concept Design, including modification and pending details, if any.

- Area statement.
- All typical details.
- External Façade /Cladding fixing arrangement.
- Signage location layout details.
- Draft of Bill of Quantities and specifications.
- Identification of conflicts within the right of way of the civic bodies and resolutions to problems Identified.
- Cost estimates for design alternatives approved/adopted by GMRC.
- Any other fixing arrangements which need structural details
- Any omissions or errors are resolved.
- Design Basis Report (The DBR shall be updated continuously till the approval of the GFC drawings. This report shall clearly communicate planning guidelines, egress calculations, room schedule, typical details, materials /finishes etc all complete for the document purpose).
- The DDC shall investigate each site in support of the environmental review process as it relates to surrounding neighborhoods and property development, both existing and proposed; and also the environmental impacts upon present and committed future recreational facilities, parks or other open spaces and landscaped facilities. The detailed design shall be finalized after the environmental review is completed.
- Designs of FOB, Skywalks underpasses or similar structure Connecting passenger catchment area and metro station

This shall include as a minimum the following:

- Identify levels of architectural and landscaping treatment necessary to mitigate environmental impacts whether physical, visual or noise related, in relation to the preparation of an Environmental Impact Report which may need to be coordinated with relevant Government and Municipal Departments. Provide continuing design support to the environmental review process.
- Prepare such designs as may be required to address and mitigate potential environmental impacts upon present and committed future recreational facilities, parks or other open spaces and landscaped facilities.

The DDC shall address additional issues as required to support the architecture and urban design concepts for station sites and property development, including but not limited to:

- Building control dimensions
- Height, depth, setback and massing requirements
- Major features such as building arcades
- Street/wall relationships
- Other relevant issues
- DDC to submit drawings on ACC BIM Platform along with 2D Auto Cad Files & 3D Revit model

Stage-5: Approval of Preliminary Design drawings.

After submission of Preliminary design drawings, approval of the same has to be taken from

GMRC to proceed to next stage.

Stage-6: Submission of documents including land plan showing temporary and permanent land requirement, Government authorities.

DDC shall refer local building bye-laws, TP scheme details, Development plans etc for the preparation of Land plans. DDC shall prepare land drawings as per the requirement of GMRC and local authorities upto finalization of the land plan. The required NOC shall be taken from local authorities as applicable for planning and execution work of Metro Station, Depot and Staff quarter.

DDC to submit drawings on ACC BIM Platform along with 2D Auto Cad Files. & 3D Revit model. However, final approved land plans to be submitted in Hard Copy submission (A3 size X 4 sets) for onwards submissions to Authority.

Stage-7: Approval of documents including land plan showing temporary and permanent land requirement for each station and Staff quarter from local authorities.

Payment shall be released only after the final approval of land plan based on finalisation of Entry Exit location and utility identification.

Stage-8: Delivery of tender drawings, BOQs, special conditions and specifications.

The Tender package for hiring of contractors shall include the Detailed GADs prepared in preliminary design stage accompanied with a typical RFP document with Project Specific conditions and General conditions as per GMRC precedents.

The deliverables at this stage will be as follows.

- A. detailed GADs.
- B. Technical Specifications for the works.
- C. Bill of Quantity with detailed Quantity survey data
- D. Estimates with detailed rate analysis
- E. Draft document for special condition of contract reference to site constraints.

The DDC shall incorporate and co-ordinate designs and prepare drawings and documentation for the following system wide elements which will be used in all stations, Depot and Staff quarter:

System wide architectural items to be included in the tender documents:

- Finishes Schedules: Floor Finishes; Wall and Column Finishes; Ceiling Systems and Finishes.
- Railings, Barriers and Gates
- Stair and Handrail Details
- Escalator Finishes Details
- Lift Finishes Details/Movingwalkway finishing details.
- Platform Details
- Doors and Frames
- Miscellaneous Public Area Details.

- Platform Edge Lighting.
- Public and Staff Toilet Room Details.
- Staff Room Details.
- Signage Scheme: Location layout drawings, tender drawings and documents , BOQ estimate, technical specification, graphics detail, interface document with E&M all complete.
- Signs and Graphics Details
- Internal and external Artwork schemes (Hand painting/photo frames/Murals etc. showcasing themes and intents)
- MMI Works
- Landscaping and External Works
- Plans, Sections, Elevations and Details of
 - Ticket Office
 - Ticket Hall Supervisor's Office and Excess Fares Collection
 - Information and Enquiries
 - Station Control Room
 - Platform Supervisor's Booth
 - Other Booth and Office Details
 - Door and Window Details
 - Countertop and Casework Details
 - Station Manager's Room, Pump Houses, Auxiliary Substation
 - Handicapped facilities (including ramps, tactile tile layouts etc.)
 - All buildings and sheds of depot
 - All buildings of staff quarter

The DDC shall prepare Standard Specifications for architectural standard design elements and for the supply and installation of architectural standard finishes and materials including specifications for any site-specific non-standard material that is to be incorporated into the design. Architectural Standard Specifications shall include but not be limited to the following:

- Site work: Granite Kerbs, Concrete Kerbs, Natural Stone Pavers, Brick Pavers, Concrete Block Pavers and Grass-Concrete Pavers.
- Concrete: Concrete Floor Surface Treatments; Precast Concrete Architectural Panels; Glass Reinforced Cement Panels.
- Masonry: Mortar, Grout and accessories for Granite or Other Stone; Mortar Grout and Accessories for Paver Tile; Mortar and Grout for Masonry and Exterior Setting Beds; Granite or Other Stone Flooring and Bases; Granite or Other Stone; Cubic and Veneer.
- Metals: Vitreous Enameled Steel Panels; Barriers and Railings; Drain Grates and Manhole Covers.
- Thermal and Moisture Protection: Sealants.
- Doors and Windows: Entrances and Storefronts; Hollow Metal Doors and Frames; Rolling Grilles; Glass and Glazing.

- Finishes: Paver Tile; Wall Tile; Metal Ceilings; Field Painting.
- Specialties: Toilet Partitions and Accessories; Equipment Cabinets; Graphics and Signage; Ashtray and Litter Bins; Telephone Enclosures; Booths and Workstations.
- Mechanical Work: Plumbing Fixtures and Trim.
- Electrical: Lighting, air conditioning and water pumping.
- Landscape: Landscape Soft works and Establishment Works.
- Natural lighting shall be harnessed to the maximum extent.

The DDC shall submit the documents and products of its architecture and urban design work as described in Section 8.

Stage-9: Delivery of final design and drawing (GAD) submission including interchange schemes.

The DDC shall provide continuing support in the form of design data, design calculations, CAD files, perspective sketches, 3D computer model renderings, 1 number 1:200 scale models of typical, non-typical and interchange station or as directed by GMRC, whether for promotion, approval, or other illustrative purposes. The model shall be A0 size mounted on a wooden base with Plexiglas cover.

Other deliverables may be identified by GMRC, as required to support the goals of architecture, urban design, and landscape or property development. The DDC shall prepare and submit to GMRC cost estimates for the architectural works at each station and Staff quarter. These estimates shall be based on quantities taken off the DDC produced drawings, but where no drawings exist, the quantities shall be determined by using similar job information and typical relationship of quantities. Cost estimates are required for each submittal.

The DDC shall submit a Design Brief describing in words, diagrams and graphics the Architectural Objectives and illustrating how these will be met. This Design Brief should take into account the following considerations:

- The alignment and the viaduct structure will greatly influence the station design.
- Stations, Staff quarter and Depot Building shall be designed to achieve highest MRTS Green Building Rating (preferably IGBC) considering sanctioned cost/ budget.
- Final Arch DBR report to be submitted for Stations, Staff quarter and Depot .
- MMI plans for stations to be submitted for 200m radius. MMI Facilities to be ensured on Street level plans of elevated stations.
- Horticulture areas to be identified along with plant species.
- Egress Calculations of stations, Evacuation Arch Drawings & Platform width calculations, AFC Gates, ESC calc.
- Design of roofs of stations and depot building shall be suitable for rooftop solar power plants installation i.e. flat/inclined roofs as per the sun direction with no shadow causing objects in between. Design of rooftops should also take into consideration the requirement for making them accessible for installation and maintenance of solar power plants with suitable

cable routing arrangement and walkways etc. However, GMRC in its discretion may order design without solar plan without any impact to cost on either party.

- The stations should be as transparent as possible to allow for maximum natural air flow through the concourse and platform areas.
- The detailing of every element within the station area is important, not only for visual and aesthetic reasons but to ensure that materials are durable and can easily be maintained.
- The integration and co-ordination of the architectural finishes with the structure and Electrical and Mechanical fittings and services run is required.
- The design of the station, staff quarter and Depot to be safe in the event of a fire is of utmost concern. In this respect, it is essential that the following considerations are incorporated into the design;
 - All building materials shall be specified to have a class “1” flame spread rating as defined under BS 476 and shall be incombustible. Accordingly, Fire submission drawing to be made by DDC for submission to concerned government authority. Seeking and obtaining the Fire NOC from the concerned statutory government authority shall be under the scope and responsibility of the E&M Discipline.
 - The fire protection of an opening depends on the construction of the complete assembly. All three elements (door, frame and hardware) shall be of types that have been proven by test to be capable of performing their required function in time of fire. All elements making up a door or roller shutter assembly shall carry a label confirming that the tests, in respect of class and fire rating, have been passed.
 - Partition walls and openings shall conform to the compartmentation requirements and the requirements of relevant local authorities.
- Durability of all station, staff quarter and Depot elements is important and as such, the following considerations shall be incorporated into the design;
 - Corrosion protection for all exposed and hidden elements.
 - Precautions to prevent bimetallic corrosion.
 - The choice of finishes shall take into account durability and ease of maintenance, safety, fire resistance, cost, source of supply and replacement, aesthetic considerations.
- The following considerations which relate to the type of finishes in stations shall also be taken into account;
 - Location
 - Services interface
 - Acoustic requirements
 - Where structural and service elements are used as part of the finished architectural effect (for example exposed ductwork or light fittings at ceiling level), the layout, configuration and detailing of those services elements shall be considered as being part of the architectural finishes and shall require architectural acceptance.
 - The selection and detailing of finishes shall take full account of passenger and staff safety.

- DDC to submit drawings on ACC BIM Platform along with 2D Auto Cad Files & 3D Revit model
- DDC to Submit 4 sets of Hard Copy of Drawings/documents for Submissions for Pre- Fire NOC FSPA (Fire Safety Plan Approval). Subsequent to signing by concern departments, DDC to submit the drawings & Documents to Fire Authority (online/offline as per Fire Authority Procedures) for approval. DDC to provide documents as and when required for any local authority.

Stage-10: Approval of final design & drawings (GAD) (in BIM software) submission including interchange schemes. For all the services including E&M.

Stage-11:Preparing MMI plans.

Preparation of Arch. multimodal integration plans and detailed designs of FOB, Skywalks, underpasses or similar structures. Street level drawings with sections shall be prepared for each station/showing details of minimum 200m radius with consideration of MMI facilities as per applicable codes, guidelines. Co-ordination with Local Authorities for submission of drawings for intimation/approval. Multimodal integration plans for each station along with applicable detail drawings for execution to be provided at Architecture GFC Stages.

DDC to submit drawings on ACC BIM Platform along with 2D Auto Cad Files & 3D Revit model.

Stage-12:Approval of MMI plans.

Approval of multimodal integration plans and detailed designs of FOB, Skywalks, underpasses or similar structures.

Stage-13: Submission of Good for construction drawings.

A set of Good for Construction drawing with all details of levels, direction of flow with functionality of station building not limited to:

- A. Site Plan including MMI Facilities in 200m radius, floor plans, Elevations & Cross Sections.
- B. Setting out Plan.
- C. Typical Arch drawings, Rooms details, finishing details, and other required details as per GMRC and site interface issues.
- D. List of Materials & Specifications. Architecture Finishing Schedule.
- E. NMT Facilities, Pedestrian paths and vehicular links, Pick-up/ drop-off facilities for various modes, Bus bay/ stops, street marking for Fire Vehicle, Ambulance and Police vehicle and wheel chair symbol at DA. drop off. Street sections & applicable details to be provided.
- F. Parking
- G. Street Furniture details- railings, signage structures, bollards etc. for Junction:
 - Key Plan of the Junction.
 - Junction/Intersection Improvement Drawings including traffic signal design.
 - Details of Land Acquisition plan.
 - Details of pedestrian walkway, drains, trees, median, service roads, ducts of running

cables etc.

- Existing utilities.
- All the traffic safety features including traffic signals, signages, road markings etc.
- DDC to submit drawings on ACC BIM Platform along with 2D Auto Cad Files & 3D Revit model
- DDC to submit hard copy of drawings of approved GFC
- Separate horticulture drawing to be provided with plant species.
- Signage including Scheme along with location layout drawings, graphics, fabrication drawings,
- DDC to Submit 4 sets of Hard Copy of Drawings/documents for Submissions for Final Fire NOC FSCA (Fire Safety Certificate Approval). Subsequent to signing by concern departments, DDC to submit the drawings & Documents to Fire Authority (online/offline as per Fire Authority Procedures) for approval. DDC to provide documents as and when required for any local authority.

Stage-14: Approval of Good for construction drawings.

Stage-15: Approval of 'As Built' Drawings.

DDC shall check, compile and certify "As built" Drawings" submitted by the Civil/E&M Contractors. The same shall be certified by execution team.

Stage-16: Site visits.

Periodic supervision shall be conducted by DDC in coordination with GMRC, duly reported and submittal to GMRC along with advice or any changes required on site issues.

3.9 Structural Design Services

3.9.1 Civil works Concept design and drawings

- A. The DDC shall perform Design Alternatives for the conceptual design drawings. DDC shall develop alternative layouts and designs for Staff quarter, viaduct and architecture of the stations. The DDC shall provide alternative designs for all stations and Staff quarter. The objective shall be to reduce construction cost without adversely affecting required transit system functions such as capacity, service life, reliability, economy of operation or ease of maintenance and which shall not require any extension of design or construction time.

Design alternatives are to be presented within stipulated time of the Date of Commencement.

Each design alternative shall be presented in sufficient detail to clearly define the proposed design alternative.

The design shall be developed from the drawings, specifications and design criteria prepared by DDC and approved by GMRC. Any critical difficulty identified shall be immediately drawn to the attention of GMRC, but not withstanding that, the DDC shall remain totally committed to the overall integrity of the design, if necessary actively seeking advice, information and clarification so as to avoid abortive work.

The DDC shall incorporate in its design, the relevant seismic criteria, earthquake design and other codal provisions, as required by the design criteria.

- B. DDC shall submit Staff quarter, Viaduct and Station GAD with levels and clearances.

3.9.2 Preliminary design, DBR and drawings

The aim at this stage is to develop the conclusions of the Value Engineering of the Detailed Project Report.

After the definition of the main principles and needs of the project, the main dimensions of the structures with integration of system requirements and others services, will be defined.

The objective will be to reach a sufficient level of design for the Tendering process, that is: definition of the functional aspects and architectural layout; definition of the final geometry of the works; selection of the construction methods; definition of the construction sequences; pre-dimensioning of the main bearing structural elements; definition of reinforcement ratios; identification of all the requirement for mitigation measures, if any; definition of the requirements for monitoring the works through proper instrumentation.

The main outputs will be:

- Set up Technical framework for the project: lists of specifications and standard selected (design and construction) including DBR.

If needed, the DDC shall request GMRC for additional surveys.

- General Arrangement Drawing:
 - Plan and profile of general alignment, with proposed station location within Right of Way and survey levels, details with dimensions, levels and clearance.
 - Structural arrangement drawings
- GAD drawings for Viaduct, special bridge, if any (cross-over, long spans), elevated stations and their other structures including embankments etc.
- GAD interface studies for system integration, cable routing etc for stations.
- GAD Interface studies for stations and system interface.
- Preliminary planning with tentative production rates.
- Estimation of preliminary quantities per structure type.
- Justification of the proposed construction methodology: launching gantry for elevated viaduct, type of retaining structures for deep excavations, etc.

As an intermediate output, the DDC will submit a report summarizing the different options and propose recommendations for each structure type. The said report will highlight the benefits of the proposed solution in terms of cost, quality and planning.

As a final output, drawings and BOQ shall form the Tender document for civil Contractor to bid. The Tender documents will be based on design calculation with a reasonable allowance for variation at Detailed Design stage. Design calculation report shall contain design of all the structural elements with reinforcement requirement considering the applicable codal provisions and accordingly drawings shall be compiled.

DDC shall submit all editable STAAD/Midas/or any other input files used, excel files workable files (with unlock password with all macros enabled).

3.9.3 Review of survey data, preparation of Land plan and utility drawings

DDC will review the survey data provided by GMRC in hard and soft copy for sufficiency for the design works. The changes along with revised plans will be suggested/ incorporated by DDC. The final approval of alignment and pier locations will be given by DDC with detailed alignment drawings. Preparation of land acquisition plans for viaduct and station, temporary and permanent structures of viaduct and stations.

GAD of Utilities layout drawings and its approval from government or private authority.

3.9.4 Tender drawings and BOQ

The deliverables at this stage for all stations including entry/exit & skywalk will be as follows.

- A) Tender Drawings.
- B) Technical Specification for the works.
- C) Bill of Quantity with detailed Quantity survey data
- D) Estimates with detailed rate analysis.
- E) Draft document for special condition of contract with reference to site condition.

3.9.5 Tender Evaluation process

The DDC shall provide additional design and other information not included in the Tender Documents as may be required by GMRC. This shall include, but not be limited to:

- Amendments as appropriate to the Bills of Quantities.
- Draft written replies to tenderers queries where relating to the DDC's design.
- Addenda to tender documents and drawings.
- Technical clarifications for technical evaluation of the tenders, whenever required.

3.9.6 Civil Works (Detailed Design Stage)

In order to ensure the compatibility with the Preliminary Design, Detail Design Consultants have to perform detailed design. The DDC is also required to carry out proof checking of all temporary structures & enabling works including construction scheme and method statement proposed by the civil contractors.

The proof-checking, which will require counter-calculations to be performed, will mainly focus on the adequacy between calculation reports and drawings, and ensure compatibility with contract provisions & proposed construction sequence. Interfaces and functional requirements will also be considered. In addition, GMRC expects technical support from the DDC in review of variation claims (if any).

The key aspects covered by DDC will be:

- Reference standards;
- Design Basis Report;
- Design Criteria;
- Interpretation of the geotechnical and hydrogeological investigations;
- Identification of the initial geological, geotechnical and construction risks and quantification of the mitigation measures and contingency measures during construction to reduce the residual risks;
- Construction method and construction sequence;
- Applied load cases and design assumptions;
- Methods of analysis, which have to be appropriate and valid;
- Proof checking of the temporary works and structural design of permanent works;
- Ultimate and service design capacities of all components;
- Proof checking of Fabrication Drawings for all Steel Structure works;
- Proof checking of temporary works (including scaffolding, shuttering details etc.) to facilitate the construction of permanent works;
- Overall stability of the structures in both the short and long term conditions;
- Water tightness requirements and proposed technical solutions;
- Construction and reinforcement details;
- Design of the mitigation measures;
- Suitability of the design to the construction methodology adopted by the civil Contractor;
- Integrity of structural member and structures as a whole;
- Constructability;
- Monitoring design;
- Interface drawings: civil works / M&E equipment;

At this stage, it is necessary to precisely define and fine tune the main dimension of the structures, with integration of latest information from systems, and others services.

The interpretation of the Survey's Work campaign and its outputs will be incorporated at this stage. To perform the Detailed Design of Civil Works, the main interface features shall be validated as an input as also approved the Preliminary Design of the selected alternative(s).

The following deliverables will be prepared:

3.9.6.1 Viaduct

- Superstructure:
 - Detailed Structural design of Standard /I/ U/ box Girder and special spans for crossing of railway, Metro, flyover, river etc. as applicable.
- Proof checking of scheme of construction for all parts of structures, superstructure spans including special span/obligatory/standard/non-standard/I-girder by launching girder or any other proposed scheme.
- Review of alignment w.r.t SOD & clearance and suggest modifications/improvements.
- Track supporting structure (Track Plinth).

- Substructure and Foundation:
 - Detailed structural design and scheme of construction for bearings, sub-structures and foundation of viaduct.
 - All temporary structures, enabling works, construction scheme, lifting plans etc. to be proof checked.
- RSI report shall be prepared and submitted for design of piers, foundation, and track plinth.
- Track plinth design calculations and construction drawings.
- Stray current and earthing design.
- Design of any special arrangement on parapet such as view cutter, noise barrier, etc.
- Design of structural arrangement for all traction, signaling & electrical works such as supporting arrangement for cables etc.
- Catenary pole anchorage design.
- Approval of all shop drawings such as bearings, expansion joints, steel structures submitted by contractor.

3.9.6.2 Elevated Station

- Preliminary and Detailed Structural design of all elements of Station of all kinds of methodologies of construction like Portal/ Cantilever/ frame structure, etc.
 - All the temporary structures to be proof checked.
 - The structural design of PEB structure for station building, entry/exit structures.
 - Proof Checking of civil Contractor's Construction method and construction sequence; including design of enabling work/ construction scheme/ lifting plans etc.
 - Submission of :
 - Rail/Structure Interaction reports which may be used for consideration of horizontal forces in design of structure.
 - Track plinth design.
 - Stray current and earthing design.
 - For at grade sections:
 - Listing of coordinates of the leading points for implantation of the Works
 - Design of embankment, soil treatment (if required), retaining wall (if required), reinforced earth wall (if required).
 - General layout drawings.
 - Architectural layout and cross sections.
 - General interface drawings and main openings for cable routing.
 - General site rehabilitation drawings.
- Quantities of main materials.

3.9.6.3 Ramp

- Technical Specification (requirements of load, materials, construction and other requirements);

- Structural design of ramp;
- Location: coordinates of the leading points, chainage;
- Architectural design, dimensions, levels of the main structures;
- Interface design with railway system and other systems (if any);
- Drainage and utilities connection (if any);
- Construction methods and sequences;
- Traffic management measures;
- Quantities of main materials.
- Interfaces:
 - Preparation of Rail/Structure Interaction reports;
 - Track plinth starter Bar design, shear stirrups, reinforcement contract drawings;
 - Stray current and earthing design;
- Catenary pole anchorage design;
- Approval of all shop drawings such as bearings, expansion joints, and steel structures submitted by civil contractors;
- The proof checking of roof PEB structure for station building, entry/exit structures & all ancillary structures such as UG Tank, Sump, Elevated water tank, DG room, Pump room, Machine room etc.;
- Proof checking of design of structural works for architectural finishing, Interfaces and functional requirements such as design of louvers, structural glazing, ACP, cladding, counters, GRC jali, etc submitted by civil contractors;
- Coordinate drawings for all structures which are used for construction purpose;

3.10 Depot-cum-Workshop

- The scope of DDC covers the cost effective and optimized Layout at various Stages, detailed design of all the structural components of Depot buildings including admin building, OCC/BCC, inspection and maintenance pit, CSD at various stages, Boundary wall, E.S.S., D.C.C S&T, DCO, U.G. Tank, OH Water Tank, inspection and workshop bay, and Office buildings, P-way Stores, Heavy Interior Cleaning Feeding post, ETP & STP, Security Room, Canteen Building, ETU & Traction W/Shop Pit Wheel Lathe, Covered Stabling Shed, Car Scooter Parking, Watch tower, Blow down Plan Strom water Drawings and all other building in the premises of Depot etc.
- The main interface features shall be validated as an input as approved during the Preliminary Design of the selected alternative(s).
- Track supporting structure (Track Plinth).

The following deliverables will be prepared for Depot buildings:

- Listing of coordinates of the leading points for implantation of the Works.
- Design of the concrete outline, reinforcements for all structures including ancillary buildings, pavements, boundary walls, track plinth, etc.

- General layout drawings.
- General interface drawings.
- Sketch of the various phases of the construction method.
- Structural design of the temporary and permanent works.
- Plan view of the various phases of the site boundaries with the authorised accesses to the site and the street temporary diversions.
- Schedule of the works.
- Quantities of main materials.

The integrity of all permanent structural member and structure as whole will be examined and reported as part of design submission.

The DDC shall provide 1:200 scale Model. The model shall be A0 size mounted on a wooden base with Plexiglas cover.

3.11 Staff Quarter

The DDC will deliver sufficient designs and documents to enable GMRCL to construct approx. 330 units of various types of staff quarters for O&M staff at depot or other location as suggested by GMRCL in Ahmedabad. The exact location, number of units and types will be intimated at the time of detailed design stage.

These Services generally includes;

- Producing concept planning and design alternatives of staff quarters as per State Government or Ministry of Railway guidelines,
- Perform cost effective detailed design of Architecture, Structures and Building Electrical and Mechanical services,
- Manage the design task for cost, schedule and performance compliance,
- Preliminary design of various structural components of foundations and superstructures,
- Perform detailed designs of staff quarters and amenities including sub-structure, general arrangement with architecture finishes and building services (E&M works) including illuminations, lifts, water supply, drainage, power supply and other amenities as appropriate.
- Design to comply with the requirements of highest Green Building rating. GMRCL to appoint a IGBC consultant to provide such requirements during the preliminary design stage and thus construction cost estimates be prepared to the expectations of GMRCL.
- Preparation of Combined Services Drawings (CSD), and Structural Electrical Mechanical Openings Drawings (Builders Work Drawings),
- Prepare BoQs, Technical specifications, construction cost estimates for the proposed staff quarters as decided by GMRCL,
- Incorporate changes in design resulting from GMRCL design reviews,

- DDC shall prepare documents for meeting and presentations with local authorities in regard to design of Staff Quarter, road widening, parking requirements and processing of the application for change of land use, etc. if required.
- DDC shall obtain the approval of competent Authorities/statutory bodies necessary according to local acts, building by-laws, regulations, etc. and make any changes desired by such authorities.
- Require all necessary support and documents for clearance of Development permissions, Pre Fire-NOC, final BU permission, Final Fire NOC, chief electrical inspector, CPCB/GPCB and any other statutory requirement for approval.
- Prepare necessary documentation and drawings for the submission to fire authorities and obtain approvals,
- Plan, design, details, control, coordinate and execute the design phase of the works for production of drawings, documents and reports to meet the key schedule dates as directed by the GMRCL,
- Architecture Team Leader will lead coordination among associated disciplines to ensure design intent is fully coordinated,
- DDC to submit drawings on ACC BIM Platform along with 2D Auto Cad Files & 3D Revit model
- GMRCL to provide topographical surveys, field surveys and actual geotechnical borehole data to prepare Geotechnical Interpretation Report.
- Review of Shop drawings and As-Built drawings.

3.12 Electrical and Mechanical Services for Stations

3.12.1 For the elevated stations, the following systems will be defined:

- Fire Fighting System;
- Fire Detection System;
- Plumbing System;
- Low voltage;
- Building Management System
- Escalators , Elevators and Moving walkway;

For each of the sub-systems above, schematics diagrams (LV distribution single line diagram, Fire fighting schematic, Fire Alarm Schematic, ...) will be submitted for approval.

The DDC will prepare design reports and preliminary calculation notes. It will mainly include (non-exhaustive list):

- Station heat loads;
- Station required cooling capacity for both summer and monsoon outside conditions;
- Electrical loads;
- Water consumption and requirements for tanks;

- Equipment sizing calculation

Great attention will be paid on interfaces with other and especially civil work by defining main requirements from building services (openings in intermediate slabs).

On the basis of the above, preliminary BOQ and Equipment Schedule will be developed by the DDC along with Design Basis Reports and submitted as part of the Preliminary Design.

3.12.2 In addition to above, for VAC services the DDC shall also prepare:

- Design Drawings (Preliminary & Final);
- Tender Drawings for Building Management System (BMS);
- Ducting Layout;
- Electrical Load Schedules after interfacing with other Departments of GMRC / System Group, Other designers / Contractors;
- Design of Electrical system for VAC works including panels, cables etc.;
- Designing, Sizing and Layout of Pumps.
- **Layout for Earthing, Cable/Wire , containment system (trays, ladders, conduit etc);**
- General arrangements and layout Drawings for Panels, PLCs and other necessary equipment etc.;
- Testing, Commissioning and acceptance Criterion;

Scope of design of VAC SERVICES shall include the followings but not limited to:

- Prepare separately plans, Section, detailed designs, definitive design drawings and documents, BOQ and specifications in sufficient detail for the construction-by-construction contractors under 'construct only' contracts for;
- Provide a comprehensive cost estimate for the works and bill of quantities for the construction contract, for each item of works;
- Provide a design program updated at monthly intervals;
- Provide design support during the construction to review the work for compliance with the design and to carry out design changes required during construction to review the Construction reference drawings (CRDs) submitted by the contractor;
- The consultant shall be available for any clarifications to the intending bidders, either through a pre-bid conference organized by the Employer or otherwise, on the drawings/designs/schedule of items prepared by them;
- The consultant shall verify bill of quantities of each schedule before issuance of tender documents and also confirm to GMRC that all items of works have been incorporated in the BOQ documents;

- Calculations;
- The relevant calculations including soft copies of software/spreadsheets to the design shall be submitted for the review with respective design submissions;
- The DDC prepare and submit a comprehensive set of calculations for the pre-final and final design in a form acceptable to the employer;

3.12.3 In addition, for E&M services the DDC shall also prepare 2D autocad and 3 D drawings in revit and produced in BIM model :

- a) Design Drawings (Preliminary & Final);
- b) Tender Drawings for Electrical and Mechanical Works (E&M), BOQ, Estimate/Rate Analysis, Material and Workmanship Specifications, Special Conditions of Contract, Instructions to Tenderers and Building Management System (BMS);
- c) Layout of the Plant Rooms;
- d) Ducting Layout;
- e) Design of Lighting for all area including Central Circulating Area of Station;
- f) Designing, Sizing and Layout of Earthing and Lighting Protection System
- g) Sizing of DG Sets, UPS, Cables and selection of Frame Size of Breakers;
- h) Provision of Dynamic Reactive power compensator (Power Electronics based) for compensation of Leading and Lagging power factor along with Harmonics Control.
- i) Review of Contractor's shop Drawings for E&M only;
- j) Preparation of CRD's to be approved by GMRC;
- k) Finalization of Electrical Load Schedules after interfacing with other Departments of GMRC / System Group, Other designers / Contractors;
- l) Lighting System Design in Station, Entry Structure and Service areas, Road and MMI area near station entries and totems etc.;
- m) Small Power Layout (Socket/Lighting DB's);
- n) Cable/Wire containment system (trays, ladders, conduit etc);
- o) Hydraulics / drainage system design and layout (including pipe work, drains, sump etc.);
- p) Fire Detection and Suppression System design and layout;
- q) General arrangements and layout Drawings for Panels, Switchboards, DG sets, UPS and other necessary equipment etc.;
- r) The DDC shall prepare Testing, Commissioning and acceptance Criterion;
- s) Prepare Documents – In the form of Data sheet and relevant Calculations;
- t) Determination of Quantities and Preparation of BOQ, etc.;

- u) Modify, update and supplement as necessary, the GMRC's Outline Design Criteria / General / Material and Workmanship Specifications as provided to suit the work;
- v) Co-ordinate and integrate designs and details with other Contractors and Consultants employed by GMRC working on contracts pertaining / relevant to the site of works for this contract including interface with Design and Construction activities of Station and Viaduct;
- w) DDC shall interface with other System Contractors for Preparation of Combined Services Drawings (CSDs), Structural Electrical and Mechanical Drawings (SEMs), Wall Opening Drawings (WOD) as defined elsewhere in the Agreement. DDC shall Prepare Tender Drawings; Construction Reference drawings for the scope of work and also prepare CSD SEM , and WOD Drawings showing all openings for E & M and identify embedded items / openings indicating System wide information for the purpose of E & M Co-ordination. Also DDC shall update during construction the CSD , SEM and WOD drawings;
- x) DDC shall interface with Traction contractor/DDC for incorporation of Traction System requirements cutouts, room layout arrangement for ASS-TSS, cable routing from Concourse to Platform, etc in the combined drawings.
- y) DDC shall also incorporate the traction requirements of cutout in track bed for DC cabling system, holes arrangement in viaduct parapet for traction cable bracket fixing, requirement of unloading platform at ASS-TSS area for equipment loading and shall incorporate in Civil Drawings
- z) DDC shall also ensue the provision in design of MDB Panel of E&M for sufficient potential free contacts of other equivalent arrangement so that the SCADA signal interface can be done as per traction requirement
- aa) DDC shall also provide the design of control of Viaduct light DB from the Station control room (SCR) for switching on and switching off of Viaduct light DB Provision for Necessary cabling from Viaduct light DB to SCR room shall be done by E&M in coordination with traction contractor
- bb) DDC shall incorporate the design of MCB and RCBO/ELCB in design of VDDB as per traction requirement
- cc) DDC shall incorporate the traction requirement in design of MDB and EMDB panel
- dd) Prepare comprehensive cost estimate for the works and Bill of Quantities (BOQs) for E & M Contracts separately for tendering by GMRC, if required;
- ee) Prepare necessary Technical Documentation, Presentation and assist GMRC to obtain necessary approvals for E&M Systems including Fire Detection/ Suppression System from the Approving/ Statutory Authorities such as Fire Service;
- ff) Plan, Design, Detail, Control, Co-Ordinate, and Execute the design phase of the Works for Production of Drawings, Documents and Reports to meet the Key Schedule Dates included

in the Agreement and as directed by the GMRC;

gg) DDC shall be available for any clarification to the intending bidders, either through a pre-bid conference organised by the client or otherwise, on the Drawings/ Designs/ Schedule of Items prepared by them;

hh) DDC shall verify Bill of Quantities of each Schedule before issuance of Tender Documents and also confirm to GMRC that all items of works have been incorporated in the BOQ documents. The quantities of various items should be carefully worked out and if found that variation w.r.t execution drawings is more than 5% then a lump sum compensation may be deducted @10% of the amount quoted in respective item of respective table of financial proposal. Decision of the GMRC shall be final and binding on the consultant. Further, the scope of design of ELECTRICAL & MECHANICAL SERVICES shall include the followings but not limited to:

- Design of Power and Control cables from LV Main Switchboard in the ASS to the Sub main and other Distribution/ Sub Distribution Boards etc. This will include provision of Bus Trunking / Feeder Cables as required.
- Design of UPS feeding all Emergency loads.
- Design of DG sets for feeding all Emergency, Essential and Semi Essential loads.
- Design of Interlocks and Protection Schemes for Power distribution, suiting to the desired operation, duly co-operated with high voltage side protections and protection of the individual equipment.
- Design of normal and emergency lighting arrangements & automatic operation in Station areas, cable galleries, parking areas, subway connecting entry/exit and other room. This includes external cabling and provision of lighting fixtures with lamps, ballast, control gear, etc.
- Design of Control and small power supplies to various station equipment/ Panel.
- Design of Lightning Protection System
- Design of tie bus Cables / Bus Trunking System for connection between ASS.

The scope of design of FIRE DETECTION AND SUPPRESSION SERVICES shall include the followings but not limited to:

- Design of complete Fire- Detection & Alarm system including monitoring and control through a Fire Alarm Panel at Station Control Room and OCC through BMS / SCADA.
- Designs of Fire suppression system in Elevated Stations, Ancillary Building / other structures including Hydrants, Hose Reels, Sprinklers System, Fire Hose Cabinets, Portable Extinguishers, Gas Based Flooding System, pipeline network with control valves for sprinklers and hydrants.
- Design of "Dynamic reactive power compensator".

The Electrical and Mechanical services shall include the detailed design of all E & M services in the stations, and ancillary buildings. The scope of DDC is limited to low voltage only except for the provision of cable duct/ trenches for the 33 kV cable looped in and out at the ASS. The route includes the trench/ conduit planned to carry 33/11 kV cable from viaduct to the electric substation. Otherwise, for lighting in the circulation area, only 415/420 V power distributions are planned. Air conditioning is planned only at a few selected office/equipment rooms. The criteria shall cover these specific areas only. The scope shall include the preparation of drawings, layouts, specifications, erection/ mounting details, interface with the systemwide contractor or arising out of concurrent works, cost estimates and other documents, as required. The substation or pump rooms shall have provision for a beam & chain pulley block for lifting of equipment for maintenance/ installation handling. Provision shall normally include unloading/ loading of material on to or from the maintenance vehicle. This shall include the incorporation of architectural co-ordination requirements with the requirements of other disciplines and the detailed design of the following services:

- Structural and facilities for lifts & escalators;
- E&M support provisions;
- Low voltage distribution;
- Normal lighting;
- Emergency lighting connected to UPS backed by DG set and normal supply;
- Essential lighting backed by DG set supply;
- General purpose power;
- Signage;
- Standby generator;
- Uninterruptible power supply system (UPS) for lighting and Power loads;
- Earthing and bonding;
- Lightning protection;
- Power factor correction at major loads; linear; short switching non-linear;
- Power supplies for other contracts;
- Fire detection;
- Fire protection;
- Water services; pumps and automatic control;
- Drainage, plumbing and sewerage;
- Lifting equipment at plant rooms;
- Public telephone facility; (local calls, STD, ISD in Booths only)

- Lighting power distribution for parking areas, circulation area, station face lighting;
- Provision of cable ducts, cable ways or trenches for all the cables including incoming 33 kV supply cable or cables supplied by all contractors.

3.12.4 Electrical

Scope of design of ELECTRICAL & MECHANICAL SERVICES shall include the followings but not limited to:

- Design of Power and Control cables from LV Main Switchboard in the ASS to the Sub main and other Distribution/ Sub Distribution Boards etc. This will include provision of Bus Trunking / Feeder Cables as required.
- Design of UPS feeding Emergency loads.
- Design of DG sets for feeding all Emergency, Essential and Semi Essential loads.
- Design of Interlocks and Protection Schemes for Power distribution, suiting to the desired operation, duly co-ordinated with high voltage side protections and protection of the individual equipment.
- Design of normal and emergency lighting arrangements & automatic operation in Station areas, cable galleries, parking areas, subway connecting entry/exit and other rooms. This includes external cabling and provision of lighting fixtures with lamps, ballast, control gear, etc.
- Design of Control and small power supplies to various station equipment/ Panel.
- Design of Lightning Protection System
- Design of tie bus Cables / Bus Trunking System for connection between ASS.

3.12.5 Fire Detection and Suppression

- Design of complete Fire- Detection & Alarm system including monitoring and control through a Fire Alarm Panel at Station Control Room and OCC through BMS / SCADA
- Designs of Fire suppression system in all Elevated Station Building / other structures including Hydrants, Hose Reels, Sprinklers System, Fire Hose Cabinets, Portable Extinguishers, Gas Based Flooding System, pipe line network with control valves for sprinklers and hydrants.

3.13 Permanent and Temporary Drainage

The DDC shall design and detail the temporary and permanent drainage of the Works and detail the connections of these Works to the existing drainage systems. The drainage systems to be detailed as part of the design shall include but not be limited to:

- Sumps and pumps inside any building or structures, whether above ground or below ground, for the collection of water other than foul sewerage;
- Drainage systems inside and outside any building or structure for the conveyance by gravity

of water from the sump(s), Or other collection points to the appropriate sewer or drain of the drainage authority;

- Systems for the surface water drainage of reinstated roadways, landscaped areas, car parks and other paved areas associated with the Works and for the conveyance of the surface water to the appropriate drainage system of the relevant drainage authority; and
- Drainage systems for the conveyance of water from GMRC station buildings to discharge points acceptable to the appropriate drainage authority;
- Design of pumping arrangement for raw water supply, treated water supply, sedimentation sump pumps, Water treatment plant, water mains within the station, make up water for the Environment Control System's requirements, Station drinking water supply, Fire fighting and Sprinkler Pumps together with the Jockey Pumps, Seepage and Sewage Pumps etc;
- Design of automatic control & monitoring of operation of pumps, incoming supply, liquid level controllers or the equivalent arrangement based on the liquid levels in the various tanks;
- Design of Sumps for Seepage & Sewage and a suitable drainage system inside / outside station, at station, entry / exit, shaft, ancillary buildings/ structures and connection with city mains;
- Design of Deep tube well, pipe line with control valves, treatment of water & storage tanks with level monitors for providing standby water supply for drinking water & toilet for staff, air conditioning, fire fighting and station cleaning etc.

3.14 Co-ordination and Utility Services

3.14.1 Identification of Utilities shall be done by DDC. GMRC will assist DDC to liaison with the Utility Authorities for all the necessary requirements for Utility. The DDC shall furnish relevant drawings and documents required to obtain approval for construction from Utility Authorities. DDC shall assist GMRC in applying for operational licences by responding to questions of Utility Authorities.

The DDC shall co-ordinate provisions, including design of connections to the existing utilities services, required for the stations, Staff quarter, depot and ancillary buildings, to include but not be limited to:

- Sewerage;
- Ducts for the future installation of public telephones;
- Fresh water supply;
- Electrical ducts;
- Fire protection and detection systems; and
- Other facilities and utilities not designed by the utility authorities.

The DDC shall co-ordinate all design work with various system wide contractors including design

connections to the utility services, to include but not be limited to:

- Electrical substations and associated high voltage and traction power supply systems;
- Electrical underground conduit banks within GMRC right-of-way;
- Fare collection system;
- Signalling;
- Telecommunications;
- Any other system wide contracts.

3.14.2 Co-ordination with Ahmedabad Fire Services

The DDC will assist GMRC to liaison with Ahmedabad Fire Services. The DDC shall furnish relevant drawings and documents required to obtain approval for construction from Fire services. At the request of GMRC, DDC shall assist GMRC in obtaining final Fire Department Clearance.

3.14.3 Existing Utilities

The DDC shall co-ordinate and gather all details of utilities from concerned Authorities/Agencies. All existing known utilities have to be charted and incorporated in the drawings. The DDC shall study and use the records and drawings of existing and planned utilities received from concerned Authorities/Agencies. The DDC shall list all the utility conflicts discovered and inform GMRC, in writing, of its recommendations for modifications and diversions. The DDC shall co-ordinate with and gather additional technical information after GMRC has arranged the initial contact with the various utility authorities that are involved in the Works. For any joint survey meeting, formal or informal, with the relative utility authority the DDC shall prepare the required information, make a presentation, and prepare meeting minutes according to the instructions of GMRC. All the correspondences, meeting minutes, and information transmittals between GMRC, the DDC, and the relative utility authorities shall be written in English.

3.15 Units of Measurements

All units of measurement used in the Design shall be in accordance with the International System of Units (S.I)

3.16 Proprietary Items

DDC shall ensure that there are no named or Proprietary products in the Documents or on Drawings

3.17 Construction Programmes

The DDC shall produce suggested construction programmes based upon its assumed methods of construction and work sequences. The programme shall be prepared through a computer package compatible with Primavera. The programme shall include interface activities with system

wide and other contractors. The programmes shall be submitted to GMRC for review of compatibility with other programmes and for any subsequent amendment as required. DDC's construction implementation schedule, shall demonstrate that the design can be constructed within the schedule guidelines of the Contract Documents and indicate the earliest available dates for completion of the Works. DDC shall submit Project Program including complete list of Deliverables, Schedule of Delivery and Mobilization Schedule of Expatriate Consultants and three months rolling programme for design submissions. During the design review stages of the approved construction programme, GMRC may require the DDC to make adjustments based upon the DDC's professional judgement. Where considered to be neither cost effective nor feasible, GMRC shall be informed of the findings.

3.18 Architectural Cost Estimates

The DDC shall prepare and submit to GMRC, construction cost estimates for each station in its design lot. These estimates shall be based on quantity take-off from prepared drawings, but where no drawings exist the quantities shall be determined by using similar job information and typical relationship of quantities. All modifications of the cost estimate before contract award shall be in the DDC's Scope of Service.

The estimates shall show the unit rates and quantities adopted and shall give details of how the unit rates were developed. The estimates shall be broken down into separately identifiable sections of Works as directed by GMRC. The DDC shall input cost estimate data onto CDs and submit these CDs in accordance with Section 8 - Submission of Documents herein.

GMRC shall review design drawings and prepare a Bill of Quantities separately to verify the DDC's take-off from the prepared drawings. The DDC shall revise the Bill of Quantities as required by GMRC and modify the Cost Estimate accordingly.

3.19 Confidentiality of Estimates and Design Budgets

All estimates shall be treated as strictly confidential and shall be submitted by the DDC in sealed envelopes separately from other documents that it is required to provide.

3.20 Presentation Material, Mock-ups, Working Models and Samples

The DDC shall provide the GMRC with information covered by this Design Lot for such purposes of presentation or display as the GMRC may require. Information shall consist of material in the form of descriptions of the Works executed and the resources and manpower employed, and shall include graphs, sketches and photographs for inclusion in publications or for making into displays and exhibits.

3.21 Tender Documentation

GMRC will prepare the Civil & E&M works and other building services Tender Documents.

However, responsibility for preparing draft material that is peculiar to each station for these documents in electronic format shall be that of the DDC based on documents prepared by GMRC. The DDC shall prepare the Bills of Quantities, Special Conditions of Contract, interface matrix and Technical Specifications, including the Scope of Work.

3.22 Amendments to Tender Documents

The DDC shall provide additional design and other information not included in the Tender Documents as may be required by GMRC. This shall include, but not be limited to:

- Amendments as appropriate to the Bills of Quantities;
- Draft written replies to tenderers queries where relating to the DDC's design;
- Addenda to tender documents and drawings.
- Technical clarifications for technical evaluation of tenders, whenever required.

3.23 Good for Construction (GFC) Drawings

The DDC shall submit to GMRC a complete set of "Good for Construction" contract drawings (duly stamped and signed by DDC)for that contract that has been produced as a coordinated package. The DDC shall also furnish a schedule of issue of construction drawings. The DDC shall also furnish a complete set of CAD file tapes/diskettes for contract drawings. The tapes/diskettes shall be fully compatible with GMRC computer system. The construction shall conform to the tender drawings specification & BOQ. Any deviation / variations with reasons shall be clearly brought out in writing to seek approval, before execution.

3.24 Property Developments

Conceptual designs of property developments along with the railway designs shall be prepared by the DDC. The property developments will occur at the stations as identified by GMRC. Continuous MRTS functions must be accommodated in all aspects. Operations and maintenance must not be compromised by construction or operation of joint development projects. Conversely, the property development project must also operate independently with minimal or no impact from the operation of the MRTS.

The schemes shall be designed taking into account the building rules and regulations of all statutory bodies. The designs shall be evolved taking into account neighbourhood Urban Planning. The water, electricity and sewage connection for property development shall be independent of main station connection.

3.25 Extent of Design Services

The DDC shall be responsible for managing and adjusting its manpower to accommodate variations in schedule during the estimated design period, and such variations shall not constitute

a claim for extended design services.

All work by the DDC shall be performed in Ahmedabad unless otherwise approved by the GMRC in advance. DDC shall attend meetings at Ahmedabad/Gandhinagar, GMRC office, as and when required, at their cost. In case some DDC staff is required to be housed in GMRC office, two nos. workstations shall be provided by GMRC for the same free of cost. Decision of GMRC towards necessity of deployment of DDC staff at GMRC office shall be final. All necessary revision in drawings or change in schemes in station/ viaduct or any structure is included in the contract value.

3.26 Alignment Design

DDC is responsible for developing complete alignment drawing with track geometry, all types of curves required as per alignment. DDC shall modify the alignment drawing as per site condition and land available till the completion of project. DDC shall revise the alignment drawings with all engineering details as instructed by engineer or GMRC.

- Review of Track Alignment :
 - Alignment DBR shall be prepared and submitted to GMRC for approval.
 - The alignment prepared will be reviewed by Engineer.
 - The possibilities of optimization shall be pointed out to GMRC for their concurrence and post confirmation, the modifications accepted shall be highlighted and documented.
- Design of Alignment for construction Contract:
 - Detailed geometric alignment (plan and profile drawings of the centreline of corridor) shall be prepared for elevated and at-grade stretch to optimize the civil work.
 - Additional detailed survey and center line pegging as per modified alignment.
 - This shall be submitted as Preliminary Drawing and post approval, of the same, Construction Reference Drawing / GFC Drawing shall be issued.
- Support During Construction :
 - Alignment designer shall be available as and when required to intervene and optimise the alignment in case required for any unforeseen events like facing uncharted utilities / land acquisition related issues etc.
 - This shall be submitted as Preliminary Drawing and post approval, of the same, Construction Reference Drawing / GFC Drawing shall be issued.
 - This shall be as per site requirement.
- Check with 'As built' Survey :
 - The survey of 'As built' structure shall require to be provided by the construction agency, and DDC shall check, confirm and propose adjustment of the alignment so that the track

alignment fits within the envelop of the structure, with least modification of the structure.

- Locations where the discrepancies are found shall be highlighted along with possibility of realignment.
- Final Design of Track Alignment:
 - Final Track Alignment drawing based on the wriggle survey provided shall be prepared and submitted. This shall be for individual track (up and down line).
 - This shall be submitted as Final Alignment, which shall be used for construction of Track.
- Following documents shall be prepared:
 - Alignment DBR.
 - Review of Alignment and Suggested Modifications.
 - Alignment Design Report along with Plan and Profile Drawings.
 - Alignment Modification Reports (As and When Required during construction Stages) and Plan & Profile Drawings.
 - 'As built' Survey Review Report and Alignment Modification Proposal.
 - Final Track Alignment Report, Plan & Profile drawing.
- Quality Control Plan updated with Alignment Design shall be submitted (shall be amended to QAP for the operational contract).
- Regarding Plan and Profile Drawings, the followings shall be submitted in stages:
 - Preliminary Drawings for approval.
 - Construction Reference Drawings / Good for Construction Drawings.
- Interface requirement with construction team and site meetings at agreed interval.
- Depot Track Layout and Preliminary layout of Buildings (only box layout of the buildings showing the placement and accessibility shall be provided based on requirement of area in each building as received from the client).

4 SERVICES TO BE PERFORMED BY THE DDC DURING CONSTRUCTION

Services during construction shall be deemed to commence for each construction package on award of the construction contract. For manpower planning purposes, estimated schedule dates are indicated in Appendix B.

4.1 Good for Construction Drawings

Additional contract drawings or revisions to the GFC drawings previously issued for construction shall be prepared by the DDC and submitted to GMRC. Where changes to the GFC drawings are required, the DDC shall be responsible for preparing all data related to the detailed design onto GFC drawings to be issued to the Contractor. GMRC will then issue the GFC drawings to the contractor for construction of the Works. DDC shall verify the shop drawings/ vendor design drawings.

4.2 System wide Information

The DDC shall incorporate full and final information relating to system-wide equipment and services into the CSDs. Final system-wide requirements defined by CSDs and those required by Systems shall be incorporated into the SEM and SOD drawings and architectural/Structural drawings for construction. The DDC shall prepare and issue intermediate submissions of the structural requirements as necessary to meet the construction schedule.

The DDC shall interface with review relevant system-wide contractors regarding system wide contractors' requirements that affect the DDC Station Design and will incorporate into its coordinated installation drawing with sign off by all contractors to ensure compatibility of Station structure, utility ducts, etc with system requirements. shop drawings that affect the DDC's design. The DDC shall review to ensure compatibility and, after review shall revise and issue all the necessary drawings as and when required by the GMRC. In case of Multi revision done, the defaulting Party (DDC/ Contractor) have to bear the cost of Stationary and Printing for Drawings and documents to be submitted as decided by GMRC. This shall be a continuous updating process in conjunction with design development extending towards the completion of the structural works.

The DDC shall design the embedded items and include these works in the respective civil contracts as directed by the GMRC. The interface between the civil contractor's work and the system-wide contractor's work shall be clearly defined.

4.3 Site Meetings

DDC shall attend site meetings as required during construction till completion.

4.4 Site Visits

At the request of GMRC, the DDC shall visit the site to provide his expert opinion on the performance, quality, progress etc., of the Works and to report whether the work is progressing generally as designed. The result of such visits shall be reported to GMRC immediately, if urgent actions are required, and shall be included in the DDC's monthly reports in all cases.

4.5 'As Built' Drawings of the works

The DDC shall review the contract record drawings and 'As built' information submitted by the contractors to the GMRC on a continuous basis prior to the issuance of the Certificate of Completion for the construction contract. The DDC shall prepare relevant design calculations reconciled with 'As built' conditions and information necessary for the maintenance of the works.

The DDC shall attend all construction issues at site and resolve them, any mismatch in structural drawings with architecture or system drawings need to be reconciled by DDC. DDC shall ensure that GFC drawings are workable and drawings shall contain all the information required for construction.

4.6 Liaison Work

The DDC shall co-ordinate and liaise with all concerned local authorities, private and all Government agencies including railways (in Ahmedabad as well as outside Ahmedabad) to obtain approvals of designs & drawings, testing and clearances as deemed necessary, depending on the conditions prevalent at site.

4.7 Alignment design/modification Work

Preparation of final Metro rail alignment and center line pegging for construction including re-designing / refining the alignment during the whole duration of the project, as and when required, based on site conditions & other interface requirements, support during construction etc.

5 ORGANISATION OF THE DETAILED DESIGN CONSULTANT

5.1 General

The DDC shall establish an efficient organization for carrying out all services according to programme requirements. The organisation shall provide effective management of the tasks of the contract including those that must be carried out concurrently by separate disciplines and teams. The organization shall also ensure that all information that becomes available during the design period is directed to the appropriate design teams and effective checking procedures are continuously maintained to ensure that required standards are met. Proper coordination between the different disciplines of DDC will be maintained.

5.2 DDC shall have to comply following Personnel requirements:

- (i) The DDC shall submit an organisation chart (refer fig.5.1) together with clear description of the responsibilities of each member within the overall work programme.
- (ii) All the qualifications and experience of the designated positions shall be as per Table A of clause 5.2.1
- (iii) The DDC team shall be headed by a 'Project Manager' having relevant experience in the concerned field will coordinate the project as a whole viz. Civil, E&M, Traction, Track, Architecture, Viaduct and station design, alignment design, interface with all system and other contractors till completion of the project. He shall sign & issue all the tender documents, GFC drawings and provide all the required construction support during construction. He will regularly organise engineering review meetings with all stake-holders & shall issue GFC drawings that are suitable as per site conditions. He shall liaison and get approval for the design and drawings from private and government authorities. Sufficient proof shall be submitted to substantiate the qualification and experience. Project Manager shall also coordinate with DDC's Hydrologist who has relevant experience in the concerned field of not less than 07 years with total experience of not less than 15 years. Project Manager should be available at site for the duration specified in Table-A: DETAILS OF KEY PERSONNEL TO BE DEPLOYED.
- (iv) The head of Architect Team shall be an Architect with not less than 7 yrs. experience as Team leader for a Project of Similar nature with overall experience not less than 15 yrs. post qualification. He should have handled at least 2 projects of MRTS/railways. Project Architect shall be directly responsible for all design coordination between DDC's (Civil, E&M and Structure) design team as well as coordinating GMRC's system wide requirements. Project Architect shall also coordinate with DDC's BIM Expert & Project Manager. Project Architect shall be mobilized and available at project office, to be set up near project sites in Ahmedabad , for the duration specified in Table-A: DETAILS OF KEY PERSONNEL TO BE DEPLOYED.

Sufficient proof shall be submitted to substantiate the qualification and experience.

- (v) The DDC team for each discipline i.e., Civil, Architectural, Building services, E&M works, staff quarters , Alignment design and Geotech shall be headed by 'Team Leader' of relevant experience in the concerned field of not less than 07 years as Team Leader with total experience of not less than 15 years and have the experience of handling minimum 02 projects of similar nature and complexity. All the Team Leaders shall be mobilised and available at project office, to be set up near project sites in Ahmedabad , for the duration specified in Table-A: DETAILS OF KEY PERSONNEL TO BE DEPLOYED

Sufficient proof shall be submitted to substantiate the qualification experience.

- (vi) Under Team Leader , 'Sr. Engineer/Sr. Architect' shall be deployed who must have minimum 5 years of relevant experience in the concerned field and should have handled minimum 03 projects of similar nature

5.2.1 Requirements for Deployment of Key Personnel:

The details of key-personnel to be deployed by the DDC along with associated minimum requirements are as mentioned in the Table-A. Additional staff shall be deployed to meet the key target dates as mentioned in Appendix-1 of SCC, if required. Any variation in the associated minimum requirement of Educational Qualification, number of years of experience in the field specified and total number of years of experience post qualifications is not permissible.

Fig. 5.1 (Organisation Chart)

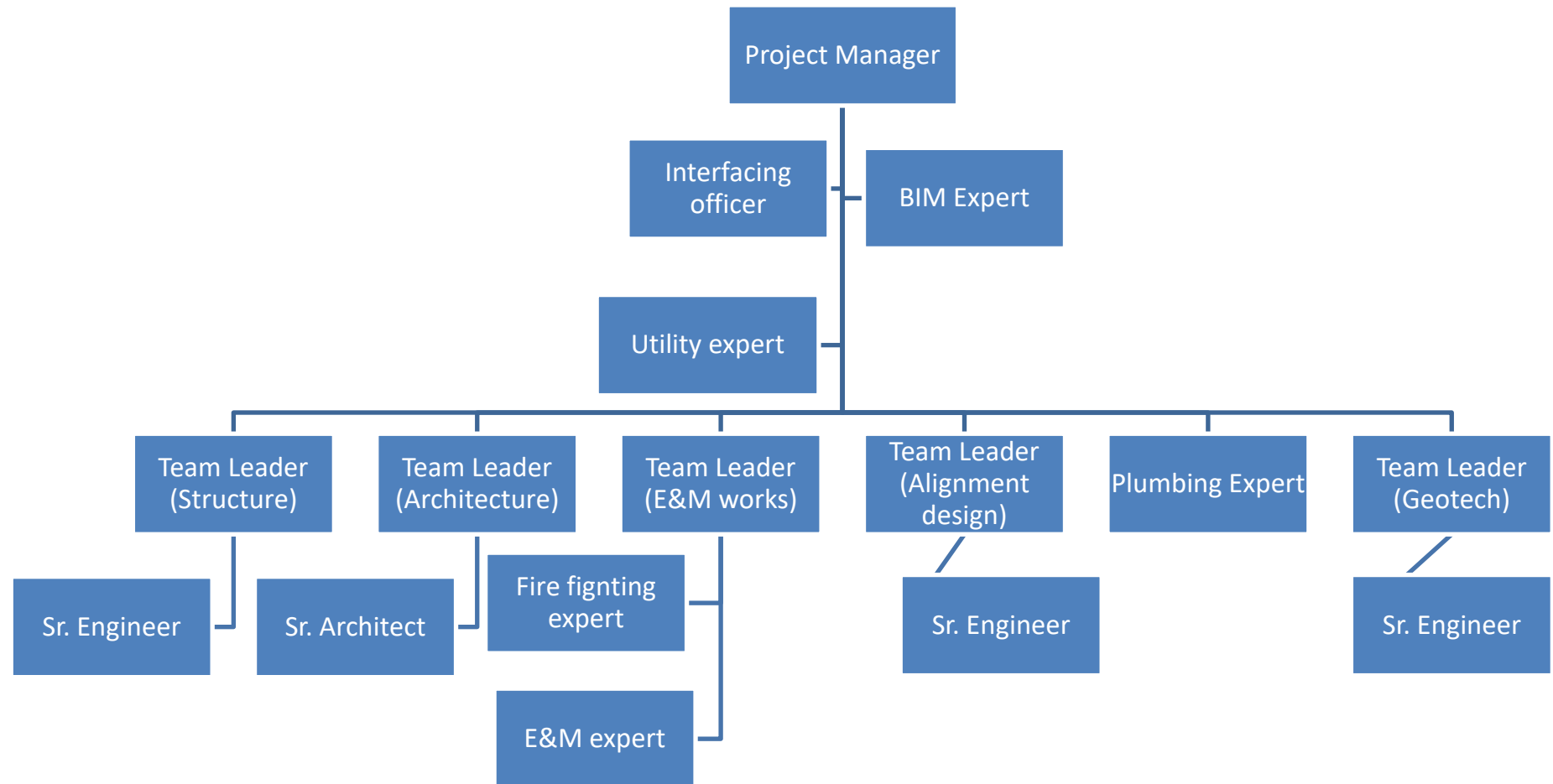


TABLE – A: DETAILS OF KEY PERSONNEL

S.N	Designated Positions	Qualification	Experience in the Specified Field of Specialization (in Years)	Total Experience, post qualifications (in Years)	Duration (Minimum)
A.	Project Leader/Manager	B.E (Civil)+M.Tech Structure	7 years relevant experience of design of Metro viaducts , stations, Depot etc	20 years of Overall Experience in field of design of bridges, viaducts, stations, Depot etc	100% of duration of the project
B.	Sr. Structural Design Engineers/ Team Leader	B.E (Civil)+M.Tech Structure	7 years relevant experience of design of Metro viaducts , stations, Depot etc	15 years of Overall Experience in field of design of bridges, viaducts, stations, Depot etc	75% of duration of the project
C.	Architect for Station layout/ Team Leader	B.Arch+ M.Arch/MPlan /M Infra Planning	7 years of relevant experience in field of Architectural Design of Metro Stations, Depot	15 years of overall experience in field of architectural design of Stations, Public buildings, depot Major infrastructure projects etc	100% of duration of the project
D.	Plumbing/drainage work expert	B.E (Civil/Mech)	Should have overall experience of 15 years with relevant experience of 5 years in		75% of duration of project

S.N	Designated Positions	Qualification	Experience in the Specified Field of Specialization (in Years)	Total Experience, post qualifications (in Years)	Duration (Minimum)
			consultancy services of Detailed design of building/ Depot/ Station works in any infrastructure project		
E.	E & M Expert	B.E. (Elec/ Mech)	Should have overall experience of 15 years with relevant experience of 7 years in consultancy services of Detailed design of building/ Depot/ Station works in any infrastructure project		50% of duration of project
F.	Fire Fighting/ Mechanical Expert	B.E. (Elec/ Mech)/ B.Tech(Elec/Mech)	Should have overall experience of 12 years with relevant experience of 8 years in consultancy services of Detailed design of building/ Depot/ Station works in any infrastructure project		50% of duration of project
G.	Utility & Services Expert	B.E (Civil)	Should have overall experience of 12 years with relevant experience of 5 years in consultancy services of Detailed design of building/ Depot/ Station works in any infrastructure project		25% of duration of project
H.	Sr. E&M Design Engineer/ Team Leader	B.E. (Mech) B.E. (Elect)	Should have overall experience of 15 years with relevant experience of 7 years in consultancy services of Detailed design of building/ Depot/ Station works in any		75% of duration of the project

S.N	Designated Positions	Qualification	Experience in the Specified Field of Specialization (in Years)	Total Experience, post qualifications (in Years)	Duration (Minimum)
			infrastructure project		
I.	BIM EXPERT	BE	Should have overall experience of 10 years with relevant experience of 3 years in consultancy services of Detailed design of building/ Depot/ Station works in any infrastructure project		100% of duration of project
J.	Interfacing Officer	BE	Should have overall experience of 15 years with relevant experience of 7 years in consultancy services of Detailed design of building/ Depot/ Station works in any infrastructure project		25% of duration of project
K.	Geo-tech and Foundation. Engineer	B.E (Civil)	7	12	25% of duration of project
L.	Alignment Engineer	B.E (Civil)	7	12	25% of duration of project
M.	BIM Engineer for CIVIL 1 nos and E&M 1 nos	B.E. (Elec/ /Civil)	3	7	75% of duration of project

Notes:

1. Detailed CVs of Key Personnel must be submitted.
2. With addition to BIM expert 2 nos. BIM engineer 1 for CIVIL and 1 for E&M shall be deployed. Candidate should proficient in Auto-cad, Revit, Navisworks, BIM platform and having certification in software Autocad, revit and navisworks and BIM.
3. The DDC should submit the list of support staff for assisting each expert for each category listed in Table-A for which payment is included in Schedule A of Financial Package.
4. The manpower required to be deployed for this Contract exclusively for each category must be implemented as mentioned above with staggered periods of deployment as per requirement, as approved

by GMRC. Additional staff shall be deployed to meet the key target dates as mentioned in Appendix-1 of SCC, if required. The actual deployment of manpower and schedule to be approved by GMRC

5. Utility Expert should be mostly related with Water supply & Sanitation Engineer Works.
6. Interface Officer may be Officer, interacted with railway engineers and Departments (RDSO, CRS, Civil, Electrical & Signal dept.)

B.E. qualification means Bachelor of Engineering or Bachelor of Technology or Bachelor of Science (Engineering) or any other equivalent name of at least 4 years professional course after 10+2 or 12 years of formal course of Education and M.E./M.Tech in Structural Engineering means 2 years post-graduate degree in Structural Engineering after successful completion of Bachelor of Engineering (Civil).

The DDC shall furnish the CVs of all the key persons as identified in the QA Plan who shall be working on this project along with a detailed organization chart and seeking approval. If GMRC judges that the continuation of any person is not in the interest of the project, a written notice will be given to DDC who will promptly remove the person within a week. GMRC can withdraw the approval of such persons if continuation of the person is judged by GMRC.

The DDC shall provide desk space in its offices for intermittent use by GMRC staff. GMRC may regularly inspect/ oversee the working of the DDC.

5.3 Performance

Notwithstanding any review of its organisation structure, staff or manning schedules, the DDC shall remain wholly responsible for providing the services. If, in the opinion of GMRC, the progress or performance of the DDC's work is seen to be at any time inadequate to meet those requirements, the DDC shall take the necessary steps to improve them on being so notified. If within a reasonable period, the DDC has not improved its progress or performance, the GMRC may by written notice require it to take additional measures, including changes in its organisation, at no additional cost to GMRC. Such notice shall be in no way deemed to constitute a waiver of GMRC's rights to terminate the Agreement by reason of the DDC's breach of contract. Failure by the GMRC to issue such a notice shall not relieve the DDC of its obligation to achieve the required rate of progress and quality of work.

6 STANDARD OF SERVICES

6.1 General

The DDC shall be responsible for the correctness and technical merit of its designs, calculations, drawings and all other documentation prepared by it in carrying out the services.

The DDC shall ensure that qualified and experienced staffs are employed in sufficient numbers and that accurate, consistent, clear and easily read drawings and documents are produced in time.

The DDC shall comply with the provisions and procedures covering standards and codes, drawings and calculations outlined in Section 6.2 below. The DDC shall also comply with the checking procedures in Section 7 hereof.

6.2 Standards and Codes

The standards and codes referred to in the design criteria, drawings, outline specifications and documents issued by GMRC to the DDC shall be used in its design and, where appropriate, shall be quoted on drawings and other documents by it. Normally the DDC shall use the Standards given in this document for design requirements in preference to other national standards except when higher standard or better quality is required. Should the DDC propose to adapt other standards or codes for its designs, it shall submit to GMRC copies thereof, together with a statement as to the cost implication of adoption and substantiation that substitution is necessary. The DDC shall also demonstrate that other standards are equivalent or superior to those they intend to replace and it shall obtain the written approval of GMRC prior to adoption.

6.3 Extent of Information

All designs and documentation produced by the DDC shall provide sufficient information and detail for contractors to determine accurately the extent of the Works during construction and execute and maintain the Works.

Drawings, Specifications and other information produced by the DDC for construction, or revisions of such documents, shall be submitted to GMRC, in sufficient time for review and further issuance of a comprehensive package to the contractor. The DDC shall ensure that these documents are produced in a timely manner such that the construction contractor is able to plan and execute its works in accordance with the contract, including the construction programme.

Drawings for construction shall be in such detail as not to require further design or detailing to be carried out by the construction contractor except as provided under Section 6.5 hereof. The DDC's drawings shall show or include details of any unusual features of construction or detailing.

6.4 Calculations

Calculations shall be prepared according to the best professional standards and compiled into sets that relate to particular aspects of design.

Each set of calculations for E&M systems shall include:

- Load calculations, equipment rating and cable sizing;
- Rating of protection devices; and
- Lighting levels and calculation for luminaries.
- Equipment and component sizing for Batteries, Diesel fuel tank, MCC's, Panel boards, Switchboards including calculation of connected load, maximum demand and short circuit level at each panel & Distribution Board.
- Load Flow Analysis including Load Study Calculation, Power Factor Correction, Protection co-ordination, Selection of Switchgear and Short circuit calculations.
- Calculation for Earthing and Lightning Protection System including earthing current / resistance, lightning protection and Step / touch voltages
- Calculation for Cable Duct / Cable Trunking System including Cable pulling tension calculation, bulk head Cable tray sizing, Provision of Conduits, Conduit / tray fill calculation, Manholes / draw box sizes
- Lighting System Calculations including Indoor lighting calculation, Outdoor lighting calculation

- Water supply, water treatment system
- Fire detection, fire suppression scheme, fire pipe arrangement
- Seepage and Sewage scheme
- Pressure drop calculation for fans
- Heat load calculation for each room/ area for air-conditioning

Each set of calculations for VAC systems shall include:

- Equipment and component sizing for MCCs, MDBs, PLCs, Damper DBs etc. including calculation of connected load, maximum demand and short circuit level at each panel & Distribution Board;
- Load Flow Analysis including Load Study Calculation, Power Factor Correction, Protection co-ordination, Selection of Switchgear and Short circuit calculations;
- Damper sizing calculations;
- Cable sizing calculations;
- Heat load calculation for each room/ area for air-conditioning.

Each set of calculations shall be bound and shall include a cover sheet and index.

A statement certified by the DDC's Authorised and Approved Project Manager that the accepted checking procedures, as defined in Section 7, have been carried out in full shall be attached to each set of calculations submitted to GMRC.

GMRC may require the submission of applicable software including in house software programme / worksheets developed by the contractor, computer input and programme logic for its review prior to the acceptance of the computer output.

Original calculations shall be submitted to GMRC for proof checking. Each sheet shall be signed in accordance with the requirements of Section 7. Original calculations shall be returned and retained by the DDC and shall be produced at such times as may be required by GMRC. The original calculations shall then be handed over to GMRC on completion of the services.

6.5 Drawings Prepared by DDC

Preliminary Drawings required for construction shall be prepared and issued by the DDC in accordance with the current requirements issued to it by GMRC (refer to Section 8 for submission of documents).

All drawings shall be prepared in A-1 size and shall be produced by CADD graphic system compatible with the GMRC system and as approved by GMRC. Drawings are defined as:

- **Concept drawings** are prepared by the DDC to conceptualize the drawing for Staff quarter, Depot, Viaduct and Station.
- **Preliminary drawings** are drawings prepared by the DDC prior to their acceptance by GMRC as Tender Drawings;
- **Tender Drawings** are drawings prepared by the DDC and approved by the GMRC which, with other relevant documentation, contain all the information necessary for tendering purposes; and

- **Combined Services Drawings (CSD)** are drawings prepared by the DDC and approved by the GMRC, showing the locations, layouts and sizes of all services including those of other Contractors, co-ordinated, so as to eliminate all clashes.
- **Services, Electrical, Mechanical drawings (SEM)** and Wall Opening Drawings (WOD) are drawings prepared by the DDC and approved by the GMRC, showing the location, sizes and details of opening in structural elements for Mechanical and Electrical facilities and other related contracts.
- **Detailed design drawings:** contain information related to temporary works details for the construction of the permanent works prepared based on primary design approved by GMRC. The DDC's design staff shall check these drawings and a report furnished to GMRC
- **Working Drawings** contain information related to temporary works details for the construction of the permanent works. The DDC's design staff shall check these drawings and a report furnished to GMRC.
- Drawings excluded from the DDC's scope of drawings include:
 - Shop drawings and working drawings;
 - Fabrication drawings;
 - 'As built' drawings; and
 - Details of elements of proprietary systems.
- **GFC Drawings** – Good for Construction Drawings shall have signature of 'Design by', 'Proof Checked by' and 'Approved by' – Team Leader/ Chief Structural Engineer/ Chief Architect. Design and drawings shall be as per site condition and utilities. DDC shall modify the GFC drawings, if required, till completion of construction without any additional cost/claims to the GMRC. It is mandatory that DDC understand the project & site conditions with utilities so that drawings issued to the civil contractors shall be constructible.

DDC shall submit to GMRC as part of a progress register, a list showing drawing numbers, titles, scales and the progress status of all drawings planned for inclusion in the documents for obtaining tenders. The format of the progress register shall be as directed by GMRC. The DDC shall update the register as required. All drawings shall be checked for compliance with design specifications and for accuracy by the DDC's design staff and shall also be subjected to the checking procedures as detailed in Section 7 hereof.

6.6 Drawings Prepared by Construction Contractors

Drawings prepared by the Construction Contractors are defined as:

- Shop Drawings contain information related to the permanent works. The DDC's design staff shall check these drawings including BBS and a report shall be furnished to GMRC.
- Temporary works drawings such as staging shuttering, shoring, launching methods, bar bending schedule, etc. are submitted by civil contractors. The DDC's design engineer shall check these drawings and submit to GMRC for construction purpose.
- 'As built' Drawings depict the completed works that have been certified complete. These drawings shall be reviewed by the DDC and a report shall be furnished to GMRC.

6.7 Documents

Documents shall be prepared by the DDC in accordance with the requirements issued by GMRC. Documents produced by the DDC shall be listed as part of the Progress Register.

6.8 Computer Programs

The DDC shall submit details and verification of all computer programs it intends to use to GMRC for acceptance prior to use in making calculations. These shall include the computer program manuals, input and output printout of a typical example and previous records of its use by the DDC. The DDC may also be required to perform test calculations using the program so that the results may be compared with those obtained by other means.

6.9 Checking Procedures**6.9.1 General**

The DDC shall establish a Quality Assurance Plan (QAP) and a system of internal check and approval of all designs, including calculations, drawings and other documents prepared and issued by it, to GMRC for acceptance.

The purpose of the check shall be to ensure accuracy and consistency, as well as compliance with current requirements, standards, codes and the requirements of this document. Certification of such a check has been carried out shall be issued to GMRC with each batch of documentation for acceptance at the final submission and subsequent submissions.

Internal checks shall be carried out by personnel who have experience and competence equal or superior to the originator, but who have not been involved in producing the original design.

6.9.2 Design Calculations

Each page of design calculations, including any amendments thereto, shall be endorsed as checked and approved prior to issuing to GMRC by being initialed and dated by both the originator and the checker. The checker shall append a statement explaining the method of checking used.

6.9.3 Drawings and Documents

Each document and drawing, including any revisions thereto, shall be endorsed as checked and approved prior to issue to GMRC by being initialed and dated by both originator and checker. In addition to compliance with the requirements of the documentation, each drawing, where appropriate, shall be checked to ensure compliance with the DDC's certified design calculations.

6.9.4 Certification

A certificate signed by the Project Manager of the DDC or his accredited representative stating that all drawings and documents have been checked and approved in accordance with the DDC's approved Q.A. Plan shall accompany all documents and drawings issued by the DDC to GMRC for acceptance.

6.10 Quality Assurance Plan

The Quality Assurance Plan (QAP) shall be submitted by the DDC to GMRC for approval before any work is submitted by the DDC for approval by GMRC.

The QAP shall identify the personnel, procedures, instructions, records and forms necessary to implement the plan with the following minimum requirements:

- Certification process of drawings and documents for issue;
- Organisational structure;

- Design control - including study and design input/analysis;
- Checking of documents;
- Document control;
- Subcontractor control;
- Internal quality audit; and
- Corrective action.

The DDC shall also identify the requirement of Quality Level and incorporate a Quality Level List in the QAP for each construction contract.

6.11 Quality Audits/Monitoring

Quality Audits and monitoring of the DDC's QAP will be conducted by Employer's Representative at intervals commensurate with the DDC's activities.

6.12 Responsibility

Notwithstanding acceptance by GMRC, the DDC shall remain responsible for the quality of the documents.

7 DESIGN SUBMISSION AND REVIEWS

7.1 Concept design and drawings: Architectural/Structural Review

Design Alternatives and a preliminary Architectural/Structural review of the DDC's design proposals will be held as per stipulated timeline after the Date of Commencement of the Contract. The DDC shall prepare and present drawings describing the architectural/structural design which shall, at a minimum, include:

- Site plans;
- Plans at each station level;
- Reflected ceiling plans at each level;
- Sections and elevations;
- Perspective sketches;
- Plans, sections, elevation and sketch design studies of all typical features. Typical repetitive conditions to be noted as such and located;
- Landscape conceptual design;
- Concept of structural elements.

7.2 Monthly Progress Meetings

The DDC shall attend monthly progress meetings. The DDC will be required to produce:

- An updated copy of the computerised project schedule and a design chart showing scheduled and actual start and finish dates and estimated percentage completion for each major design activity;
- An updated copy of the Progress Register showing the titles and status of all drawings and documents.

7.3 Preliminary design, DBR and drawings Submission

When the design, including preliminary drawings and drafts of the Bill of Quantities and specifications is substantially developed to define the Works for all the elements, including locations, shapes (typical and non-typical) and sizes, it shall be submitted to GMRC for the Preliminary design.

Indicative costs are to be prepared for all design alternatives proposed by the DDC. Detailed cost estimates will be required for those design alternatives approved / adopted by GMRC.

The Preliminary design Submission shall include, but not be limited to:

- Design calculations and Design Basis report to reflect the scope of the Works to be executed;
- Drawings detailed to define the scope of the Works to be executed;
- Review of Bill of Quantities for all the works in sufficient accuracy to be able to proceed to construct;
- Review of Technical specifications in sufficient detail of materials and workmanship to permit contractors to work;
- A design brief for E&M services covering the basis / principles / norms followed for various activities. Draft drawings of all drawings to be submitted in final review / submission.
- An environmental impact mitigation action plan;
- Identification of conflicts within the right-of-way of the Civic bodies, and resolutions to problems identified;
- Initial construction cost estimates and estimate reconciliation with the estimate and, if appropriate;
- Land plans and MMI plans;
- Comments, if any, on the documents supplied by GMRC;
- Any other documents that may have been requested by GMRC.

7.4 Preliminary design, DBR and drawings Submission Procedure

GMRC will complete the Preliminary design of all details submitted within 7 working days, and furnish the DDC with its review comments either in writing or on marked up drawings. Within 3 days of receiving the comments, the DDC shall meet with GMRC to discuss the review comments such that further actions can be determined for the DDC to proceed with its services in a timely and efficient manner.

7.5 Delivery of Tender Drawings, BOQ's, Cost Estimates and Specifications for E&M and other Building Services Works

These documents will comprise material for inclusion in the tender documents issued to Construction Contractors for tendering purposes by GMRC. The documents will be complete and incorporate the Preliminary design comments. It shall not be necessary to make adjustments to the BOQ's at a later date to accommodate changes in quantities or bill items.

7.6 Detailed Design Review/ GAD Submission

When the design, including preliminary drawings and other details for the Contract Documents for construction, is substantially complete, the DDC shall submit the documents for the Final Review. The quality of this submission shall be such that the Contract Documents can be completed by incorporation of GMRC's review comments.

7.6.1 Detailed Design Review Submission / GAD Submission

The Final Review submission shall include, but not be limited to:

- Design calculations which are indexed and checked, along with analytical model and design excel sheets;
- Drawings sufficiently detailed to define the Scope of Works, complete and checked;
- Combined Service Drawings; (CSDs);
- Structural-Electrical-Mechanical Drawings (SEMs) and Wall Opening Drawings (WOD);
- Systems Erection Drawings;
- Design Basis Report
- A Property Development Report (if applicable);
- Construction cost estimates, estimate reconciliation with prior estimates, and back-up data;

The Final Review Submission shall include the following documents and products of its architecture and urban design work:

- Property development proposals in accordance with the Master Plans: Such proposals shall include typical floor plans, sections, elevations, perspective sketches, landscaping, environmental mitigation, and interfaces with stations and ancillary facilities.
- Site Plans for each station, ancillary facility, or property development proposal, including surrounding land uses, roads, landscaping, existing or proposed buildings and infrastructure, as well as any proposed additions, modifications, or required demolition.
- Station Floor Plans for all levels, including all public and non-public areas: Indicate vertical circulation elements; access and parking; load bearing and partition walls; fire separation walls; Automatic Fare Collection (AFC) equipment layouts, ancillary facilities and equipment rooms; facilities and spaces for station commercial trading functions; and any other required furniture, fixtures, and equipment.
- Station Sections and Elevations, keyed to the plans, including all major structural elements; vertical circulation elements; track bed and drainage; mechanical and electrical equipment; provisions for secondary and tertiary building systems and elements; walls and ceilings; doors, windows and other significant openings; and general materials and finishes.
- Station Reflected Ceiling Plans, indicating layouts and integration of ceiling mounted services, structural and architectural elements, electrical and mechanical equipment, environmental control systems, systemwide components, signs and graphics, and the like.
- Plans and sections of sufficient size and scale to indicate proposed construction interfaces; methods of construction; and relationships between structures, finishes and services.

Calculations and Miscellaneous Schedules and Tables comprising:

- Schedules of Accommodations, indicating room and space dimensions, functions, and requirements for stations, ancillary facilities and property development.
- Schedules of Finishes for stations, indicating materials and finishes, type and extent for each station room or space.

- Schedule of Electrical fixtures, wiring, utilities, pumping, E & M and control systems.
- Tables of Vertical Circulation Equipment for stations, including escalator and lift numbers, types, landing elevations, runs and rises.
- Tables of Automatic Fare Collection (AFC) Equipment for stations, including
- Automatic Ticket Machines (ATMs) and Automatic Ticket Gates (ATGs).
- Schedule of Electrical fixtures, wiring, utilities, pumping, E & M and control systems.
- Electrical drawing comprising as a minimum of the following:
 - (i) Single line diagram of electrical system including Panels and DB's, Cable Sizing etc.
 - (ii) Wiring layout floor wise and external: This shall include location of DB's, Lighting fixtures, sockets, fans etc and wiring details.
 - (iii) Cable tray layouts showing section of cable tray at different places, number of cable, spacing, spare capacity etc.
 - (iv) Equipment layout of Generator room, UPS room, ASS, Pump Room, Tanks and Water Treatment Room and other such equipment room showing layout of equipments, cable tray / trenches / ladders / raceways, clearances and spacing.
 - (v) Earthing single line diagrams: The location of earth mats / pits may be shown on electrical layout.
 - (vi) Lighting protection layout.
 - (vii) Lighting Layouts including fixture mounting arrangements.
 - (viii) Other details as may be necessary for proper execution of requisite E&M works.
- Fire drawings comprising as a minimum of the following:
 - (i) Fire detection single line diagram
 - (ii) Fire detection system layout floor wise
 - (iii) Fire suppression single line diagram
 - (iv) Fire suppression layout floor wise and external layout.
 - (v) Details of various sub-systems, sprinkler layout, automatic gas flooding (as applicable).
- Integrated Services Drawings, indicating both existing and proposed services, utilities, structural and architectural elements, electrical and mechanical equipment, environmental control systems, system wide components and other infrastructure as required to support the stations, ancillary facilities and property development. From these drawings shall be derived sizes of holes and other penetrations through structural and non-structural elements together with any cast in items required for the installation of services and utilities during the construction of the station.
- In addition to final modified Preliminary design submissions of E & M items, the DDC shall furnish cost estimates, construction sequencing and programme indicating critical items.
- Pedestrian circulation models calculating and detailing pedestrian flows, vertical and horizontal circulation and passageway requirements, platform size, and emergency evacuation times for the stations and property development sites.
- Outline specification for all architectural elements
- Property development programme.

7.6.2 Detailed Design/GAD Review Procedure

GMRC will complete the Final Review of all details submitted within 14 working days, and furnish the DDC with its review comments either in writing or on marked up drawings. Within 3 days of receiving the comments, the DDC shall meet with GMRC to discuss the review comments such that further actions can be determined for the DDC to proceed with its services in a timely and efficient manner. The responsibility of obtaining approval from Local Authorities is that of the DDC. GMRC will assist in the approval process provided a request is made in good time so as not to affect the overall submission schedule. The overall responsibility for obtaining approvals remains with the DDC, however.

7.7 Detail Design Summary Report

The Final Design Summary Report shall include, but not be limited to:

- Scope of Work;
- Work Description;
- Drawing Index;
- Key Design Drawings from all disciplines;
- Site Plan;
- System Operation;
- Design Criteria;
- Technical Descriptions;
- Statutory Complaint Certificates.

The purpose of this report is to provide a convenient reference to the design and operation of the system. The report shall be in two volumes:

- Before Construction; and
- After Construction

7.8 Design Report

The Design Report shall include, but not be limited to:

- Consideration of the possibility of overland floods and recommendations of measures necessary to provide protection during construction;
- Plans for diversion and support (or protection) of existing utility services, with an indication of the work to be performed including maintenance of utilities serving adjacent properties;
- A programme for all utilities involved in the Works, listing the following:
 - Proposed method of treatment;
 - Allocation of responsibility for the work to the Contractor or others;
 - Critical dates for completion of temporary and permanent diversions;
 - Test pit requirements.

7.9 Property Development Report

A Property Development Report shall be prepared to include, but not be limited to:

- General description;

- Planning data;
- Architectural design;
- Details of fire separation;
- Constructability aspects; and
- Outline drawings.

7.10 Submission of Originals

When all the comments of the Final Review submission are incorporated, the submission of originals shall be made to GMRC.

7.11 Delivery of Documents

After GMRC has accepted the submission of the Originals, the DDC shall deliver in electronic format on diskette all Documents prepared by it to GMRC. The original documents, typed but not bound, shall have been proof read, reviewed, approved and certified, and be ready for reproduction. The DDC shall furnish a complete set of CAD diskettes to the GMRC, prepared in accordance with requirements within 60 days of the submittal of the original drawings. A CAD File Control Log, which describes the contents of the CAD diskettes, shall also be furnished.

7.12 Delivery of Contract Documents

The DDC shall issue the documents, as specified in Section 8, to GMRC for issuance to the contractor "Good For Construction".

7.13 Delivery of Alignment design Documents

- Pre-Construction Stage:
 - Quality Assurance Plan Updated with Alignment design document inputs.
 - Alignment DBR.
 - Design submission programme (update) .
 - Design calculation Report, detailed design of track geometry, curves, coordinates.
 - Preliminary Design Drawing of Alignment (Plan, Profile, curve details).
 - CRD/GFC Design Drawing of Alignment (Plan, Profile, curve details).
- During Construction Stage:
 - Report for updating of the alignment in case required for any unforeseen events.
 - Preliminary Design Drawing of Alignment (Plan and Profile).
 - CRD/GFC Design Drawing of Alignment (Plan and Profile).
- Post Construction Stage:
 - Report for updating of the alignment to accommodate the 'As built' Structure.
 - Design Drawing of Alignment (Plan and Profile) .

8 SUBMISSION OF DOCUMENTS

The DDC shall deliver the drawings and documents as listed to GMRC, and packaged as directed by GMRC.

8.1 Quality Assurance Plan

4 copies of the Quality Assurance Plan

8.2 Concept design and drawings Submission

3 sets of concept report including design alternatives with cost comparison and merits-demerits;

3 full size (A-1) sets of drawings (including 5 additional sets of full size (A-1) utility drawings);

3 half size (A-3) sets of drawings;

Arch. Drawings to be submitted on ACC BIM Platform along with 2D and 3d Revit Model

8.3 Preliminary design, DBR and drawings

1 full size (A-1) sets of mylar reproducible;

3 full size (A-1) sets of drawings (including 5 additional sets of full size (A-1) utility drawings);

3 half size (A-3) sets of drawings;

3 sets of BOQ's;

3 sets of Specifications;

3 sets of design calculations;

3sets of Land plans (5 Full size (A2) , additional 5 half size (A3));

3 Full size (A1) Multimodal integration plans;

3 sets of Construction Cost Estimates 5 copies of the Design Report;

3 copies of additional topographical surveys and field surveys (if applicable);

Arch. Drawings to be submitted on ACC BIM Platform along with 2D and 3d Revit Model

8.4 Land Plans

DDC to submit drawings on ACC BIM Platform along with 2D & 3D Revit model& Auto Cad Files

However, final approved land plans to be submitted in Hard Copy submission (A3 size X 4 sets) for onwards submissions to Authority.

8.5 Submission of Tender Drawings, BOQ's, Cost Estimates and Specifications

One full size (A-1) set of mylar reproducible;

5 sets of full size (A1) drawings;

5 half size (A-3) sets of drawings;

5 sets of Bills of Quantities;

5 sets of special specifications;

2 sets of Cost Estimates; \

8.6 Detailed Design Submission

One full size (A-1) set of mylar reproducible;

3full size (A-1) sets of drawings (including 5 additional sets of full size (A-1) utility drawings);

3half size (A-3) sets of drawings;

3 sets of design calculations;

3 copies of the Design Report;

3 copies of the Construction Cost Estimates;

3 copies of the Property Development Report;

Arch. Drawings to be submitted on ACC BIM Platofmr along with 2D and 3d Revit Model

DDC to Submit 4 sets of Hard Copy of Drawings/documents for Submissions for Pre- Fire NOC FSPA

(Fire Safety Plan Approval).

8.7 Submission of Originals

- 1 half size (A-3) sets of prints of drawings;
- 1 copy of Construction Cost Estimates;
- 2 sets of CD in AutoCAD format of all drawings;
- 2 sets of Property Development Report;
- 3 sets of Quantity Take off Sheets;
- 3 sets of floppy diskettes for construction cost estimates;

8.8 Submission of Construction Drawings

3 sets of all conformed drawings marked "Good for Construction".

E&M drawings to be submitted on ACC BIM platform along with PDF, 2D and 3 D Revit models

Arch. Drawings to be submitted on ACC BIM platform along with 2D and 3d Revit Model

Approved Arch drawings to be submitted in hard copy of 7 sets of all confirmed drawings marked "Good for Construction".

DDC to Submit 4 sets of Hard Copy of Drawings/documents for Submissions for Final- Fire NOC FSQA (Fire Safety Certificate Approval).

8.9 Submission of 'As Built' Drawings

- 5 sets of 'As Built' drawings endorsed by the DDC, and
- 5 sets of Final Design Summary Report.

8.10 Submission of Combined Services Drawings (CSDs)

5 sets of drawings with 6 No. Soft copies.

8.11 Submission of Services Electrical and Mechanical Drawings (SEMs)

5 sets of drawings with 6 No. Soft copies.

8.12 Design Certificate

All submissions shall be accompanied by two original copies of a 'Design Certificate' and signed by the Contractor and the Designer.

8.13 Alignment Design

3 set full size (A1) of drawings at each stage.

NOTE: The above list is not exhaustive and shall also include revisions in drawings as required in consideration of specific coordination issues and site constraints.

Annexure 1**Superstructure**

Sr No	Type of Girder	Span Length	Curve Radius R in m	Design Cases
1	Precast PSC Superstructure	20.0 m, 23.0 m & 25.0 m	$R \geq 1000$	3

Substructure

Sr No	Span Arrangement	Pier Height (Top of Pile cap to Top of Pier Cap)	Pier Cap Type	Design Cases
1	31.0 m and 31.0 m, 31.0 m and 28.0 m, 28.0 m and 28.0 m, 28.0 m and 25.0 m, 25.0 m and 25.0 m, 25.0 m and 22.0 m, 22.0 m and 22.0 m, 31.0 m and 22.0 m,	8.0 m, 10.0 m, 12.0 m, 14.0 m and 16.0 m	Standard type with no eccentricity	40

Note:

- i) Metro loading approved by RDSO to be considered in the superstructure and substructure design.
- ii) Type and width of superstructure will be provided at later stage.