NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

Contract NGNDD01: Engagement of Detailed Design Consultant (DDC) for Civil, Architectural and E & M Works of Noida-Greater Noida Metro Corridor from Sector – 51 Noida to Greater Noida Sector – 2, Consisting of 9.605 Km Viaduct including 5 elevated Stations.

CONTRACT NO: NGNDDC01

TENDER DOCUMENTS

VOLUME 2

SCOPE OF WORK

Noida Metro Rail Corporation (NMRC) Limited
Block-III, 3rd Floor, Ganga Shopping Complex, Sector-29, Noida -201301,
District Gautam Budh Nagar, Uttar Pradesh, India

VOLUME - 2

NOIDA METRO RAIL CORPORATION LTD

SCOPE OF WORK

(ARCHITECTURE, STRUCTURE AND E&M SERVICES)

Contents

SCOPE OF WORK

1 INTRODUCTION

1.1 Purpose of this Document

Noida Metro Rail Corporation Ltd. has started the development of its 1st Phase of Noida Extension Metro Project, which is of 9.605 km of elevated line. This phase has to be realized within the next 3 years.

It is proposed to Engage Detailed Design Consultant (DDC) for Civil, Architectural and E & M Works of Noida-Greater Noida Metro Corridor from Sector – 51 Noida to Greater Noida Sector – 2; Consisting of 9.605 Km viaduct including 5 elevated Stations.

This document describes the General Scope of Services to be provided by the Detailed Design Consultant (DDC). The emphasis is to explain the requirement of work, interfaces with other DDCs/ Contractors/ NMRC for achieving an efficient and safe system to the best International Standards and Practices. DDC shall follow acceptable standards and design procedures akin to best systems wherever not explicitly mentioned.

2. EXTENT OF SERVICES

2.1 Services to be provided

The DDC shall perform the Services set out in this Agreement.

The DDC shall deliver sufficient designs and documents to enable NMRC to construct works as per the details below:

S.No	Description of Corridor	Total Length (Kms) (including station length)	Stations (in Nos.)
		Elevated	Elevated
1	**Sector- 51 Noida to Greater Noida Sector -2**	9.605	05

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

a) Producing concept planning and design alternatives of elevated and interchange stations for NMRC's review;

b) Review of alignment in general and station locations in particular with a view of optimization of neighborhood connectivity and MMI integration; Detailed review of alignment with respect to construction cost optimization and ease of construction and providing alignment drawings for Civil work tenders.

c) Perform cost effective detailed designs of Architectural, Structure (including track supporting structure), Building Electrical and Mechanical services, based on

approved designs and design criteria for elevated stations

d) Manage the design task for cost, schedule and performance compliance;

e) Preliminary design for stations, viaduct as per project requirement for tendering process.

f) Proof checking of structural design and scheme of construction suggested by the Contractor for elevated stations, sub-structure and superstructure of viaduct.

g) Perform detailed designs for building works, the fitting out of stations with architecture finishes and services including illuminations, lifts, escalators, water supply, drainage, power supply and other passenger amenities;

h) 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;

i) Review and suggest change as necessary in the detailed designs done by Design Build Contracts for viaduct works to the plan made by contractor for temporary and permanent diversion works for all utilities affected by the station works / viaducts. Take into account utilities identified by contractors during execution and design structures accordingly. Provide items in the Contract BOQ for diversion of these utilities. Review of alignment plan duly marked with, utilities identified by concerned agencies which will be given to DDC in hard/ soft copies by NMRC.

j) Co-ordinate and integrate designs and details with contractors and consultants employed by NMRC working on contracts pertaining/relevant to the site of works for this contract regarding DDC's drawings;

k) Integration of Building Services with the existing M&E systems at stations including fire compartmentation.

l) 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;

m) Computational Fluid Dynamics (CFD) Analysis, if required by NMRC.

n) Prepare BOQs, special specifications, construction cost estimates for the associated construction contracts for tendering by NMRC and modify the cost estimate as necessary before the contract is awarded. The BOQs, special

specifications, construction cost estimate is to be prepared separately for stations and for BOQ of chartered utilities in a number of packages as decided by NMRC so as to facilitate NMRC to call construct only tenders in different contract packages

o) Incorporate and co-ordinate changes in design due to system wide interfacing with other DDCs/ Contractors/ NMRC;

p) Incorporate changes in design resulting from NMRC's design reviews;

q) Consult and co-ordinate with various City and Government authorities that interface with the NMRC project. NMRC will assist with the co-ordination;

r) Prepare necessary documentation and obtain necessary planning and other required approvals for 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 authority;

s) 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 NMRC;

t) Maintain a Quality Control activity and an effective internal procedure for checking the accuracy of Work and assuring compliance with contract requirements;

u) Attend meetings connected with the Work whenever required; and

v) 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 NMRC's site supervision staff in clarification of queries resulting from the design; to review and confirm Contractor prepared "As-Built" drawings.

w) Provide Value Engineering inputs to NMRC before and after award of civil and E&M contracts

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 NMRCs, 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.) as well as viaduct designs/proof checking shall be done using BIM modelling. DDC shall implement the necessary hardware, software and human resources towards this end. 3D Coordination between all disciplines shall be achieved by incorporating them in a single model. BIM Model LOD and related deliverables shall be as per Clients requirement.

DDC shall be required to produce, update and present to NMRC 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. **The DDC shall deploy one BIM expert in addition to the team specified in organization structure and who shall be housed in either NMRC office at NOIDA. Decision of NMRC in this regard shall be final & binding**.

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

1. Station Architecture Modelling
2. Station Mechanical Modelling
3. Station Electrical Modelling
4. Station Plumbing Modelling
5. Station HVAC Modelling
6. Rail Track Modelling/Viaduct modelling
7. Terrain modelling
8. Clash Detection
9. Quantity takeoff from BIM model
10. Visualization and Animated Walkthroughs

Final coordinated GFC drawings 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.

2.2 Contracting strategy for construction

2.2.1 Elevated packages – Civil Works

The Detail Design Consultant will prepare the Preliminary design for elevated stations and viaduct superstructure. The Cost of these shall be deemed to be included in the lumpsum price.

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

The performed Preliminary design should allow reasonably estimating the construction costs within a margin of error in a range of ±5%, and providing the tenderer with all the elements necessary to prepare their offers.

For the viaducts, the detailed design of the substructures and superstructure other than standard C/U/Box girder spans would be done by the Civil Contractors based on the preliminary designs prepared by Detail Design Consultant.

Following the award of the construction contracts, the detailed design of elevated stations and viaduct superstructure (other than standard Box/C/U girder Spans) will be performed by the Civil Contractor. The Detail Design Consultant will have to perform the Proof Checking of structural design of elevated station and viaduct substructures and superstructure (other than standard Box/C/U girder spans) done by civil contractors.

Post award of civil contracts The Detail Design Consultant will have to perform:

- Proof checking of Stations and viaduct other than standard Box/C/U girder Spans
- Detailed design of Architecture for stations;
- Detailed Design of Standard Box/C/U girder Spans

For detailed Scope of work, section 3.9 of this volume shall be referred.

2.2.2 Elevated packages – Building Services

The DDC shall prepare the preliminary/definitive design for the Elevated Stations. Based on the design, tender documents for Elevated stations 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.

Post award of civil contracts, the detail design consultant will however to perform:- Detailed design of BMS, SCADA and E&M for all stations as well as incorporate requirements of Signalling, Telecom, AFC, Traction, Rolling Stock, Track, Lift, Escalator, PSG and all other system wide contractors in 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.

The DDC represents that it is 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 for the stations, station areas, and any associated joint developments. NMRC will provide co-ordination for this process.

2.4 Basis of Detailed Design

`The detailed design, drawings and documents shall be developed by the DDC from the appropriate conceptual, preliminary and standard drawings, design criteria, outline specifications and other information to be issued to or gathered by the DDC and as approved by NMRC.

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

In order to ensure uniformity of all Design Contracts, conceptual drawings, design criteria, outline specifications, standard pro-formats, and documentation will be issued to the DDC, and compliance with the requirements specified therein shall be mandatory unless prior agreement in writing for any changes has been obtained from NMRC.

The DDC shall thoroughly study the information contained in the conceptual drawings, Design Criteria, specifications, standard pro-formas and documentation issued to it. If there are any points of disagreement or inconsistency, the DDC shall immediately refer these, giving reasons for the disagreement, in writing to NMRC for a ruling.

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

The basic interface inputs will be provided at the time of preliminary design, in stages.

Survey Maps and Plot Size of each station

The survey of land of stations shall be made available in NMRC either on tracing paper or on AutoCAD. Any survey required outside the NMRC land will have to be carried out by DDC.

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 NMRC, which will be provided, if available.

3.2 Additional Information

The DDC, shall, if so required carry out topographical surveys, field surveys and building surveys. The cost of these services shall 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 NMRC as the basis for developing the full design, Construction reference Drawings, Cost Estimates and BOQs for all Architecture, Structure and E&M works.

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

National Building Code of India, 2016

The Guides of the Chartered Institution of Building Services Engineers

Acceptable Internationally recognized 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
BS 7671: 1992	"Requirements for Electrical Installations"

In case, standards and Codes for any specific element are not defined in documents referred to in Clause 3.2 above, DDC may use applicable Standard or Code from the above list with the approval of NMRC.

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 2016
- Chief Inspector (Electrical),State Govt. of UP
- Central Pollution Control Board
- UP Fire Services
- Public Works Department
- Central Public Works Department
- NOIDA Power Supply Units (PSO)/UP State Power holding Company Limited.
- Chief Electrical Inspector for NOIDA MRTS
- NOIDA Administration
- NOIDA Municipal Corporation
- National Safety Council

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 NMRC for review and acceptance within 2 weeks from the Issue of Letter of acceptance.

3.2.4 The DDC shall study all subsurface and sub-soil data made available to it. The DDC shall be responsible for all-additional borings, geophysical surveys, and field and laboratory tests that it may require for the performance of the DDC services. The cost of such additional investigations will be paid separately by NMRC either through DDC or directly to the agency hired for such Geotechnical Investigations.

The DDC shall prepare a Geo-technical Survey Assessment incorporating the additional Geo-technical data and shall submit to the NMRC for acceptance.

The soil samples and rock cores obtained in the course of the additional geo-technical investigations shall be delivered to the NMRC by the DDC on acceptance of the Geo-technical Assessment Report by the NMRC.

3.3 Design Alternatives

The DDC shall perform Design Alternatives as per the conditions of the Contract. The DDC shall develop alternative layouts and designs for the substructure, superstructure and architecture of the 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 elevated stations and viaduct, 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

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

Design alternatives are to be presented within 2 week of the Date of Commencement.

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 NMRC. 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 NMRC 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 system wide

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 NMRC. Any critical difficulty identified shall be immediately drawn to the attention of NMRC, 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 bones to steel reinforcement to be catered for. 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 system wide contracts. The DDC shall incorporate the requirements of the system wide 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 System wide Information

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

- Rolling Stock;
- Track Work;
- Overhead Line Electrification;
- Signaling;
- 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; and

- Environmental Control System (if applicable)
- Platform Screen Gates (if applicable)

3.7 System wide Requirements

System wide requirements in the form of preliminary Systems information, as indicated in Clause No. 3.6 above, will be provided by NMRC 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 NMRC, and other system wide DDC's 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 NMRC 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 system wide DDC's 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 system wide requirements defined by the system wide CSD's.

Additional layout details and system wide 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 system wide 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. This Design Brief should take into account the following considerations.

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 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:

- Station and ancillary buildings architecture design
- Site design, landscape design and urban design.
- Existing site characteristics, which are to remain.
- 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 to have 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 he shall not be required to prepare detailed drawings.
- 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 finalised after the environmental review is completed.

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 co-ordinated 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

The DDC shall analyse available flood data and propose solutions for flood control at interfaces and thresholds between proposed grade levels and stations and ancillary facilities.

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:

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 Finish Details
- Lift Finishes Details
- Platform Details
- Doors and Frames
- Miscellaneous Public Area Details
- Platform Edge Lighting
- Public and Staff Toilet Room Details
- Staff Room Details
- Signs and Graphics Details
- 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.)

The DDC shall prepare Standard Specifications for architectural standard design elements and for the supply and installation of architectural standard finishes and materials. He shall also include 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 Enamelled Steel Panels; Barriers and Railings; Drain Grates, Manhole Covers, Cladding and Shutters.
- 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.

The DDC shall provide continuing support in the form of design data, design calculations, CADD files, perspective sketches (BIM Model), 3D computer model renderings, 1:200 scale models of each station and the like as requested, whether for promotion, approval, or other illustrative purposes. The model shall be A0 size mounted on a wooden base with Plexiglas cover and shall be submitted within 4 months of the date of issue of the Letter of Commencement.

Other deliverables may be identified by the NMRC, as required to support the goals of architecture, urban design, and landscape or property development. The DDC shall prepare and submit to the NMRC cost estimates for the architectural works at each station. These estimates shall be based on quantities taken off the DDC produced drawings and BIM Model, 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 Building shall be designed to achieve highest MRTS Green Building Rating.
- Design of roofs of stations buildings shall be suitable for rooftop solar power plant 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.
- 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 runs is required.
- The design of the station 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 relevant BIS standard and shall be incombustible.
- 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 elements is important and as such the following considerations shall be incorporated into the design:
- Corrosion protection is required for all exposed and hidden elements
- Precautions must be taken 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.
- Review of As-Built Drawings of Station which have been prepared and submitted by the contractor.

3.9 Structural Design Services

3.9.1 Civil works (Preliminary Stage)

The aim at this stage is to develop the conclusions of the Value Engineering of the Detailed Project Report, and prepare the concepts for the design.

After the definition of the main principles and needs of the project in the transverse tasks, 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)
- Review of the Survey Works performed by NMRC for sufficiency for the design works (Topographic survey and mapping, Utilities investigation, Hydro-meteorological data, Geotechnical survey and investigation).

If need be, the Detail Design Consultant shall request NMRC for additional surveys.

It is intended that the Detail Design Consultant will review the investigation campaigns launched by NMRC and advise if further surveys are required to perform the design.

The Detail Design Consultant will be preparing the Geotechnical Interpretation Report, indicating the uncertainties, the residual risk and suggesting to NMRC the way of sharing or transferring this risks between NMRC and the future Contractors.

- General Arrangement Drawing:
    - Plan and profile of general alignment, with proposed station location within Right of Way and survey
    - Structural arrangement drawings
    - Utilities layout drawings
- Conceptual drawings for Viaduct, special bridge (if any, cross-over, long spans), elevated stations and their other structures including embankments etc.
- Conceptual interface studies for system integration, cable routing etc for stations.
- Conceptual Interface studies for stations
- Preliminary planning with tentative production rates
- Estimation of preliminary quantities per structure type
- Identification of land acquisition (if required) for temporary and permanent

structures

- Justification of the proposed construction methodology: U/C/I girder Erection Methodology for elevated viaduct, type of retaining structures for deep excavations, etc.

The vertical and horizontal alignment of the entire stretch inclusive of its geometrics and pier locations will be provided by NMRC in hard and soft and will be reviewed by the DDC and changes along with revised plans will be suggested/ incorporated by DDC by issuing the revised plans after duly approved by NMRC. The final approval of alignment and pier locations will be given by NMRC.

As an intermediate outputs, The Detail Design Consultant 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 term of cost, quality and planning.

As a final output, drawings and preliminary BOQ shall form the Tender document for Contractor to bid. The Tender documents will be based on preliminary calculation with a reasonable allowance for variation at Detailed Design stage.

3.9.2 Civil Works (Detailed Design Stage)

For the Elevated sections (viaduct), NMRC has planned to have partial design & built contracts which would include detailed design of substructures based on Detail Design Consultants preliminary designs. However, in order to ensure the compatibility with the Preliminary Design, Detail Design Consultants have to perform proof-checking of this 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 contractor.

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

The key aspects covered by the proof checker/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;
- geotechnical and structural design of the temporary and permanent works;
- ultimate and service design capacities of all components;
- 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 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:

3.9.2.1 Viaduct

- Superstructure:

  Please note that Standard C/U/box Girder Drawings has to be be provided by DDC. However, in case of obligatory/special span/non standard span/I- girder, if any, the DDC shall carry out,

  - Proof checking of structural design of Special Spans (including Balanced Cantilever Bridges, Extradossed Bridges etc.)/obligatory/non standard/I-girder/steel span, as submitted by the Contractor.
  - Proof checking of scheme of construction for all 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 & suggest modifications/improvements.
- Track supporting structure (Track Plinth).

- Substructure and Foundation:
  - Proof checking of structural design and scheme of construction submitted by the Contractor for bearings, sub-structures and foundation of viaduct.
  - All temporary structures, enabling works, construction scheme, lifting plans etc. shall also be proof checked by the DDC.

    Proof checking of:

    - Rail/Structure Interaction reports
    - Track plinth design
    - 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.

3.9.2.2 Elevated Station:

- The scope of DDC covers the Proof Checking of all the structural component of station building and its ancillary components including entries, exits, connecting corridors/FOBs etc submitted by the contractor. The proof-checking, which we assume will require counter-calculations/independent calculation to be performed. The adequacy between calculation reports and drawings, and ensure compatibility with contract provisions proposed construction sequence/Method statement.

- All the temporary structures shall also be proof checked by the consultant.
- The proof checking of roof PEB structure for station building, entry-exit structures shall also be in the scope of the DDC.
- Construction method and construction sequence; including design of enabling work/ construction scheme/ lifting plans etc.

  Proof checking of:

  - Rail/Structure Interaction reports
  - Track plinth design
  - Stray current and earthing design

  - For at grade sections: (if applicable)
    - Listing of coordinates of the leading points for implantation of the Works
    - Proof checking of 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.
  - Ramp: (If applicable)
    - Technical Specification (requirements of load, materials, construction and other requirements);
    - Proof checking of 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 measure;
    - Quantities of main materials.
  - Interfaces:
    - Preparation of Rail/Structure Interaction reports
    - Track plinth starter Bar design
    - Stray current and earthing design
  - Catenary pole anchorage design
  - Approval of all shop drawings such as bearings, expansion joints, and steel

structures submitted contractor.

- 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. shall also be in the scope of the DDC
- 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

3.9.2.3 Deleted

3.10 Electrical and Mechanical Services for Stations

3.10.1 For the elevated stations the following systems will be defined:

- Fire Fighting System;
- Fire Detection System;
- Plumbing System;
- Low voltage;
- Escalators & Elevators.

For each of the sub-systems above, schematics diagrams (air flow schematics, LV distribution single line diagram…) will be submitted for approvals.

The Detail Design Consultant 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
- Airflow for normal and emergency modes (fire and congestion).
- Electrical loads
- Water consumption and requirements for tanks

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 Detail Design Consultant and submitted as part of the Preliminary Design.

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

- Design Drawings (Preliminary & Final);
- Tender Drawings for Building Management System (BMS);
- Layout of the Plant Rooms;
- Ducting & Piping Layout;
- Detailed designs for Air-conditioning Scheme, Smoke Management, Ventilation of Plant Rooms and Auxiliary areas, Stand by Air- conditioning for certain Plant Rooms and Electrical requirements along with layout;
- Electrical Load Schedules after interfacing with other Departments of NMRC / System Group, Other designers / Contractors;

- Design of Electrical system for VAC works including panels, cables etc.
- Layout for 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:
- Ventilation and Air conditioning system including smoke management for station
- The design for station VAC system shall be based on the results of the Subway Environmental Simulation analysis using SES (Ver. 4.1) program, which will be performed by NMRC and results shall be provided to DDC. CFD analysis, if required, shall be performed by the DDC.
- Produced detailed combined services drawings (CSDs) and provide structural electrical/Mechanical drawings (SEM) showing all openings.
- 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 CRDs submitted by the contractor.
- The consultant shall be available for any clarifications to the intending bidders, either through a pre bid conference organised 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 NMRC 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.

3.10.3 In addition, for E&M services the DDC shall also prepare:

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, Instruction to Tenderer and Building Management System (BMS).

c) Layout of the Plant Rooms;

d) Ducting & Piping Layout;

e) Design of Lighting for Central Circulating Area of Station.

f) Designing, Sizing and Layout of Earthing and Lighting Protection System (excluding preparation of Drawings and Layout)

g) Sizing of DG Sets, UPS, Cables and selection of Frame Size of Breakers.

h) Review of Contractor's shop Drawings for E&M only.

i) Preparation of CRD's which is to be approved by NMRC.

j) Finalisation of Electrical Load Schedules after interfacing with other Departments of NMRC / System Group, Other designers / Contractors;

k) Lighting System Design in Station, Entry Structure and Service areas, Road and MMI area near station entries and totems etc.

l) Small Power Layout (Socket/Lighting DB's),

m) Cable/Wire containment system (trays, ladders, conduit etc),

n) Hydraulics / drainage system design and layout (including pipe work, drains, sump etc.),

o) Fire Detection and Suppression System design and layout,

p) General arrangements and layout Drawings for Panels, Switchboards, DG sets, UPS and other necessary equipment etc.

q) The DDC shall prepare Testing, Commissioning and acceptance Criterion.

(c) Prepare Documents – In the form of Data sheet and relevant Calculations.

(d) Determination of Quantities and Preparation of BOQ, etc.

(e) Modify, update and supplement as necessary, the NMRC's Outline Design Criteria / General / Material and Workmanship Specifications as provided to suit

the present work.

(f) Co-ordinate and integrate designs and details with other Contractors and Consultants employed by NMRC working on contracts pertaining / relevant to the site of works for this contract including interface with Design and Construction activities of Station and Viaduct.

(g) DDC shall interface with other System Contractors for Preparation of Combined Services Drawings (CSDs), Structural Electrical and Mechanical Drawings (SEMs) as defined elsewhere in the Agreement. DDC shall Prepare Tender Drawings; Construction Reference drawings for the scope of work and also prepare CSD and SEM 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 and SEM drawings.

(h) Prepare comprehensive cost estimate for the works and Bill of Quantities (BOQs) for E & M Contracts separately for tendering by NMRC, if required.

(i) Prepare necessary Technical Documentation, Presentation and assist NMRC to obtain necessary approvals for E&M Systems including Fire Detection/ Suppression System from the Approving/ Statutory Authorities such as Fire Service.

(j) 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 NMRC.

(k) 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.

(l) DDC shall verify Bill of Quantities of each Schedule before issuance of Tender Documents and also confirm to NMRC that all items of works have been incorporated in the BOQ documents. The Quantities of various item should be carefully worked out and if found that the variations with respect to execution drawings is more than 5% then a lump sum compensation may be deducted at 10% of the total fee. Decision of the NMRC Engineer, 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 Trucking / 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 arrangement & automatic operation in Station areas, cable galleries, parking areas, sub way connecting entry/exit and other room. This includes external cabling and provision of lighting fixtures with lamps, ballast, control gear, etc.
- Design of Earthing System comprising of earth mats, earth electrodes and Main earth Bus in Auxiliary Sub Stations, Clean Earth System and bus, earthing arrangement.
- Design of Control and small power supplies to various station equipment/ Panel.
- Design of Lightning Protection System
- Design of tie bus Cables / Bus Trucking 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 and Ancillary Building / other structures including Hydrants, Hose Reels, Sprinklers System, Fire Hose Cabinets, Fire Mains, Portable Extinguishers, Gas Based Flooding System, pipe line network with control valves

for sprinklers and hydrants.

- Designing 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 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 system wide 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;
- Stand-by generator;
- Uninterruptible power supply system (UPS) for lighting 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 in coming 33 kV supply cable or cables supplied by all contractors.

3.10.4 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 Trucking / 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 arrangement & automatic operation in Station areas, cable galleries, parking areas, sub way connecting entry/exit and other room. This includes external cabling and provision of lighting fixtures with lamps, ballast, control gear, etc.
- Design of Earthing System comprising of earth mats, earth electrodes and Main earth Bus in Auxiliary Sub Stations, Clean Earth System and bus, earthing arrangement.
- Design of Control and small power supplies to various station equipment/ Panel.
- Design of Lightning Protection System
- Design of tie bus Cables / Bus Trucking System for connection between ASS.

3.10.5 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.

3.11 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 NMRC 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 area, 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.

3.12 Co-ordination and Utility Services

3.12.1 NMRC will assist DDC to liaison with the Utility Authorities for all the necessary requirements for Utility supply. The DDC shall furnish relevant drawings and documents required to obtain approval for construction from Utility Authorities. DDC shall assist NMRC 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 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 NMRC right-of-way;
- Fare collection system;
- Signalling;
- Telecommunications;
- Any other system wide contracts.

3.12.2 Co-ordination with UP/NOIDA/Statutory Fire Services

The DDC will assist NMRC to liaison with statutory Fire Services. The DDC shall furnish relevant drawings and documents required to obtain approval for construction from BFS. At the request of NMRC, DDC shall assist NMRC in obtaining Fire Department Clearance by responding to questions of NOIDA/G.NOIDA FS.

3.13 Existing Utilities

All existing known utilities have been charted and incorporated in the drawings. The DDC shall study and use the records and drawings of existing and planned utilities made available by NMRC. The DDC shall list all the utility conflicts discovered and inform NMRC, in writing, of its recommendations for modifications and diversions. The DDC shall co-ordinate with and gather additional technical information after NMRC 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 NMRC. All the correspondence, meeting minutes, and information transmittals between NMRC, the DDC, and the relative utility authorities shall be written in English. If information is not sufficient for the detailed design, the DDC shall make recommendations for additional surveys shall be included in the lump sum prices set forth in the Agreement.

DDC shall be responsible for preparation of Minutes of Meeting, and its issue, for all the meetings with NMRC, Architects or System wide Consultants / Contractors.

3.14 Units of Measurements

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

3.15 Proprietary Items

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

3.16 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 NMRC 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. During the design review stages of the approved construction programme, NMRC may require the DDC to make adjustments based upon the DDC's professional judgment. Where considered to be neither cost effective nor feasible, NMRC shall be informed of the findings.

3.17 Architectural Cost Estimates

The DDC shall prepare and submit to NMRC, 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 NMRC. The DDC shall input cost estimate data onto CDs and submit these CDs in accordance with Section 9 - Submission of Documents herein.

NMRC 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 NMRC and modify the Cost Estimate accordingly.

3.18 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.

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

The DDC shall provide the NMRC with information covered by this Design Lot for such purposes of presentation or display as the NMRC 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.

3.20 Tender Documentation

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

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 instructions by NMRC. The DDC shall prepare the cost estimates, Scope of work, Bills of Quantities, Special Conditions of Contract, Tender drawings and Technical Specifications, including the Scope ofWork.

3.21 Amendments to Tender Documents

The DDC shall provide additional design and other information not included in the Tender Documents as may be required by NMRC. 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 clarification for technical evaluation of the tender, whenever required.

3.22 Contract Drawings

The DDC shall submit to NMRC a complete set of "For Construction" contract drawings for that contract that has been produced as a co-ordinated 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 NMRC computer system. The construction shall confirm to the tender drawings specification & BOQ. Any deviation / variations with reasons shall be clearly brought out in writing to seek approval, before execution.

3.23 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 NMRC. 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.

3.24 Extent of Design Services

For manpower planning purposes, the schedule dates are indicated in Appendix B. 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.

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 1, SCC.

4.1 Contract Drawings

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

4.2 System wide Information

The DDC shall incorporate full and final information relating to systemwide equipment and services into the CSDs. The timing for issue of the CSDs will be determined by NMRC dependent upon the award of the E&M Contracts. Final systemwide requirements defined by CSDs and those required by Systems and by E&M Contractors shall be incorporated into the SEM and SOD drawings and architectural drawings for construction.

The DDC shall review relevant systemwide contractor shop drawings that affect the DDC design. The DDC shall review to ensure compatibility and, after review shall revise and issue all the necessary drawings as and when required by NMRC.

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

4.3 Site Meetings

DDC shall attend weekly and site meetings when requested by NMRC.

4.4 Site Visits

At the request of NMRC 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 NMRC 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 NMRC on a continuous basis prior to the issuance of the Certificate of Completion for the construction contract. The DDC shall prepare relevant calculations reconciled with as-built conditions and information necessary for the maintenance of the works.

4.6 Liaison Work

The DDC shall co-ordinate and liase with all concerned local authorities and private and Government agencies to obtain approvals, testing and clearances as deemed necessary, depending on the conditions prevalent at site.

5 ORGANISATION OF THE DETAILED DESIGN CONSULTANT

5.1 General

The DDC shall establish an efficient organisation 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 organisation 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. All the design and drawings will be certified by all the experts of concerned disciplines like E&M Systems, Fire Detection / Suppression system etc. In addition, all CSD and SEM opening drawings shall be signed by the Project Architect who will be in charge of inter disciplinary coordination.

Upon its appointment, the DDC shall promptly commence setting up its exclusive organisation to the satisfaction of the NMRC and in confirmation with the organisation chart and work experience requirements given in clause 1.1.3.2 of NIT of this Agreement, and shall be housed in one place in Delhi at his own cost. All works by the DDC shall be performed in Delhi unless otherwise approved by the NMRC in advance. In addition to this, a DDC team is to be required for coordinating the various

activities at NOIDA. The team will be housed at NMRC NOIDA office for which three workstations shall be provided by NMRC.

The DDC shall furnish the CV's of all the key persons as identified so in the QA Plan who shall be working on this project along with a detailed organization chart and seek approval. If NMRC 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. NMRC can withdraw the approval of such persons if continuation of the person is judged by NMRC.

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

5.2 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 NMRC, 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 NMRC may by written notice require it to take additional measures, including changes in its organisation, at no additional cost to NMRC. Such notice shall be in no way deemed to constitute a waiver of NMRC's rights to terminate the Agreements by reason of the DDC's breach of contract. Failure by the NMRC 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 number and that accurate, consistent, clear and easily read drawing 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 NMRC 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. Standards quoted in the **Annexure 3** will take preference over those indicated elsewhere. Should the DDC propose to adapt other standards or codes for its designs, it shall submit to NMRC 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 NMRC 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 NMRC, 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 circuitcalculations.
- 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, Cable tray sizing, Provision of Conduits, Conduit / tray fill calculation, Manholes / draw box sizes
- Lighting System Calculations including Indoor lighting calculation, Outdoor lighting calculation, lighting calculation
- Water supply, water treatment system
- Fire detection, fire suppression scheme
- 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;
- Deleted;
- 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 NMRC.

NMRC 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 NMRC 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 NMRC. The original calculations shall then be handed to NMRC on completion of the services.

6.5 Drawings Prepared by DDC

Preliminary and Contract Drawings required for construction shall be prepared and issued by the DDC in accordance with the current requirements issued to it by NMRC (refer to Section 9 for submission of documents).

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

- **Preliminary drawings** are drawings prepared by the DDC prior to their acceptance by NMRC as Tender or Contract Drawings;
- **Tender Drawings** are drawings prepared by the DDC and approved by the NMRC 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 NMRC, 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)** are drawings prepared by the DDC and approved by the NMRC, showing the location, sizes and details of opening in structural elements for Mechanical and Electrical facilities and other related contracts.
- **Contract Drawings** are drawings that have been prepared by the DDC from Tender Drawings that have been approved by NMRC and which, together with other relevant documentation, will form the Construction Contract. The Contract Drawings shall be stamped "Issued for Construction" and will be added or

revised as noted in Section 4.1.

- 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.

DDC shall submit to NMRC 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 NMRC. 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 staff shall check these drawings and a report shall be furnished to NMRC.
- **Working Drawings** contain information related to temporary works details for the construction of the permanent works. The DDC's NMRCing staff shall check these drawings and a report furnished to NMRC.
- **As-Built Drawings** depict the completed works that have been certified complete. These drawings shall have been reviewed by the DDC and a report furnished to NMRC.

6.7 Documents

Documents shall be prepared by the DDC in accordance with the requirements issued by NMRC. 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 NMRC 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.

7 CHECKING PROCEDURES

7.1 General

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

The purpose of the checking 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 NMRC 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.

7.2 Design Calculations

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

7.3 Drawings and Documents

Each document and drawing, including any revisions thereto, shall be endorsed as checked and approved prior to issue to NMRC by being initialled 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.

7.4 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 NMRC for acceptance.

7.5 Quality Assurance Plan

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

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.

7.6 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.

7.7 Responsibility

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

8 DESIGN SUBMISSION AND REVIEWS

8.1 Design Alternatives and Architectural Review

Design Alternatives and a preliminary Architectural Review of the DDC's design proposals will be held 3 weeks after the Date of Commencement of the Contract. The DDC shall prepare and present drawings describing the architectural 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; and
- Landscape conceptual design.

8.2 Monthly Progress Meetings

Monthly Progress Reports will not be provided, however the DDC will 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;

8.3 First Review Submission

When the design, including preliminary drawings and drafts of the Bill of Quantities and specifications is substantially developed to define the Works, including locations, shapes and sizes, it shall be submitted to NMRC for the First Review.

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 NMRC.

The First Review Submission shall include, but not be limited to:

- Design calculations 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 drawing 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 Northern Railway/ Civic bodies, and resolutions to problems identified;
- Initial construction cost estimates and estimate reconciliation with the estimate and, if appropriate;
- Comments, if any, on the documents supplied by NMRC;
- Any other documents that may have been requested by NMRC.

8.4 First Review Procedure

NMRC will complete the First Review of all details submitted within approximately 7 working days, and furnish the DDC with his review comments either in writing or on marked up drawings. Within 3 days of receiving the comments the DDC shall meet with NMRC 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. Within seven (7) days of this meeting the DDC shall deliver to NMRC 6 copies of the minutes of the meeting together with its responses to all comments.

8.5 Delivery of Tender Drawings, BOQ's, Cost Estimates and Specifications for civil, 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 NMRC. The documents will be complete and incorporate the First Review 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.

8.6 Final Review

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 NMRC's review comments.

8.7 Final Review Submission

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

- Design calculations which are indexed and checked;

- Drawings sufficiently detailed to define the Scope of Works, complete and checked;
- Combined Service Drawings; (CSDs);
- Structural-Electrical-Mechanical Drawings (SEMs);
- Systems Erection Drawings;
- Design Basis Report including specific actions which are necessary to complete the design;
- 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 first review 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.

8.8 Final Review Procedure

NMRC will complete the Final Review of all details submitted within approximately 14 working days, and furnish the DDC with his review comments either in writing or on marked up drawings. Within 3 days of receiving the comments the DDC shall meet with NMRC 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. Within seven (7) days of this meeting the DDC shall deliver to NMRC 6 copies of the

minutes of the meeting together with its responses to all comments.

The responsibility of obtaining approval from Local Authorities is that of the DDC. NMRC 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.

8.9 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.

8.10 Submission of Originals

When all the comments of the Final Review submission are incorporated, the submission of originals shall be made to NMRC. This will consist of all documents prepared by the DDC including the Design Estimate Procedures for review shall follow those of the Final Review Procedure

8.11 Delivery of Documents

After NMRC has accepted the submission of the Originals, the DDC shall deliver in electronic format on diskette all Documents prepared by it to NMRC. 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 GC, 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.

8.12 Delivery of Contract Documents

The DDC shall issue the documents, as specified in Section 9, to NMRC for issuance to the contractor "For Construction".

8.13 Final 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; and
- Technical Descriptions
- Statutory Complaint Certificates

9 SUBMISSION OF DOCUMENTS

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

9.1 Quality Assurance Plan

4 copies of the Quality Assurance Plan

9.2 First Review Submission

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

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

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

5 sets of BOQ's

5 sets of Specifications

5 sets of design calculations;

5 sets of Construction Cost Estimates

5 copies of the Design Report;

5 copies of additional topographical surveys and field surveys (if applicable)

9.3 Final Review Submission

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

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

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

5 sets of design calculations;

5 copies of the Design Report;

5 copies of the Construction Cost Estimates;

5 copies of the Property Development Report.

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

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

10 sets of full size (A1) drawings

10 half size (A-3) sets of drawings;
10 sets of Bills of Quantities

10 sets of special specifications

4 sets of Cost Estimates

9.5 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; and

3 sets of CD/DVD for construction cost estimates.

9.6 Submission of Construction Drawings

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

9.7 Submission of "As-Built" Drawings

Three sets of "As-Built" drawings endorsed by the DDC, and

5 sets of Final Design Summary Report

9.8 Submission of Combined Services Drawings (CSDs)

5 sets of drawings with 6 No. Soft copies in Auto Cad and PDF Format.

9.9 Submission of Services Electrical and Mechanical Drawings (SEMs)

5 sets of drawings with 6 No. Soft copies in Auto Cad and PDF Format.

9.10 Design Certificate

All submissions shall be accompanied by two original copies of a 'Design Certificate' as set out in Attachment D1 hereto and signed by the Contractor and the Designer.

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