NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

CONTRACT NO: NGNECC-01

Part Design & Construction of Elevated Viaduct and 10 nos. of Elevated Stations for Extension Projects of NMRC's Aqua Line from Botanical Garden to Noida Sec-142 (from Chainage (-) 383.959 to 12130.143) and from Depot Station to Boraki MMTH (Chainage 28678.253 to 31263.482).

E Tender No.: NMRC/Projects/NGNECC/2026/457

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Noida Metro Rail Corporation (NMRC) Limited

Block-III, 3rdFloor, Ganga Shopping Complex, Sector-29, Noida - 201301, District Gautam Budh Nagar, Uttar Pradesh, India

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A. EMPLOYER'S REQUIREMENTS – GENERAL

Noida Metro Rail Corporation (NMRC) Limited

Block-III, 3rdFloor, Ganga Shopping Complex, Sector-29, Noida - 201301, District Gautam Budh Nagar, Uttar Pradesh, India

Contents

EMPLOYER'S REQUIREMENTS – GENERAL

1. INTRODUCTION

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

(a) **General:** these apply throughout the Contract.

(b) **Functional:** these include the specific core requirements for the design and performance of the Works.

(c) **Design:** these apply in respect of duties & requirements relating to the design of the Permanent & Temporary Works.

(d) **Construction:** these apply in respect of duties and other requirements relating to the construction of the Works.

(All works as mentioned in Employer's Requirement General, Functional, Design, Construction & Appendices unless otherwise specified shall be included in Lumpsum quoted price of Contract i.e., Schedule-A)

2. DEFINITIONS AND INTERPRETATIONS

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

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

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

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

"Construction Reference Drawings": means those drawings referred to in Clause 2(8) of the Employer's Requirements - Design in respect of which a Notice has been issued.

"Construction Reference Drawings Submission": means the submission of Construction Reference Drawings representing elements of the Permanent Works and for which the Contractor seeks a Notice.

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

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

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

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

Requirements - Design.

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

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

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

"Notice": means a Notice of No Objection.

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

"Preliminary Design": means the submission of documents which comprise the initial stage of the design phase.

"Railway Envelope": means the zone or zones within the Works containing the trackwork and equipment necessary for the operation of the railway.

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

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

"Specification": has the meaning identified in Clause 5 of the Employer's Requirements - General.

"Structure Gauge": means the profile related to the designed normal co-ordinated axis of the track into which no part of any structures or fixed equipment may penetrate.

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

"Utilities"- Utilities are defined as public utilities above or below ground and include all live water mains, power cables, street lights, transformers, telephone posts, telecommunication cables, sewers, storm water drains shown on tender drawings OR uncharted which are not shown on the tender drawings.

3 RELEVANT DOCUMENTS

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

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

In the event of a conflict between any Design Criteria and any other standards or specifications quoted, the requirement of the Design Criteria shall prevail.
Notwithstanding the precedence specified above the Contractor shall always immediately seek advice from the Engineer in the event of conflicts between Specifications.

The order of precedence is:

(i) Design Criteria (Volume-4)

(ii) Employer's Requirements (Volume-3)

(iii) Indian and other International Standards referenced herein.

(iv) Indian and other International Standards.

4 PHASES (DESIGN AND CONSTRUCTION)

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

(ii) The Design Phase shall commence upon the date of issue of Letter of Acceptance. This phase shall include the preparation and submission of:

(a) the Preliminary Design

(b) the Definitive Design; and

(c) the Construction Reference Drawings.

The Design Phase will be complete upon the issue of a Notice in respect of the comprehensive and complete Construction Reference Drawings Submission for the whole of the Permanent Works.

(iii) The requirements for the Preliminary Design, Definitive Design and Construction Reference Drawings are stated in the Employer's Requirements - Design.

(iv) The Construction Phase for the whole or a part of the Permanent Works shall commence immediately upon the issue of a Notice by the Engineer/Employer in respect of the relevant Construction Reference Drawings Submission. Such Notice may be issued by the Engineer in respect of a Construction Reference Drawing Submission covering a major and distinctive part of the Permanent Works. However, construction shall not be commenced until the original negatives of the appropriate Working Drawings have been endorsed:

(a) by the Contractor as "Good for Construction"; and

(b) by the Engineer that he has no objections to the drawing.

The Construction Phase shall include the completion and submission of the Final Design and the preparation and submission of the As-Built Drawings and other records as specified.

(v) Notwithstanding Clause 4(iv) above, for those elements identified under Clause 2(6) of the Employer's Requirements - Design, the Construction Phase may commence immediately upon the issue of the Notice in respect of the Definitive Design Submission in respect of each such element subject to availability of the site in accordance with

agreed programme.

(vi) The Contractor shall furnish Contractor's Warranty in the format approved by the Employer given in Volume-3 - SCC.

(vii) The Design and Construction Standards shall be in conformity with the requirements of "Rules for Opening of a Railway or a Section of a Railway for Public Carriage of Passengers" and "Rules for Introduction of New Type of Rolling Stock" and to the satisfaction of the Commissioner of Metro Railway Safety whose sanction is mandatory for commissioning of the System.

5. SPECIFICATIONS

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

6. SPECIFICATIONS IN METRIC AND IMPERIAL UNITS

(i) The Contract shall utilise the SI system of units. Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.

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

7. WORKS PROGRAMME

(i) The Key Dates are defined in **Appendix 2B** to these Employer's Requirements.

(ii) The Contractor shall prepare and submit its Works Programme and three-month rolling programmes and the detailed requirements contained in Appendices 3 and 4 to these Employer's Requirements.

(iii) In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for co-ordinating and completing the design, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors, the review procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or licence is required prior to the execution of any work.

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

8. MONITORING OF PROGRESS

(i) The Contractor shall submit to the Engineer three copies of a Monthly Progress Report (MPR), as described in **Appendix 5** to these Employer's Requirements, describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.

(ii) The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from twenty sixth day of the last month and up to twenty fifth

day of the current month

(iii) The MPR shall be divided into two sections. The first section shall cover progress and current status relating to design and the second section shall cover progress and current status relating to construction.

(iv) A monthly meeting to monitor & review the progress of the project shall be convened by the Engineer. Contractor's site Representative & Designer Representative of Contractor and site agent of all interfacing contractor shall also attend the meeting. The Employer may also be present in the meeting.

(v) The Engineer or Employer may also conduct progress review meetings and interface meeting on weekly /bi-weekly intervals depending upon the requirements or urgency of works. In these review meetings Engineer may call Contractor's Supplier/Sub-Contractor/Designer etc. as per the requirements.

(vi) All construction location including Casting Yard & Batching plants are to be monitored through CCTV and also be linked with GM/Projects' office. Videography by drone shall also be done at all work places once in a month as per Outline Construction Specifications for Civil works

9. QUALITY ASSURANCE

The Contractor shall establish and maintain a Quality Assurance System in accordance with **Appendix 6** to these Employer's Requirements for design and construction procedures and the interfaces between them. This Quality Assurance system shall be applied without prejudice to, or without in any way limiting, any Quality Assurance Systems that the Contractor already maintains.

10 SOFTWARE SUPPORT

10.1 GENERAL

(i) The Contractor shall provide full support to the Employer or Engineer for all computer programs provided by the Contractor under the Contract.

(ii) The Contractor shall submit a software support plan at least 90 days before commencement of software installation. This plan shall require the Contractor to provide all changes, bug fixes, updates, modifications, amendments, and new versions of the program as required by the Engineer.

(iii) The contractor to provide one licenced working copy for each software, being used by its DDC, to design department, maintained for the entire contract period.

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

(v) The Contractor shall submit all new versions to the Engineer for review at least 2 weeks prior to their installation. New Versions of any program shall not result in any non-conformance with the Specification, or degrade the operation of the System. The Contractor shall:

(a) Ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.

(b) Ensure that all new versions are fully tested and commissioned once installed on the Site.

(c) Deliver to the Employer/Engineer any new version, together with the updated Operation and Maintenance Manuals.

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

(vii) The contractor shall Implement appropriate software-based labour management system during the project execution phase.

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10.2 SECURITY OBLIGATIONS

(i) Within 14 days of the installation of any software into the Permanent Works by the Contractor, the Contractor shall submit to the Engineer for retention by the Employer/Engineer two back up copies of the software, which shall include, without limitation:

(a) All licenses in favour of Employer for their use.

(b) all source and executable code;

(c) all design documentation relating to the software; and

(d) Any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.

10.3 ERROR CORRECTION

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

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

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

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

10.4 TRAINING

(i) The Contractor shall provide training for the Employer's staff to enable the Employer to make proper use of any software and its new versions. In case Contractor fails or unable to provide training, the Engineer may ask for value engineering proposal.

11. CO-ORDINATION WITH DESIGNATED AND OTHER CONTRACTORS

11.1 General

(i) The Contractor is responsible for detailed co-ordination of his design and construction activities with those of the Designated Contractors, System wide contractors, Utility

Agencies, Statutory Authorities, Private Service Providers, Developers, Consultants and other Contractors whether or not specifically mentioned in the contract, that may be working on or adjacent to the site for the purpose of the Project. For the purpose of this Specification, all of the above parties shall be referred to as Interfacing Contractors. The Contractor shall note that there are other contractors, consultants, etc. which the Employer will engage from time to time with whom the Contractor shall have to similarly co-ordinate. Such co-ordination responsibilities of the Contractor shall include the following:

(a) To provide all information reasonably required by the Interfacing Contractors in a timely and professional manner to allow them to proceed with their design or construction activities, and specifically to meet their contractual obligations.

(b) To ensure that the Contractor's requirements are provided to all other Interfacing Contractors before the cut-off dates to be identified in the Interface Management Plan (IMP).

(c) To obtain from the Interfacing Contractors information reasonably required to enable the Contractor to meet the design submission dates as identified in **Appendix 2B** of Employer's Requirement.

(d) Where the execution of the work of the Interfacing Contractors depends upon the site management or information to be given by the Contractor, the Contractor shall provide to such Interfacing Contractors the services or correct and accurate information required to enable them to meet their own programme or construct their work.

(e) To co-ordinate access and delivery routes, and to ensure that all provisions for access and delivery of Plant is co-ordinated with and reflected in the Interfacing Contractor's Delivery Route Drawings. The Interfacing Contractors shall ensure that all Plants are delivered at the time agreed to allow openings left in the structure for such delivery to be sealed in accordance with the Contractor's programme.

(f) To co-ordinate with the Interfacing Contractors on attendance.

(g) To attend regular co-ordination meetings convened by the Engineer with the Interfacing Contractors. The Contractor shall conduct separate meetings with the Interfacing Contractors as necessary to clarify particular aspects of the interfacing requirements of the Works. The party who convenes the meeting shall prepare minutes recording all matters discussed and agreed at the meeting.

(h) To ensure that copies of all correspondence, drawings, meeting minutes, programmes, etc. relating to the Contractor's co-ordination with the Interfacing Contractors are issued to all concerned parties and four (4) copies issued to the Engineer no later than two (2) calendar days from the date of such correspondence and meetings.

(ii) The Contractor, shall in carrying out his co-ordination responsibilities, raise in good time and provide sufficient information for the Engineer to decide on any disagreement between the Contractor and the Interfacing Contractors as to the extent of services or information required to pass between them. If such disagreement cannot be resolved by the Contractor despite having taken all reasonable efforts, then the decision of the Engineer shall be final and binding on the Contractor.

(iii) Where an Interfacing Contract is yet to be awarded the Contractor shall proceed with the co-ordination activities with the Engineer until such time when the Interfacing Contractor is available. The Contractor shall provide the Interfacing Contractor with all information necessary to enable the Interfacing Contractor to follow-on and proceed with their co-ordination.

(iv) The cut-off dates to be identified in the IMP are the latest dates. Any claim of additional costs by the Interfacing Contractors as a result of the Contractor's failure in adhering to these dates shall be borne by the Contractor. The Contractor shall note that the information exchange is an iterative process requiring the exchange and update of information at the earliest opportunity and shall be carried out on a regular and progressive basis so that the process is completed for each design stage by the cut-off dates.

(v) The Contractor shall co-ordinate with the Engineer on all matters relating to works that may affect the Operation & Maintenance of the already operational Section corridor of the Employer in general. Such work shall be subject to the rules and regulations imposed by the Employer.

11.2 Dedicated co-ordination team

(i) The Contractor shall establish a dedicated co-ordination team, led by a Chief Co-ordinator at work site reporting to the Contractor's Site Agent (Team Leader). The primary function of the team is to provide a vital link between the Contractor's design and construction teams and the Interfacing Contractors.

(ii) The Chief Co-ordinator shall assess the progress of the co-ordination with Interfacing Contractors by establishing lines of communications as indicated in the co-ordination model shown in Figure 1 and promote regular exchange and updating of information so as to maintain the Contractor's programme.

(iii) The complexity of the Project and the importance of ensuring that work is executed within time limitations require detailed programming and monitoring of progress so that early programme adjustments can be made in order to minimise the effects of potential delays.

(iv) The Chief Co-ordinator in conjunction with the Interfacing Contractors shall identify necessary provisions in the Works for plant, equipment and facilities of the Interfacing Contractors. These provisions shall be allowed by the Contractor in his design of the Works.

(v) During the course of the contract, information will be obtained in a number of ways. These may include direct inspection, regular site meetings, the obtaining of progress reports and the use of turn round document to obtain design and programme data. Turn round document shall be issued to the Interfacing Contractors to be returned giving the current positions on their programme.

11.3 Design & Construction Interface

(i) The dates shown in Employer's Requirements **Appendix 2B** are critical to the timely completion of the project. The Contractor shall commence design interface with the

Interfacing Contractors as soon as he has been notified by the Engineer that such Interfacing Contract has been awarded. In the case of utility agencies and other statutory boards, interface shall commence as soon as it is practicable. Where no design interface date has been established whether because the Interfacing Contractor(s) have not been identified or for whatever reason, the Contractor shall liase with such Interfacing Contractor/s as soon as they have been awarded.

(ii) The Contractor shall immediately upon award of the Contract gather all necessary information and develop his design to a level where meaningful interaction can take place as soon as the Interfacing Contracts are available. The Contractor shall submit together with each of his Design Submissions a joint statement from the Contractor and the relevant Interfacing Contractor confirming that design co-ordination has been completed and that they have jointly reviewed the appropriate document to ensure that a consistent design is being presented.

(iii) The design interface is an iterative process requiring regular exchange and update of interfacing information. The Contractor shall ensure that the information he requires from the Interfacing Contractors is made known at the outset of each design interface and vice versa so that the information can be provided in time for the Contractor and the Interfacing Contractors to complete their design to meet their various design submission stages.

11.4 Construction Interface

(i) The contractor shall coordinate design/ activities/ making due care of complete integration of works –

a. Integration of Boraki Station and associated Viaduct falling in the DMIC-IITGNL's MMTH area with the upcoming Multi-Modal Transport Hub at Boraki MMTH in co-ordination with DMIC-IITGNL.

b. Integration of Existing Botanical Garden metro station on Blue Line of Delhi Metro in coordination with DMRC

c. Existing Noida Sec-142 metro station and Dead End at Depot Station on Aqua Line of Noida Metro

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

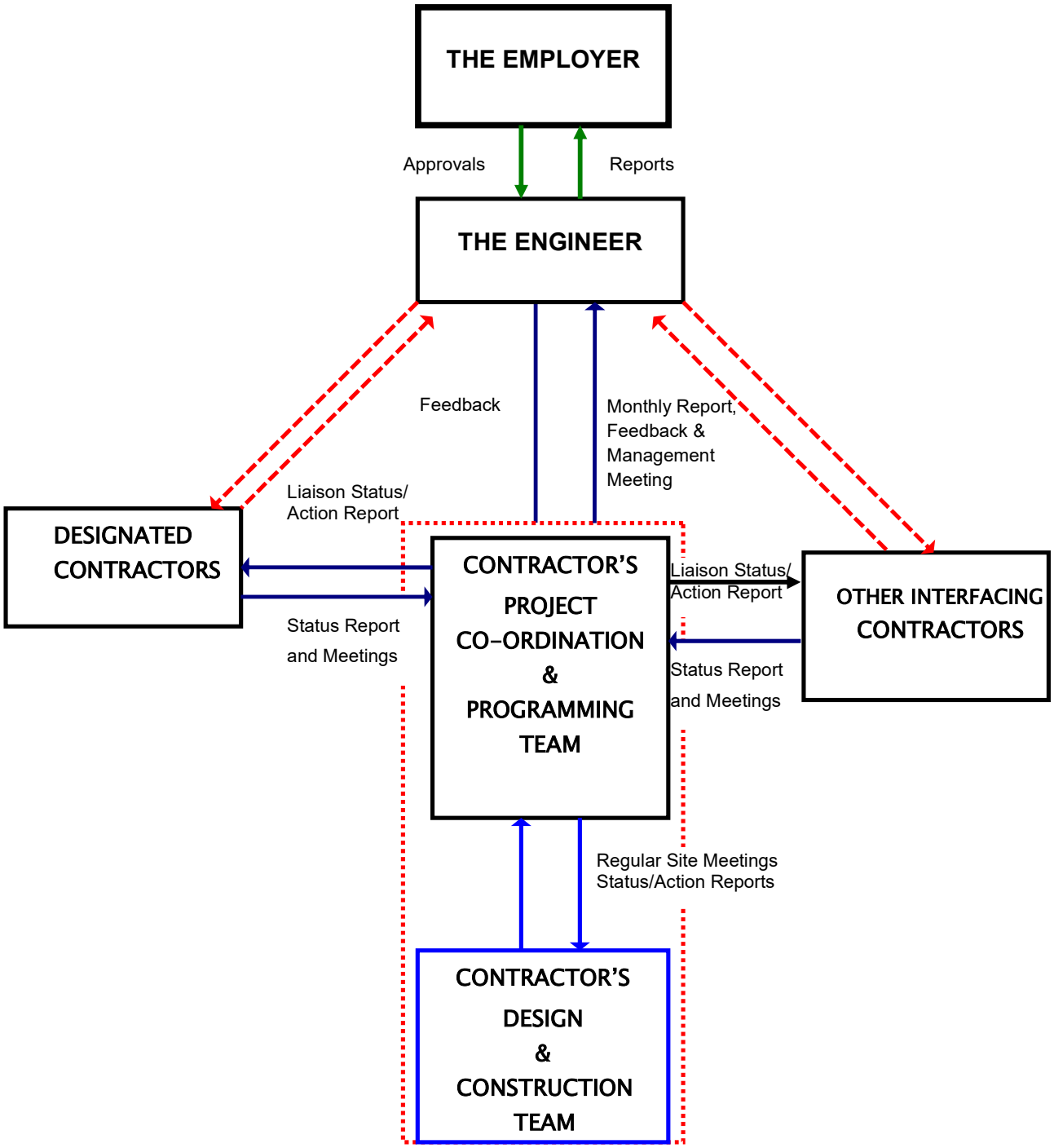
(iii) The Contractor shall ensure that there is no interference with the Works of the Interfacing Contractors and shall maintain close co-ordination with them to ensure that his work progresses in a smooth and orderly manner. The Contractor shall carry out and complete the Works, or any part thereof, in such order as may be agreed by the Engineer or in such revised order as may be requested by the Engineer from time to time. The Contractor shall, unless otherwise provided, be liable for and shall indemnify the Employer against all costs, charges, expenses and the like resulting from failure of the

Contractor to co-ordinate the Works as specified.

(iv) Auto CAD Operator:

(a) The contractor shall provide one experienced Auto CAD operator and Surveyor with the experience in Metro works along with computer systems and A0 size plotter including cartridges, rolls, papers and other consumables etc. exclusively for the Office of the Engineer till six months beyond the date of completion of project. The contractor shall also provide one experienced person for digitization of all the documents/records along with one computer system, colour printer cum scanner of A-3 size including cartridges, papers and other consumables etc. exclusively for the Office of the Engineer till six months beyond the date of completion of project.

(Note: Besides above conditions contractor has to ensure conditions mentioned in Appendix-2D of Employer's Requirements (Interface Management Document)



CONTRACTOR'S ORGANISATION

Figure 1

12. SURVEY AND SITE INVESTIGATIONS

(i) The datum used for the Contract shall be Mean Sea Level Datum. Reference frame for survey shall be WGS84.

(ii) The Contractor shall carry out all further site investigations (such as detailed utility identification, detailed geo technical investigation, detailed survey of alignment etc.) necessary for the design of the Permanent Works and to enable the determination of the methods of construction and the nature, extent and design of the Temporary Works. The contractor shall also engage alignment expert during the currency of the contract.

13 CLIMATIC CONDITIONS

Noida experiences extreme climatic conditions and tenderers must acquaint themselves about the same before submitting the tender. The Employer shall in no way be responsible on this account.

14. PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

The Contractor shall devise and utilise a PMIS such that all documents generated by the Contractor can be transmitted to the Engineer by electronic means (and vice versa) and that all documents generated by either party are electronically captured at the point of origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer office at site and the Employer's Office by the Contractor.

15 CONTRACTOR'S PROJECT ORGANISATION

(i) The Contractor shall have a competent team of Managers, Engineers, Technical staff etc so as to complete the work satisfactory as per various requirements of the contract.

(ii) A control room with round the clock radio communication or telephone switch board links with all safety offices, works sites, site offices, batching plants, casting yards, workshops, fabrication yard, off site offices, Engineers site office, GM's office, testing labs etc shall be maintained and manned round the clock. Residences of all senior project team members shall also be linked with the control room. Vehicles for emergency use should be on stand-by at the control room around the clock along with two dedicated vehicles for use of engineer for quality inspections of site works, round the clock.

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

16. TECHNOLOGY TRANSFER

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

17. MAINTENANCE REPORT

(i) The Maintenance Report shall be submitted as part of the Definitive Design and shall include full details of the long-term inspection and maintenance operations for each major component of viaduct, station, PEB & water supply.

(ii) The Contractor shall provide inspection and maintenance manuals for the civil, structural and building works covering the following areas.

- Viaduct
- Special Span Viaduct
- Station Structures (separated into the main structural elements)
- PEB structure

(iii) For each area an inspection checklist shall be supplied giving inspection frequency, items to be inspected, criteria for acceptance, criteria for remedial works and details of the remedial works, including proposed materials and method statements. The recommended regular maintenance regime of each area shall also be given including cleaning methods and frequency for different surfaces; removal of leakage borne salts from concrete surfaces; cleaning of drainage channels, sumps and pipes; repainting of metallic items;

(iv) A long-term monitoring regime shall also be included covering items such as

- Viaduct/station water leakage
- Differential movement at viaduct / station junctions/PEB structure or other areas identified in the design

(v) All instruments necessary to carry out the inspections and monitoring that are identified in the report shall be provided by the Contractor within the lump sum tender price.

18. CONTRACTOR CERTIFICATE

The contractor shall provide his registration details for GST Registration, EPF registration, ESI registration, Statutory Certificate, Certificate as per SHE Manual etc. as required for the execution and completion of the works.

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VOLUME 3

B. EMPLOYER'S REQUIREMENTS – FUNCTIONAL

Noida Metro Rail Corporation (NMRC) Limited

Block-III, 3rdFloor, Ganga Shopping Complex, Sector-29, Noida - 201301, District Gautam Budh Nagar, Uttar Pradesh, India

EMPLOYER'S REQUIREMENTS – FUNCTIONAL

CONTENTS

EMPLOYER'S REQUIREMENTS - FUNCTIONAL

OBJECTIVE

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

1. GENERAL

a. The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Employer's Requirements -Functional.

b. The design of the Permanent Works shall be developed in accordance with these Employer's Requirements - Functional, the Contractor's Technical Proposals and the other requirements of the Contract.

c. The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date good Engineering practices. The Specification shall in any case not specify standards which, in the Engineer's opinion, are less than or inferior to those described in the Outline Design Specification (Design Criteria) and Outline Construction Specification (OCS) contained in the Tender Documents. Construction shall be carried out employing the procedures established by the Contractor in his Quality, Safety Health and Environmental management plans.

d. The Contractor shall be responsible for obtaining all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies in the design and construction of the works.

2. SCOPE OF WORKS

GENERAL

Contract NGNECC-01: Part Design & Construction of Elevated Viaduct and 10 nos. of Elevated Stations for Extension Projects of NMRC's Aqua Line from Botanical Garden to Noida Sec-142 (from Chainage (-) 383.959 to 12130.143) and from Depot Station to Boraki MMTH (Chainage 28678.253 to 31263.482).

SCOPE UNDER LUMP SUM PRICE

The scope of work in brief is given below but the scope includes all other requirements stipulated in various parts/volumes of the contract document including appendices and annexure there to. Entire scope of work for Viaduct section, Viaduct in stations excluding the concourse portion, special spans, as shown in General Arrangement Drawing/ General Alignment Drawing (GAD), shall be included in Lump Sum price (Schedule A of BOQ). The detailed scope of work of viaduct & stations included in lump sum shall be as described in clause 2.1.

The Scope of work 2.1 to 2.9 including Notes 1) to 12) (applicable for viaduct & stations) & 3 to 14 unless otherwise specified shall be included in Lump sum quoted Price of contract i.e. Schedule-A of BOQ.

The Civil, Architectural Finishing work, Plumbing work and PEB work of station shall be

paid in BOQ on item rate basis as described in clause 2.10.

The water supply arrangements for construction works shall be arranged by contractor at his own cost, in case borewell is to be done for construction works, the permission for the same is to be obtained before the borewell is done. The permanent water supply connections from local authorities and borewells along with its permission for all stations shall be arranged by Contractor at his own cost and relevant statutory permissions from concerned authorities shall also be arranged by contractor.

2.1. LUMPSUM SCOPE OF WORK – (Viaduct, Viaduct in station excluding concourse portion)

(i) Detailed survey of entire alignment including Viaduct, Stations with Entry/Exit & FOB and MMI for execution of work.

(ii) Geotechnical Investigation Work at every pier location for Viaduct and Station including Entry/Exit & FOB.

(iii) Utility Investigation Work along the alignment for Viaduct as shown in the GAD.

(iv) Design & construction of Pile foundation, Pile cap, Pier, Pier cap, all type of Piers including Cantilever & Portals, Pedestals, Cross Arm, Extended Pier cap, Cantilever Pier cap, Table top Pier cap, Portal Beams, standard Pier Cap, bearings, bearing pedestal & crash barrier, reflector tapes for Piers, Portal Pier, etc. for all spans.

(v) Design & Construction of super structure of Standard U-Girder span and all other spans for Viaduct including Viaduct in station excluding the concourse portion .

(vi) Design and construction of non-standard spans, I-Girder/T-Girder spans, spans at crossover location, spans for crossing existing structure and spans in sharper curvature wherever necessary or instructed by engineer.

(vii) Design and construction of parapets. The shape shall be as per tender drawings.

(viii) Design, construction & erection of special spans. Type of bridge and method of construction shall be approved by NMRC prior to execution of work. This includes all temporary works such as shoring, staging, any other related works. Apart from special spans indicated in GAD, there may be requirement of additional special spans as per the site conditions / NMRC or civic requirement, which is also included in lump-sum price.

(ix) All Piers location, span arrangement for special/ obligatory spans have been shown in the alignment GAD drawings. These special spans / obligatory span lengths may have to be changed as per requirements of the concerned authorities.

(x) Design & Construction of Spherical bearing and seismic restrainers for special spans approved by NMRC including GI brackets for cables laying, walkway, parapets & railing.

(xi) Design and construction of emergency siding line.

(xii) Standard spans for viaduct shall be 28m Twin U-Girder Spans except obligatory spans/ special spans shown in GAD, However, in case of sharper radius wide U-Girder may have to be used without any extra cost. The Span arrangements of Viaduct have to be decided in such a way that pier locations do not disturb the road geometry, ROW, clear carriageway width of roads, flow of nallah, utilities and traffic flow. The max. Cantilever permissible is 2.5 m.

(xiii) All Viaduct foundation shall be on piles of minimum 1000 mm dia. with or without permanent liners as per site requirements except at location met with hard/rocky strata

with adequate bearing capacity in which open / raft foundation may be provided duly anchored in rock. All piles shall be bored cast in-situ concrete driven by hydraulic rotary rig only.

(xiv) Permanent liners, if required at any location.

(xv) Pile caps / Open Foundations resting at any depth depending upon the site condition shall include excavation, levelling course, PCC, dewatering, sheet pilling/ soldier pilling & wooden lagging, if required. Earth filling of pile cap area falling off the road to be done with proper compaction with good earth wherever required. For the area falling on the road, backfilling shall be done with sand as per Outline Construction Specification (OCS).

(xvi) Elastomeric bearings (both horizontal and vertical) on all spans including bearing pedestals, seismic devices, shear key restrainers, holding arrangement for vertical bearing, and MS wedge plate required between bottom of U- Girder and bearing duly painted with epoxy paint on exposed surface.

(xvii) Spherical bearings on continuous spans/special spans including vertical stoppers of same specification on special span.

(xviii) OHE Pedestals with bolts, Parapets, MS railing as per tender drawing including epoxy painting on MS railing.

(xix) Providing and fixing GI brackets on both sides of U-Girders, I-Girder/T-Girder or any type of superstructure, parapet walls/ railing of viaduct and ramp for electrical cables & signalling as per tender drawing.

(xx) Crash Barrier as per Tender drawing.

(xxi) Inserts / dowels for Track plinth (Track plinth is not in the Scope of this work).

(xxii) Expansion joint omega seal or liquid rubber stretchable system with suitable end fixing protective cover, in the expansion joints as per Outline Construction Specification (OCS).

(xxiii) Earthing arrangement, inserts/ bolts including supporting structure for OHE/signalling masts as per tender drawing in the parapets/superstructure and for other systems as may be required including extra reinforcements required for strengthening these locations.

(xxiv) Drainage for spans including Down Take Pipes with all supporting arrangements as per tender drawing. Ground water recharging /Rain water harvesting (RWH) systems in alternate span to cater all the spans as per guidelines of Central Ground Water Authority for rain water harvesting. The general arrangement of Rain water harvesting system (minimum size) is shown in the Tender drawing, However, the size of RWH pit & depth of bore may increase as per the guidelines of Central Ground Water Authority, the details shall be submitted to NMRC for approval before execution.

(xxv) Shape and profile of Piers including Cantilever piers, portal piers and portal beams is to be as per tender drawings.

(xxvi) Provision for cut-outs in the viaducts required for services in coordination with various system contractors.

(xxvii) Providing & fixing MS/ RCC ladders / staircases along with railing for approaching the viaduct track bed from station platform at both ends for up & down lines. Design & providing access manholes with locking arrangement including inspection ladder of MS structure from deck to pier cap for inspection where approach road is not available. All MS structure shall be painted with Epoxy paint of approved colour.

(xxviii) Anti-carbonation Paint on the Viaduct Structure

(xxix) Demolition/dismantling/Restoration of any structure. Restoration as per the original

condition prior to the construction.

(a) Demolition/dismantling of RCC/Framed/Steel structure buildings, masonry buildings, basement, ground and above floors as existing at site on the alignment and making provision of any utility infringing the pile cap area, without making damages to the adjacent structures/ utilities etc. including disposing off retrieved materials out of site.

(b) Demolition/dismantling & restoration of existing FOB's, Bus Shelters, Signages.

(c) Demolition/dismantling of road, footpath, RCC drain or any type of drain, kerbstone, pavers central verge, boundary wall, grill, kerb stone etc. and restoration of same with new material of similar specification. Tenderer must visit the site and ascertain actual magnitude of quantum of work involved for road, footpath, RCC Drain, kerbstone, pavers, overhead utilities & underground, central verge, boundary wall, signages, grill, bus shelters etc. and nothing shall be payable on this account. Retrieved materials obtained from demolition/dismantling shall be property of the contractor.

(d) Damage of any horticulture, landscaping, green area during currency of contract and its restoration to its original condition. The pile cap level shall have to be kept below the drain wherever the same is fouling with drain and the drain demolished shall have to be restored back with similar specifications after casting the pile cap, till such time arrangement of temporary drainage shall also be made to ensure proper drainage of water.

(xxx) Necessary permission/ NOC from the Railway/ Road/ Forest department and other concerned regulatory authorities for block and working in such locations. NMRC will facilitate for getting them permission from concerned regulatory authorities for working in such locations.

(xxxi) Making access to site at any location in alignment to facilitate movement of vehicles, cranes, machineries etc. and preparation of area for positioning of cranes and any other machinery to facilitate construction & execution including removal of any construction material and restoration of area to its original condition.

(xxxii) During construction at road area required arrangements to be made to facilitate movement of vehicles, cranes, machineries etc. and preparation of area for positioning of cranes and any other machinery to facilitate construction & execution including removal of any construction material from the location and restoration of area to its original condition. Also, view cutter arrangement of sufficient height above barricading board to be made at this location.

(xxxiii) Wall, curtain walls of varying heights, drainage system, grills on ramp. All MS structure to be painted with epoxy paint of approved colour.

(xxxiv) Dynamic Integrity test on 100% piles and cross hole sonic integrity test on 25% of piles as per Outline Construction Specification (OCS).

(xxxv) Design and Installation of temporary structures/ construction methodology for construction of Viaduct & Station and getting it approved from third party.

(xxxvi) Providing & Fixing GI Brackets along both sides of track in Viaduct and Viaduct in station for electrical & signaling cables as per the site requirement and as instructed by Engineer-in-charge. Providing cutouts, concealed pipes, earthing, inserts, bolts. required for various services and systems as per co-ordinations with Employer and service providers and the other system contractors.

(xxxvii) Traffic marshals to guide the road users and to avoid traffic congestion. The deployment of the Traffic marshals shall be as per the approved Traffic Diversion Plan.

(xxxviii) Any horticulture, landscaping, green area etc. damaged by contractor during currency of contract for Viaduct and Viaduct in Station excluding concourse portion shall be restored back to its original condition under lump sum head of schedule-A of BOQ.

(xxxix) Provision of barricading board as per the specification as provided in tender drawing at the land to be used for Viaduct, Viaduct in station excluding concourse portion, Casting Yard, Batching Plant, etc. Barricading board for station portion including Entry/Exit will be paid in Schedule B of BOQ.

(xl) Diversion of Charted Utilities is under Lump Sum scope. Charted utilities comprises of All existing above ground utilities falling along the alignment (including Viaduct & stations) along with their underground/elevated connections except Overhead HT Lines above 11 KV.

(xli) For stations located over road, temporary arrangement is to be made for providing working platform at suitable height so that traffic run below it unhindered and safety of road user and use of sufficient cherry pickers for carrying out the work shall also be ensured. This arrangement shall be maintained till completion of work. The working platform has to be covered with suitable material so that nothing falls on the road. A detailed scheme is to be submitted for approval before start of work. The provision of same is covered in the lumpsum quoted price.

NOTES:

1) Pile foundation for Viaduct & Viaduct in station excluding concourse portion, shall be of minimum of 1000mm dia. with or without permanent liners with hydraulic rotary piling rigs.

2) Earth filling of pile cap area falling off the road to be done with proper compaction with Contractor's own good earth wherever required. For the area falling on the road, backfilling shall be done with sand as per Outline Construction Specification (OCS).

3) It is obligatory for the contractor to provide a single pier structure in the viaduct of minimum dia 1.80 m..

4) Contractor has to maintain a minimum vertical clearance of 5.5m from road surface to bottom of any structure.

5) The location of piers should be decided in such a way that they do not disturb the road geometry and also should not obstruct the traffic flow for which the decision of NMRC shall be final. The accuracy of alignment and interface with adjoining contractor shall also be responsibility of the contractor.

6) In some stretches placing of heavy cranes for erection of U-girders is not possible and U –Girder launcher is to be used in such locations. Launcher and cranes are to be used for erection depending upon site conditions.

7) Upstand at expansion joint for viaduct, & siding line shall have to be casted in casting yard only to have monolithic construction to avoid seepage at expansion joint. Similarly, U- girders to be used in station must have slope to drain water.

8) Obtaining NOC & Approval of Diversion scheme of Utilities from the concerned regulatory / statutory / Local Authority is the responsibility of the Contractor and nothing extra is payable on this account.

9) The supervision charges require by the Utility owning agencies such as UPPCL, UPPTCL, PVNL, Local Authorities, etc. for uncharted utilities shall be paid by NMRC. The supervision charges require for chartered utilities shall be borne by contractor.

10) The pile cap level shall have to be kept below the drain wherever the same is fouling with

drain and the demolished drain shall have to be restored back with specifications approved by utility owning agency after casting the pile cap, till such time arrangement of temporary drain shall also be made to ensure proper drainage of water.

11) Closer of gap between two U-girders inner webs and deck slab junctions (deck slab on I Girders/arch girders etc) by RCC/steel plates profiled to required shape, inserts, plates with welded hold fasts, insert plates with welded hold-fasts, internal threaded sleeves including HSFG bolts etc complete.

12) Any change in rail level up to +/- 300mm from the tender drawing subject to fulfilment of the other tender conditions will be part of lump sum price and nothing will be paid/deducted for this variation.

2.1. A.1 There is possibility of some of the items not getting mentioned in the above list of works of Viaduct and Viaduct in Station excluding concourse portion. Contractors are requested to go through the tender drawings also in details as the works listed in 2.1 above as well as indicated in the tender drawings would be considered inclusive in the scope of work under lump sum quoted price. Employer decision shall be final in this regard in case of dispute. Some of the major utilities cannot be diverted. Contractor shall take into consideration the existence of these utilities and design the foundations at these locations accordingly, if required, the pile cap top level shall be fixed at the bottom of the utilities without any extra cost. This is the part of Lump sum quoted price. No payment shall however be made for supporting the utilities during course of work.

2.1. A.2 The Detail Design Consultant(s) for structural designs for sub structure/super structure of viaduct shall be engaged by the contractor subject to having executed similar one work in last 7 years and their concerned structural engineer having minimum 15 years relevant experience of designing viaduct structures. All documentation pertaining to the DDC having the relevant experience shall be submitted to NMRC for approval prior to engagement. The work is to be designed, constructed and maintained as per relevant codes, Outline Design specifications (ODS), Special Specifications and drawings and/or as directed by the Engineer.

2.1.A.3 The work content against the lump sum component of the work shall also include but not limited to the following:

(i) Though Alignment plans (both vertical and horizontal) are provided by the Employer to the Contractor. Contractor would however design the span configuration (only) based upon his proposal subject to obligatory requirements. Utility identification at all the foundation locations will be done by the Contractor before starting piling/excavation and in case utility(s) is encountered or obligatory requirements of Local Authorities are to be met out, the Contractor would modify the span configuration at such locations to save the utility(s) or to meet out the obligatory requirements within the accepted price. The shifting of the utility(ies) would be undertaken only in exceptional circumstances where in the opinion of the Engineer no other option is available. Cost of such utility shifting except RCC drain will be paid separately under relevant item of BOQ. No claim as regard to delay on account of execution of utility diversion will be entertained. All temporary diversion of any utilities done to facilitate the construction activity shall also be the part of the lump sum quoted price. RCC drain if encountered which will be restored back with similar specification after casting of pile cap & cost of the same is included in lump sum` quoted price. No payment shall however be made for supporting the utilities, carriage of excavated earth during execution of work

(ii) Site clearance and dismantling of obstructions etc., before commencement of Viaduct and Station work as specified or as directed;

(iii) True and proper setting out and layout of the Viaduct and Stations Works, bench marks and provision of all necessary labour, instruments and appliances in connection therewith as specified or as directed;

(iv) OHE & signalling structures themselves are excluded from the scope of the work, but civil works required for fixing the structures such as strengthening of structures and providing inserts are included. As per requirement of OHE contractor, MS railing at U-Girder (including epoxy painting) to be provided by the civil contractor. The specific location of OHE mast & railing shall be provided by the OHE contractor. These shall be finalized and provided in co-ordination with the OHE/ signalling Contractor and the Engineer. The necessary coordination with system contractors and engineer shall form a part of the work.

(v) Conducting initial and routine load test on piles as per frequency given in Outline construction specification as per IS-2911- Part IV and Conducting load test on completed span (Standard U-Girder span – 01 no., Special spans-as per requirement. & I-Girder/T-Girder span-01 no.) as per IRC-SP-51 for Viaduct and Viaduct in station excluding concourse portion.

(vi) All aspects of quality assurance, including testing of materials and other components of the work for Viaduct and Station, as specified or as directed. The payment is included in lump-sum price.

(vii) The Contractor has to ensure cleanliness of the roads and footpaths by deploying man power for the same. The Contractor shall have to ensure proper brooming, cleaning and washing of roads and footpaths at regular interval or as and when required or directed throughout the entire stretch till the currency of the contract including disposal of sewage. Nothing extra shall be payable on this account.

(viii) Day to day cleaning of worksite for Viaduct and Station throughout the execution period.

(ix) Clearing of site and handing over of all the Works, as specified or as directed.

(x) Maintenance of the all the completed Work during the period as specified;

(xi) Submission of completion (i.e. 'As-Built') drawings and other related documents as specified. (3 sets in hard copy and soft copy in excel hyperlinked with piers numbers/stations name. All piers to be marked with specific pier number as directed by Engineer.

(xii) Preparing detailed designs, general drawings and working drawings for various components of the works and obtaining approval in respect thereof from the Engineer's DDC & Engineer, inclusive of incorporation of all modifications, alterations, changes, etc. that may be required to be carried as directed.

(xiii) The contractor shall have to provide barricading board as per the specification as provided in tender drawing at all the land to be used for Viaduct, Viaduct in station excluding concourse portion, store, site office & casting yard. The total working space within the barricading along the viaduct shall not be more than 8mt. Requirements of Safety, Health & Environment as specified in condition of contract on SHE.

(xiv) Locations where road vehicles / pedestrians are moving, along the Viaduct / Stations / Construction sites, as directed by Engineer, contractor shall provide & maintain barricading as per the drawing provided in the tender drawing, the payment of the such additional barricading as directed by Engineer shall be made as per the relevant head of Schedule 'B' and the rates of these items include shifting and maintaining barricading at new location during the currency of the project. Illumination of these barricades/ areas including adjacent road along barricade is included in the lump sum price.

(xv) Results of sub-surface investigations conducted at project site are enclosed with the tender document. This information about the soil and sub-soil water conditions is being made available to the contractor in good faith and the contractor shall have to obtain the details of sub soil investigation independently. No claim whatsoever on account of any discrepancy between the sub surface conditions that may be actually encountered at the time of execution of the work and those given in these tender documents shall be admissible to the contractor under any circumstances. Provisions made in DBR shall prevail in this regard.

(xvi) Maintaining Road, Footpaths, drains (including de-silting) etc. during the contract period/ handing over to road owing agencies which is earlier, is included in lump sum quoted price. Dismantling of any road, footpaths, any type of drains etc. for construction purpose including its restoration after completion of work (within barricade) is included in lump sum price of Schedule 'A'. Also, any road work i.e. widening / diversion required to facilitate the movement of traffic shall be paid separately under BOQ items of relevant Schedule. However, repair & maintenance of road along alignment, diverted road and widened road during currency of contract is included in lump sum quoted price. Final carpeting of road within barricading areas and outside the barricade i.e., areas affected by construction to be done before handing over to road owing agencies which shall be paid separately as per relevant head of BOQ. Contractor has to maintain a minimum clearance of 5.5 m from road surface to bottom of structure. Any earth work, subgrade work, levelling or other such works for facilitating the movement of the vehicles/ trailers crane positioning etc. is included in the lump sum price.

2.1.A.4 Any other item of work as may be required to be carried out for completing the construction of Viaduct Structure and Viaduct in Station excluding concourse portion of specified length including all necessary interfaces works with station and system-wide Contractors in all respects in accordance with the provisions of the Contract and/or to ensure the structural stability and safety during and after construction Works to be performed shall also include all general works, preparatory works of any kind necessary for satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and Outline Construction specifications, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first –aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the execution of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

2.1.A.5 There is possibility of some of the items not getting mentioned in the above list of works of Viaduct and Viaduct in station excluding concourse portion. Contractors are requested to go through the tender drawings also in details as the works mentioned above as well as indicated in the tender drawings would be considered inclusive in the scope of work under lump sum quoted price. Employer decision shall be final in this regard in case of dispute. Some of the major utilities cannot be diverted. Contractor shall take into consideration the existence of these utilities and design the foundations at these locations accordingly, if required, the pile cap top level shall be fixed at the bottom of the utilities without any extra cost.

2.1.A.6 Any other item of work as may be required to be carried out for completing the necessary interfaces works with system Contractors and other contractors in all respects in accordance with the provisions of the Contract and to ensure the structural stability and safety during and after construction.

2.1.A.7 The shifting of the utility(s) would be undertaken only in exceptional circumstances where in the opinion of the Employer no other option is available. The utilities are to be diverted with proper liaising and approval of the utility owning agencies and will be paid under Schedule-B of BOQ. For the utilities which are not to be diverted proper supporting shall be done to prevent any damage. No payment shall however be made for supporting and protecting the utilities during execution of the work. Cost of such utility shifting (i.e. permanent diversion) unless otherwise specified will be paid separately under relevant item of BOQ. No claim on account of delay in execution of utility diversion will be entertained. All temporary diversion of any utilities done to facilitate the construction activity shall be the part of the lump sum quoted price. No payment shall however be made for supporting the utilities, carriage of excavated earth during execution of work.

2.1.A.8 Inserts/bolts/Supports/Hangers for system contractors & other contractors. All system contractors' structures like OHE, Signalling etc. are excluded from the scope of the work, but civil works required for fixing these structures such as strengthening of structures and providing inserts, bolts, supports, hangers are included. These shall be finalized and provided in co-ordination with the System Contractors & other contractors and the Engineer. The necessary coordination with system contractors, other contractor and engineer shall form a part of the work.

2.1.A.9 All aspects of quality assurance, including testing of materials and other components of the work, as specified or as directed. Arranging & performance dynamic Integrity test on 100% piles and cross hole sonic integrity test on 25% of piles as per outline construction specification (OCS). Conducting initial and routine load tests on piles as per frequency given in outline construction specification (OCS) as per BIS-2911- Part IV.

2.2 OTHER WORKS UNDER LUMP SUM

2.2.1 Interface Works

2.2.1.1 Co-ordination/co-operation with other Contractors & Agencies (External/Internal)

(i) In addition, the Contractor shall be required to carry out various miscellaneous works as per interfacing requirements. The contractor shall carry out necessary co-ordinations with various system contractors pertaining to lift, escalator, traction power supply, signaling, telecommunication, AFC , track & E&M contractor, etc. for keeping provisions pertaining to cut outs, shafts, raceways, concealed conduits, other conduits, fixtures, inserts, clearances etc. all complete for the scope of work. Temporary door with locking arrangements to be provided in all rooms in station building & Ancillary building.

(ii) Earthing and lightening protection wherever required.

(iii) The track supporting structure will support ballast less track (long welded rail) which will be laid later by a separate contractor. Arrangements of inserts/ dowels required for provision of such ballast less track will have to be incorporated in the deck in consultation with the Engineer where the ballast less track concrete is to be laid at the top of the deck slab by Track Contractor.

(iv) The contractor shall cooperate with the other contractors appointed by the employer so that the work proceeds smoothly to the satisfaction of engineer. The contractor shall plan & execute the works with proper interfacing with other contractors.

(v) NOC & Approval of schemes of Diversion of Utilities from the concerned regulatory / statutory / Local Authority is the responsibility of the Contractor.

(vi) The contractor shall attend regular coordination meetings convened by the employer/engineer for interface and adhere to the decisions taken in the meeting.

(vii) Access will be provided to the staff of the other Contractor appointed by the employer for carrying out their works and bringing materials and equipments at the site. However, the security of materials and Equipments brought at the site will be the responsibility of the respective Contractors.

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

2.2.1.2 Interface with E&M Works and Finishing Works

E & M works and finishing work of station are to be executed by a separate E & M and Finishing contractors. The Civil Contractor shall ensure efficient Interface and Coordination with E & M Contractor concerning Electrical, Fire Fighting, and Hydraulics works & finishing works etc. on site.

Such coordination responsibility of the contractor shall include the following:

i. To obtain from the E & M Contractor information reasonably required to meet the construction target dates.

ii. The Civil Contractor will be the coordinating entity and play major role in the interface with E & M Contractor.

iii. E & M Contractor will make sure that he provides the updated valid documents, for the reference of the Civil Contractor in time, where E & M Contractor requires the Civil Contractor to execute work as his requirements. These documents will be the reference documents for the Interface Management being carried out by the Civil Contactor.

iv. Where the execution by Civil Contractor depends upon the Site management or information to be given by the E & M Contractor. The E & M Contractor shall provide correct and accurate information in time so as to enable them to meet their respective programs.

v. It is to be ensured that all provisions for access and delivery of plant is coordinated with and reflected in the coordinated drawings for Delivery schedule. The E & M Contractor shall also ensure that all plants and equipments are delivered at mutually agreed time to allow openings to be left in the structure for such delivery in accordance with the Civil Contractor's Programme.

vi. E & M Contractor will ensure that the production of Working Drawings for Services to be provided in the base slab, other slabs, viaducts and structures such as earth mats, electrodes, provision of conduiting, cable support, brackets,

cable trays / cable ladders, cable routing, fixture mounting, DB mounting, lighting protection, piping, fire fighting system and other works included in E & M tender is carried out in time and approval obtained from the Employers Representative. Civil Contractor shall obtain Copy of Drawings along with schedule for execution of such works including information required for any concreting/other works where electrical works is involved.

vii. The Civil Contractor shall conduct regular meetings with the E & M Contractor, finishing contractor and other system contractor as necessary to clarify particular aspects of the interfacing requirements of the works. He will also attend regular coordination meetings convened by the Employer / Engineer for Interface.

viii. The E & M Contractor & other contractors shall ensure that the presence of his qualified and experienced engineer (Chief – Co - coordinator) during Civil construction of the station to enable proper interface with Civil Contractor so as to ensure smooth completion of works.

ix. Access will be provided to the staff of the E & M Contractor for carrying out their works and bringing materials and equipments at the site. However, the security of a materials and Equipments brought at the site will be responsibility of the E & M Contractor.

x. Construction of Plant rooms, Ancillary building, Cable duct, sumps for seepage and sewage, provision of slope in slabs as per drainage requirements, ceiling fan hooks shall be the responsibility of the Civil Contractor. Civil Contractor shall interface with E & M Contractor / other contractors regarding this.

xi. Civil Contractor shall interface with E&M Contractor & finishing contractor regarding cutouts to be made in structures for routing E&M services. The Civil Contractor shall provide these cutouts.

2.2.1.3 Interface with Elevator/escalator contractor

i. Providing Shaft structure

ii. Providing lifting beams at the top of shafts and sumps in pits

iii. Providing Head room structure

iv. Providing lifting hooks at the top of lift shafts and escalator as required.

v. Providing Intermediate support structures for escalators

2.2.1.4 Interface with Traction Power Supply Contractor

Civil Contractor shall construct appropriate passages/ trenches, ducts, cable shaft and also keep provision of crossing of various cables in the station along with walls, central column, under the platform in interface with Power Supply Contractor.

i. Civil Contractor shall coordinate with Power Supply Contractor in order to maintain specific Static and Dynamic clearances.

ii. Providing earthing arrangements in viaduct / U Girders, I-Girder, Pier, Pier caps, railing, Pile, Pile cap etc.

iii. Providing Anchors/ U shape bolts for OHE mast on viaduct.

iv. Cable support arrangement for carrying power and control cables on viaduct.

v. Providing opening in viaduct structure for passing cables etc.

vi. Connection of BEC, OPC, ITL etc as necessary to earth plate on parapet, girder, segment, piers etc to hand rail for earthing.

vii. Provision of canopy earthing.

viii. Providing OHE mast/anchors on external parapet at stations.

ix. Providing electrical and mechanical clearances for OHE.

x. Providing earthing connections.

xi. Auxiliary Substations/ASS Rooms.

xii. Providing of opening/ Cut-out in Platform slabs etc for cable entry and cable exit.

2.2.1.5 In addition to above, the Interface management Document as per **Appendix-2D** of Employer's Requirement shall also be complied.

2.2.2 TRAFFIC MANAGEMENT

The Contractor shall make the detailed traffic diversion plans in consultation with Noida & Greater Noida Authorities and traffic police department. The work is to be executed with proper liasioning with traffic police. Necessary assistance will be given by NMRC. The scheme should be such that minimum one lane for traffic on each direction of the road should be available for the smooth flow of traffic. The Contractor should inspect the site.

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

2.3 STRUCTURES

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

2.4 DESIGN CRITERIA

Design criteria shall be as per Outline Design Specification (ODS).

Results of the sub surface investigations conducted at the project site are enclosed with

the tender document. The information about the soil and sub soil water conditions is being made available to the contractor in good faith and the contractor is advised to obtain results independently as may be considered necessary by him before quoting rates in the tender & condition given in DBR will prevail in case of difference in results of two reports.

No claims whatsoever on account of any discrepancy between the sub surface conditions that may be actually encountered at the time of execution of work and those given in these tender documents shall be admissible to the contractor under any circumstances whatsoever.

2.5 REFERENCE TO THE STANDARD CODES OF PRACTICE

2.5.1. All Standards, Outline Construction Specification (OCS) and Codes of practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Indian Standard Codes of practice, IRS, BS, ASTM, IRC & IS Codes as applicable in hard and soft copies.

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

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

(i) Provision in NIT,

(ii) Outline Design Specifications (ODS) / Outline Construction Specifications (OCS),

(iii) MORTH Specification for road & Bridges,

(iv) CPWD specifications,

(v) Standard Codes of Practice

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

2.6 DIMENSIONS

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

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

2.7 ASSOCIATED WORKS

Works to be performed shall also include all general works, preparatory works for the construction and works of any kind necessary for the design and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and outline construction specification (OCS), to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance

by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the erection of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion

2.8 CONSTRUCTION / CASTING YARD & DUMPING AREA

For casting yard, batching plant and other activities a plot of land of approx. 60,000 Sq. m. (approx..) will be made available by NMRC on as is where is basis within 45 Km from the work site free of cost as the precast member of viaduct and stations are large in number. This land shall be made good for such offsite activities as needed by the Contractor at no extra cost to the employer. The land shall be cleared from debris, all structures made by the contractor including, RCC footings and rafts etc. and reinstated to the line, level and to the same conditions as existed before the work started before handing over back to the Employer within 60 days after Taking over Certificate. The final bill shall be released to the contractor after all structures from the construction depot are removed & clearance of site. The cost of setting of yard & reinstatement is included in lump sum price in schedule 'A'.

A mechanical tyre washing plant shall have to be installed by the contractor for the vehicles leaving the depot to avoid the spillage on the connecting roads.

C&D Waste generated from construction depot, viaduct, station during construction to be transported to NMRC/any other processing plant only within 45 km lead from the site and cost of the same is also included in lump sum cost of schedule A.

2.9 TIME SCHEDULE & MONITORING OF PROGRESS

(i) The agency shall submit with the tender "Time Schedule" for completion of various portions of works. This schedule is to be within the overall completion period of 36 Months. The detailed programme in the form of a quantified bar chart or CPM network shall include all activities starting from design to completion.

(ii) In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for coordinating and completing the design, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors, the review procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or license is required prior to the execution of any work.

(iii) The Contractor shall submit to the Engineer Four copies of a Monthly Progress Report (MPR), describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme. Videography by drone shall also be done at all work places every one month as per outline construction specification (OCS). All construction locations including casting yard to be monitored through CCTV and also be linked with GM/Projects' office.

(iv) The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from twenty sixth day of the last month and up to twenty fifth day of the current month.

(v) A monthly / biweekly / weekly meeting to monitor the progress of the project shall be convened by the Engineer, Contractor's site agent and site agent of all interfacing contractors shall attend the meeting. The Employer may also be present in the meeting.

2.10 SCOPE OF WORK UNDER BOQ ITEMS (SCHEDULE- 'B' & 'C')

(i) Tree cutting and (or) transplantation along the alignment after getting permission from forest department/nodal agency.

(ii) Barricading along the Stations directed by Engineer, shall be provided & maintained with barricading as per the drawing provided in the tender drawing. Traffic barricade with blinker, reflective tapes and other necessary signage's shall be provided wherever required as per detailed plan.

(iii) Construction of foundation structures, all station building, additional floors within station premises, Ground, Concourse, Platform, Property development, entry/exit structures, FOB, corridor, ancillary building i.e. Underground/surface water tank, Pump room & DG room, Lift shafts, escalator pits, staircases as shown in tender drawings.

(iv) Construction of all structural works of stations including ground supported/grade slab RCC Screed slab, screed, Mullions (to support brick/block work as shown in arch dwgs), Stub columns, lintel beams, Band beams, Plinth beams, toe wall, gutters and other miscellaneous structures at all levels.

(v) Construction of Lift shafts and escalators pits and other fixtures in stations in coordination with respective system contractors including water proofing of lift pits and escalator pits as per specifications and as per tender drawing.

(vi) Providing and fixing of façade with insert plate & bolting arrangement in the station building.

(vii) Bore wells 2 nos. (capacity 24000 lph) with submersible pumps of required capacity, cables, starter and necessary connection in main panel at each station and connection with suitable dia. of G.I. Line from bore wells to the underground water tanks as approved by Engineer.

(viii) Water proofing in the underground structures, water tanks & overhead terrace tank with injection grouting & water proofing plaster along with ceramic tiles. Providing and fixing of MS Manhole duly painted covers along with necessary locking arrangement in water tanks at all stations.

(ix) Earth filling with compaction with good earth wherever required. For the area falling on the road, backfilling shall be done with sand as per outline construction specification.

(x) Foundations for the system equipment (water supply pumps, firefighting pumps, DG, Panels) in co-ordination with various service/ system contractors/ finishing contractors engaged by NMRC.

(xi) Construction of ground water recharging /Rain water harvesting systems two nos. at each station to cater all the station as per guidelines of Central Ground Water Authority for rain water harvesting. The general arrangement of Rain water harvesting system (minimum size) is shown in the Tender drawing, However, the size of RWH pit & depth of bore may increase as per the guidelines of Central Ground Water Authority, the design shall be submitted to NMRC for approval before execution.

(xii) Crash barriers for track supporting piers.

(xiii) Inserts / dowels for track plinth (Track plinth in not in the scope of this work) as per drawing.

(xiv) Earthling arrangement for station & ancillary building as per requirement of system contractor.

(xv) Construction of Man holes, Sumps, drain, buttle flanges, sleeves as required for automation-based water supply scheme in Ancillary Building for E&M works & finishing works in coordination with E&M & finishing contractors.

(xvi) Any horticulture, landscaping, green area etc. damaged by contractor during currency of contract for Station work shall be restored back to its original condition.

(xvii) Architectural finishing works such as Flooring, Cladding, External Facade, Painting, SS work, MS work, False ceiling, Aluminium, Fire doors, metal doors, Glass work, Glazing works, Counters, Toilet cubicles, Waterproofing, GRC, site development works, Plumbing, Drainage, sanitary works, etc.

(xviii) Fabrication, Supply, Erection & Testing of Pre-Engineered Building (PEB) Structures and Roof sheeting work over PEB structures including Entry/Exit structures. The credentials of specialized agency having experience of similar works shall be submitted well in advance to NMRC for approval.

(xix) Construction of connecting structures between Station building and Entry/exit structures including the supporting prefabricated structure and roofing system.

(xx) The works as mentioned in the Employer's Requirement, Outline Design Specifications (Design Criteria), Outline Construction Specifications for Civil Works & Technical Specification for Architectural & Finishes Works, manufacturer's specifications and other tender documents are inclusive in the quoted price unless otherwise specified. Nothing extra shall be payable on this account.

(xxi) The rates are inclusive of all cost such as for Plants, Equipment, tools, all types of labour, Tools, Plants & machineries, supervision, all materials from the source of supplies as approved by Engineer/Employer including wastage of material, all lead and lifts, transportation, all temporary works, erection, maintenance, contractors profits & establishment/overheads together with preparation of designs, proof check by third party designer for temporary structures/Cranes/Gantry, etc., architectural drawings, shop drawings, As-built drawings, CRD drawings etc., all works covered under Employer's Requirement, all general risks, taxes, royalties, duties, cess, octroi and other levies, insurance liabilities including compliance of General Condition of Contract, Special Condition of Contract, conditions of contract on Safety & Health and Environment, Outline Design Specifications (Design Criteria), Outline Construction Specifications for Civil Works & Technical Specification for Architectural Finishes Works and all other obligations set out or implied in the contract for completion of work except otherwise specified in Bill of Quantities. Only Finished work/ product shall be measured for payment. Nothing extra shall be payable on this account.

(xxii) The rates are also inclusive of material sample and testing from external NABL accredited Testing Laboratories to be conducted as per Outline Design Specifications (Design Criteria), Outline Construction Specifications for Civil Works, Technical Specification for Architectural Finishes Works, relevant codes and as per the details / frequency given in the approved Inspection Test Plan (ITP) of Quality Assurance Plan (QAP).

(xxiii) In case of difference in item given in BOQ and as shown in drawings, the contractor shall

bring it to the notice of the Engineer & work shall be done only as per written instructions

(xxiv) Any other Station, FOB & Entry & Exit related works shall be executed as per site requirement and as per the direction of Engineer In-charge.

(xxv) Utility identification at foundation locations will be done by the contractor and in case utility (ies) is encountered or obligatory requirement is to be met out; the contractor shall modify the span configuration at such location out of the standard span's configurations provided in the tender drawing to save the utility(ies) or to meet obligatory requirements within the accepted price. However, if neither the utility(ies) can be diverted/shifted nor the pier location be altered then the substructure will be designed by accommodating the utility(ies) and the extra cost incurred on this account shall be paid. This difference shall be calculated by working out the difference between the cost of actual substructure work executed vis-a-vis the assessed cost of substructure that would have been constructed at this location as per tender requirements and conditions. Shifting of utility(ies) would be done only in exceptional cases where in the opinion of the Engineer no other option is available. Cost of such utility shifting except RCC drain will be paid separately under relevant item of BOQ. No claim on account of delay in execution of utility diversion will be entertained. All temporary diversion of any utilities done to facilitate the construction activity shall be the part of the lump sum quoted price. RCC drain will be encountered at most of the places which will be restored back with similar specification after casting of pile cap & cost of the same is included in lump sum quoted price. No payment shall however be made for supporting the utilities, carriage of excavated earth during execution of work.

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

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

(b) Till rectification of the damaged trunk sewers, the Contractor shall arrange alternate arrangement for sewer pumping and its disposal as per directions of Engineer or Utility owning agency at his own cost. The similar arrangement is done for other utilities also.

(c) The manholes of Trunk/Sewers should not be covered under the foundation as these may create hindrances to the annual de-silting/cleaning of sewer lines.

(d) Sufficient distance of foundation from outer edge of Trunk / Sewers is to be kept in view of further maintenance/Safety of Trunk /Sewers.

(e) The covers of manholes be saved from heavy machinery movement to avoid any accident/Slippage of malba in manholes etc into the Trunk /Sewers lines which may cause blockage of lines. In case of damage of manhole cover & frame the same shall be replaced immediately by the Contractor at his own cost with similar specifications.

(f) Manholes of the trunk sewer should be kept freely accessible for cleaning and removal of blockages and malba should not be dumped over these manholes.

(g) Branch sewer connections which are connected with the trunk sewers should also be taken care of. If the same are damaged, the same should be restored immediately on priority.

(h) NOC & Approval of schemes of Diversion of Utilities from the concerned regulatory / statutory / Local Authority is the responsibility of the Contractor and nothing extra is payable on this account.

These are only indicative for one of the utilities. Similarly, necessary precautions which are specified from time to time by the utility owning agencies shall also be ensured.

Contractor should make his own survey for identification of underground/above ground utilities.

3. INSPECTION

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

4. ALIGNMENT OF TRACKWAYS

(i) The alignment shall be as shown in the tender drawings. The alignment has been developed by the Employer to meet operational and technical criteria. The Contractor is not required to evaluate the alignment for compliance with these criteria, but shall review it with respect to his own design and construction proposals and shall satisfy himself that there is no conflict with existing structures which are to be preserved.

(ii) The Contractor is permitted to propose minor deviations in alignment to suit his construction proposals, but he must demonstrate that any such deviations shall comply with good design practice and the alignment requirement of the Design Criteria. Such deviations shall require prior approval of the Employer subject to following conditions: -

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

5. CLEARANCES

(i) The Permanent Works shall not infringe the Structure Gauge as shown on the drawings. Extra clearance shall be provided on curved alignment as per the Schedule of Dimensions.

(ii) The Permanent Works shall provide for the installation by the Designated Contractors of operating equipment for the railway and without infringement of the Structure Gauge.

(iii) Railway clearances:

Various clearances shall be provided as per the Schedule of Dimensions (SOD) approved for the Noida- Greater Noida Metro Rail Corridor (Aqua Line).

(iv) Construction limits:

(a) The limits of land for the Works are shown on the Worksite Drawings. The Contractor shall design the Works to be contained totally within these limits, respecting the regulations concerning construction and property boundaries of the local authorities such as Noida / Greater Noida Authorities, DMIC-IITGNL, Irrigation Department, Forest Department, DMRC etc. In the event that the Contractor, having used its best endeavours, is unable to design the permanent works and utilities to be contained totally within these limits, then the Employer

will obtain the necessary additional land or the Contractor may be required to redesign the structure as instructed by Engineer

(b) The limits of land as shown in the right of way survey drawings may undergo changes after final survey and the Contractor shall make any adjustments necessary to the design to acknowledge the change to the limits as then defined.

6. DESIGN LIFE

The design life of all the Permanent Works shall be 100 Years.

7. DURABILITY AND MAINTENANCE

(i) The Permanent Works shall be designed and constructed such that, if maintained reasonably and in accordance with the Contractor's statement of maintainability contained in the Contract, they shall endure in a serviceable condition throughout their minimum lives

(ii) The Permanent Works shall be designed and constructed so as to minimise the cost of maintenance whilst not compromising the performance characteristics and ride quality of the railway.

(iii) Restoration of roads, utilities and other services dislocated during construction.

(iv) Survey, Instrumentation, ground treatment, ground and building monitoring, risk analysis, settlement prediction, preventive and corrective actions.

(v) Traffic management along the worksite including works connected with traffic management.

(vi) Reinstatement of services (such as signalling system, bus stand, footpath including kerb stone, boundary wall, horticulture work and any other work to bring the site to original position) within barricading area as per similar specifications with new materials (except electrical/signal post which may be reused).

(vii) The contractor shall be responsible for obtaining relevant certificates or clearance from local civic authorities viz. completion certificate, fire clearance etc.

(viii) The contractor shall be responsible for obtaining approval by all relevant civic authorities having jurisdictional authority wherever required.

8. OPERATIONAL REQUIREMENTS

(i) The Permanent Works shall be designed to permit the railway to operate satisfactorily at a maximum design speed of 95 km/hr where applicable.

(ii) The vertical and horizontal alignments for the main line track work shall comply with the conditions laid in para 4 (i) & 4(ii) of this document.

(iii) Particular attention shall be paid to locations where flooding could enter the station or underground structures or otherwise damage the railway. In particular,

a) Construction of surface water drainage systems including plinths and ducts shall be avoided in the vicinity of traction substations to obviate any risk of flooding of electrical equipment areas.

(iv) Entrances and all other points of access to the stations shall be adequately protected against flooding. During construction the contractor shall be responsible for providing and maintaining adequate flood protection to ensure protection of the works.

(v) In the design and construction of the Works, the Contractor shall, as a fundamental objective and as a priority, ensure that passengers, staff and the public will, throughout the operational period of the Aqua line (N-GN Metro Corridor), and within the confines thereof, be provided with safe environment as is reasonably possible. The Contractor's attention is drawn to Clause 13 of this Employer's Requirements - Functional, concerning the role of the Commissioner of Metro Railway Safety.

(vi) The design of the works shall be such that the Forecast Passenger Flows can be met without congestion occurring and without risk to the safety of passengers or railway employees including during any emergencies. Exits and passages, in particular, should be suitably designed and provided. Unless otherwise stated, design of the Works shall be based on the 100K Passenger Forecast.

(vii) Escalator pits shall be designed to enable drainage by gravity flow system. However, where length of the drainage is exceptionally long, the pumping system may be considered subject to approval of Employer. Installation of pumps is not in the scope of this contract.

9. FUNCTIONAL REQUIREMENTS OF PUMPING INSTALLATIONS

(i) Water pump installations shall be designed for unmanned operation, controlled through liquid level controllers, capable of pumping the requisite amount of water to the utility or to the ground / over head tanks.

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

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

10. ENVIRONMENTAL CONSIDERATIONS

All provisions and conditions contained in the conditions of contract on Safety & Health and Environment, shall be strictly complied with.

11. URBAN PLANNING FUNCTIONAL REQUIREMENTS

(i) The Station Site Plans are based on the urban planning design carried out by the Employer and specific land acquisition plans have been submitted to the concerned govt. authority and to the concerned land-owning agencies of Noida and Greater Noida Authorities, for approval. The land acquisition initiated to date is therefore based on the entrance, ventilation shafts, ancillary buildings and redevelopment of the site areas as shown on the site plans. The Contractor must therefore, if revising the tender drawings for any reason, develop his layouts to suit the available land provided for the metro works.

(ii) Requests for temporary power supplies for the construction of the works must be submitted by the contractor to the concerned authorities. Alternatively, separate power supplies may be arranged by the Contractor independent of concerned electricity distribution/transmission authority subject to compliance with all necessary statutes.

(iii) In addition, a number of agencies are involved in the reinstatement works, permanent road accesses, temporary road accesses, refuse collection accesses, street lighting, traffic management and fire hydrant positions. The Contractor is responsible for obtaining the approvals for these other works.

(iv) The Contractor is responsible for obtaining the approval of applications from the above authorities for the design and construction of works. The Employer may provide assistance in order to obtain any permission on clearances.

12. TRAFFIC MANAGEMENT

The Contractor shall carry out the Works so as to minimise disruption to road and pedestrian traffic. The Contractor shall prepare his traffic management plan based on his proposed construction methodology in co-ordination with Engineer and in consultation with Traffic Police Department and Noida & Greater Noida Authorities. He shall comply strictly with the approved plan during construction of his works. The design shall provide for temporary road decking's wherever necessary to provide minimum no. of traffic lanes as agreed with UP Traffic Police. Necessary approval from Traffic Police shall be arranged by contractor without any extra cost.

13. MISCELLANEOUS

The Contractor shall note that the Commissioner for Metro Railway Safety (CMRS) will inspect the Works from time to time for the purpose of determining whether the Metro Corridor Project complies in terms of operational and infra structural safety in accordance with the Laws of India. The contractor shall note that CMRS approval is mandatory for commissioning the system. Notwithstanding other provisions of the Contract, the Contractor shall ensure that the Works comply with the requirements CMRS in terms of construction to the drawings, and shall make all necessary arrangements and assist the representatives of O&M of NMRC and CMRS in carrying out their inspection duties and also comply with their instructions regarding rectifying any defects and making good any deficiencies. Contractor shall prepare and make available all drawings, documents, sketches, photographs etc. as required for submission of application for inspection of CMRS as instructed by the engineer.

14. STANDARDS

(i) Equipment, materials and systems shall be designed, manufactured and tested in accordance with the latest issue of International and/or National codes and standards. The Contractor shall submit hard copies in original to the Engineer of all codes and standards used for the work.

(ii) Reference to standards or to materials and equipment of a particular manufacturer shall be regarded as followed by the words "or equivalent". The Contractor may propose alternative standard materials, or equipment that shall be equal to or better than those specified. If the Contractor for any reason proposes alternatives to or deviations from the specified standards, or desires to use materials or equipment not covered by the specified standards, the Contractor shall apply for the consent of the Engineer. The Contractor shall state the exact nature of the change, the reason for making the change and relevant specifications of the materials and equipment in the English language. The decision of the Engineer in the matter of quality will be final.

NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

CONTRACT NO: NGNECC-01

Part Design & Construction of Elevated Viaduct and 10 nos. of Elevated Stations for Extension Projects of NMRC's Aqua Line from Botanical Garden to Noida Sec-142 (from Chainage (-) 383.959 to 12130.143) and from Depot Station to Boraki MMTH (Chainage 28678.253 to 31263.482).

E Tender No.: NMRC/Projects/NGNECC/2026/457

TENDER DOCUMENTS

VOLUME 3

C. EMPLOYER'S REQUIREMENTS – DESIGN

Noida Metro Rail Corporation (NMRC) Limited

Block-III, 3rdFloor, Ganga Shopping Complex, Sector-29, Noida - 201301, District Gautam Budh Nagar, Uttar Pradesh, India

CONTENTS

EMPLOYER'S REQUIREMENTS - DESIGN

1. INTRODUCTION

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

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

(iii) The Contractor shall engage the Designer(s) with prior approval of NMRC who shall undertake and prepare the design of the Permanent Works and Temporary Works. The Contractor shall establish an office for his core design team at the Site in Noida. The core design team shall function from this office and all meetings and discussions relating to design shall be held in this office.

a. The Designer i.e. Details Design Consultant (DDC) for structural designs shall be engaged by the contractor subject to having executed at least one similar work as defined in clause no.1.1.3.2A of NIT. The team leader of structural engineers should have minimum 15 years' relevant experience of designing viaduct structures. All documentation pertaining to the DDC having the relevant experience shall be submitted to NMRC for approval prior to engagement. The work is to be designed, constructed and maintained as per relevant codes, Outline Design Specifications (ODS), Outline Construction Specifications (OCS), Special Specifications and drawings and/or as directed by the Engineer.

b. The design of the temporary works shall be undertaken by a designer who has experience in the design of temporary works. A third party (it can be contractor's DDC if they have relevant experience and have not designed the temporary works) shall be engaged by the contractor with prior approval of Engineer for checking of the design of all temporary works.

c. The contractor shall, prior to commencing the construction of the Temporary Works, submit a certificate to the Engineer signed by him and endorsed by its DDC certifying that the Temporary works have been properly and safely designed and checked and that the Contractor has checked the effect of the temporary works on the Permanent works and has found this to be satisfactory.

d. The Designer will do regular inspection of the works to confirm that construction complies with the intent of the design.

e. During execution of work, if at any stage the performance of Designer(s) is not found satisfactory, the contractor shall change the Designer(s) with prior permission of Engineer.

(iv) The Contractor shall ensure that the Designer continues to be represented in Noida at all times by staff whose seniority and experience are to the satisfaction of the Engineer and whose representative is available on the Site as necessary or as required by the Engineer.

(v) The Contractor shall submit his Quality Assurance Plan as required at **Appendix 6** for the design required by the Contract.

(vi) The Contractor shall furnish Designer's Warranty in the format approved by the Employer.

2. REQUIREMENTS DURING DESIGN PHASE

(i) The principal requirements of the Design Phase are the production of the Preliminary Design, the Definitive Design and the Construction Reference Drawings.

(ii) Preliminary Design

The Preliminary Design shall incorporate the Contractor's tender design developed to sufficiently define the main structural elements. In addition, general construction methods and documentation needed to develop the Definitive Design shall be submitted.

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

(a) Calculation and analysis are complete;

(b) All main and all other significant elements are delineated;

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

(d) Shall take full account of the effect on the Permanent Works of the proposed methods of construction and of the Temporary Works.

(iv) During the preparation of the Definitive Design, the Contractor shall complete all surveys investigations and testing necessary to complete the design of the Permanent Works.

(v) The Contractor shall sub-divide the proposed Definitive Design into Design Packages to be submitted in advance of the Definitive Design Submission and to be identified in the Design Submission Programme. The Design Packages are to relate to the significant and clearly identifiable parts of the proposed Definitive Design and shall address the design requirements as described herein. The Design Packages shall facilitate the review and understanding of the Definitive Design as a whole and shall be produced and submitted in an orderly, sequential and progressive manner.

(vi) Separate Definitive Design Submissions may be prepared for those major elements to be procured by sub-contract and which sub-contracts include design. Where such work is to be procured by the Contractor on the basis of outline design, design briefs and performance specifications, such documents may be submitted as Definitive Design Submissions.

(vii) Upon issue of the Notice in respect of the Definitive Design Submission, the Contractor shall complete the design in all respects and produce the Construction Reference Drawings, the purpose of which is to illustrate all the Permanent Works and to be the drawings governing construction.

(viii) Construction Reference Drawings shall fully detail for the construction of the elements covered by the Definitive Design and shall show in full the works to be constructed.

3. REQUIREMENTS DURING CONSTRUCTION PHASE

(i) The principal requirements relating to design during the Construction Phase are the production of Working Drawings, the preparation of technical submissions as required under the Contract, the compilation of the Final Design & Drawings and the production of the As-Built Drawings.

(ii) Working Drawings (GFC) shall be prepared as required under the Contract. They shall be endorsed by the Contractor as being in accordance with the Construction Reference

Drawings.

(iii) The Contractor shall endorse the submissions required under the contract that "all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of these parts"

(iv) At least 3 months but not more than 6 months prior to the anticipated date of substantial completion of the Works, the Contractor shall submit the Final Design to the Engineer.

(v) The Final Design is the design of the Permanent Works embodied in:

(a) The latest revisions of the documents comprised in the Definitive Design, taking account of comments in the schedules appended to Notices of No Objection

(b) The latest revisions of the Construction Reference Drawings with NOC status along with properly closed comments response sheet;

(c) Editable calculations/formulated spreadsheets, analysis file and final design reports compiling all annexures (see Clause 11 herein); and

(d) Such other documents as may be submitted by the Contractor at the request of the Engineer to illustrate and describe the Permanent Works and for which a Notice has been issued.

(e) Working Drawings (GFC) as per point 3(ii) above

(vi) The Contractor shall maintain all records necessary for the preparation of the As-Built Drawings. Upon completion of the Works or at such time as agreed to or required by the Engineer, the Contractor shall prepare drawings which, subject to the Engineer's agreement, shall become the As-Built Drawings. All such drawings shall be endorsed by the Contractor as true records of the construction of the Permanent Works and of all temporary works that are to remain on the site. The Contractor shall also show the locations of utilities exposed, and retained as directed.

4. DESIGN INTERFACES WITH DESIGNATED CONTRACTOR

The Contractor shall co-ordinate all design and installation work with the various Designated Contractors, and establish the Co-ordinated Installation Plan (CIP). The co-ordinated installation Plan (CIP) shall be developed by the contractor in a format acceptable to the Engineer. The Contractor shall co-ordinate with all interfacing Designated Contractors to produce a detailed programme of access dates, equipment delivery routes and occupation periods for each room and area inside the station envelope. The CIP shall be signed off by each Designated Contractor and Submitted to the Engineer not later than 3 (Three) months before basic structure is completed as described in **Appendix 2B**.

5 DESIGN SUBMISSIONS

5.1 PRELIMINARY DESIGN SUBMISSION

5.1.1 GENERAL

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

(a) the quality assurance plan for design

(b) a review of the outline design criteria/specification

(c) the submission of design manuals

(d) the submission of proposed software

(e) the preliminary equipment layouts and details

(f) the preliminary maintenance analysis

(g) the preliminary off site testing recommendation

(h) Deleted

(i) the submission of specifications proposed for the work

(j) the identification of design codes and standards

(k) the CAD procedures

(l) Deleted

(m) preliminary viaduct sizing

(n) an alignment review

(o) the preliminary construction methodology

(p) the design submission programme (update)

(q) the utility diversion plan

(r) proposed site surveys and other field surveys

(s) a review of permanent land requirement

(t) the preliminary ground treatment and building protection proposal.

(u) The preliminary reinstatement drawings.

5.2 DEFINITIVE DESIGN SUBMISSION

5.2.1 GENERAL

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

(a) the dimensions of all major features, structural elements and members;

(b) all materials;

(c) Potential forces and movements due to all possible loadings and actions on the structures, and their accommodation;

(d) all second order effects;

(e) the layout and typical details of reinforcement in structural concrete members;

(f) the locations and nature of all relevant joints and connections and details thereof;

(g) standard details;

(h) location, geometry and setting-out of all main elements and features;

(i) electrical and mechanical services and equipment and their interaction with the structures;

(j) Provisions and proposals for construction interfacing with the Designated Contractors;

(k) Utilities to be diverted /supported;

(l) Predictions of effect on structures due to ground movements and the proposed protective measures to limit the effects to a degree not exceeding the limit as defined in Outline design specification

(m) Traffic or other civic service affected.

(n) Prediction of lowering of water table and its effect on (m)& (n) above.

(o) Erection and Launching arrangement of Precast elements

5.2.2 DRAWINGS

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

(i) general arrangements;

(ii) Deleted

(iii) layouts and details of structural elements;

(iv) associated fittings;

(v) slopes and earthworks;

(vi) structural and surface drainage;

(vii) Deleted

(viii) Deleted

(ix) Deleted

(x) Deleted

(xi) Deleted

(xii) Existing and proposed utilities;

(xiii) Road works and works related to traffic management including decking.

(xiv) Deleted

(xv) Deleted

(xvi) Deleted

5.2.3 CONTRACT SPECIFICATION

The Specification included in the Contractor's Technical Proposals together with the Outline Design Specification and Outline Construction Specifications shall be amplified so as to specify comprehensively the design and construction of the Permanent Works. The format of the Contract Specification shall be the Three-Part Format of the Construction Specification Institute (CSI) of America.

(i) DESIGN MANUAL

The Design Manual shall incorporate all design requirements, standards, codes, loading cases, permissible movements and deflections, limit states, design stresses and strains, material properties and all other documents or matters which are relevant to and govern the design. The Design Manual shall refer to all materials, codes and standards used, making clear their specific applications. The Design Manual shall be produced so that it can be used

by those involved in the preparation or review of the design of the Permanent Works as a comprehensive reference text and efficient working document.

(ii) INTERFACE REPORT ON DESIGNATED CONTRACTS

This will include the following:

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

(iii) TESTING AND COMMISSIONING REPORT

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

(iv) MAINTENANCE REPORT

A report updating the Statement of Maintainability in the Contractor's Technical Proposals and detailing maintenance routines necessary for the achievement of the required lives of the various elements of the Works.

5.2.4 SUPPORTING DOCUMENTS

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

(i) GEOTECHNICAL/GEOPHYSICAL INTERPRETATIVE REPORT

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

(ii) SURVEY REPORT

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

(iii) UTILITIES REPORT

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

(iv) TEMPORARY WORKS DESIGN REPORT

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

(v) CONSTRUCTION / INSTALLATION ANALYSIS REPORT

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

(vi) CONSTRUCTION METHOD STATEMENT

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

(vii) PROJECT SCHEDULE REVIEW

(a) The Contractor shall, prior to submitting the Definitive Design Submission, review the Project Schedule against the current version of the Design Submission Programme.

(b) In the event that the Contractor considers that there are any discrepancies or inconsistencies between the Design Submission Programme and the Project Schedule, the Contractor shall submit with the Definitive Design Submission its proposed revisions to the Project Schedule such that the discrepancies or inconsistencies are removed.

(c) The Contractor shall provide details of submissions of the proposed Working Drawings and their anticipated timing during the Construction Phase and shall identify information required from or actions to be undertaken by the Employer or others which are necessary to permit the completion of the design of the Permanent Works and the Working Drawings. Desired Dates for the receipt required by the Contractor of such information or for the completion of such actions shall be included with appropriate justification.

(vii) REPORT ON THE USE OF WORKS AREAS

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

5.2.5 NOTICES ON DEFINITIVE DESIGN SUBMISSION

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

(a) The temporary works for construction of the viaduct & station works.

(b) All works related to the viaduct,

(c) Major elements as identified under Clause 2(vi) herein.

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

6. DESIGN SUBMISSIONS - CONSTRUCTION REFERENCE DRAWINGS SUBMISSIONS

(i) The Construction Reference Drawings shall be derived directly from the Definitive Design and shall detail and illustrate in full the Permanent Works. The Construction Reference Drawings shall form part of the Working Drawings to be used for construction purposes.

(ii) Prior to any Construction Reference Drawings Submission, the Contractor shall prepare a full list of Construction Reference Drawings in order to demonstrate, to the satisfaction of the Engineer, that such Construction Reference Drawings will be sufficient in extent to cover the construction of the whole of the Permanent Works.

(iii) Unless otherwise required by the Engineer, the Construction Reference Drawings need not include bar bending schedules, bar reference drawings, fabrication or shop drawings as well as other schedules or erection drawings which are to be provided by the Contractor during the Construction Phase.

7. DESIGN SUBMISSIONS - CONSTRUCTION PHASE

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

(ii) Prior to submission of the proposed Working Drawings, the Contractor shall endorse the appropriate original paper drawings as "Good for Construction". If the Engineer so requires, the endorsed original shall be submitted to the Engineer who shall, if he has no objection to the contents of the submission, further endorse the original by stating that he has no objection to the proposed Working Drawings. On the endorsement by the Engineer, the original will forthwith be returned to the Contractor as the Working Drawings.

(iii) Only the Working Drawings (GFC) endorsed as in 7(ii) above or those that the Engineer has expressly stated as not requiring his endorsement shall be issued to the Site. The Construction of the Works shall be strictly in accordance with these Working Drawings.

(iv) The Contractor shall finalise details of the proposed method of construction and submit such finalised details to the Engineer for review. The proposed method shall have no adverse effects on the partially completed Permanent Works and shall ensure the Works are statically and, if appropriate, aerodynamically stable.

(v) The Contractor shall undertake and submit a stage-by-stage construction sequence and the effect of any Temporary Works and the Contractor's Equipment on the Permanent Works. This analysis shall be in sufficient detail to demonstrate that the Contractor's proposals are safe and have no adverse effects upon any parts of the Permanent Works.

(vi) As-Built Drawings, endorsed by the Contractor shall be submitted to the Engineer for agreement in accordance with **Clause 5.6** of the GCC.

8. DESIGN SUBMISSIONS - REVIEW PROCEDURES

(i) Submissions of Design Data shall be made available for reviewed by the Engineer. The form and detail of the review shall be as determined by the Engineer and will not release or remove the contractor's responsibility for the design under the contract.

(ii) The issue of a Notice shall be without prejudice to the issue of any future Notices.

(iii) The Contractor shall, prior to the submission of the Design Data, obtain all required and/or statutory approvals that relate to that submission including, where appropriate, the approval of the Concerned Government Authorities and utility undertakings, and demonstrate that all required approvals have been obtained.

(iv) 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.

9. DESIGN SUBMISSION PROGRAMME

(i) The Contractor shall prepare the Design Submission Programme which is to set out fully the Contractor's anticipated programme for the preparation, submission and review of the Design Packages, the Definitive Design Submission and the Construction Reference Drawings Submissions and for the issue of Notices in relation thereto.

(ii) The Design Submission Programme shall:

(a) be consistent with and its principal features integrated into the Works Programme, and show all relevant Key Dates;

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

(c) make adequate allowance for periods of time for review by the Engineer and other review bodies;

(d) make adequate allowance for the design and development of specialist works;

(e) include a schedule identifying, describing, cross-referencing and explaining the Design Packages into which the Contractor intends to divide the Definitive Design and Construction Reference Drawings; and

(f) indicate the Design Interface and Co-ordination periods for each Designated Contractor.

(iii) The Contractor shall submit the Design Submission Programme to the Engineer within thirty (30) days of the date of Notice to Proceed, and thereafter up-dated versions thereof at intervals of not more than one (1) month throughout the Design Phase.

10. PROGRAMME FOR SUBMISSIONS DURING THE CONSTRUCTION PHASE

In accordance with Clause 4 of the Employer's Requirements - General, the Contractor shall identify submissions required during the Construction Phase.

11. CALCULATIONS

(i) Unless otherwise required by the Engineer, calculations relevant to the Definitive Design and Construction Reference Drawings shall be submitted for review with the respective Design Packages or Submissions. The Engineer may require the submission of applicable software including in house software programmes/ editable worksheets (formulated spreadsheets) developed by the Contractor, computer input and programme logic for its review prior to the acceptance of the computer output.

(ii) The Contractor shall prepare and submit a comprehensive set of calculations for the Definitive Design in a form acceptable to the Engineer. Should the design of the Permanent Works be revised thereafter and such revision renders the calculations as submitted obsolete or inaccurate, the Contractor shall prepare and submit the revised calculations

(iii) Similarly, the Contractor shall submit such further calculations as have been prepared in connection with the Construction Reference Drawings.

(iv) Calculations to be included as part of the submission herein shall comprise the up-to-date calculations in respect of the Definitive Design, the Construction Reference Drawings and

such further calculations which the Contractor has prepared during the production of Working Drawings.

(v) The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

(vi) First few pages of every design calculation report will consist the Summary of Inputs and Results of the design intended for (along with quantities worked for each element & item wise separately).

12. DOCUMENTS REQUIREMENTS

(i) Drawings shall be prepared generally to A1 size, but to ISO AO size where appropriate. **Appendix 7** defines the Drawings and CAD Standards required for drawing preparation and submittal.

(ii) The Contractor shall submit 6 copies of his design and/or drawings for review by the Engineer. After receipt of "No Objection" from the Engineer's Representative, the Contractor shall submit 6 copies of design and/or drawing for the use of the Engineer.

(iii) The submission of drawings may be by CAD Media files and **Appendix 7** specifies the drawing submission requirements for CAD Media files.

(iv) The contractor to provide one licensed working software copy being used by its DDC to design department maintained for the entire contract period.

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ATTACHMENT D 1

DESIGN CERTIFICATE

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

(Description of Permanent Works to which the submission refers)

DESIGNER'S STATEMENT:

We certify that:

a) the outline designs, design briefs and performance specifications of those elements of the Permanent works as illustrated and described in the documents scheduled in the attached transmittal, complies with the Codal requirements, Outline Design Specification (ODS) and other contract provisions.

b) an in-house check has been undertaken and completed in accordance to approved Quality Assurance Plan (QAP) to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in the attached transmittal.

c) all necessary and required approval relating to the design of the Permanent Works, as illustrated and described in the documents listed in the attached transmittal, have been obtained.

d) all effects of the design comprising the submission on the design of adjacent or other parts of the works have been fully taken into account in the design of those parts.

Signed by Designer's Authorised Representative

Name : .....

Position : .....

Date : .....

CONTRACTOR'S CERTIFICATE:

The Certifies that all design has been performed utilizing the skill and care to be expected of a professionally qualified and competent designer, experienced in work of similar nature and scope. This further certifies that all works relating to the preparation, review, checking and certification of design has been verified by us and the design proposed by the designer has been accepted by us vide clause 5.2 of GCC.

Signed by Contractor's authorised representative

Name : .....

Position : .....

Date : .....

Note 1

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

(i) the Contractor's Technical Proposals

(ii) the Contractor's Technical Proposals and Design Packages Nos. ..... for which a Notice of No Objection has been issued.

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

(iv) The Definitive Design

SAMPLE DRAWING TEMPLATE

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

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

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

Notice of 'No Objections' from Employer's Representative			
Notice of "No Objections" from Employer is being accorded for design Principles. However, the overall responsibility for the detailing and design accuracy lies with Design and Build Contractor.			
	REMARKS	**Date**	**Signature**
Structure Expert/GC	Reviewed & comments as marked on drawing		
Dy. PD/GC	Reviewed & comments as marked on drawing		
PD/GC	Reviewed & comments as marked on drawing		
AM DESIGN	Reviewed & comments as marked on drawing		
DGM	Reviewed & comments as marked on drawing		
GM	Reviewed & No objection issued with comments as marked on Drawing		

Section C

[Contractor to attach copies of necessary and required approvals]

NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

CONTRACT NO: NGNECC-01

Part Design & Construction of Elevated Viaduct and 10 nos. of Elevated Stations for Extension Projects of NMRC's Aqua Line from Botanical Garden to Noida Sec-142 (from Chainage (-) 383.959 to 12130.143) and from Depot Station to Boraki MMTH (Chainage 28678.253 to 31263.482).

E Tender No.: NMRC/Projects/NGNECC/2026/457

TENDER DOCUMENTS

VOLUME 3

D. EMPLOYER'S REQUIREMENTS – CONSTRUCTION

Noida Metro Rail Corporation (NMRC) Limited

Block-III, 3rdFloor, Ganga Shopping Complex, Sector-29, Noida - 201301, District Gautam Budh Nagar, Uttar Pradesh, India

CONTENTS

EMPLOYER REQUIREMENTS - CONSTRUCTION

1. CONTRACTOR'S SUPERINTENDENCE

(1) The Contractor shall submit a Staff Organisation Plan in accordance with the GCC. This plan shall be updated and resubmitted whenever there are changes to the staff. The plan shall show the management structure and state clearly the duties, responsibilities and authority of each staff member.

(2) The site agent and his associates/supervisors shall have experience and qualification appropriate to the type and magnitude of the Works. Full details shall be submitted of the qualifications and experience of all proposed staff to the Engineer for his approval.

2. CHECKING OF THE CONTRACTOR'S TEMPORARY WORKS DESIGN

The Contractor shall, prior to commencing the construction of the Temporary Works, submit a certificate to the Engineer signed by him certifying that the Temporary Works have been properly and safely designed and checked and that the Contractor has checked the effect of the Temporary Works on the Permanent Works and has found this to be satisfactory. A third party to be engage by the contractor for checking to be carried out for all temporary works.

3. THE SITE

(1) Works Areas are those areas identified in **Appendix 2A** to these Employer's Requirements and on the Drawings.

USE OF THE SITE

(2) The Site or Contractor's Equipment shall not be used by the Contractor for any purpose other than for carrying out the Works in the scope of this contract, except that, with the consent in writing of the Engineer, the Site or Contractor's Equipment such as batching and mixing plants for concrete and bituminous materials may be used for the work in connection with other contracts under the Employer.

(3) Rock crushing plant shall not be used on the Site.

(4) The location and size of each stockpile of materials, including excavated materials, within the Site shall be as permitted by the Engineer. Stockpiles shall be maintained at all times in a stable condition.

(5) Entry to and exit from the Site shall be controlled and shall be only available at the locations for which the Engineer has given his consent.

ACCESS TO THE SITE

(6) The Contractor shall make its own arrangements, subject to the consent of the Engineer, for any further access required to the Site.

(7) In addition, the Contractor shall ensure that access to every portion of the Site is continually available to the Employer and Engineer.

(8) Following the handover of the Railway Envelope, (as defined in the Employer's Requirements- General), to the Employer, the Employer will control the Railway Envelope and will be responsible for all matters relating to security and safety therein. Access to the Railway Envelope by the Contractor shall be in accordance with any procedures, requirements and conditions defined in Employer's Requirements.

(9) The Employer shall grant the Contractor right of access to, and / or possession of, the Site progressively for the completion of Works. Such right and possession may not be exclusive to

the Contractor. The Contractor will draw/modify the schedule for completion of Works according to progressive possession/right of such sites.

(10) The Employer will not provide any machinery or materials under the Contract.

ACCESS TO OUTSIDE THE SITE

(11) The Contractor shall be responsible for ensuring that any access or egress through the Site boundaries are controlled such that no disturbance to residents or damage to public or private property occur as a result of the use of such access or egress by its employees and sub contractors.

SURVEY OF THE SITE

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

BARRICADES AND SIGNBOARDS

(13) The Contractor shall erect barricades as per Tender Drawing and gates around its areas of operations to prevent entry by unauthorised persons to his Works Areas and necessary identity cards /permits should be issued to workers and staff by the contractor. The Contractor shall submit proposal for barricades of the complete perimeter of all works areas to the Engineer. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re-painting of the entire barricades on regular basis. No work shall be commenced in any Works Area until the Engineer has been satisfied that the barricades installed by the Contractor are sufficient to prevent, within reason, unauthorised entry. The cost of all this barricade is included in quoted lumpsum price for Viaduct and Viaduct in Station excluding concourse portion. The existing barricading boards as in where is basis shall be maintained by the contractor which includes fixing of nailing/ nuts & bolts/ rope lights & blinkers and shifting of barricading boards from one location to another at any number of times. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re-painting of the entire barricades on regular basis.

(14) Project signboards shall be erected not more than four (4) weeks, or such other period as the Engineer has given his consent, after the date of commencement of the Works. The types, sizes and locations of project signboards shall be agreed with the Engineer before manufacture and erection. Other advertising signs shall not be erected on the Site.

(15) The consent of the Engineer shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates, blinkers and signs which are to be left in positions after the completion of the Works shall be repaired and repainted as instructed by the Engineer.

(16) Hoardings, barricades, gates, blinkers and signs shall be maintained in clean and good order by the Contractor until the completion of the Works, whether such hoardings, fences, gates, blinkers and signs have been installed by the Contractor or by others and transferred to the Contractor during the period of the Works. All the fencing, hoardings, gates, blinkers and signs etc. shall be mopped minimum one in a week and washed monthly.

(17) All hoardings, barricades, gates and signs installed by the Contractor shall be removed by the Contractor upon the completion of the Works, unless otherwise directed by the Engineer.

(18) Hoarding/ barricades can be reused after removing from one place to other locations / sites provided they are in good condition and approved by Engineer.

(19) Damage/worn-out barricades /hoarding and blinkers shall be replaced by contractor within 24 hours. Engineer 's decision regarding need for replacement shall be final and binding and if no action is taken by contractor, the Engineer may get it repaired through other agency and the cost of any repairs will be deducted by the Engineer from any payment due to the Contractor.

CLEARANCE OF THE SITE

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

4. SURVEY

(1) The Contractor shall relate the construction of the Works to the Site Grid. To facilitate this, survey reference points have been established and the Engineer will provide benchmarks in the vicinity of the Site.

(2) Before the Contractor commences the setting out of the Works, the Engineer will provide a drawing showing the position of each survey reference point and bench mark, together with the co-ordinates and/or level assigned to each point. The Contractor shall satisfy itself that there are no conflicts between the data given and shall establish and provide all subsidiary setting out points, monuments, towers and the like which may be necessary for the proper and accurate setting out and checking of the Works.

(3) The Contractor shall carefully protect all the survey reference points, bench marks, setting out points, monuments, towers and the like from any damages and shall maintain them and promptly repair or replace any points damaged from any causes whatsoever. The Contractor shall regularly recheck the position of all setting out points, bench marks and the like to the satisfaction of the Engineer.

(4) Upon handover to the Contractor, the survey reference points will become the responsibility of the Contractor. The Contractor shall, by annual or more frequent review, ensure that these survey points continue to remain consistent with the bench marks.

5. SAFETY, HEALTH AND ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with in the conditions stipulated in the Conditions of contracts on Safety & Health and Environment. To ensure IGBC Green Mass Rapid System (MRTS)Certification of the stations, the civil contractor shall ensure and provide the data as and when required by the Employer in requisite format.

5.1 Training of Contractor's Employees/Staff/Workers:

Contractor shall provide a training/workshop on Safety, Health & Environment (SHE) to all its workers/staff/employees/subcontractors of at least 2 weeks (96 hrs) at the time of induction. Before postings of any his workers/staff/employees/subcontractors, the contractor shall give a certificate that the said person had undergone the requisite SHE training.

However, the Contractor shall comply with the conditions of contract on Safety, Health &

Environment (SHE).

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

5.2 Use of "Tractor Transmission type" Pick and Carry Hydra crane:

Prohibition on use of vision on use "Tractor Transmission type" Pick and Carry Hydra crane

"Tractor Transmission type" Pick and Carry Hydra crane – 1st Generation model is prohibited at NMRC works. Contractor shall mobilize "Truck Transmission type" pick and carry (Hydra) crane – 2nd Generation model only.

6. OTHER SAFETY MEASURES

Site Safety & Health Plan and Site Environment Plan

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

Fire Regulations and Safety

(2) The Contractor shall provide and maintain all necessary temporary fire protection and fire fighting facilities on the Site during the construction of the Works, and shall comply with all requirements of the UP (Noida, Greater Noida) Fire Services Department. These facilities may include, without limitation, sprinkler systems and fire hose reels in temporary site buildings, raw water storage tanks and portable fire extinguishers suitable for the conditions on the Site and potential hazards.

(3) The Contractor shall submit details of these facilities to the Engineer for review prior to commencement of work on the Site.

(4) If, in the Engineer's opinion, the use of naked lights may cause a fire hazard, the Contractor shall take such additional precautions and provide such additional fire fighting equipment (including breathing apparatus) as the Engineer considers necessary. The term "naked light" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.

(5) Oxyacetylene burning equipment will not be permitted in any confined space. Burning equipment of the oxypropane type shall be used.

Hazard and Risk Assessments:- As per Conditions of Contract on Safety & Health and Environment.

(6) The Contractor shall, prior to the commencement of any operation carry out a detailed hazard and risk assessment. The results of such assessments shall be recorded and the records kept for inspection by the Engineer.

(7) The Contractor shall produce detailed method statements for all medium and high-risk operations and shall submit them to the Engineer for his consent prior to commencement of any task to which they relate.

(8) The Contractor shall produce and implement a Permit to Work system for all high-risk

operations. The Permit to Work system shall be submitted to the Engineer for consent before application.

Explosives

(9) Explosives shall not be used without prior written consent of the Engineer. Before consent to blasting is granted, the Contractor shall prepare a Specification as to the size of charge, the method of firing and any other restrictions that may be imposed from time to time.

(10) Where the Engineer has consented to the use of explosives, the Contractor shall be responsible for obtaining the requisite licences and permits for complying with all statutory requirements for blasting.

(11) The storage, transportation and use of explosives shall at all times be governed by the Explosives Acts and such other statutory regulations which may be applicable and as imposed by the Statutory Authorities.

Launching Girder

(12) No Launching Girder shall be used without the prior written consent of the Engineer.

(13) No Launching of PEB structures shall be done without the prior written consent of the Engineer

(14) The Contractor shall prepare a detailed specification based on specification & drawings as detailed in Outline Construction Specification (OCS) for the operation of Launching Girder and submit it to the Engineer for review.

(15) The Contractor shall prepare a detailed specification based on specification & drawings as detailed in Outline Construction Specifications Civil Works for the operation of Launching of PEB structures and submit it to the Engineer for review.

(16) In case of Launcher, the feeding point shall have to be changed to ensure the key dates & the temporary rails provided for carrying the U-Girder on viaduct shall have to be removed.

Standby Equipments

(17) The Contractor shall provide adequate stand-by equipment to ensure the safety of personnel, the Works and the public. These measures shall include as a minimum the following:

(a) stand-by pumping and generating equipment for the control of water;

(b) stand-by equipment and spares for illumination of the Works; and

(c) Stand-by generating equipment and equipment for the lighting for the works.

Co-operation

(18) The Contractor shall provide full co-operation and assistance in all safety surveillance carried out by the Engineer or the Employer. Any breaches of the Site Safety Plan or the statutory regulations or others disregard for the safety of any persons may be the reason for the Engineer to exercise his authority to require the site agent's removal from the Site.

7. CARE OF THE WORKS

(1) Unless otherwise permitted by the Engineer all work shall be carried out in dry conditions.

(2) The Works, including materials for use in the Works, shall be protected from damage due to water. Water on the Site and water entering the Site shall be promptly removed by temporary drainage or pumping systems or by other methods capable of keeping the Works free of water. Silt and debris shall be removed by traps before the water is discharged and shall be

disposed of at a location or locations to which the Engineer has given his consent.

(3) The discharge points of the temporary systems shall be as per the consent of the Engineer. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant authorities for discharging water to drains, watercourses etc. The relevant work shall not be commenced until the approved arrangements for disposal of the water have been implemented.

(4) The methods used for keeping the Works free of water shall be such that settlement of, or damage to, new and existing structures do not occur.

(5) Measures shall be taken to prevent flotation of new and existing structures.

PROTECTION OF THE WORKS FROM WEATHER

(6) Work shall not be carried out in weather conditions that may adversely affect the Works unless proper protection is provided to the satisfaction of the Engineer.

(7) Permanent Works, including materials for such Works, shall be protected from exposures of weather conditions that may adversely affect such Permanent Works or materials.

(8) During construction of the Works storm restraint systems shall be provided where appropriate. These systems shall ensure the security of the partially completed and on-going stages of construction and in all weather conditions. Such storm restraint systems shall be installed as soon as practicable and shall be compatible with the right of way, or other access around or through- out the Site.

(9) The Contractor shall at all times programme and order progress of the work and make all protective arrangements such that the Works can be made safe in the event of storms.

PROTECTION OF THE WORK

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

8. DAMAGE AND INTERFERENCE

(1) Work shall be carried out in such a manner that there is no damage to or interference with:

(a) watercourses or drainage systems; (b) utilities; (c) structures (including foundations), roads, including street furniture, or other properties; (d) public or private vehicular or pedestrian access; (e) monuments trees, graves or burial grounds other than to the extent that is necessary for them to be removed or diverted to permit the execution of the Works. Heritage structures shall not be damaged or disfigured on any account. The Contractor shall inform the Engineer as soon as practicable of any items which are not stated in the Contract to be removed or diverted but which the Contractor considers need to be removed or diverted to enable the Works to be carried out. Such items shall not be removed or diverted until the consent of the Engineer to such removal or diversion has been obtained.

(2) Items which are damaged or interfered with as a result of the Works and items which are removed to enable work to be carried out shall be reinstated to the satisfaction of the Engineer and to at least the same condition as existed before the work started. Any claims by Utility Agencies due to damage of utilities by the Contractor shall be borne by the Contractor.

UTILITIES

(3) Please refer Employer's Requirement - Functional

STRUCTURES, ROADS AND OTHER PROPERTIES

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

ACCESS

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

TREES

(6) The felling of trees in the Noida/ Greater Noida/NCR Delhi is governed by the Uttar Pradesh Protection of Trees Act, 1976 and associated latest amendments. The Contractor is not permitted to cut any trees without the permission of the Employer. The Employer has assessed the number of trees existing within the right-of-way and contractor has to arrange permission from Forest Department cutting back or removal of trees which are deemed to be affected by the right of way (ie. within the limits of permanent works) construction works. The trees requiring to be felled will be removed from ground level up by the Forest Department/ Noida-Greater Noida Authorities. The Contractor will not be permitted to cut or remove any further trees. If for the purposes of the works additional trees are required to be cut/trimmed or removed, the Contractor must notify the Engineer of further tree felling requirements. Subject to compliance with the aforementioned act, arrangements for permission from Forest Department for tree felling/transplantation shall be done by the contractor. The payment of tree cutting, removal, transportation and transplantation required shall be paid in relevant schedule of BOQ.

REMOVAL OF GRAVES AND OTHER OBSTRUCTIONS

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

PROTECTION OF THE ADJACENT STRUCTURES AND WORKS

(8) The Contractor shall take all necessary precautions to protect the structures or works being carried out by others adjacent to and, for the time being, within the Site from the effects of vibrations, undermining and any other earth movements or the diversion of water flow arising from its work.

The Key Existing Structures falling along the alignment, but not limited to, are listed as below -

1) Crossing of Alignment over Delhi Metro's Blue Line & Magenta Line,
2) Crossing of Alignment over Noida Metro's Aqua Line and connection to existing Noida Sec-142 metro station.
3) Noida Authority's Flyover at Noida Sector-37, Under pass at Noida Sector-96, Flyover near Max Hospital & Bridge at Noida Sector-142,
4) Botanical Garden Bus Station at Noida Sector-37
5) Crossing over ROB-146 at Boraki

9. WORK ON ROADS

(1) Traffic Management Plan

The Contractor shall develop a detailed Traffic Management Plan for the work under the contract. The purpose is to develop a Traffic Management Plan to cope with the traffic disruption as a result of construction activities by identifying strategies for traffic management on the roads and neighbourhoods impacted by the construction activities. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract.

Principles for Traffic Management

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

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

Integrated Traffic Management Plan

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

- proper phasing and timing of traffic signals;
- modifications to intersection geometry;
- changes in lane usage;
- parking prohibitions;
- re-location of bus stops;
- reducing width of footpaths and median;
- right-turn prohibition;
- work site access management;
- minimising the duration of *any* road closure;
- reversible lane operations;
- modification of roadway alignment affected by the construction, which shall be in conformance with the requirements and regulations defined by the relevant authorities; and may include widening of roads, Construction of temporarily new road etc.
- other traffic engineering measures as may be applicable.

(2) Mitigation of Traffic Disturbances

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

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

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

Other considerations include:

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

APPROVAL FOR TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

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

TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

(4) Temporary traffic diversions and pedestrian routes shall be surfaced and shall be provided where work on roads or footpaths obstruct the existing vehicular or pedestrian access. The relevant work shall not be commenced until the approved temporary traffic arrangements and control have been implemented.

(5) Temporary traffic arrangements and control for work on public roads and footpaths shall comply with the requirements of the Traffic Police. Copies of documents containing such requirements shall be kept on the Site at all times.

(6) Temporary traffic signs, including road marking, posts, backing plates and faces, shall comply with the requirements of the Traffic Police and should be in accordance with the requirements of Ministry of Surface Transport. All overhead traffic management signs that are fixed to bridges and gantries shall be illuminated at night. Pedestrian routes shall be illuminated at night to a lighting level of not less than 50 lux.

(7) Adequate number of traffic marshals shall be deployed for smooth regulation of traffic.

(8) Temporary traffic arrangements and control shall be inspected and maintained regularly, both by day and night. Lights and signs shall be kept clean and legible. Equipment which are damaged, dirty, incorrectly positioned or not in working order shall be repaired or replaced promptly.

PARTICULARS OF TEMPORARY TRAFFIC ARRANGEMENTS AND CONTROL

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

(a) details of traffic diversions and pedestrian routes;

(b) details of lighting, signage, guarding and traffic control arrangements and equipment;

(c) any conditions or restrictions imposed by Traffic Police or any other relevant authorities, including copies of applications, correspondence and approval.

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

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

USE OF ROADS AND FOOTPATHS

(12) Public roads and footpaths on the Site in which the work is not being carried out shall be maintained in a clean and passable condition. Regular brooming, removal of debris collected is the responsibility of contractor.

(13) Measures shall be taken to prevent the excavated materials, silt or debris from entering gullies on roads and footpaths; entry of water to the gullies shall not be obstructed.

(14) Surfaced roads on the Site and leading to the Site shall not be used by tracked vehicles unless protection against damage is provided.

(15) Contractor's Equipment and other vehicles leaving the Site shall be loaded in such a manner that the excavated material, mud or debris will not be deposited on roads. All such loads shall be covered or protected to prevent dust being emitted. The wheels of all vehicles shall be washed, when necessary, before leaving the Site to avoid the deposition of mud and debris on the roads.

REINSTATEMENT OF PUBLIC ROADS AND FOOTPATHS

(16) Temporary diversions, pedestrian access and lighting, signing, guarding and traffic control

equipment shall be removed immediately when they are no longer required. Roads, footpaths and other items affected by temporary traffic arrangements and control shall be reinstated to the same condition as existed before the work started or as permitted by the Engineer immediately after the relevant work is complete or at other times permitted by the Engineer..

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

- Parking bays
- Footpath and kerbs
- Road Signage
- Street Lighting
- Landscaping
- Traffic Lights and Control Cable
- Road painting

10. SITE ESTABLISHMENT

SITE LABORATORIES

(1) The Contractor shall provide, erect and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of concrete, soil and rock samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in **Appendix 11** to these Employer's Requirements.

CONTRACTOR'S SITE ACCOMMODATION

(3) The Contractor shall provide and maintain its own site accommodation at locations consented to by the Engineer. Offices, sheds, stores, mess rooms, garages, workshops, latrines and other accommodation on the Site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the Site. The Contractor shall comply with the requirements of **Appendix 8** to the Employer's Requirements.

In addition, the contractor shall provide & maintain facilities at field offices for use of NMRC Staff during the contract period as mentioned in **Appendix-2C** of Employer's Requirement.

LATRINES AND WASHPLACES

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

(4) The Contractor shall be responsible for maintaining all latrines and wash places on the Site in a clean and sanitary condition and for ensuring that they do not pose a nuisance or a health threat. The Contractor shall also take such steps and make such provisions as may be necessary or directed by the Engineer to ensure that vermin, mosquito breeding etc. are at all times controlled.

SITE UTILITIES AND ACCESS

(5) (a) The Contractor shall be responsible for providing water, electricity, telephone, sewerage and drainage facilities for contractors site offices, structures and buildings and for all site laboratories in accordance with **Appendix 11** to these Employer's Requirements and all such services that are necessary for satisfactory performance of the Works. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant civil and utility authorities for the facilities.

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

(c) The Contractor shall be responsible for making his own arrangements at his own cost to obtain supply of water, electricity or gas for the Works. The Employer where feasible may at its discretion assist the Contractor in this respect.

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

ASSISTANCE TO ENGINEER - Deleted

(7) Any operation of the Works that interferes with the checking of lines and levels shall be temporarily suspended at the request of the Engineer until the checking is complete.

SUBMISSION OF PARTICULARS

(8) The following particulars shall be submitted to the Engineer for his consent not more than fifty-six (56) days after the date of commencement of the Works:

(a) drawings showing the formation works and the layout within earmarked area for the Contractor's offices, project signboards, principal access and other major facilities required early in the Contract, together with all service utilities;

(b) drawings showing the details to be included on the project signboards and diversion boards.

(9) Drawings showing location of casting yard, stores, storage areas, concrete batching plants and other major facilities and their access roads/paths shall be submitted to the Engineer for his consent as early as possible but in any case, not less than twenty-eight (28) days prior to when such facilities are intended to be constructed on the Site.

11. SECURITY

(1) The Contractor shall be responsible for the security of the Site for the full time the Site is in its possession, except for the specific case of the Railway Envelope after handover to the Railway Operator It shall set up and operate a system whereby only those persons entitled to be on the Site can enter the Site. To this end, the Contractor shall with the consent of Engineer provide the specific points only at which entry through the security fence can be effected, and shall provide gates and barriers at such points of entry and whereby maintain a twenty-four (24) hours security guard, and such other security personnel and patrols elsewhere as may be necessary to maintain security.

(2) The Contractor shall maintain all site boundary fences in first class condition, and shall so

arrange site boundary fences at all access drainage points of work areas that it's use of such access points etc., are not restricted by the system or method of achieving the required security measures. Notices shall be displayed at intervals around the Site to warn the public of the dangers of entering the Site.

(3) During the progress of the Works the Contractor shall maintain such additional security patrols over the areas of the Works as may be necessary to protect its own and its sub-contractor's work and equipment and shall co-ordinate and plan the security of both the work under this Contract and the work of others having access to and across the Site and the Works.

(4) In order to operate such a security system, it will be necessary to institute the issue of unique passes to personnel and vehicles entitled to be on the Site, and which may need to be separately identifiable according to the shifts being worked on Site. The Contractor shall at the outset determine, together with the Engineer, a system and the design of passes to suit the requirements of the foregoing and to suit the methods of work to be adopted by the Contractor. The Contractor shall at all times ensure that the Engineer has an up-to-date list of all persons entitled to be on the Site at any time. The contractor shall also introduce a system of issue passes to any outsider or person/vehicles belonging to agencies other than employer/ Engineers who may have to visit the site in connection with work

(5) The Contractor shall liase with the Designated Contractors and the contractors responsible for the adjacent and other interfacing contracts and ensure that co-ordinated security procedures are operated, in particular in respect of vehicles permitted to pass through the Site and/or the adjacent sites in the latter periods of the Contract.

(6) Security and checking arrangements as felt necessary shall be provided with advice and help of Police.

12. TESTING

GENERAL

(1) The Contractor shall provide and perform all forms of testing procedures applicable to the Works and various components and the interfacing of the Works with the other Contract works and shall conduct all necessary factory, site and acceptance tests.

(2) Deleted

(3) All testing procedures shall be submitted at least thirty (30) days prior to conducting any Test. The Testing procedures shall show unambiguously the extent of testing covered by each submission, the method of testing, the Acceptance Criteria, the relevant drawing (or modification) status and the location.

(4) The testing Procedures shall be submitted, as required, by the Contractor during the duration of the contract to reflect changes in system design or the identification of additional testing requirements.

(5) The Engineer shall have the facilities for monitoring all tests and have access to all testing records. Ample time shall be allowed within the testing programmes for necessary alterations to equipment, systems and designs to be undertaken, together with re-testing prior to final commissioning.

(6) The Contractor is reminded that at some point, the High Voltage Power Supply system will be energised and the additional precautions for the safety of staff and co-ordination of activities after power-on shall be anticipated in its testing and commissioning programmes.

(7) All costs associated with the Testing shall be borne by the Contractor, unless otherwise specified, including the services of any specialised personnel or independent assessors. The Contractor shall also bear any expenses incurred due to resetting caused by defects or failure of equipment to meet the requirements of the Contract in the first instance.

(8) Unless agreed in writing by the Engineer, the personnel engaged on testing shall be independent of those directly engaged in the design or installation of the same equipment.

(9) All testing equipment shall carry an appropriate and valid calibration labels.

BATCHES, SAMPLES AND SPECIMENS

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

(11) A sample is a specified quantity of material that is taken from a batch for testing and which consists of a specified amount, or a specified number of pieces or units, of the material.

(12) A specimen is the portion of a sample that is to be tested.

SAMPLES FOR TESTING

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

(14) Samples taken on the Site shall be selected by, and taken in the presence of, the Engineer and shall be suitably marked for their identification. An identification marking system should be evolved at the start of works in consultation with the Engineer.

(15) Samples shall be protected, handled and stored in such a manner that they are not damaged or contaminated and such that the properties of the sample do not change.

(16) Samples shall be delivered by the Contractor, under the supervision of the Engineer, to the specified place of testing. Samples on which non-destructive tests have been carried out shall be collected from the place of testing after testing and delivered to the Site or other locations instructed by the Engineer.

(17) Samples which have been tested may be incorporated in the Permanent Works provided that:

(a) The sample complies with the specified requirements;

(b) The sample is not damaged; and

(c) The sample is not required to be retained under any other provision of the Contract.

(18) Additional samples shall be provided for testing if in the opinion of the Engineer:

(a) material previously tested no longer complies with the specified requirements; or

(b) Material has been handled or stored in such a manner that it may not comply with the specified requirements.

TESTING

(19) The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests shall be carried out in the Contractor's laboratory, unless otherwise permitted or required by the Engineer. Where the laboratory is not appropriately equipped and/or staffed for some tests, or if agreed to by the Engineer, tests may be carried

out in other laboratories provided that:

(a) they are accredited for the relevant work to a standard acceptable to the Engineer; and

(b) Particulars of the proposed laboratory are submitted to the Engineer for his consent.

(20) In-situ tests shall be done in the presence of the Engineer.

(21) Equipment, apparatus and materials for in-situ tests and laboratory compliance tests carried out by the Contractor shall be provided by the Contractor. The equipment and apparatus shall be maintained by the Contractor and shall be calibrated before the testing starts and at regular intervals as permitted by the Engineer. The equipment, apparatus and materials for in-the situ tests shall be removed by the Contractor as soon as practicable after the testing is complete.

(22) The Contractor shall be entitled in all cases to attend the testing carried out in the Employer's or other laboratories, to inspect the calibration certificates of the testing machines and to undertake the testing on counterpart samples. Testing of such samples shall be undertaken in laboratories complying with Clause 12(19)(a) above and particulars of the laboratory proposed shall be submitted to the Engineer for consent prior to the testing.

(23) Attendance on tests, including that by the Engineer, Contractor and Designer, shall be as laid down in the Quality Assurance procedures.

COMPLIANCE OF BATCH

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

(25) A batch shall be considered as complying with the specified requirements for a material if the results of specific tests for of the specified properties comply with the specified requirements for the properties.

(26) If additional tests are permitted or required by the Engineer but separate compliance criteria for the additional tests are not stated in the Contract, the Engineer shall determine if the batch complies with the specified requirements for the material on the basis of the results of all tests, including the additional tests, for every properties.

RECORDS OF TESTS

(27) Records of in-situ tests and laboratory compliance tests carried out by the Contractor shall be kept by the Contractor on the Site and a report shall be submitted to the Engineer within seven (7) days, or such other time stated in the Contract or in the Quality Assurance Programme, after completion of each test. In addition to any other requirements, the report shall contain the following details:

(a) material or part of the Works tested;

(b) location of the batch from which the samples were taken or location of the part of the Works;

(c) place of testing;

(d) date and time of tests;

(e) weather conditions in the case of in-situ tests;

(f) technical personnel supervising or carrying out the tests;

(g) size and description of samples and specimens;

(h) method of sampling;

(i) properties tested;

(j) method of testing;

(k) readings and measurements taken during the tests;

(l) test results, including any calculations and graphs;

(m) specified acceptance criteria; and

(n) other details stated in the Contract.

(28) Reports of tests shall be signed by the site agent or his assistant, or by another representative authorised by the Contractor.

(29) If requested, records of tests carried out by the Employer's staff or by the Engineer shall be given to the Contractor.

(30) Sampling, handling & testing of cube specimens for compressive strength are to be carried out as per the CPWD guidelines/ITP and this guideline should be part of method statement for production and transportation of concrete.

13. RECORDS

DRAWINGS PRODUCED BY THE CONTRACTOR

(1) Drawings produced by the Contractor including drawings of site layouts, Temporary Works, etc. for submission to the Engineer shall generally be to ISO A1 size. They shall display a title block with the information as detailed in **Appendix 7** to these Employer's Requirements. The number of copies to be submitted to the Engineer shall be as stated in the Contract, or as required by Engineer.

PROGRESS PHOTOGRAPHS

(2) The Contractor shall provide monthly progress photographs which have been properly recorded to show the progress of the works to the Engineer. The photographs, of not less than 72 in number, shall be taken on locations agreed with the Engineer to record the exact progress of the Works. Two sets of photographs shall be provided on CD ROM format with two sets of colour prints of 175 mm x 125 mm size. Videography by drone shall also be done at all work places every one month.

(3) The Contractor shall mount each set of each month's progress photographs in a separate album of a type to which the Engineer has given his consent, and shall provide for each photograph two typed self-adhesive labels, one of which shall be mounted immediately below the photograph and one on the back of the photograph. Each label shall record the location, a brief description of the progress recorded and the date on which the photograph was taken.

(4) All photographs shall be taken by a skilled photographer whose name and experience shall be submitted to the Engineer for consent and approval received. Processing shall be carried out by a competent processing firm to the satisfaction of the Engineer.

(5) The Contractor shall ensure that no photography is permitted on the Site without the agreement of the Engineer. Contractor should be aware of the local regulations and conditions with regard to Photography in some "RESTRICTED AREA' in NOIDA/ GR. NOIDA.

RECORDS OF WAGE RATES

(6) The Contractor shall keep monthly records of the average, high and low wage rates for each trade/tradesman employed on the Site and records shall be made available to the Engineer during inspection.

14. MATERIALS

(1) Materials and goods for inclusion in the Permanent Works shall be new unless the Engineer has consented otherwise. Preference shall be given to local materials where available. Approved Manufacturers/Suppliers of few important items have been given in **Appendix 9** of this document. These materials shall be procured only for these manufacturers/Suppliers.

(2) Certificates of tests by manufacturers which are to be submitted to the Engineer shall be current and shall relate to the batch of material delivered to the Site. Certified true copies of certificates may be submitted if the original certificates could not be obtained from the manufacturer.

(3) Parts of materials which are to be assembled on the Site shall be marked to identify the different parts.

(4) Materials which are specified by means of trade or proprietary names may be substituted by materials from a different manufacturer which has received the consent of the Engineer provided that the materials are of the same or better quality and comply with the specified requirements.

(5) Samples of materials submitted to the Engineer for information or consent shall be kept on the Site and shall not be returned to the Contractor or used in the Permanent Works unless permitted by the Engineer. The samples shall be used as a mean of comparison which the Engineer shall use to determine the quality of the materials subsequently delivered. Materials delivered to the Site for use in the Permanent Works shall be of the same or better quality as the samples which have received consent.

PROVISION AND DISPOSAL OF EARTHWORKS MATERIAL

(6) The Contractor shall be responsible for the provision of all classes of earthworks material required for the Works, whether sourced from the excavations within the Contract or obtained from any other sources, which are located outside the Site, for which the Engineer has given the consent.

(7) For fill or dumping sites, the Contractor shall prepare a land plan with details of surface drainage requirements, final formation levels, spreading and compaction of the fill during dumping acceptable to the Engineer. The Contractor shall also provide security for such sites. The dumping sites to be used by the Contractor shall be as directed by the Engineer.

(8) All excavated material, excluding waste material, polymer fluid and polymer contaminated material shall be disposed of at the appointed site only. This material shall be placed and compacted in accordance with the Construction Specification for Earth Works or as otherwise directed by the Engineer's Representative. The disposal of waste material, polymer fluid and material contaminated with polymer shall be the full responsibility of the Contractor and these materials shall be disposed of by the Contractor at an approved location. The dumping sites provided by the Employer shall not be used for disposal of waste material, polymer fluid or material contaminated with polymer.

(9) Rock deposited as fill material at the dumpsites shall be capable of compaction with single pieces no larger than 300 mm.

15. RESTORATION OF AREAS DISTURBED BY CONSTRUCTION.

Unless otherwise directed by the Engineer, any areas disturbed by the construction activity, either inside or outside the Project Right of Way, shall be reinstated as follows:

All areas affected by the construction work shall be reinstated to their original condition, with new materials of similar specification, including but not necessarily limited to, sidewalks, parking lots, access roads, roads, footpath, kerbstone, boundary wall, grill, fencing, grill, any existing structure prior to construction, bus shelter, cycle stand, horticulture, adjacent roads, properties and landscaping. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

16. SOIL INVESTIGATION

The soil investigation report included in the tender document is for reference purpose only. The bidder should carry out detailed investigation on his own along the alignment, any changes in design due to change in geology based on our report shall not be the responsibility of NMRC.

No claim whatsoever on account of any discrepancy between the sub surface conditions that may be actually encountered at the time of execution of the work and those given in these tender documents shall be admissible to the contractor under any circumstances.

NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

CONTRACT NO: NGNECC-01

Part Design & Construction of Elevated Viaduct and 10 nos. of Elevated Stations for Extension Projects of NMRC's Aqua Line from Botanical Garden to Noida Sec-142 (from Chainage (-) 383.959 to 12130.143) and from Depot Station to Boraki MMTH (Chainage 28678.253 to 31263.482).

E Tender No.: NMRC/Projects/NGNECC/2026/457

TENDER DOCUMENTS

VOLUME 3

E. EMPLOYER'S REQUIREMENTS – APPENDICES

Noida Metro Rail Corporation (NMRC) Limited

Block-III, 3rdFloor, Ganga Shopping Complex, Sector-29, Noida - 201301, District Gautam Budh Nagar, Uttar Pradesh, India

CONTENTS

Employer's Requirement

APPENDIX 1

DRAWING LIST

The Tender Documents contains a set of reference/Tender drawings that are applicable to the Contract Works. The Tenderer shall incorporate into the Tender only those drawings from that set which amplify aspects of the Contractor's Technical Proposals. General information drawings will not be included in the Contract. The dimensions mentioned in the tender drawings are indicative and may vary as per the design of the contractor.

The List of Drawings issued with the tender documents is stated in Volume-5

EMPLOYER'S REQUIREMENTS

APPENDIX 2A

WORKS AREAS

The employer will provide the work area of Approx. 60,000 sq.m. for Casting Yard within 45 Km radius of work site as per availability for construction of precast elements of viaduct. All the work areas (land for casting yard, batching plant & site office) are to be handed over back to the Employer within 2 months from the date of issue of Take over Certificate.

Employer's Requirement - Key Dates

Appendix-2B

For complete Viaduct including Viaduct in station portion:

Key dates no	Description of stage	Time to achieve (weeks)	Liquidity Damages for non-achieving the key dates
KD 1	Submission of construction programme	4	0.01% of total contract value per week of delay for the key date
KD 2	Commissioning of 1st Batching Plant (production of 1st batch of concrete)	10	0.01% of total contract value per week of delay for the key date
KD 3	Submission of Definitive Design	12	0.01% of total contract value per week of delay for the key date
	Commissioning of 2st Batching Plant (production of 2nd batch of concrete)	14	
KD 4	Completion of 1st Formwork for precast U – girder element of production line for Engineer's approval	14	0.01% of total contract value per week of delay for the key date
KD 5	Completion of 1st working pile	16	0.01% of total contract value per week of delay for the key date
KD 6	Casting of 1st U-Girder	18	0.01% of total contract value per week of delay for the key date
KD 7	Erection of 1st U-Girder	28	0.01% of total contract value per week of delay for the key date
KD 8	(i) Partial Access of the Viaduct including in stations area (minimum 2.0 Km in one stretch) to Track contractor for laying track	68	0.01% of total contract value per week of delay for the key date
	(ii) Partial Access of the Viaduct including in stations area (minimum 2.0 Km in one stretch) to Track contractor for laying track	90	0.01% of total contract value per week of delay for the key date
	(iii) Full Access of the Viaduct including in stations area to Track contractor for laying track. (**Note** - In case of Launcher, the feeding point shall have to be changed to ensure the key dates & the temporary rails provided for carrying the U-Girder on viaduct shall have to be removed.)	122	0.01% of total contract value per week of delay for the key date
KD 9	Full Access to system contractors including G.I. Hangers for laying of cables, railings, expansion joint etc all balance civil work complete in all respect	130	0.01% of total contract value per week of delay for the key date

For Stations:

Key dates no	Description of stage	Time to achieve (weeks)	Liquidity Damages for non-achieving the key dates
KD 1	Completion of 1st Pile	16	0.01% of total contract value per week of delay for the key date
KD 2	Completion of Casting of Slab for Concourse Level		
	i) For First Station	36	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	48	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	64	0.01% of total contract value per week of delay for the key date
KD 2	Completion of Casting of Slab for Track Supporting Structure		
	i) For First Station	56	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	78	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	94	0.01% of total contract value per week of delay for the key date
KD 5	Completion of all Architectural finishing works in following operational rooms and rooms & flooring with required cutting for raceways for fixing AFC, Signaling room, Telecommunication room, ASS room, Pump room & UPS room		
	i) For First Station	56	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	78	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	94	0.01% of total contract value per week of delay for the key date
KD 6	Completion of all Architectural internal & external finishing works in entire station and rooms		
	i) For First Station	66	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	88	0.01% of total contract value per week of delay for the key date

	iii) For All Stations	104	0.01% of total contract value per week of delay for the key date
KD 7	Access to lift shaft & Escalator pits (Concourse to Platform)		
	i) For First Station	66	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	88	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	104	0.01% of total contract value per week of delay for the key date
KD 8	Completion of structure works of one Entry/Exit (Ground to Concourse)		
	i) For First Station	70	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	92	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	108	0.01% of total contract value per week of delay for the key date
KD 9	Delivery for all fabricated parts of roof and roof portals with purlins etc. complete, for:		
	i) For First Station	100	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	115	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	135	0.01% of total contract value per week of delay for the key date
KD 10	Completion of structure work & roof sheeting, Complete		
	i) For First Station	120	0.01% of total contract value per week of delay for the key date
	ii) For next three Stations	135	0.01% of total contract value per week of delay for the key date
	iii) For All Stations	150	0.01% of total contract value per week of delay for the key date
KD 11	Completion of entire works including Finishing, etc. as per contract and all relevant works for testing & commissioning of the section at all stations.	150	0.01% of total contract value per week of delay for the key date
KD 12	Completion of all other outstanding works like re-instatements etc. that doesn't affect the testing of the stations.	156	0.01% of total contract value per week of delay for the key date

APPENDIX 2C

ACCOMMODATION FOR THE ENGINEER

- Furnished office accommodation of approx. 500 sqm (with 80% air-conditioned) for the Engineer including site office at casting yard with minimum two watchman and two office Boy in each office for 24 hrs and also, as per increased on its requirement.

- Additional Offices set-up of 30 sq. m. at station site locations for staff deployed at site.

- The Contractor has to provide the following furniture/ facilities for engineers at his own cost:

Sr. No.	Description	Nos
1	File Storage Cabinet	6
2	Digital Photocopy Machine (upto A3 size)	1
3	Water Dispenser (Hot & Cold)	2
4	Refrigerator (290 litres)	1
5	Standby DG Power Connection	As per requirement
6	Safety Helmets, Boots and any other safety device	As per requirement
7	Executive Chair	15
8	Table with Side Drawers	15
9	Visitor Chair	30
10	Steel Almirah	5
11	Meeting room table and chair	For 20 Seatings with table
12	Projector with screen in Meeting Room	
13	Office Table & Chair at station site	10
14	Intercoms	15
15	Desktop Computer	10

- The Contractor is required to maintain the offices throughout the contract period and provide the following, but not limited to:
    i. Pay all Electricity, Water charges and Broadband connection.
    ii. Fire Fighting Detection and Suppression System.
    iii. Carry out necessary repairs to office and equipment as and when required.
    iv. Drinking water.
    v. Tea and Coffee
    vi. Crockery including cups and saucers for office use
    vii. Daily Cleaning of Office Space and Toilet.

- Fire extinguishers shall be provided in accordance with the recommendations of the Surat City Fire Brigade.

- The Contractor shall provide, erect and maintain appropriate name boards as specified for each of the offices. The wording on each name board and its location shall be agreed by the Engineer before it is erected.

- Two vehicles are to be provided round the clock for NMRC staff.

Employer's Requirement APPENDIX 2D

INTERFACE MANAGEMENT DOCUMENT

The Interface management Document of this Appedix-2D is given in 27 Pages from page no.1 to 27 shall also be complied.

INTERFACE MANAGEMENT DOCUMENT FOR CIVIL & S&T (SIGNALLING, TELECOM, AFC/IT, PSD, UPS, GSM), TUNNEL VENTILATION, ECS, E&M, POWER SUPPLY, ESCALATORS, LIFTS, SOLAR SYSTEM AND TRACK CONTRACTORS OF UNDERGROUND, ELEVATED SECTION(s) & DEPOTS.

INDEX

This document describes the interface responsibilities and obligations of Civil / DDC Contractor(s) with other system contractors viz. Signalling, Telecom, AFC/IT, PSD, UPS (S&T), GSM, Tunnel Ventilation, ECS, E&M, Power Supply, Escalators, Lifts, Solar System and Track and vice versa.

All above **"Contractors"** have been addressed as **"SYSTEM WIDE CONTRACTOR(s)"** for all interface purposes wherein any specific mention has not been done. This document shall be made partof all these contracts so that clear responsibility of each contractor is defined in every contract. This document is for underground, elevated & depot works**.**

The details of the works related to Underground Metro Structures doesn't pertains to Contract NGNECC-01.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
1.	**Attendance of Civil Contractor(s) on System Wide Contractor(s)**		
(i)	**Work Areas**	i) Civil to provide properly levelled and debris free site storage space and works areas, access to and within the site, offloading and loweringareas for the use of all Contractors subject to availability. ii) Civil to provide compacted and fully levelled space for movement of Hydra and parking of Cranes for lifting and lowering activities including the space required for crane outriggers.	i) System Wide Contractors to advise requirements and date for handover to suit civil Contractor's site program. ii) System Wide Contractor to coordinate with Civil Contractor for proper Work Areas, Access to/from site and loading / unloading areas.
(ii)	**Cranes**	Civil to permit use of cranes on site by other Contractors on a mutually agreed rental basis and subject to the availability of the same at the worksite.	System Wide Contractors to ensure their own arrangements for cranes and other machinery in case of the unavailability of the same with civil contractor
(iii)	**Scaffold**	Civil to permit other Contractors the usage of scaffolding erected at site but only within the timings as agreed by the Civil Contractor so that it does not hamper the progress of civil works at mutually agreed terms and conditions.	System Wide Contractors have to arrange their own scaffolding. The usage of scaffolding erected by the civil contractor shall be allowed only during the periods as agreed by the civil contractor, under the supervision of SHE staff of System Wide Contractors.
(iv)	**Medical**	As per "Conditions of Contract on Safety & Health and Environment".	As per "Conditions of Contract on Safety & Health and Environment".
(v)	**Drinking Water**	As per "Conditions of Contracton Safety & Health and Environment".	As per "Conditions of Contract on Safety & Health and Environment".
(vi)	**Lighting**	Civil to provide general lighting to all common / general areas of the worksite till permanent lights become functional in that area or issuance of Taking over certificate whichever is earlier.	Task lighting will be the responsibility of the various agencies / system contractors.
(vii)	**Power**	i) Civil to supply power distribution boards at each end of the concourse and platform and at 150m intervals along the tunnel length for the use of all Contractors, power capacity to suit the combined requirements of each Contractor. The energy charge	System Wide Contractors may obtain power supply from civil contractor on mutually agreed basis.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		rate per unit of consumption is to be mutually agreed with the system Contractors. ii) The power supply shall be maintained until one month after energization of the LV system at ASS level or the confirmation from the system Contractors whichever is later. iii) Thereafter Civil may take power supply at single point from ASS level on chargeable basis from NMRC, as per the rates conveyed by NMRC to the contractor for that period and the same shall be re-distributed to all system wide contractors by civil contractor on suitably revised rates. In Elevated station (two nos. at concourse and two nos. at each platform level)	
(viii)	**Survey and Marking**	i) Civil to provide survey/ setting outgrid line and level reference for stations and tunnels. ii) Civil Contractor to promptly provide Grid Marking, Finish Floor Level (FFL), Platform Centre & Platform Edge marking at station(s) and Track Centre line marking as required by system wide contractors for ducting, piping, and cable tray work etc. in case the marking gets faded/ erased due to painting or any other work, then civil should restore it promptly. iii) In Elevated station (only FFL, False Floor Level and False Ceiling Level)	
(ix)	**Cleaning**	i) Civil will be responsible for general site, Tunnel & Viaduct cleaning (except for removal of material pertaining to System contractors)and will identify separate designated dump areas for each contractor for material to be deposited prior to removal. ii) In case any system contractor fails to remove his material, the Engineer / Engineer's representative (NMRC employee) of Civil contract along with the Engineers / Engineer's representative (NMRC employee) of respective system wide contractors shall inspect the site jointly and prepare a joint note. After written	i) Once technical room is handed over, the principal system contractor for that room will take over responsibility for cleaning the room. ii) Other system contractors to be permitted to continue their work following a mutually agreed and reasonable sequence on sharing basis without hampering/ damaging the work of any other system contractor. System wide contractor shall be responsible only for cleaning of room/ area after taking over the room / area from civil.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		notice of minimum three days to the system contractor to remove his material, thereafter civil Engineer may instruct civil Contractor to remove it and the cost of the same shall be borne by the system contractor as mutually agreed upon by the NMRC Engineers of various system wide contractors and civil. Civil will hand over the rooms to respective system contractors in properly cleaned condition and after providing proper lockable door & keys in a secured condition.	
(x)	**Security**	i) Civil in general will be responsible for establishing an overall site security system to the approval of the Engineer. The system should ensure that no person from any agency working at site may take out / bring in material without written authorization from the respective contractor's nominated site incharge and civil security-in-charge. ii) The verification of any person removing material from site or bringing any material to site, shall be sole responsibility of the contractor to whom the material belongs. iii) The system once approved by the Engineer of Civil contractor shall be binding on all system contractors. iv) In case civil contractor is demobilized before completion of System wide contractors work, the Engineer / Engineer's representative (NMRC employee) of Civil contract along with the Engineers / Engineer's representative (NMRC employee) of system wide contractors shall decide to entrust the responsibility to the system wide contractor generally having the largest scope of remaining work.	i) System wide contractors have to provide prior authorisation in case they have to bring- in/remove any material from worksite. No loading/unloading ofmaterial shall be allowed without prior authorisation. ii) In case civil contractor is demobilized before completion of System wide contractors work, the Engineer / Engineer's representative (NMRC employee) of Civil contract along with the Engineers / Engineer's representative (NMRC employee) of system wide contractors shall decide to entrust the responsibility to the system wide contractor generally having the largest scope of remaining work.
(xi)	**Safety**	As per "Conditions of Contract on Safety & Health and Environment".	As per "Conditions of Contract on Safety & Health and Environment".
(xii)	**Toilet & Amenities**	As per "Conditions of Contract on Safety & Health and Environment".	As per "Conditions of Contract on Safety & Health and Environment".
(xiii)	**Drainage**	Civil Contractor to provide and maintain temporary pump arrangements for all requirements related to station and	Civil and E&M contractors will coordinate to install permanent pumps such that drainage of the

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		tunnel until commissioning of permanent pumps or completion of civil works (issue of Taking over certificate).	sump is not interrupted. E&M contractor shall promptly commission the permanent pumps post installation.
(xiv)	**Access Dates**	Civil contractor to provide and update System Wide Contractor the access date for various area in station, tunnel, ancillary building etc.	System Wide Contractor to coordinate and interface with Civil contractor to obtain the access dates for various area in station, tunnel, ancillary building etc.
(xv)	**Civil Drawings**	i) Civil Contractor to provide the same as requested by System Wide Contractor. Any proposed Change in drawings to be promptly communicated by Civil contractor to System Wide Contractor for his consent and subsequent up-dation of drawings prior to execution of civil works ii) In case common BIM interface is implemented, the drawings to be obtained from the same.	i) System Wide Contractor shall collect Station, Tunnel Architectural/ Structural drawings and sectional views in the concourse level, platform, and under croft level, ground level and etc. from Civil Contractor. ii) Any proposed design / drawing changes as communicated by civil contractor to System Wide Contractors are to be approved / commented by respective System Wide Contractors promptly prior to execution of civil works. iii) Any proposed Change in system drawings which may affect civil drawings to be promptly communicated by System Wide Contractor to Civil contractor for his consent and subsequent up-dation of drawings prior to execution of civil works. iv) In case common BIM interface is implemented, drawings shall be obtained from the same.
(xvi)	**Services Requirements**	Civil Contractor to carry out works as per requirements of latest approved drawings.	System Wide Contractor to timely provide the room size, door size and finish details for equipment rooms to DDC for incorporation in Drawings.
(xvii)	**Niches**	Civil Contractor to provide the following niches as per latest approved drawings. a) Niches for ESP/PSP/L2-Switch/PSA at 1200mm from FFL b) Niche for FHC (Fire Hoze Cubicle) with proper drain arrangement	System Wide Contractor to timely provide details of Niches required by them in the station area along with necessary cut-outs.
(xviii)	**Site Office and Storage Space (applicable for underground stations)**	Civil contractor to provide properly levelled and debris free site storage space and Office Space to System Wide Contractor as per the instructions of the Engineer.	System Wide Contractor to coordinate with Civil Contractor for provision of Proper and adequate Site Office and Storage Space.
(xix)	**Regular**	Civil Contractor to organize coordination	System wide contractors to attend

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
	Interface Meeting	meetings as per project requirement to discuss interface issue, exchange information, drawings, documents etc. and inform NMRC for critical issues. Minutes of Meeting for these meetings to be maintained and communicated by Civil Contractor.	coordination meetings as per project requirement to discuss interface issue, exchange information, drawings, documents etc. and inform NMRC for critical issues.
(xx)	**Cut-outs in Slab (Floor / Ceiling), Walls etc.**	Civil contractor to provide the cut-outs and recesses in slab, walls etc. for passage of services as per SEM, WRD, CSD etc. drawings provided by DDC. Civil contractor to coordinate with System Wide Contractor for joint inspection of cut-outs prior to casting.	System Wide Contractor to coordinate with DDC for timely incorporation of his requirement in SEM, WRD, CSD etc. drawings. System Wide Contractor to jointly verify the compliance of all requirements prior to casting as per the approved drawings.
(xxi)	**Lifting / Pulling Hooks**	Civil contractor to provide the lifting hooks to the System Wide Contractors as per the location and hook design communicated by the System Wide Contractors.	System Wide Contractor to provide the equipment / plant weight, hook location and dimensional drawing of the hooks.
(xxii)	**Foundations for Equipment**	i) Civil contractor to provide foundations as per requirements of System Wide Contractor. Any structural detailing required for foundations has to be carried out by Civil Contractor based on design from System Wide Contractor. ii) Similarly, for underground stations, filling of concrete in pump base etc is part of foundation and to be done by Civil contractor as per the requirement raised by ECS TVS contractor. iii) All foundations should be properly levelled and edge protection (Nosing) to be provided as per drawings.	System Wide Contractor to provide details of Foundations required by them in various station areas for various equipment.
(xxiii)	**Water Tanks**	i) Civil contractor to provide Water tanks of required capacity with partitions, waterproofing, inter connection etc. as per details provided in latest approved drawings, as per Employer's requirements with all necessary sleeves, cut-out, flanges, access manholes, manhole covers, monkey ladder, drainage arrangement etc. as per requirements given by System Wide Contractor in approved architectural drawings. ii) Tiling to be provided in all the tanks and drain with sump also to be	System Wide Contractor to coordinate and interface with Civil Contractor for adequacy of E&M, ECS, TVS & BMS requirements.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		provided in all the tanks. The Tank opening covers are to be provided with lock and key arrangements. Unused sleeves to be closed by civil contractor. Overflow of water tanks to be properly drained out to respective sump by civil contractor as per approved drawings.	
(xxiv)	**Tunnel Cross Passage with or without Sumps**	i) Civil contractor to provide the Cross Passage as per the approved drawings. ii) Connection of pipes from Pump Deliver Header and piping network for discharge of sump water along with all associated accessories like Butterfly valve, NRV, PG etc. to be done by Civil Contractor.	i) System Wide Contractor(s) to coordinate with Civil contractor for requirement of crosspassages and provide the details of Emergency Phones, Sump pits, cutouts for pumps, access manhole, sleeves / cutout for pipes in cross passage wherever required for incorporation in cross passage drawings by DDC prior to construction of cross passage. ii) Supply & Installation of Sump Pumps with LV Panel & Cabling etc. to be done by System Wide Contractor.
(xxv)	**Reflected Ceiling Plan (RCP)**	i) Civil Contractor to provide the RCP and False Ceiling Installation Schedule to the System Wide Contractor whenever required by a system contractor. Furthermore, Civil Contractor to interface and coordinate with System Wide Contractor for provisions and installation arrangement of Services. Civil Contractor to obtain clearance from System Wide Contractor before starting False Ceiling Works in any area. System Wide Contractor to provide the same without unnecessary delay. ii) Civil Contractor shall provide openings and any specific supporting arrangement if required by System Wide Contractor in false ceiling to install PIDS, Speaker, micro phone, CCTV, Analog/Digital clock, Leaky cables, light fixtures, detectors or any other minor equipment etc. iii) Easily Openable and re-fixable access doors / Trap doors for system wide installations/piping valves, duct dampers etc to be provided by Civil contractor in the false ceiling as per the requirement given by System Wide Contractors in approved drawings.	i) DDC to provide the coordinated RCP along with all services arrangement and location. ii) System Wide Contractor(s) incl. Telecomm. to further coordinate with DDC & Civil Contractor for finalisation of E&M, ECS, TVS & BMS Services and installation arrangement along with False Ceiling Installation schedule. iii) System Wide Contractor to ensure that no fixtures/installations/cabling is done over the ceiling after issuing clearance for False Ceiling Works. Only those works which can only be done subsequently/after installation of false ceiling shall be allowed in coordination with civil contractor. iv) System Wide Contractor to provide location and opening size for any opening required to be left by the civil contractor to facilitate installation of fixtures such as lights, detectors etc.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		iv) False ceiling supports should be installed after coordination with System Wide Contractor as per approved RCP.	
(xxvi)	**Flooring / Wall cladding works**	Civil contractor to provide the cutouts and recesses in flooring/cladding works as per latest architectural drawings provided by DDC. Civil contractor to coordinate with System Wide Contractor for joint inspection of the same prior to carrying out flooring/cladding in that area.	System Contractor to coordinate with DDC for timely incorporation of his requirement in architectural drawings. They also need to jointly verify the compliance of all requirements prior to execution of works.
(xxvii)	**Dewatering**	Civil Contractor to provide temporary pumping arrangements along with Discharge piping at all locations to avoid water logging in the Station and Tunnel Areas. Pumping arrangement to be provided till Taking Over Certificate.	After issuing of Taking Over Certificate issued to Civil, E&M Contractor will do the same till ROD.
(xxviii)	**Closing of Cut-outs**	i) Civil Contractor to close / optimize all cut-outs as cleared by System Wide Contractor, wherever the gap for closing is more than 200 mm in stations. ii) Civil contractor will carry out fire proof sealing of all cut-outs opening of more than 200 mm size gap at Stations with concrete / block work.	i) System Wide Contractor to give clearance to civil for optimization / closing of cut-outs after installation of services. ii) In Stations Fire sealing of openings of 200 mm and below gap, shall be done by the E&M contractor.
(xxix)	**Temporary Doors**	Civil Contractor to provide proper Temporary Doors with Locking arrangement at the time of giving access to work areas till the provision of permanent doors.	System Wide Contractor to take over the rooms for working only after provision of Temporary Doors with proper locking arrangement by Civil Contractor.
(xxx)	**Epoxy Flooring**	Civil contractor will provide Epoxy flooring in TER, SER, UPS (S&T) at both Elevated & Underground Station) & in PS room at Underground Station, ASS, CHILLER, LIFT PIT and ECS Rooms as per the procedure and specifications provided System Wide Contractor in the contract / as per the instructions of the Engineer and as per the provision in BOQ of Civil / Finishing works	System Wide Contractor will coordinate with civil contractor for Epoxy flooring in TER, SER, UPS (S&T) at both Elevated & Underground Station) & in PS room at Underground Station and in ASS, CHILLER, LIFT PIT and ECS Rooms.
2.	**GENERAL INTERFACE REQUIREMENTS BETWEEN CIVIL AND SYSTEM WIDE CONTRACTOR(s)**		
2.1	**GENERAL INTERFACE REQUIREMENTS**	(i) Civil to provide openings as per latest approved drawings. (ii) Civil will get pour card signed by concerned System Wide Contractor prior to casting to ensure that work has been done as per approved drawings.	i) Any changes if proposed are tobe requested by system wide contractor in writing well in advance, through the Engineer of his contract to architecture wing of NMRC for incorporation in architectural drawings, prior to

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		(iii) Any modification in cut-outs etc for improvement / better functioning of the system shall be done by civil along with undertaking from Electrical & S&T systems contractors duly approved by respective NMRC Engineers. (iv) Civil to assist System Wide Contractors in planning equipment delivery route for major materials and plant of the system contractors showing temporary and permanent provisions in slabs and walls to permit future replacement of plant and to allow initial transport from ground level to final room location in consultation with system contractors. (v) Civil to provide ingress / egress route including loading deck (in case of elevated stations), closing / opening arrangements in consultation with System Wide Contractor. (vi) Civil contractor to provide the temporary opening of required size and access routes for delivery of equipment as proposed in equipment delivery route. No wall etc. to be altered/ closed in the delivery route before clearance from respective System Wide Contractors. (vii) Civil contractor to provide earthing terminal for their structures, false ceiling structures etc. (at underground stations) for which E&M contractors will provide no's of earthing points at ~~north~~ sides of platform. (viii) Treated / Raw *WATER (QUANTITY & TYPE OF WATER AS PER REQUIREMENT OF SYSTEM CONTRACTOR 8 Lacs litres approx. per station)* shall be provided by civil for carrying out testing activities if a permanent water supply arrangement is not available. (ix) Louvers (with bird mesh) in elevated stations to be provided by civil contractor. (x) The civil contractor shall conduct regular meetings with other system contractors and vice versa as necessary to clarify particular aspect of the requirement of the works. (xi) Civil contractor as well as other system contractors shall, in carrying	execution of civil works. ii) System Contractor to sign the pour card in coordination with civil contractor. iii) Any changes (such as change in service opening, lifting / pulling hooks, foundation, ducts etc.) desired by the System Wide Contractor post execution of any civil work shall be on the account of the agency/ System Wide Contractor responsible for the change, if not as per approved drawings. iv) System Wide Contractor to plan and propose their own Equipment Delivery Route in consultation with civil contractor. v) All System Wide Contractors to provide the equipment & plants weight, dimension etc. to Civil contractor to provide temporary opening and access route and the same to be agreed and reflected in Equipment Delivery Route Drawings vi) System Wide Contractor to deliver the plants and equipment. vii) E&M contractors will connect earthing points to earth civil structures, false ceiling structures etc. (at underground stations) viii) Louvers size and specifications to be provided by E&M contractor in elevated stations. ix) All system contractors shall ensure the presence of their qualified / experienced coordinating engineer during civil construction works to enable proper interface with civil contractor so as to ensure timely intervention (if necessary) and swift interfacing of works.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		out their interface coordination responsibilities, raise their observations well in time and provide sufficient information for the employer to decide on any disagreement between contractors. If any contractor, despite having made reasonable efforts, cannot resolve any such disagreement, then the decision of the employer shall befinal.	
3.	**ADDITIONAL INTERFACE BETWEEN CIVIL / DDC AND INDIVIDUAL SYSTEM WIDE CONTRACTOR(s) (ELECTRICAL)**		
3.1	**Civil with Tunnel Ventilation System (TVS)**	(i) Civil to provide in designated rooms for system contractors drainage, shafts, precast RCC slabs for covering the access hatch, galleries cutouts, lifting/pulling hooks, walls for nozzles, niches in C&C tunnel roof, trackside knockout panels. (ii) All ECS / TVS shafts, Masonry plenums, Masonry ducts etc including OTE and UPE (if applicable) to be properly sealed and to be provided with evenly finished internal surface free from any extra sticking / hanging ply, wooden pieces or any other material, any protrusions, debris and unwanted material etc. The internal surface including floors to be provided with anti-dust paint as per finishing schedule. (iii) Louvers pertaining to architectural finishing works to be provided by Civil contractor as per the architectural drawings. For any open to sky shaft, MS gratings to be provided by civil contractor as per approved drawings. (iv) Access doors suitably rated for Fire shall be provided by civil in TVS shafts as per requirements given by TVS contractor. Handrail shall be provided around ETVD cut outs in ECS / TVS plenum. (v) Skirting of 200 mm on all TVS vertical cut outs and up stand of 200 mm on horizontal cut outs shall be provided by civil as per requirements given by TVS in approved drawings.	i) TVS Contractor to supply the details of all loads, plant layouts, equipment foundation for room sizes. Knockout panels, cutout recesses, shaft/gallery sizes and tunnel niche dimensions, Changes required to details incorporated in approved drawings to be provided well in advance of casting. ii) Chequer plate infill around nozzles will be provided by the TVS contractor. iii) The details of lifting hooks to be provided by Electrical System Contractors to civil contractor prior to the casting. iv) Louvers pertaining to VAC ventilation purposes and other technical requirements such as in TVS / EVS / SVS and other locations, are to be provided by the respective Electrical System Contractors. v) Any pipe pedestals if required by TVS/VAC contractor shall be installed by them.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		(vi) Lifting hooks shall be provided in nozzle and fan rooms at location provided by TVS contractor in approved drawings. (vii) Block work in nozzle room shall be done after installation of nozzle.	
3.2	**Civil with ECS**	(i) Civil to provide in designated rooms for system contractors drainage, equipment foundations, pipe / pedestals, shafts cut-outs, lifting / pulling hooks, canopy / slabs to cover access hatch as perdrawing. (ii) Civil to design and build architectural finishes in public areas with provision for ECS & E&M fixtures including cut-outs in architectural finishes for passage of services and installation of fixtures. (iii) Civil to carry out a joint check with ECS contractor for all drain points provided for ECS / TVS to be free of any obstruction and hand over before commencement of testing of ECS Equipment. Drain channel shall be covered with perforated drain traps.	i) ECS contractor to supply details of all loads, plant layouts, equipment foundations, room drainage requirements, room sizes, pipe support pedestals, lowering hatches, cut-outs, recesses, shaft/gallery sizes. ii) Louvers pertaining to ECS such as in shafts and other locations, are to be provided by the respective Electrical System Contractors. iii) Any pipe pedestals if required by TVS/VAC contractor shall be installed by them.
		Concealed Drain pipe (vertical and horizontal) will be laid by civil contractor wherever required as per design. (iv) Louvers pertaining to architectural finishing works to be provided by Civil contractor as per architectural drawings. For any open to sky shaft, MS gratings to be provided by civil contractor as per approved drawings. (v) All ECS Shafts, Masonry plenums, all the rooms provided with air conditioning with FCUs or other means, are to be provided with drainage arrangements. (vi) All ECS / TVS shafts, Masonry plenums, Masonry ducts etc including OTE and UPE to be properly sealed and to be provided with evenly finished internal surface free from any extra sticking / hanging ply, wooden pieces or any other material, any protrusions, debris and unwanted material etc. The internal surface	

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		including floors to be provided with anti-dust paint as per finishing schedule. (vii) Access doors suitably rated for Fire shall be provided by civil in ECS shafts as per requirements given by ECS contractor. (viii) All FCUs coming above false ceiling are to be provided with good quality hinged openable access doors as per the sizes given by ECS contractor. (ix) All the cut outs in the slabs for Piping, cables / cable trays and ducts – whether inside or coming under open sky- are to be provided with adequate protection to prevent any ingress of seepage / rain water etc. (x) Civil shall provide piping connection in cooling tower area from soft water tank to the cooling tower make up pipe. (xi) Pedestrian / walkway over pipe for crossings the pipes shall be provided by civil in cooling tower area to avoid damage of pipe as per requirements by ECS.	
3.3	**Civil with E&M**	(i) Civil to provide in designated rooms for system contractors drainage, equipment foundations shafts/galleries, cutouts & recesses in stations & tunnel crosspassages, lifting/pulling hooks, earth mat (U/G station), earthing risers through base slab to earthingterminals (U/G station). (ii) Civil to design and build architectural finishes in public area with provision for E&M fixtures including cutout and provision in architectural finishes for passage of services and installation of fixtures. The same shall be done in accordance with approved architectural drawings. Civil contractor will also provide structure member for installation of Lightning Arrestors (LA), platform cable tray etc. as per details furnished by E&M contractor and DDC. (iii) Civil to provide drainage channels at track and undercroft level as per approved drainage plan.	i) E&M contractor / E&M DDC to supply details of all loads, plant layouts, equipment foundations room drainage requirements, room sizes, cutouts, recesses, cables gallery / shaft sizes, poles / structures for lighting, support structures for cable trays / lightning arresters, LV earth mat (U/G station) and earthing terminals (U/G station) for assisting civil contractor in planning his activities. ii) E&M contractor to provide chequer plate / fire rated infill where opening in floors exceed the dimensions of LV equipment in ASS. iii) E&M contractor will provide required breaker feeder, cabling and terminations up to Civil starter Panel of Submersible and Borewell pumps. iv) All hydraulic & plumbing pumps (except bore well pumps) as well

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		(iv) Civil to mark walkway level continuous in Tunnel and track to give rail level marking on Tunnel sidewalks, to facilitate system contractor. (v) All borewell pumps to be provided by civil contractor. For all pumps including all drainage pumps; all pipings, fittings, accessories, etc. shall be provided by civil contractor However, Civil to provide details of submersible & borewell pumps rating & quantity of all pumps to E&M contractor for providing required breaker feeder & cabling up to Civil starter Panel Civil contractor to provide and maintain temporary drainage pumps for all requirements related to station and tunnel until commissioning of permanent pumps. All Plumbing / piping along with associated accessories for water supply requirements to be done by civil contractor. (vi) Civil to provide HDPE Pipes for cables as required by E&M contractor for external lighting poles at road crossing, foot-patharea etc. In case of FOB (where roof is not provided), civil contractor to provide mounting arrangement as per E&M requirement. (vii) Equipment foundations shall be provided by Civil contractor as per approved drawings. (viii) Concealed Drain pipe (vertical and horizontal) will be laid by civil contractor wherever required as per design. (ix) The Civil contractor needs to co-ordinate with E&M contractor so that both the E&M and civil works are executed in sync and no re-work is required (x) All finishing work of cut-outs, wall chipping and AC drainage provided by E&M contractor, to be done by the civil contractor, in elevated stations. (xi) For laying of earth-strip in floor of ASS, Concourse and platform, the interface to be done by E&M,	as their starter Panels shall be provided by E&M. v) External Bus duct / Cable Tray support to be provided by E&M contractor. vi) The E&M contractor needs to provide all foundation details / drawings, hook details, cutout details etc. to NMRC well in advance so that the same are incorporated in the approved GFC prior to execution of civil works. vii) The E&M contractor needs to co-ordinate with civil contractor so that both the E&M and civil works are executed in sync and no re-work is required.

S.No	Item Description	Role of Civil Contractor(s)	Role of System Wide Contractor(s)
		Traction and Civil contractor. (xii) Civil to provide suitable location for outdoor units of AC installation and easy maintenance access in elevated station. (xiii) Water connection with drainage arrangement to be provided by civil contractor at outdoor units location for cleaning of outdoor units as per approved drawings. (xiv) Civil contractor to interface with E&M contractor before laying of stones / granite. Any cutting of floor / wall granite required for laying raceway by E&M contractor as per approved drawing to be done by civil contractor.	
		Earthing Risers (for underground stations only) E&M Contractor to coordinate with DDC for providing proper drawings and design of earth mat to Civil Contractor.	Proper earthing risers as per approved design with desired value shall be provided by Civil Contractor. Earthing risers have to be provided up to the location of test links provided by E&M contractor. Furthermore, the risers shall be covered by suitable and mutually agreeable means to avoid theft.
		Earthing Terminals at Underground Stations Civil to provide earthing terminal on all metallic non-current carrying services related to civil in the tunnel including terminals on OTE & station box reinforcements as per inputs and intervals provided by power supply contractor to civil contractor.	
3.4	**Civil with Power Supply (ASS & ROCS)**	(i) Civil contractor to construct rooms, knockout panels, room finishes, equipment foundations, shafts / galleries, cut-outs, recesses, cable ducts within slabs, lifting/pulling hooks, earth mat, earthing risers through base slab to earthing terminations as per the approved drawings. (ii) Civil to mark centre line of track on the soffit of the tunnel and station box area. (iii) Civil / Tunnel building contractor to provide the wriggle survey of the station & Tunnel sections of the alignment for the designing of the OCS. The wriggle survey data will be provided according to the	(i) Power supply contractor to supply details of all loads, plant layouts, equipment foundations, room sizes (ASS, UPS, Sectioning rooms), cutouts, recesses, cable gallery/shaft sizes, cable ducts within slabs, lifting/pulling hooks, HV earth mat and earthing terminations. (ii) Power supply contractor to make good any unused OCS bracket drill holes in the tunnel roof. (iii) Power supply contractor to provide chequer plate / fire rated infill where openings in floors or walls exceed the dimension of the HT equipment or due to any other reason.

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		requirements of the traction contractor. All the parameters to be provided by the civil / tunnel building contractor in the wriggle survey should be fixed in consultation with the traction contractor.	
		Auxiliary Substations Station building contractor will provide ASS room complete in all respects, including flooring, access doors, and interior finish, but excluding foundations for transformer and panels. Station building contractor will provide the necessary cut-outs for cables entry and exit.	i) Power supply contractor will provide ASS layout drawings showing equipment layout, access doors etc. ii) Power supply contractor will provide necessary details of foundations for transformers, panels other equipment etc. Alternatively, the Contractor of this Tender can provide suitably designed anchor fasteners to fix transformers, 33kV panels, Battery chargers etc to the basic floor / pedestal.
		i) Provision of openings in slabs etc. for cable entry and cable exit ii) HDPE pipes for cables as per approved drawing / as per requirement for track crossing of cables inside station area / tunnel will be provided by Civil contractor. The construction should take into consideration cable bending radius (specified in the drawing), cable fastening arrangements and suitable provision to cover the cables in public places.	i) Power supply contractor will provide drawings showing the locations and sizes of openings to be provided in slabs etc. to allow passage of cables. ii) DDC will prepare cable route drawing and Station Building Contractor will provide openings as per drawing. iii) Power supply contractor will interface with Station Building Contractor to ensure correct and adequate cable routings,openings etc. iv) Power supply contractor will supply, install and connect cables.
		i) Provision of cable path–shafts, cable supports for cables from Ground level to ASS. ii) Station building contractor will provide a cable gallery or shaft for entry of cables coming from RSS buried in ground /pipes etc. for takingthem up-to ASS (at designated stations). Sealing and water proofing, if any required shall be provided by civil. This excludes the cable path from RSS to station.	i) Power supply contractor / DDC will provide necessary drawings & details for cable routing. ii) Cable path / route from RSS to station to be done by Power supply contractor.
		iii) Cable path for 33 kV cables on Via-duct from Via-duct to ASS room	iii) Traction contractor will provide HT cable path and brackets or tray inside ASS room and from

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		iv) Civil Contractor will provide HTCable path and brackets over Via-duct.	Viaduct to ASS.
3.5	**Civil with Escalators**	(i) Civil contractor to design and build escalator shaft with top, mid and bottom supports, finishes meeting the escalator requirements at top/bottom and sides of escalator, lifting hooks, pit, drainage and provision for cable and sprinkler pipe routing, ECP recess and SCR layout (ii) Civil Contractor to provide properly levelled, clean, clear and debris free work areas, shaft, shaft access (including cable entry holes / cut-out), hooks / holes, loading / unloading areas and clear access from road to shaft for erection of Escalator as requested by Escalator Contractor. (iii) Civil contractor to provide properly levelled, clean, clear and debris free site storage space. (iv) Civil contractor to provide embedded hooks In case of drilled hooks, load test also to be conducted and test report to be provided. (v) Civil contractor to match stone finished floor level with the level of escalator floor plate (at top and bottom landings). If required, civil contractor will create suitable slope as per approved architectural drawings. (vi) Civil contractor to provide Slope of finished floor away from Escalator to prevent entry of mopping water as per approved drawings. (vii) Civil Contractor to provide gravitation drainage system of Escalator Pit as per approved drawings. In addition, for underground stations Drainage system of Escalator Pit must be connected with sump pump, whereas sump pump depth must be more than Escalator pit to avoid backflow of water in Escalator pit. Drainage sump pit of escalator should be away from the escalator landing to avoid any inconvenience to users. (viii) Civil contractor to provide canopy	Escalator contractor to supply shaft & pit dimensional data, end and intermediate support details, earthing requirement, equipment loads, cutout & recess details, lifting hook locations & details, services routes, delivery route and method of erection, ECP recess dimensions, SCR equipment layout, well in advance so that same can be incorporated in architectural GFCs of civil works.

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		and rain shelter for Ground to Concourse Escalator as per approved drawings. (ix) Civil contractor to provide SS railing near top and bottom landings (both LHS & RHS) of Escalator for preventing falling hazard as per approved drawings as per the provision in scope of work. (x) Civil contractor to fill the gap between Escalator and adjacent wall / stairs as per the provision in scope of work. (xi) Civil contractor to ensure access to escalator top and bottom pits through floor plate for maintenance requirements and there shall be no obstruction in full opening of floor plate. (xii) Civil contractor to ensure suitable protection and covering of future escalator shafts as per the provision in scope of work. (xiii) Civil contractor to ensure that Station Entry Escalators shall be provided with suitable locking arrangements through gate / rolling shutters / or any other arrangement to prevent theft and sabotage. The locking arrangement shall not obstruct with escalator maintenance requirement in any way as per the provision in scope of work. (xiv) Escalator floor plate landing sill stone flaming for making it rough surface to be done by civil contractor as per the provision in scope of work. (xv) PCC work in lift and pit cleaning to be done by civil contractor before handing over to Escalator contractor.	
3.6	**Civil with Lifts**	(i) Civil contractor to design and build lift shaft with cutouts, recesses, provision for lifting beams, drainage, rain shelter and internal shaft plaster & anti-dust paint finish as per approved drawings (Finishing of the shaft as per approved drawing and BOQ). (ii) Civil Contractor to provide properly levelled, clean, clear and debris free work areas, shaft access	Lift contractor to supply shaft dimensional data and details of cut-outs, recesses, lifting beams, drainage, provision for surface mounted fixtures, detailed load calculation, design and drawings of load beams / hooks etc. well in advance so that the same can be incorporated in the architectural GFCs prior to casting of the lift shaft.

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		(including cable entry holes / cut-out), hooks / holes, loading / unloading areas and clear access from road to shaft for erection of LIFT as per requirement of Lift Contractor. (iii) Civil Contractor to provide gravitation drainage system of Lift Pit as per requirement of Lift Contractor. In addition, for Underground station Drainage system of Lift Pit must be connected with sump pump and its depth must be more than Lift pit to avoid backflow of water into Lift pit. Drainage sump pit of elevator should be away from the elevator landing to avoid any inconvenience to users. (iv) Civil Contractor to do water proofing of Lift Shaft (wherever required) as per requirement of Engineer (v) Civil contractor to provide Slope and proper drainage arrangement of accumulated water on roof of lift shaft. (vi) Civil contractor to provideventilation cut-out for adequate fresh air ventilation as per requirement of Lift Contractor as per approved drawings. (vii) Civil contractor to provide canopy (including drainage system at roof of Lift Shaft) and rain shower protection for Lifts Shaft exposed to open sky. (viii) Civil contractor to construct lift shaft as per dimensions in drawing with proper plumbness. In case of any subsequent correction / alteration, civil contractor to provide certificate that Lift Shaft is suitable for installation and safe operation of lift. (ix) Civil contractor to match stone finished floor level with the level of Lift Landing Sill (at all landings). If required, civil contractor will create suitable slope in stone finishing work as per approved architectural drawings. (x) Civil contractor to provide adequate slope (away from Lift Landing) as per approved drawings.	

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		(xi) Civil contractor to provide plaster on rear side (visible from inside of Lift Shaft) of landing brick / block work as per the provision in scope of work. (xii) Civil contractor to provide embedded hooks. In case of drilled hooks, load test also to be conducted and test report to be provided. (xiii) Civil contractor to interface with NMRC and Lift Contractor for the placement of water tank to avoid any seepage in Lift Shaft. (xiv) Civil contractor to coordinate with Lift Contractor for construction of Lift Landings brick and finishing work at each landing. (xv) Civil contractor to provide ramp along with SS Handrails on both sides for access to ground floor elevators as per the provision in scope of work. (xvi) Future elevator shafts to be protected suitably by suitable block / brick work by civil contractor. (xvii) Civil contractor to fill PCC at entrance sill and sill stone at all landings. (xviii) Landing sill stone flaming for making it rough surface to be done by civil contractor as per the provision in scope of work.	
3.7	**Civil / PEB with Solar Power Plant Developer**	i) Design, fabrication, supply and erection of structural steel for roof inspection platforms and catwalks on the roof shall be done by civil contractor as per the drawings and details approved by NMRC. ii) Roof structure and roof sheet shall be planned as per solar module installation arrangements. iii) Providing life-line (safety rope on the roof) for maintenance / cleaning purpose as per the approved drawings shall be in the scope of civil contractor. iv) Civil contractor shall provide ladder to access roof and water connection on the roof for cleaning of solar modules.	Solar contractor to provide detailed drawings / arrangements details etc. to NMRC well in advance so that the same may be incorporated in the architectural GFC of the civil works.
3.8	**Civil with Elevated OHE & ASS contractor**	(i) Since Over Head Equipment are installed on the outer parapets of viaduct, access to OHE from stations	i) Electrical System contractor will provide drawings, and connect earthing points.

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		through the parapet is required. (ii) Railing on both sides of viaduct (UP and Down) is required for the safety of the staff attending OHE at designated locations like Anchor mast, Anticreep mast, Switching Posts etc. Civil Contractor to interface with OHE contractor for locations with monkey ladder as perrequirement of Traction contractor at designated locations within SOD. (iii) In case of Box girders, the man- holes may be provided with heavy duty covers and proper locking arrangement so that viaduct cannot be accessed by miscreants (through these holes) (iv) ASS should be avoided under the expansion joints of viaduct. (v) Trees at both side of viaduct may be removed in such a manner that no tree branch comes within 10 m from the viaduct. Long trees such as Eucalyptus may not be allowed up to 50m distance from the via-duct as per advice and confirmation of NMRC. (vi) The earthing terminal of the railing should be provided. Sectioning of railing to be done as per earthing requirement, and drawings. (vii) Drop Arms provided under the RCC Roof of the Elevated stations to be provided with earthing terminal. Proper earthing arrangement in the RCC Roof is required for the safety of the occupants. This aspect may be taken care. Earthing scheme and drawing for such installation is to be developed in consultation with Electrical department. (viii) The width of the parapet should accommodate the mast base plates properly, as at several locations in Ph III base plates were protruding beyond the parapet. Adequate width of parapet to be ensured by the civil contractor as per approved drawings approvedby NMRC. (ix) OHE Holding down bolt threads at parapets should be greased and properly covered by civil contractor so that damage to threads can be avoided during Shifting / transportation.	ii) System Contractor to sign the pour card in coordination with civil contractor for each location.

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		(x) For Underground Station design should be such that access to the ASS rooms are directly from the platform and no access to track is required for the entry to entry ASS/Switching stations. (xi) For all bridge-type structures, minimum electrical clearances from rail level/parapet level/platform level and from central line of the track should be as per Annexure-A (xii) A loading deck of minimum size 3.0 m x 5.0 m for loading and unloading of equipment outside the ASS room to be considered which may change as per the requirements at site and system contractors' requirements. Niche of about 2.5 m x 2.0 m x 0.5m should be provided nearer to S & T room for the installation of ACDB.	

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
4.	**ADDITIONAL INTERFACE BETWEEN CIVIL / TRACK/ DDC AND SYSTEM WIDE CONTRACTOR(S) (SIGNALLING, TELECOM, PSD, UPS & AFC) (UNDERGROUND, ELEVATED & DEPOT)**		
4.1	**Common Requirements**		
(i)	a) Water clogging is to be avoided near signalling equipment like Signal, Axle counter, Point machine, Marker board, Norming Points and in S&T rooms. b) There should not be any water flowing in S&T rooms. Any drainage pipe passing through S&T Room should be avoided. There should not be any provision of water tank above the S&T rooms.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by S&T Contractor(s) b) Execution of thework to be coordinated with Civilcontractor.
(ii)	There should not be any kind of infringement with Signalling/ Telecom/ PSD installations in Tunnel /Viaduct and station box area with other systems	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s).	Signalling/Telecom/PSD contractor to coordinate with DDC/Architect contractor.
(iii)	a) Provision of architectural finishes in station and S&T rooms, acoustic treatment and building materials of the entire station b) At Elevated/ underground station & depot	a) Material for Acoustic treatment shall be jointly decided by DDC/Architect, Telecom and Civil contractors.	Inputs to be given by Signalling, Telecom, PSD, AFC/UPS(S&T)/ S&T PS Contractor(s).

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
	provision of space for Telecom, Signalling, AFC, PG/PSD cable tray/ Raceway connectivity between platform level, concourse level, under-croft level, road level & different buildings in depot. Access provision at each level for future maintenance should be kept. c) S&T shaft of appropriate size to beprovided for each level at station area and Slab (working platform) appropriate size in S&T Shaft is required at each level	b) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). c) Civil Contractor to execute the work as per drawing. d) However, since Signalling, Telecom, PSD, AFC/UPS(S&T)/ S&T PS system Contractor(s) are not in place at time of finalisation of drawings, minor changes, if required, in the drawings (pre-execution) / work (post execution) may have to be undertaken, based on inputs from the respective contractors, when they are on board.	
(iv)	a) Minimum distance of 2 meters (horizontal) to be maintained between OHE and Signalling, Telecom, PSD equipment at Platform level. b) Height of lowest part of Display Board/ Clock should be at least 2.5 meters above finished floor level.	DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s).	Inputs to be given by Signalling, Telecom, PSD contractor(s)
(v)	At elevated station following cut-outs are to be provided in vicinity of TER/SER in Platform beams and track supporting structure of both platforms for cable entry from cable - trough / hangers provided on viaduct at track level to TER/SER. These cut-outs should be at least 300 mm above the track bed level to avoid any seepage. a) **For signalling**: - **Interlocking station** 4 no's cut-outs (500x200) in DN/UP PF beam & 2 no. cut-outs (500x200) in UP/DN PF beam - **Non-Interlocking station** 2 no. cut-outs (500x200) in each UP & DN PF beam for b) **For Telecom**: 2 Nos of cut outs (500x200mm) in both UP & DN side c) **For PSD**:	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). b) Civil Contractor to execute the work as per drawing.	Inputs to be given by Signalling, Telecom and PSD Contractor(s)

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	2 Nos of cut outs (500x200mm) in both UP & DN Side		
(vi)	**At underground station:** - **with side platform-** 2 nos. of PSBs of area 4 SQM or ESP/PSP/CCTV/PSA niche should be provided at each platform for side platform station, and - **with island platform** - 1 number of PSB of area 4 SQM. In case of ESP/PSP/CCTV/PSA niche, appropriate size should be taken to accommodate signalling requirements.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). b) Civil Contractor to execute the work as per drawing.	Inputs to be given by Signalling, Telecom and PSD Contractor(s)
(vii)	**For Underground Stations with side platforms** connectivity between both under crofts for Signalling Cable routing should be provided with cross over pipes and connectivity with other station areas as per signalling/ Telecom/ PSD requirements.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). b) Civil Contractor to execute the work as per drawing.	Inputs to be given by Signalling, Telecom. and PSD Contractor(s)
(viii)	a) In Depot, Data/Power trenches with covers and pull pit arrangement to be provided from TER/ SER to different utility buildings like DCO, Canteen, substation, Time office, P-Way, Inspection Bay, Auto wash plant, Stabling Shed, Pump room, Workshop building, Pit wheel lathe and RSS/TSS building, security rooms, Staff rooms, watch tower, depot entry /exit etc. Hume pipes shall be used for track crossings and providing connectivity from trench up to utility buildings, Staff Quarter etc. b) Trench for OFC to be provided with maximum possible route diversity from ramp up to TER/ SER. Cable support/ladder on pillars for OFC route from viaduct to ground level up to telecom trench.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). b) Civil Contractor to execute the work as per drawing.	Inputs to be given by Signalling and Telecom. Contractor(s)
(ix)	a) Provision of Temporary power and illumination in Tunnel/station area to be provided for installation of signalling/Telecom/GSM/AFC/PSD/ UPS(S&T)/PS system equipment(s). b) The energy charge rate per unit of consumption to be mutually agreed between concerned contractors.	a) Civil to provide power distribution boards at each end of concourse and platform level and at 150 m interval along tunnel length for use of all contractors, power capacity to suit the combined requirementsof each contractor. **b)** Civil Contractor to coordinate with Signalling/ Telecom/ UPS (S&T)/ PS / GSM	a) Task lighting will be responsibility of Signalling/ Telecom/ UPS(S&T) / PS/ GSM/ AFC contractor(s). b) Compliance to Safety, Health and Environment (SHE) requirements shall be ensured by Signalling/Telecom/ UPS (S&T)/ PS/ AFC) contractor

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		contractor(s).	
4.2	**Tunnel Requirements**		
(i)	Provision of space on outer edge of tunnel wall of Bored Tunnel /Cut & Cover tunnel for installation of stand-offs for laying of LCX cables for GSM/TETRA /Signalling System.	DDC/Architect to make relevant provisions in the drawing as per inputs given by Signalling &Telecom System contractor(s)	Inputs to be given by Signalling and Telecom. Contractor(s)
(ii)	Provision of space on tunnel, outer edge/Inner edge of tunnel wall of Bored Tunnel and Cut &Cover area of tunnel for installation of Signalling/Telecom/GSM equipment (s) (signal, axle counter, point machine, WNRA, CCTV, marker boards/GSM repeaters etc) as per Signalling/Telecom/GSM requirements.	DDC/Architect to make relevant provisions in the drawing as per inputs given by Signalling &Telecom System contractor(s)	Inputs to be given by Signalling and Telecom. Contractor(s))
(iii)	a) Cross over pipes are required for laying of Signalling /TETRA /GSM/ Fibre/ Emergency Telephone (Data & Power) cables from under-croft to the outer edge of tunnel wall in station Box /Cut and Cover/ Tunnel Area for each tunnel as per Signalling & Telecom requirements. b) Separate pulpit to be provided in Cut and Cover area for Signalling and Telecom. c) Cross over pipes are required wherever crossing of Telecom/Signalling/GSM cables is needed.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&TSystem contractor(s). b) Civil/Track Contractor to execute as per drawing.	a) Inputs to be given by Signalling & Telecom Contractor(s) b) Execution of the work to be coordinated with civil contractor
(iv)	Provision of space for emergency telephones at cross passages	DDC/Architect to make relevant provisions in the drawing as per inputs given by Telecom. System contractor(s).	Inputs to be given by Telecom Contractor.
(v)	Provision of Signage and Operating instructions for Emergency/ Help Telephone in Tunnel and at Station area.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by Telecom. System contractor(s). b) Civil/Signage Contractor to execute as per drawing	Inputs to be given by Telecom Contractor
(vi)	Provision of 2 X 100mm of Core cutting in Mid shaft wall (UP & DN side) for Telecom cables Entry shall be required.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by Telecom. System contractor(s). b) Civil contractor toprovide the cut out and recesses in slab, walls, Mid shaft wall (both UP & DN side) etc. for passage of services as per SEM, WRD, CSD etc. as per drawing	a) Inputs to be given by Telecom Contractor. b) Execution of the work to be coordinated with civil contractor

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		provided by DDC. c) Civil contractor to coordinate with system wide contractor for joint inspection of cut outs prior to casting.	
4.3	**Via- Duct Requirement**		
(i)	Provision of Cable trench withcovers/hangers for Signalling & Telecom on via duct for laying Optical Fibre cable (UP & DN side of track) and Provision of Hanger arrangement for laying of Signalling copper cables (DN side of track)	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by Signalling & Telecomm. System contractor(s). b) Civil Contractor to provide Cable trench with covers/ hangers as per drawing.	a) Inputs to be given by Signalling and Telecom Contractor(s). b) Execution of the work to be coordinated with civil contractor
(ii)	Provision of space on viaduct and parapet for installation of Telecom and Signalling equipment (signal, axle counter, point machine, WNRA, CCTV Norming point, marker boards / Telecom CCTV etc) as per Signalling & Telecom requirements.	DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s).	Inputs to be given by Telecom and Signalling Contractor(s).
4.4	**S&T Rooms** **(TER / SER / SMR - at all locations,** **UPS(S&T) room - at Elevated stations & Depot,** **Power Supply (PS), GSM rooms - at Under-ground stations)**		
(i)	Area of S&T rooms	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by S&T System contractor(s). b) Civil Contractor to execute the work as per drawing.	Inputs to be given by Signalling, Telecom, UPS (S&T) & PSD Contractor(s).
(ii)	Provision of Fire rated Door(s) with clear opening size (FD1) of min. 1500 mm (W) x 2405 mm (H) with glass vision panel in S&T rooms.	DDC / Civil to provide required fire rated doorswith glass vision panel in S&T rooms. Height of centre of glass vision panel from bottom will be 1500 mm.	Inputs to be given by Signalling, Telecom, UPS (S&T), PSD Contractor(s).
(iii)	Height Clearance	DDC/Civil to ensure availability of clear height of: i) 3 meters min. from FFL (False Floor Level)S&T rooms and ii) 3.5 meters in GSM room forinstallation of Signalling / Telecom/ PSD/ UPS(S&T)/ S&T PS and GSM	Inputs to be given by Signalling and Telecom Contractor(s).

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		equipment.	
(iv)	Expansion Joints	a) DDC/Civil to ensue expansion joint/platform joint and Escalator area is avoided above TER/ SER/ UPS (S&T)/PS rooms. b) In case expansion joint is unavoidable, proper treatment of Expansion Joint to be done to prevent water ingress.	Inputs to be given by Signalling and Telecom Contractor(s).
(v)	False Ceiling/ Window/ false floor	a) False ceiling, windows/ ventilators are not required to be providedby Civil contractors inS&T rooms. b) Proper ventilation is required in SMR room. c) DDC/Civil to provide floor level of GSM/SMR room to be kept a step higher above the level of corridor to avoid any water ingress from outside.	a) Inputs to be given by Signalling and Telecom Contractor(s). b) Under floor tray & False floor in TER and SER to be provided by nominated Telecom / Signalling Contractor respectively.
(vi)	**Cut-Out location** UPS(S&T) room /S&T PS/ SMR room	**a) Underground Stations** DDC to ensure that S&T PS Room should be located between TER and SER. Civil to provide two cut outs (300 x 200 mm), in the common wall between SER & S&T PS and TER &S&T PS room below the false floor/ in front of trench as per Signalling & Telecom requirements. **b) Elevated Stations/Depot** DDC to ensure that UPS (S&T) room should be in between TER and SER. Civil to provide two cut outs (300 x 200 mm) in the common wall between SER & UPS (S&T) and TER & UPS (S&T) room below false floor/ in front of trench as	Inputs to be given by Signalling/ UPS(S&T)/ S&T PS and Telecom Contractor(s).

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		per Signalling and Telecom requirements. c) There should not be any cut-out in floor of UPS (S&T)/ S&T PS/ SER room	
(vii)	**Trenches -** UPS(S&T) /S&T PS room(s)	a) Civil to Construct trenches in: - UPS (S&T) room at Elevated station and - S&T PS room at Underground station. b) Provision of Galvanised Checker plates with handle over trenches, false flooring if necessary, Epoxy painting of floor, cut-outs for raw power and data cables to SER, TER & ASS. c) Seal the gaps after cable installation work with fire resistant material	Inputs to be given by Signalling/ UPS(S&T)/ S&T PS and Telecom Contractor(s).
(viii)	Handover of S&T rooms	Civil to ensure availability of following items as a minimum during handover of S&T rooms: - - Wall cut-outs, concrete floor with anti dust/Epoxy paint, - Wall finish with paint, - Trenches in UPS (S&T)/ S&T PS room, - Doors with lock arrangement with three keys, - Temporary lighting etc.	a) Inputs to be given by Signalling/ UPS(S&T)/ S&T PS and Telecom Contractor(s). b) Execution of the work to be coordinated with civil contractor
4.5	**Operational Rooms Requirement**		
(i)	SCR/ DCR /PCR /PPIO/ Crew control room	a) Civil to provide counter /slab / furniture in SCR/DCR/PCR/PPIO crew control room to keep Telecom/ Signalling/ PSD/ AFCsystemsequipment, MMIs etc. b) Holes are to be provided on SCR/DCR/PCR counter table as per requirement for installation of Signalling/	Inputs to be given by Signalling, Telecom, PSD, AFC Contractor(s).

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		Telecom/ AFC/ PSD systems equipment MMIs, etc. c) In case false ceiling is provided in SCR/DCR, Openable Trap doors/ Openable type False Ceiling are to be provided near cable tray risers.	
4.6	**Telecom Specific Requirement**		
(i)	a) Suitable arrangement for separate pipes i.e., Hume pipe/HDPE pipe for data & power cables up to **Entry/Exit gate** of parking. If entry & exit is through separate gate, then, connectivity for power/data cable is required, for both. b) **Underground station:** Hume/HDPE pipe Connectivity from MTNL/BSNL Termination to nearest room (Pump/DG room/ ASS room/S&T shaft) c) **Elevated station:** Hume pipe /HDPE pipe/ Cable Tray connectivity with pulpit arrangement in DG Room, Pump room etc. at road level. Pull Pits are to be provided at every bend and after every 15mts. Separate suitable arrangement i.e. Hume pipe/HDPE pipe will be provided by Civil for data cables. If above connectivity is not provided by Civil, following connectivity provided by E&M in DG Room & Pump room shall be shared: ➢ Hume pipe/ HDPE pipe to be shared b/w E&M and Telecom for Power &Data Cable.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by Telecomm. contractor(s). b) Civil Contractor to execute the work as per drawing	Inputs to be given by Telecom Contractor(s).
(ii)	The route for LCX cable of TETRA shall have following conditions. a) False ceiling shall be non-metallic and at least 200mm below LCX route b) there shall be no obstructions between the ceiling and leaky coaxial cable. c) Wherever, LCX is close to wall, there should not be any obstructions for hanging the brackets.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by Telecomm. contractor(s). b) Civil Contractor to execute the work as per drawing	Inputs to be given by Telecom Contractor(s).
(iii)	a) Provision of space for installation and mounting of PID/ Speaker/ CCTV/ Clock	a) DDC/Architect to make relevant provisions in the	Inputs to be given by Telecom, Contractor(s)

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
	on portal in Station(s) & Depot(s). b) Signage should not block visibility of PIDs, Clocks, CCTV cameras c) In Station/Depot area with false ceilings, cut outs/ openable type Ceiling are to provide for installation of speakers, clocks, PIDs and CCTV cameras d) At **underground stations**, holes are to be provided in wall cladding for installing Telecom equipment and Cut outs in false ceiling are to be provided for mounting of speakers, PIDs, Clocks, CCTV cameras etc.	drawing as per inputs given by (Telecom) System contractor(s). b) Civil Contractor to execute the work as per drawing.	
(iv)	For Station/ Depot with Radio tower, minimum 5x5 sq. meter space at road level in vicinity of TER is required for Radio tower. The total cable length from TER to top of radio tower (including radio tower height) should not be more than 100meters. Minimum distance from OHE should be 15meters. Also, 5x50sqmtr. open space is required for assembly of tower and its erection. Hume pipes to be provided from nearest S&T shaft up to Tower location with Pull pits as per requirement. At every bend of Hume pipe, pull pit is required. 'Or' If space for Radio Tower is not available as per site conditions, then Roof Top tower can be planed over entry/exit structure. Civil contractor to provide foundations as per requirements of Telecom Contractor. Any structural detailing required for foundations has to be carried out by Civil Contractor based on design from Telecom Contractor. Proper access to Radio Tower shall be provided by Civil Contractor.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by Telecom (Radio) System contractor. b) Civil Contractor to execute the work as per drawing/requirement	Inputs to be given by Telecom, Contractor(s).
4.7	**PG/PSD Specific Requirement**		
(i)	Provision of continuous RCC/steel structure beam throughout the platform at a height of 3250 mm from FFL for installation of full height PSD and perpendicular to track at a height of 3250 mm from FFL for installation of PED at both platform end. Design dead load of PSD will be less than 300kg/m, crowd load will be minimum +3000 N/m2 ,shock load will be minimum 2800 N and wind pressure will be minimum ± 1200 N/m2.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by PSD System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by PG/ PSD Contractor(s) b) Execution of the work to be coordinatedwith civil contractor
(ii)	Level of base plate of PG/PSD to be 940(+/-5mm) from rail level.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by (PG/PSD) System contractor.	a) Inputs to be given by PG/ PSD Contractor(s)

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		b) Civil Contractor to execute the work as per drawing	b) Execution of the work to be coordinated with civil contractor
(iii)	Installation of PG/PSD structure requires punching of holes on platforms for which 600mm (unfinished) should be clear from platform edge towards the platform.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by (PG/PSD) System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by PG/ PSD Contractor(s) b) Execution of the work to be coordinatedwith Civil contractor
(iv)	Any gap remaining between PG/PSD structure and civil structure near track access stairs to be closed with block work/suitable means by Civil	a) Civil Contractor to execute the work as per drawing b) Any gap remaining between PSD header box and down stand beam of underground station structure to be covered with suitable arrangement by civil to segregate the platform and trackside environment	a) Inputs to be given by PG/ PSD Contractor(s) b) Execution of the work to be coordinated with Civil contractor
(v)	After installation of PG/PSD the remaining gap between platform stone and PG/PSD base plate to be filled in aesthetic manner matching the PSD base.	Civil Contractor to execute the work as per drawing	a) Inputs to be given by PG/ PSD Contractor(s) b) Execution of the work to be coordinatedwith Civil contractor
(vi)	PG/PSD contractor will drill approximately 350 to 400 numbers of holes throughout the platform edge of various sizes of diameter:20mm,40mm,50mm, 100mm etc.	Execution of the work to be coordinated with PG/PSD contractor	PG/PSD Contractor to execute the work as per their requirement.
(vii)	a) All PG Installation will be done keeping in view the SOD measurement. b) High tension electrical cables should run at a minimum separation of 600 mm from PS/PSD cables and preferably in covered duct, when margin is less. c) Track central line	a) At Elevated station first cable hanger below platform coping provided by Civil contractor shall be used by PSD contractor b) DDC/Architect to make relevant provisions inthe drawing as per inputs given by (PG/PSD) Systemcontractor. c) Civil Contractor to execute the work as per drawing d) Track contractor shall provide track central line as well as co-ordinate installation of	a) Inputs to be given by PG/ PSD, Contractor b) PG/PSD Contractor to execute accordingly.

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		PG/PSD system.	
4.8	**AFC Specific requirement**		
1.	a) Arrangement of main cable routes including cable trays, troughs, hangers, trenches and ducts etc to all AFC Equipment b) Drainage and pits should not interfere with Raceway/trench	DDC/Architect to make relevant provisions in the drawing as per inputs given by AFC system contractor	Inputs to be given by AFC system contractor
2.	**Tom/ EFO ROOM**		
(A)	a) Construction of counter in TOM Room with false ceiling and windows with glass panes. b) Cut out in counter for cable/equipment fixing c) Cut out on front glass pane for exchange of ticket and money with passenger. d) Cut for Speaker/mic to communicate with passenger. e) Trench covered with chequered plates/alternative arrangement for cable routing inside the TOM/EFO Room. f) Cut out on outside counter for installation of pole of Ticket Reader. g) For handicapped counter, space for raceway. h) Space on wall for placing wall mounted Electrical cabinets and Switch Rack in both TOM and EFO Rooms. i) Provide cutting and punching of EFO/TOM wall for installation of ticket reader pipe.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by AFC System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by AFC system contractor b) Execution of the work to be coordinatedwith Civil contractor
3	**TVM/RCTM**		
(A)	a) Covered arrangement / Niche arrangement for placing Ticket Vending Machines (approx. width 900mm) as deployed at line 8 Kalkaji Mandir. b) Provision for laying raceways providing connectivity to TVM.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by AFC System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by AFC system contractor b) Execution of the work to be coordinated with Civil contractor
4	**AFC OCC (Data Centre)**		
(A)	Construction of AFC Operation Control Centre (Data Centre)	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by AFC System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by AFC system contractor b) Execution of the work to be coordinated with Civil contractor
5	**Barrier Related Works**		
(A)	Installation of necessary Fixed glass barrier	a) DDC/Architect to make	a) Inputs to be given

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
	alongside gate array	relevant provisions in the drawing as per inputs given by AFC System contractor. b) Civil Contractor to execute the work as per drawing	by AFC system contractor b) Execution of the work to be coordinated with Civil contractor
6	**Tactile path**		
(A)	Provision and construction of tactile path for differently enabled people	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by AFC System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by AFC system contractor b) Execution of the work to be coordinated with Civil contractor
7	**Cut-out marking for AFC Gate array**		
(A)	a) Cut-out for gates and marking for future gates below the fixed barrier, on stone above junction boxes alongside the Gate array. b) Finishing of cut out works after gates are installed.	a) DDC/Architect to make relevant provisions in the drawing as per inputs given by AFC System contractor. b) Civil Contractor to execute the work as per drawing	a) Inputs to be given by AFC system contractor b) Execution of the work to be coordinated with Civil contractor
4.9	**Signalling with Track manufacture/ Supplier contractor**		
i)	Turn out assemblies and their mounting and driving arrangement (with Turnout supplier/vendor)	Track contractor shall: a) supply turnout assemblies including second drive arrangement. b) Co-ordinate with Signalling contractor for design of second drive arrangement. c) Turnout interface drawings including Point Machine are to be signed jointly duly specifying location ofholes with size and switch opening location from SRJ.	Signalling System contractor Shall: a) coordinate with track manufacture/supplier and will advise them about the points machine to be used with dimensional design of holes and their locations to facilitate the installation of machine with turnout-assembly. b) Coordinate with track manufacture/supply contractor (s) for design of second drive arrangement. c) Turnout interface drawings with point machine are to be signed jointly specifying location of holes with size and switch opening

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
			location from SRJ.
ii)	Installation of point machine over with turnout PSC sleeper vendor/manufacturer.	Track contractor shall: a) provide details of long sleeper to be placed near ATC for installation of point machine. b) provide the supports, mounting arrangement for Point machine over extended sleepers and size and location ofholes as per requirement of S&T to install the point machine.	Signalling System contractor Shall: a) coordinate with supplier of turnout sleepers and will provide the co-ordinate of holes for facilitating the installation of point machine. b) Provide location of holes at switch rail for installation drive if required. c) Determine the position (LHS or RHS), dimension, supply and install the point machines with all associate mechanism and co-ordinate with track contractor.
iii)	Scope of supplies	a) Track contractor shall supply all track assemblies and track fasteners turnouts, all stretcher bars (except leading (1st) stretcher bar), second drive with all accessories, wherever required for second pull. b) The design of second drive arrangement shall be co-ordinated and interfaced with Signalling Contractor to ensure full compatibility.	Signalling contractor shall supply leading (1st) stretcher bar / drive and coordinate with track contractor(s) for design and installation. Signalling contractor Shall supply locking arrangement for second drive, if required.
4.10	**Signalling with Track Installation contractor**		
i)	Final track alignment and profile plans	Track Contractor shall provide the same giving the details of Turnout including curve, Gradient and Speed restrictions for Up and DN line separately.	Signalling contractor shall incorporate the same in Signalling and Train Control design.
ii)	Turn out assemblies and their mounting and driving arrangement (Ballast less and Ballasted track).	Track Contractor shall provide location of SRJ and turnout assemblies and shall provide mounting arrangement for point	Signalling System contractor shall: a) Coordinate with track installation contractor (s) on mounting of the

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		machines including second drive arrangement.	turnout assemblies including point machines. b) Supply and install the point machines and 1st drive (stretcher bar) suitable to drive turnouts. c) Coordinate with track Installation contractor (s) for design and installation of second drive arrangement. d) Turnout interface drawings with point machine are to be signed jointly specifying location of holes with size and switch opening location from SRJ.
iii)	Installation of point machine [Ballast less track and ballasted track]	Track Contractor shall: a) Provide location of SRJ (Stock Rail Joint). b) Provide supports, mounting arrangement for Point machine (extended sleepers) c) Provide pedestal/ foundation for installation of point machine and second drive based on information provided by Signalling contractor and co- ordinate for the same with the Signalling contractor (in case of ballast less track).	Signalling System contractor shall: a) Incorporate the same in Signalling andTrain Control design. b) Provide all necessary information such as dimension of points and machine tofasten with extended sleepers and co-ordinate for the same. c) Determine the position (LHS or RHS), supply and install the point machines with all associate mechanism and coordinate with track contractor.
iv)	Scope of installation	Track Contractor Shall install all track assemblies and track fasteners turnouts, all stretcher bars (expect leading (1st) stretcher bar), second drive with all accessories, wherever required forsecond pull.	Signalling contractor shall: a) supply & install the point machines, leading (1st) stretcher bar and co-ordinate with track contractor(s) for design and installation of

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
			second drive arrangement. b) supply locking arrangement for second drive, if required.
v)	Track X-ings of cables	Track Contractor Shall provide cutouts in the track plinth on ballast less track at regular intervals in both elevated and underground section. The gap between two plinths to be used for cable crossings by Signalling contractor.	Signalling contractor shall: a) provide all track crossings requirements to track installation contractor. b) provide pipes and support and/or drilling of holes in the plinth for installation of signalling gears if required.
vi)	Installation of trackside equipment, Balise in track plinth/bed in Underground section	Track Contractor shall ccoordinate with Signaling contractor: a) and provide pocket/cavity of adequate size in track plinth/bed for installation of balise **(in under-ground sections).** **b)** for drilling of holes in guard structure for installation of Balise stand. **(In elevated section).** c) to ensure full compliance of schedule of dimensions.	Signalling Contractor shall coordinate with Track installation contractor(s) and **a)** provide location and size of pocket/cavity for installation of balise **(in UG sections).** b) Drill the holes in guard structure for installation of Balisest and. **(In elevated section).** c) Furnish the final sizes of track side equipment and co-ordinate with Track installation contractor(s) to ensure full compliance of schedule of dimensions.
vii)	Track connections	Track Contractor shall: a) Coordinate with Signalling Contractor for axle counter fixtures/wheel sensors and provide proper space between bottom of the rail and track	Signalling Contractor shall supply and install axle counter fixtures/wheel sensor and co-ordinate with track installation contractor so as to ensure that proper

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		plinth/bed for installation of axle counter wheel sensor. b) Coordinate with Signalling contractor in installation of axle counter fixture / wheel sensor as per the requirement of Signalling contractor. c) Coordinate with Signalling contractor and chipping of track plinth upto 20 mm to accommodate the clamp of axle counter wheel sensor will be done so as to ensure the provision of 65 mm space between bottom of rail and track plinth.	space is available between bottom of the rail and track plinth/bed for installation of axle counter wheel sensor (will ensure installation of axle counter by 45mm below the topsurface of the rail).
viii)	Installation of points operating mechanism.	a) Track Contractor shall provide proper gauge, housing and packing of points and opening of switches at agreed locations and shall carry out all other works as required to make the point suitable for installation of point machine by Signalling Contractor. b) No Gap in housing and packing should be there up to 3rd sleeper/ fastener/ chair plate w.r.t. Point Machine location in facing direction/towards turnout (1:9 in S. G).	a) Signalling Contractor shall check proper gauge, housing and packing of points and opening of switches as agreed during supply contractor stage and shall co-ordinate for operation of switches and all other items necessary from signalling point of view. b) Signalling contractor shall make necessary adjustment to points operating mechanism as required by track installation contractor(s) at the time of track parameters correction and tamping of ballasted turnouts.
ix)	Testing of points and crossings	Track Contractor Shall Jointly test with Signalling contractor during installation and while commissioning of point machines and during integrated testing and commissioning and rectify	Signalling Contractor shall Jointly test with track installation contractor(s) during installation and while commissioning of point machines and during integrated testing and

S. No.	Item Description	Role of Civil /Track / DDC Contractor(s)	Role of System Wide Contractor(s)
		all defects pertaining to track, if any, identified during testing and commissioning of points.	commissioning.
x)	Marking of Fouling Mark at site and installation of Fouling Mark marker board(s) at appropriate location(s).	a) Track contractor shall provide the location(s) of Fouling Mark and mark the location(s) ofFouling Mark at site. b) The track contractor shall install the Fouling Mark marker board(s) at appropriate location(s).	Signalling Contractor shall incorporate the same in Signalling and train control design.

5) Interfacing Requirements of Traction with Design & Build Contractor of Tunnel / Box Section / Ramp (referred to as RAMP)

Item No.	Item Description	RAMP	DDC/EPC/TRACTION CONTRACTOR
1	Installation of RTU Equipments in the UG sections	The ASS, SWITCHING STATION Rooms will be constructed by the RAMP Contractor as per the layout given by DDC/EPC/ Traction contractor in the approved drawings.	RTU Equipments, including communication links to TER etc will be supplied and erected by EPC/TRACTION CONTRACTOR, as per Specifications.
2	Earthing arrangements inside the tunnel portion / in the Underground station	This will be done by the RAMP-1 Contractor as per drawing.	DDC/EPC/ Traction contractor to provide details.
3	Earthing arrangements in the Ramp portion	The earthing bars embedded in concrete and earth plates will be provided by RAMP, as per designand specifications provided by DDC /EPC / TRACTION CONTRACTOR in the approved drawings.	Connections to Earth plates, as per design and specifications provided by DDC, will be made by EPC/TRACTION CONTRACTOR.
4	Erection of Masts / Cantilevers / OHE terminations for OHE support, Lightning arresters etc in the Ramp portion	RAMP will provide the necessary holding down bolts, for masts, fasteners for cantilevers on walls and for termination of OHE on walls, for mounting Lightning arresters as per design and specifications.	DDC will provide necessary designs, showing locations and holding down bolts arrangements. EPC/TRACTION CONTRACTOR will supply and erect OHE Masts with Base Plates or Cantilevers at the locations as per design.
5	At transition of tunnel towards rail corridor where viaduct height is low, side railing with concertina wires to be provided	At transition of tunnel towards rail corridor where viaduct height is low, RAMP will provide side railing with concertina wires to be provided	EPC/TRACTION CONTRACTOR will interface with RAMP for provision of side railing with concertina wires at transition of tunnel towards rail corridor where viaduct height is low.

6) Interfacing Requirements - Traction with Viaduct Contractor (VDC)

Item No.	Item Description	Viaduct Contractor (VDC)	DDC /Traction Contractor
1.	Providing OHE Poles, anchors etc. on viaduct The bending moment shall be taken into account.	Will provide segment list and alignment drawing for preparation of LOP. Will arrange to strengthen the concerned segments and provide holding down bolts along with nuts (as per drg provided bythe DDC for Viaduct). Viaduct contractor shall ensure that the bolts provided shall be greased and covered and undamaged for easy movement of nuts.	DDC/EPC/Traction contractor will prepare list of segments / U-Girder mast location requiring strengthening, to receive OHE masts, anchors etc. based on available track plans. EPC/TRACTION Contractor will verify at site. If there are any changes in the track layout plans, EPC/TRACTION Contractor will interface with viaduct contractor to further add segments to the list (wherever segments are not cast) or modify OHE design etc. to suit available strengthened segments/ U-Girder.
2.	Cable bracket arrangement for carrying power and control cables on viaduct.	Will provide brackets as per design given by DDC/EPC/Traction contractor.	DDC/EPC/Traction contractor will give drawing of brackets for power and control cables on viaduct.

Item No.	Item Description	Viaduct Contractor (VDC)	DDC /Traction Contractor
3.	NOT USED		
4.	Providing openings in Viaduct structures for passing cables etc.	Will provide openings as per requirements shown in the design.	DDC/EPC/TRACTION contractor will advise the size and locations where the cut-outs are required
5.	Earthing connections	Will supply and provide welding of Reinforcement bars and earth terminals according to drawings ensuring continuity of reinforcement bars of via duct segments piers and parapet segments. Provide earth terminals for connection.	DDC/EPC/TRACTION contractor will provide drawings showing arrangement of Earth terminals required to be provided on piers, pedestals, segments, parapet, railing etc. and the extent of welding required to be done on Reinforcement bars.
			EPC/TRACTION Contractor will provide the necessary earthing connections between BEC/OPC/ITL/any other steel structure earthing plates etc. and the earth terminals. This will include supply of cable to connect BEC and other connecting plates.
6.	Earthing connection for hand rail	The viaduct contractor shall ensure proper welding of Vertical and horizontal bars of the railings and will provide the necessary earth connection.	DDC/EPC/TRACTION Contractor will provide drawings showing arrangement of earth terminals required to be provided for earthing the hand rail.
7.	Electrical and physical clearances as specified in the drawing	Respect the given clearances throughout the viaduct.	DDC/EPC/TRACTION contractor will co-ordinate with Viaduct Contractor
8.	At viaduct suitable monkey ladder/platform may be provided for easy accessibility of BM & Isolator for manual operation.	The viaduct contractor shall provide the monkey ladder / platform access as per requirement of DDC/EPC/Traction contractor at designated locations within SOD.	EPC/TRACTION contractor will interface with Viaduct Contractor and give the locations for the provision of monkey ladder / platform for accessibility.
9	All the junction of girders should be sealed to avoid entryof thief.	The viaduct contractor shall ensure the sealing of junction of girders.	DDC/EPC/TRACTION contractor to check

7) Interfacing Requirements – Traction with Station Building Contractor(s) (SBC)

Item No.	Item Description	Station Building contractor (SBC)	DDC/EPC/TRACTION Contractor
1.	Support of OHE from Platform shed roof trusses	SBC will provide the necessary / suitable (as per required loading) steelwork and bolt-holes etc. to enable the suspension members to be supported from the platform shed roof trusses.	DDC will provide general arrangement showing suspension members from station ceiling, from which OHE can be supported. DDC will also indicate typical bending moment and direct load arising from OHE, at suspension points. EPC/TRACTION contractor will prepare

Item No.	Item Description	Station Building contractor (SBC)	DDC/EPC/TRACTION Contractor
			detailed drawings for support of OHE from suspension members.
2.	Providing OHE masts / anchors on external parapets at stations.	Will provide holding down bolts as per approved drawings (used on viaduct to take the base-plate).	DDC will indicate the locations where masts/anchors are required to be provided (in the pegging plans)
			EPC/TRACTION contractor will provide bolted base OHE masts / anchors etc.
3.	Providing electrical and mechanical clearances for OHE	Will ensure that the clearance diagrams are respected and there are no infringements.	DDC/EPC/TRACTION contractor will provide the necessary clearance diagrams showing minimum clearances required from OHE.
4.	Providing earthing connections	Will provide necessary earth terminals, earth mesh etc. and risers and respect the schematic earthing drawing, will ensure provision of minimum of 50mm dia pipe-5Nos. on each platform under the floor for continuity of earthing platform shelter/canopy, as per approved drawings	DDC/EPC/TRACTION contractor will provide Earthing connection drawings, showing locations of earth terminals, separate MET for RTU, earth mesh etc required at stations.
			EPC/TRACTION contractor will provide necessary interconnections between earth terminals/riser terminals and earth conductors (OPC, BEC) as shown in the Earthing connection drawings.

8) Interfacing Requirements - Traction with Track Contractor(s)

Item No.	Item Description	Track Contractor	DDC/EPC/TRACTION Contractor
1.	Information regarding track alignment, curves, levels etc.	Will provide information to DDC/EPC/Traction contractor	
2.	Viaduct and bridges, earthing through tracks plinth and plates welded to plinth reinforcement steel.	Supply and install GI plates on every deck end. Ensure the electric plinth continuity on every span by providing earth terminals at each end of the plinth duly connected with cable. The material details and specifications ofconnecting cables shall be interfaced with EPC/TRACTION contractor.	EPC / Traction contractor will supply and connect the connection cable to the BEC and plinth connecting plates atthe end of consecutive spans.
3.	Providing pipes for track crossing, for cables.	Track contractor shall interface with Traction Contractor for finalizing location of pipe crossings. Will provide pipes buried in concrete as per design provided by DDC for Viaduct and seal them temporarily.	DDC/ EPC / TRACTION will provide drawings showing requirement of pipes at specific locations. EPC/TRACTION contractor shall supply and provide the pipes over viaduct and pipes over parapet walls and interface with TRACK for correct location of pipes and verify before plinth casting.
4.	Providing continuity	Will check the details and confirm	DDC will provide bonding details.

Item No.	Item Description	Track Contractor	DDC/EPC/TRACTION Contractor
	bonds in tracks.	acceptability.	
			EPC / TRACTION contractor will provide the continuity bonds
5.	Electrical and Physical clearance	Respect the given clearance.	Shall provide necessary drawings
6.	Track Centre Line	Track Contractor shall provide the track centre line.	

9) Interfaces – Traction with Depot Contractor

Item No	Item Description	Depot Contractor (Depot)	DDC / EPC/TRACTION Contractor
1	Feeding Post	Prepare a space as per the drawing.	Install equipments in the Feeding Post
2	Installation of OHE in Workshop (Inspection Bay),Stabling shed, Interior cleaning Plant and Emergency Equipment Building. The overall weight to be taken into account is 500 kg at each suspension.	Realize supporting structure preparation for OHE suspension / bracket assemblies on the columns and drop arms fixed on trusses as per specific detailed drawings.	Supply of Interface drawings including requirements of mounting plates on columns and drop arms fixed to the trusses, supports for termination arrangements on beams/ slabs etc., for various buildings. Supply and install bracket assemblies with fastening devices on the columns and drop arms.
3	ASS room preparation according to drawing and the following criteria: ASS room layout principle ➢ Preparation of ASS Room as per drawings and specification ➢ Possibility of concrete refilling 0.3m depth. ➢ Floor and walls prepared with anti-dust paint. ➢ 2 doors 2x3 m with anti-panic system (bar across the door facilitating its opening) ➢ Low voltage installations (Lighting, Socket, fans, ventilation, fire protection) ➢ Transformers access from the nearest suitable road)	Prepare the ASS room as per the drawing and criteria.	Supply Interfacing drawings

Annexure-A

Sub: Provision of adequate OHE clearance for structures.

S. No.	Locations/Cases	Clear height from Rail level	Clear width from Central line of track
1.	At Metro/Viaduct Road/Rall Crossings above metro viaduct/ at grade section under construction	8500 mm	2150mm on either side up to the height of 7500 mm from parapet level
2.	At Steel Bridges		
2.1	If the Bridge is open to sky and no Cross beams are there	NA	2150 mm on either side up to the height of 6250 mm from parapet level/walkway.
2.2	If there is cross beam at steel bridge	8000 mm	2150 mm on either side up to the height of 7000 mm from parapet level/walkway.
3.	At Ramps near UG section		
3.1	If the Ramp is open to sky and no cross beams are there	NA	2150 mm on either side up to the height of 5750 mm from parapet level/walkway.
3.2	If ramp is open to sky and there are cross beams	6750mm	2150 mm on either side up to the height of 5750 mm from parapet level/walkway.
4.	At stations or at other structures above OHE. (Minimum height of station DA support)	7500 mm	2150 mm on either side up to the height of 5750 mm from platform level.

Wherever it is not possible to achieve the clearances as stipulated above, the case may be sent to NMRC office for approval.

EMPLOYER'S REQUIREMENTS

APPENDIX 3

PROJECT CALENDAR

(1) The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week.

(2) Requirements for the computation of Key Dates are given in Appendix 2B to the Employer's Requirements.

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

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

EMPLOYER'S REQUIREMENTS

APPENDIX 4

PROGRAMME REQUIREMENTS

1. GENERAL

(1) **Purpose of Programme**

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

a. Evaluation of Tender

b. Status Reports during Construction

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

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

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

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

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

2. METHODOLOGY

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

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

(3) The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design,

pre-construction, construction, and sub-contracts in executing the CPM scheduling by PDM. The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

3. PROGRAMME MANAGEMENT SOFTWARE

(1) CPM programming software used shall be Primavera Project Planning (P6) Program - Ver 20.12 or later. Any other compatible system capable of direct file interchange capability with software program used by the Employer - Primavera (P6), Ver 20.12 can be used with Engineer's consent. Scheduling software and relevant instruction manuals, licensed for use in connection with the contract, shall be provided by the Contractor according to the Employer's specifications

(2) The Tenderer may use a system other than Primavera but will be required to demonstrate that full electronic data transfer to Primavera is available and that the various levels of reporting and coding capabilities are at least equivalent to Primavera. Compatibility and comparable performance between Primavera and the Tenderer's proposed system shall be demonstrated in his Tender submission. Should compatibility not be demonstrated to the Employer's satisfaction the Contractor shall utilise Primavera for development, statusing, updating and revision of all the Programmes during the duration of the Contract. Upon the Engineer's consent of a system other than Primavera, the Contractor shall supply the Engineer with an original licensed copy, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

4. (Not Used)

5. POST CONTRACT AWARD

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

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

5.3 Following the Contractor's Initial Works Programme submission but in any case, no later than three (3) months from the date of award of contract, the contractor shall make submissions of the detailed **Works Programme** suitably amended to take into account the programmes of Designated Contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to review, revise and finalise his Initial Work Programme so as not to affect the progress of Works/ and or the works of the Designated Contractors. The resubmitted programme when approved by the Engineer shall form the **Baseline Programme** against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline programme but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.

5.4 For Initial & Detail Work Programme submission, one (1) original and six (6) copies each of the

following Programmes and Reports shall be submitted to the Engineer:

a) Programme: Baseline CPM Network

b) Programme: Baseline Milestone based Cost Activity Schedule

c) Baseline Schedule Report

d) Narrative

e) Baseline Physical Progress 'S' curve

f) Baseline Resource Charts

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

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

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

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

5.8 Failure to include any element of work required for performance of the Contract shall not relieve the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

6. WORKS PROGRAMME

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

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

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

(a) Key Dates,

(b) All physical work to be undertaken in the performance of the Contract obligations, including Temporary Works,

(c) The requested date for issue of any drawings or information by the Engineer,

(d) Incorporation of principal aspects of the Design Submission Programme,

(e) Procurement of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment,

(f) Any off-site work such as production or pre-fabrication of components,

(g) Installation of temporary construction facilities,

(h) Interface periods with Designated Contractors or utility undertakings,

(i) Design, supply and/or construction activities of sub-contractors,

(j) Any outside influence which will or may affect the Works.

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

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

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

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

(a) Activity ID and Activity Code.

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

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

(8) The Works Programme, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic (3½" diskettes or CD-R) and hard copy format (time scale logic diagrams in A1 size, reports in A4 size).

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

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

(a) Activity identification number and description,

(b) Duration expressed in Days,

(c) early and late start, & early and late finish dates. Planned start and finish dates,

(d) Calculated total float and free float,

(e) Predecessor and successor(s), accompanying relationships and lead/lag duration,

(f) Imposed time or date constraints,

(g) Calendar.

(10) **Narrative Statement**

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of key dates, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major

items of work including construction sequences and primary item of plant, Construction Equipment, Temporary Works and the like. It shall fully explain the reasons for the main logic links in the Programme and include particulars of how activity duration is established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

(11) **Baseline Physical Progress 'S' Curve**

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

(12) **Baseline Resource Charts**

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

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

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

7. INITIAL WORKS PROGRAMME

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

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

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

8. WORKS PROGRAMME REVISIONS

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

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

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

9. THREE MONTH ROLLING PROGRAMME

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

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

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

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

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

10. THREE MONTH ROLLING PROGRAMME REVISIONS AND UPDATE

(1) The Three-Month Rolling Programme shall be extended forward each month as described under Clause 5(1) above. Each submission of the Three-Month Rolling Programme shall be accompanied by a Programme Analysis Report, describing

actual progress to date, and the forecast for activities occurring over the next three-month period.

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

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

11. THREE WEEK ROLLING BAR CHART SCHEDULE

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

12. PROJECT CALENDAR

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

13. PROGRAMMING PERSONNEL

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

14. PROGRAMME AND REPORT SUBMISSION FORMAT

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

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

15. FAILURE TO SUBMIT PROGRAMME

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

EMPLOYER'S REQUIREMENTS

APPENDIX 5

MONTHLY PROGRESS REPORTS

1. GENERAL

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

2. FINANCIAL STATUS

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

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

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

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

3. PHYSICAL PROGRESS

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

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

4. PROGRAMME UPDATE (For Entire Project)

Programme updating shall include:

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

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

(ii) Updated Detail Programme Submittals – state in narrative the Works

actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:

- If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.
- Identify by activity number and description, activities in progress and activities scheduled to be completed.
- Discuss Variation Order Work Items, if any.

(b) the Programme Status which shall:

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

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

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

5. KEY DATES STATUS

A report on the status of all **Key dates** due to have been achieved during the month and forecasts of achievement of any missed **Key dates**, and those due in the next month.

6. THREE MONTH ROLLING PROGRAMME

The monthly issue of the Three-Month Rolling Programme.

7. PLANNING AND CO-ORDINATION

(1) A summary of all planning/co-ordination activities during the month and details of outstanding actions.

(2) A schedule of all submissions and consents/approvals obtained/outstanding.

8. PROCUREMENT REPORT

(1) A summary of all significant procurement activities during the month, including action taken to overcome problems.

(2) A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

(a) purchase Order Date - Scheduled/Actual,

(b) manufacturer/Supplier and Origin,

(c) letter of Credit Issued date,

(d) manufacturer/Supplier Ship Date - Scheduled/Actual,

(e) method of Shipment,

(f) arrival Date in India- Scheduled/Actual.

9. PRODUCTION AND TESTING

Deleted

10. SAFETY

(1) A review of all safety aspects during the month including reports on all accidents and actions proposed to prevent further occurrence.

11 ENVIRONMENTAL

(1) A review of all the environmental issues during the past month to include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

EMPLOYER'S REQUIREMENTS

APPENDIX 6

QUALITY ASSURANCE

1. General

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

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

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

2. Quality Assurance Management Plan

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

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

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

The Plan shall identify:

- Design Process: that control, check and verify the accuracy, completeness and integration of the design shall be performed by certified personnel and in accordance with documented procedure that have the written consent of the Engineer.
- Special Processes: that control or verify quality shall be performed by certified personnel and in accordance with documented procedures that have the written consent of the Engineer;
- Inspection and Test: Inspection and testing instructions shall provide for reporting non-conformances or questionable conditions to the Engineer; Inspection shall occur at appropriate points in the installation sequence to ensure compliance with drawings, test specifications, process specifications, and quality standards. The Engineer shall

designate, if necessary, inspection hold points into installation or inspection planning procedures;

- Receiving Inspection: These procedures shall be used to preclude the use of nonconforming materials and to ensure that only correct and accepted items are used and installed;
- Identification and Inspection Status: a system for identifying the progressive inspection status of equipment, materials, components, subassemblies, and assemblies as to their acceptance, rejection, or non-inspection shall be maintained;
- Identification and Control of Items: an item identification and traceability control shall be provided;
- Handling, Storage, and Delivery: provide for adequate work, surveillance and inspection instructions.

The Plan shall ensure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, and defects in materials and equipment shall be promptly identified and corrected.

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

3. Plan Implementation and Verification

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

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

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

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

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

Monthly Quality Report (MQR): The contractor shall submit the Monthly Quality Report, on the lines of sample document of MQR approved by the NMRC, to the Engineer, (Copy of sample document of MQR is available with the Engineer). MQR will contain, apart from the Material Testing Reports, the following major items:

a) Status of Approval of Method Statements: The Contractor shall submit Method Statements including check lists & ITP (Inspection & Test Plan) for execution of each and

every item of work including temporary works at least four weeks before their execution, conforming to the outline construction specifications given in the contract document and sample Method Statements approved by the NMRC, for review and approval by the Engineer. (copies of sample Method Statements are available with the Engineer).

b) Quality Walk: Quality Walk of the project site shall be held once in a week by the employer/Employer's authorized representative.

c) Weekly Quality Report (WQR): The contractor shall submit the Weekly Quality Report for review of the quality by the Engineer in weekly progress review meeting. The WQR will be based on the lines of MQR.

d) Internal Quality Audit (IQA): The contractor shall conduct an internal audit of the quality of the project by the quality team of their HQ every month and shall submit the report to the Engineer.

e) External Quality Audit (EQA): The contractor shall get conducted the External Quality Audit quarterly by the reputed agency approved by the Engineer and shall submit the report to the Engineer.

f) Calibration of Batching Plant: The contractor shall get done the calibration of batching plant, immediately after installation of the batching plant and at an interval of six months thereafter, by a reputed external agency approved by the Engineer. However, the contractor shall check the calibration in presence of Engineer's authorized representative on regular basis at least once in a month.

g) Laboratory at Site: The contractor shall get calibrated the Laboratory equipment and their dial gauges from the reputed agency/laboratory accredited by NABL and approved by the Engineer. The calibration certificate including their validity shall be displayed near each and every equipment of the Lab.

h) External Laboratory for Conducting Tests: The contractor shall get conducted the tests of materials and elements of the work for which testing facility is not available in the field Lab, from the external laboratories having valid accreditation of NABL approved by the Engineer. In addition to this, the contractor shall get conducted 5% of the tests, for which testing facility is available in field Lab also, in the external Lab, to facilitate independent review.

i) Water: The contractor shall get the water tested, from the reputed external laboratory approved by the Engineer, at the start of the work and at an interval of three months thereafter. The contractor shall also conduct the testing of the water at least once in a month in the field laboratory.

j) Status of deployment of Machinery and other T&P (Tools & Plants): The contractor shall deploy machinery and other T&P as per the provisions of the contract. Method statements approved by the Engineer and as per the requirement of the site. The contractor shall indicate the schedule of deployment of the machinery and other T&P in the Monthly Quality Report. The fitness of the machinery and other T&P shall be regularly got checked by the contractor by external inspection/Audit Team.

k) NCNs (Non-Conformity Notice) of quality issued by NMRC & NCR's (Non-Conformity Report) of quality raised by the Contractor: The status of NCNs and NCRs of quality shall be included by the contractor in the Monthly Quality Report. The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out on-site and off-site surveillance of Quality Assurance Audits to verify that the quality system which has the consent of the Engineer is being implemented fully and properly.

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

EMPLOYER'S REQUIREMENTS

APPENDIX 7

DRAFTING AND CAD STANDARDS

1. INTRODUCTION

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

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

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

(a) the Contract;

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

(4) Paper and drawing sizes shall be "A" series sheets as specified in BS 3429.

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

Document Type	**Electronic Document Format**
Text Documents	MS Word,
Spread Sheets	MS Excel,
Data Base Files	MS Access,
Presentation Files	MS PowerPoint,
Programmes Ver2.0a	Primavera for Windows, Suretrack
AutoCAD Graphics	CorelDraw / AutoCAD
Photographic	Adobe Photoshop,
Desktop Publishing	Page Maker
CADD Drawings	AutoCAD

(6) Media for Electronic File Submission

One copy shall be submitted unless otherwise stated in CD-ROM.

(7) Internet File Formats/Standards

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

(b) All the data formats or standards must be supported by Microsoft Internet Explorer version 3 or above running on Windows NT and Windows 98.

(c) The following lists the file types and the corresponding data formats to be used on Internet. The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different Data format:

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

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

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

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

2. GENERAL REQUIREMENTS

2.1 General

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

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

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

P - Preliminary Design Drawing

D - Definitive Design Drawing

C - Construction Reference Drawing

W - Working Drawing

B - As-Built Drawing

M - As Manufactured Drawing

E - Employer's Drawing

2.2 Types of drawings

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

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

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

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

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

3 COMPUTER AIDED DESIGN & DRAFTING (CAD) STANDARDS

3.1 Introduction

Scope of Use

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

3.2 Objectives

The main objectives of the CAD standards are as follows:

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

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

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

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

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

3.3 General

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

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

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

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

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

3.4 Terminology & Associated Standards / Guidelines

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

3.5 Paper Drawings

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

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

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

3.6 CAD Data Creation, Content & Presentation

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

(1) Model Space Files

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

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

(2) Paper Space CAD Files

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

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

3.7 CAD Quality Control Checks

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

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

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

3.8 CAD Data Transfer Media and Format

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

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

(b) Operating System - / Window NT 3.51 /Windows 95/98

(c) Data Transfer Media:

3.5" high density diskettes in DOS format (Maximum 10 diskettes)

12cm Compact Disc (650 MB) is highly preferred

Portable SCSI hard disk (return to the Contractor upon data transfer) with software

(d) All floppy diskettes or tapes must be labelled on the data shield with:

(i) Name of Company

(ii) Project Title

(iii) Drawing Filenames (for diskettes only)

(vi) Diskette No. / Total No. of diskettes or Tape No. / Total No. of Tapes

(e) All media shall be submitted with a completed Form (CAD Disk/Tape Sheet)

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

3.9 CAD Media Receipt & Transmittal

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

(a) CAD Digital Media (disk(s), CD's or tape (s)) shall typically contain CAD "Model Space" and "Paper Space" files.

(b) CAD data sheet

(c) CAD issue / revision sheet

(d) CAD Quality Checklist confirming compliance.

(e) Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).

(2) The above CAD media will be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by Employer' Representative from all contractors shall be in AutoCAD (version 14)

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

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

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

(i) CAD Digital Media (disk (s) or tape (s)) typically contain only CAD "Model Space" files.

(ii) CAD data sheet.

(iii) CAD issue / revision sheet

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

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

3.10 Revisions

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

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

3.11 Block Libraries, Blocks, & Block Names

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

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

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

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

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

3.12 CAD Dimensioning

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

3.13 CAD Layering

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

3.14 Global origin, Location & Orientation on the Alignment Drawing.

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

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

3.15 Line Thickness and Colour

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

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

3.16 CAD Utilisation of 2D & 3D Files

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

3.17 CAD File Numbering

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

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

3.18 CAD File Naming Convention – General

CAD "Model Space" files shall be named in accordance with general drawing conventions.

EMPLOYER'S REQUIREMENTS

APPENDIX 8

WORKS AREAS & TEMPORARY POWER SUPPLY

1. INTRODUCTION

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

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

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

2. STANDARD ENGINEERING CONDITIONS

The following standard engineering conditions apply to all Works Areas:

(1) Formation

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

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

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

(2) Roads & Parking

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

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

(3) Drainage & Sewerage

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

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

(c) Damages or obstructions caused to any watercourse, drain, water- main or other installations within or adjoining the Works Areas shall be made good to the satisfaction of the Engineer.

(d) Treatment and disposal of sewage and wastewater from the Works Area shall be provided to the satisfaction of the Engineer.

(4) Buildings

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

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

(c) No potable water from the municipal authority shall be used for heating, cooling and humidification purposes, or vehicle washing without the written consent of the Engineer.

(5) Pedestrian Access

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

(6) Fencing

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

3. Temporary Water & Power Supply to Designated Contractors

Designated Contractors, during construction phase, shall use power & water supply provided by the Contractor. Facilities provided shall be:

(a) at the ends of each station, at concourse level, a mains water supply of 25 mm diameter complete with stopcock; and

(b) at the ends and at the midpoint of each station, at both the concourse and platform levels and at agreed locations along the viaduct (at a maximum distance of 150 m), 415V three phase / 230 V single phase power supply, suitably earthed and each with sockets capable of receiving three (3) electric plugs of the size and type used for hand-held construction equipment.

Such provisions shall be available to the Designated Contractors from the commencement of the first Installation Interfacing and Co-ordination Period until the Permanent water and power supplies are connected and commissioned within the respective stations. The Designated Contractors shall be responsible for reimbursement to the contractor of the utility charges for consumption of mains water and electricity by the Designated Contractors, supplies shall be individually metred for each Designated contractor. The Contractor shall charge the Designated Contractors for consumption of mains water and electricity at the unit rates as billed to the Contractor by the water and electricity authorities for such utilities.

4 Applicability

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

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

5 Work on Site

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

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

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

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

6. Electrical General

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

(1) Indian Electricity Rules

(2) The Power Companies' Supply Rules;

(3) Electricity and its subsidiary Regulations;

(4) IEE Wiring Regulations (16th Edition);

(5) BS 7375 Distribution of Electricity on Construction and Building Sites;

(6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and

(7) BS 6164 Safety in Tunnelling in the Construction Industry.

(8) Any other applicable national standards

7. Materials, Appliances and Components

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

8. Design Considerations

(1) Distribution equipment utilised within the temporary electrical distribution system shall incorporate the following features: -

(a) flexibility in application for repeated use;

(b) suitability for transport and storage;

(c) robust construction to resist moisture and damage; and

(d) safety in use.

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

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

9. Mains Voltage

(1) The Site mains voltage shall be as per the Electricity Authority, 415V/ 3 phase 4 wire system.

(a) Single phase voltage shall be as per the Electricity Authority, 230V supply.

(b) Reduced voltages shall conform to BS 7375.

(2) Types of Distribution Supply

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

(a) fixed plant - 415V/ 3 phase;

(b) movable plant fed by trailing cable - 415V /3 phase;

(c) installations in Site buildings - 230V /1 phase;

(d) fixed flood lighting - 230V/ 1 phase;

(e) portable and hand-held tools - 115V /1 phase;

(f) Site lighting (other than flood lighting) - 115V /1 phase; and

(g) Portable hand-lamps (general use) - 115V /1 phase.

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

(4) Protection of Circuits

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

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

(i) BS 88;

(ii) BS EN 60898; and

(iii) BS 7375;

(iv) Any other appropriate Indian Standards.

10. Earthing

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

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

(a) IEE Wiring Regulations (16th Edition);

(b) BS 7430;

(c) BS 7375; and

(d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

11. Plugs, Socket Outlets and Couplers

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

12. Cables

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

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

(a) BS 6708 flexible cables for use at mines and quarries;

(b) BS 6007 rubber insulated cables for electric power and lighting; and

(c) BS 6500 insulated flexible cords and cables.

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

(a) BS 6346 for armoured PVC insulated cables; and

(b) BS 6708 Flexible cables for use at mines and quarries.

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

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

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

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

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

13. Lighting Installation

(1) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.

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

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

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

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

14. Electrical Motors

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

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

15. Inspection and Testing

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

16. Identification

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

17. Maintenance:

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

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

18. Metering

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

(a) Site fabrication facilities;

(b) Site workshops and work yards; and

Site offices and stores.

EMPLOYER'S REQUIREMENTS

APPENDIX 9

APPROVED MANUFACTURERS / SUPPLIERS

Refer Outline Construction Specifications

EMPLOYER'S REQUIREMENTS

APPENDIX 10

CURVE AND GRADIENT DETAILS

METRO CORRIDOR

Horizontal and Vertical Alignment

All details with regard to the Horizontal and Vertical Alignment are shown on the plan & profile sheets of the drawings provided in **Volume 5** of the tender documents.

EMPLOYER'S REQUIREMENTS

APPENDIX 11

CONTRACTOR'S SITE LABORATORY

1. SITE LABORATORY

(1) The Site Laboratory shall be approximately 250m^2 in area. It shall consist of the following accommodation:

1 concrete laboratory	60m^2 floor area
1 Soil laboratory	30m^2 floor area
2 office	each15m^2 floor area
1 store room	10m^2 floor area
1 kitchen	10m^2 floor area
male toilets, changing room & shower	sufficient for 6 persons

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

2. STANDARD OF CONSTRUCTION

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

(2) A water tank with minimum capacity of 2000 litres shall be installed, as a source of constant water pressure (15 KPa minimum) for each laboratory.

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

3. FURNISHINGS AND FIXTURES

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

4. LABORATORY EQUIPMENT

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

(2) The layout of the equipment in the testing laboratory shall be instructed by the Engineer. The equipment shall be maintained to an accuracy appropriate to the required testing methods with routine calibration by an accredited organisation as

recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.

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

Determining Liquid Limit (1 complete set)	
Liquid limit device (Casagrande type)	1 set
Grooving tools	1 No.
Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Laboratory balance, capacity 500 gm,	1 No.
(Sensitivity 0.01 gms.)	
Wash bottle, capacity 500 ml.	1 No.
Moisture cans, capacity 50 ml.	24 No.
Determining Plastic Limit (1 complete set)	
Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Glass plate 250mmx250mmx12mm	2 No.
Moisture cans, capacity 50 ml.	12 No.
Stainless steel rods, 3 mm dia.	2 No.
Determining Moisture Content (1 complete set)	
Micro Oven, capacity 35 litres, control temperature	
up to 200 °c	1 No.
Balance, capacity 200 gm., sensitivity 0.01 gm.	1 set
Lab. Tongs	1 No.
Moisture cans 75ml. with lid	36 No.
Compaction Characteristics (1 complete set)	
Standard compaction mould 100mm dia.	1 No.
Modified compaction mould 150mm dia.	1 No.
Standard compaction Rammer, 2.5 kg.	1 No.
Modified compaction Rammer, 4.5kg.	1 No.
Straight edge 300mm long	1 No.
Sample ejector for 100mm and 150mm mould	1 No.
Sample tray 60 x 60 x 8 cm	3 No.

Wash bottle, 500 ml.		2 No.
Moisture cans 250 ml.		24 No.
Density of soil in-place by sand cone method (2 complete set)		
Sand density cone apparatus, 150mm		2 No.
Plate, 300mmx300mm with centre hold 150mm		2 No.
Glass jug for sand cone		2 No.
Chisel 25mmx 150mm		2 No.
Hammer		2 No.
One-gallon field cans		24 No.
Sampling spoon		2 No.
Soft hair brush		2 No.
Moisture cans 250 ml.		48 No.
Sieve Analysis		
Sieve shaker (portable)		1 unit
Coarse sieves	In Sizes from 100mm to 10mm	(1 set
Fine Sieves	#4,#8,#16,#30,#40,#50,#100,#200	each)
Pans & Covers		
Specific Gravity and Absorption of Coarse Aggregate		
Wire basket, 200mm dia.		
Heavy duty suspension balance, 20 kg x 1 gm. with accessory		
for weight in water		1 set
Suitable water container		1 No
Unit Weight of Aggregate		
Balance, 100 kg. capacity with 10 gm precision		1 No.
Tamping rod 16mm diameter x 600mm long		1 No.
Measuring containers (3,10,15,30 litres)		1 each
Flakiness and Elongation		
Flakiness gauge, elongation index		1 set
Soundness Test		
Sodium sulphate		25 kg
Soaking tank		1 No.
Balance, Capacity 3 kg., Sensitivity 0.1 gm.		1 set
Sieves: Coarse		1 set
Fine		1 set
Concrete		

Buckets for concrete sampling 12 No.	
Slump cone	12 No.
Tamping rod	12 No
Base plate	12 No.
Mixing pan for concrete	2 No.
Scoop for general purpose	2 No.
Concrete thermometer	1 No.
Concrete cylinder mould, 150 mm * 300 mm;	
100 mm * 300 mm	10 each
Concrete cube mould, 100 mm cube & 150 mm cube	10 each
Adjustable spanners for dismantling cube moulds	6 No.
Capping set	2 No.
Capping compound	
Concrete curing tank with capacity for 270 cubes,	
temperature controlled, with circulation system drain	
and lockable cover	5 No.
Schmidt test hammer	1 No.
Compression testing machine (simple hand operated)	1 No.
Mould oil	
Temperature chart recorder	1No.
Small concrete mixer	**1No**
Miscellaneous	
Vernier callipers to measure up to 200mm,	
with elongated jaws	5 No.
Steel rule, 300 mm long graduated	2 No.
Rubber gloves	10 pr.
Cotton working gloves	20 pr.
First aid kit	1 set
Wire brush	6 No.
Steel tape, 3m, 5m, 30m	3 each
Ball peen hammer, 1 kg	2 No.
Paint scraper. Approx. 100mm wide	8 No.
Float, steel Approx.280 x 120 mm	8 No.
Sack barrow	1 No.
Shovel: Square Mouthed	2 No.

Round Mouthed	2 No.
24-wheel trolley, heavy duty, approx. 0.7m x 1.0m long pneumatic tyred type	1 No.
Wheelbarrow, rubber tyred	1 No.
Comprehensive tool kit. To include screwdrivers, pliers, claw hammer, multi-grips, spanners (adjustable)	1 No.
Type NR Schmidt Hammer and tester with recording device	1 No.
Testing Anvil for Schmidt Hammer test (SHT)	1 No.
Chart recording paper for SHT	10 pkts
Covermeter for detecting metal objects to depth of 100mm below the surface of non-magnetic objects	3 No.
Noise meter	1 No.
RCPT Testing Machine	1No.
Permeability Testing Machine	1No.

SCHEDULE OF DIMENSIONS

FOR

STANDARD GAUGE

List of Manufactures/Suppliers of Major Civil & Architectural Items

All materials and products shall conform to the Outline Construction Specification (OCS) of NMRC, BIS codes, and other relevant codes, etc., and shall be approved by Engineer.

An indicative list of Manufactures/Suppliers of Major Civil & Architectural Items is mentioned as below –

Major Civil Items

Sr. No.	Material / Item / Product	Manufacturer / Supplier
1	Cement	As approved by Engineer
2	Reinforcement Bars	As approved by Engineer
3	Epoxy Grout	Fosroc, Asian Paints, Sunanda, Sika, Fairmate, Kunal Conchem, Hindcon Chemicals, STP Limited, Apple Chemie
4 a	Expansion Joints for Viaduct	Prequalified Manufactures as per RDSO DECG International
4 b	Expansion Joints for Buildings	VR Engineers, MAURER-Sanfield, DECG International
5	Admixture	As approved by Engineer
6 a	Low strain Pile Integrity Testing, UPV Test, Rebound Hammer Test	CEG Test House, Aadco Testing, Cengrs, DVG Lab, ADS Labtech, Raicon Labs Pvt. Ltd., Innovato Solution, Independent Consultants & Technocrates Pvt. Ltd., QA Testing Lab
6 b	Cross-hole Testing of Piles	CEG Test House, Aadco Testing, Cengrs, ADS Labtech, Independent Consultants & Technocrates Pvt. Ltd., QA Testing Lab
7	Anchor Fasteners (for Structural Works)	Trutek, Pioneer nuts and bolts, Fosroc, Hilti, Styrene Packings, Fischer, Wuerth
8	Structural Steel (Fabrication)	As approved by Engineer
9	Pre-stressing Strand (LRPC)	Tata SSL Ltd., Usha Martin, DP Wires, Miki Steel, Kataria Group, Bajrang Wire and Infra Ltd., Neotrex Steel
10 a	Pot/PTFE Bearings	Deevin Systems, VSIL, MAURER-Sanfield, Dynamic Prestress, Kanta Rubber, RKC Infra Projects, Steel Auto Industries, DECG International
10 b	Elastomeric Bearings	Deevin Systems, VSIL, Kanta Rubber, Polymer Products, DECG International, CECO, RKC Infra Projects, Steel Auto Industries
10 c	Spherical Bearings	MAURER-Sanfield, Mageba
11	Horizontal Tie Bars/ Shear Bars	Dextra
12	High-Density Polyethylene (HOPE) Sheathing (for Prestresslng works)	Dynamic Prestress, JK Prestresslng, Fosroc, Tirupati Plastomatics
13	Formwork Release Agent	Eastern Petroleum, Yahska Polymers, Kunal Conchem, Ado Additives, STP Limited, Falrmate, Hindcori Chemicals, Apple Chemie
14	Prestresslng System	Dynamic Prestress, Tensa India, JK Prestressing, Usha Martin
15	Reinforcement Couplers (Cold forged parallel threaded type)	Tata-Steel, MAURER-Sanfield, Dextra India, Levlat India, Rebar Couplers India Pvt. Ltd., Vadol

		Corporation, Vruddhi Engineering Works Ltd., SNTP Technologies
16	Hollow Sections, Tubes	Surya Roshni, Dadu Pipes, APL Apollo Tubes, Tata Steel, Goodluck India Ltd., Mahalakshml Profiles Pvt. Ltd.
17	Drainage Pipes (> 150 mm dla.)	Texmo Pipes, Tirupati Plastomatlcs
18	Non-Shrink Grout	DURABUILD, Yahska Polymers, Fosroc, Asian Paints, Slka India, Kuna! Conchem, Falrmate, STP Limited, Chryso India, Mapel, MYK Arment, Hlndcon Chemicals, Apple Chemie
19	Epoxy Bonding Agent (for Construction Joint)	Asian Paints, STP Limted, Fairmate, Chryso India
20	Polysulphide Sealant (for Structural works)	Asian Paints, Sika, Kunal Conchem, IVVL India, Hindcon Chemicals, STP Limited, Fairmate, Chryso India, Apple Chemie
21	Steel Structural Fasteners	Panchsheel Fasteners, Pioneer Nuts and Bolts, Kirti Fasteners, Haryana Fasteners, Imperial Bolts and Fasteners, Karamtara
22	Corrosion Protection Paints	Berger Paints, Fosroc, Advance Paints, Grauer & Well India, Sunanda, Asian Paints, Ameetuff Technical Paints
23	Mlcrosilica / Ultra- Fine Ground Granulated Blast Furnace Slag (UGGBS) (conforming to IS 16715:2018)	Ultrafine Minerals and Admixtures, Counto Microfine Products, Rockfit, CAC, Kunal Conchem, Hlndcon Chemicals, Normet India, Technokem, Mapel, Sunlight Conschem Corporation
24	Fire Resistant Paint	Advance Paints, Asian Paints, Ameetuff Technical Paints
25	Integral Crystalline waterproofing	As approved by Engineer
26	Water Stopper / Bar	Asian Paints, HITECH Rubber, Penetron, Kantaflex, Puraflex Industries
27	Liquid Polymer Membrane Waterproofing	Pidilite, Berger Paints, TECHNONICOL, Fosroc, Asian Paints, ECMAS, Sika, Kunal Conchem, Sunanda, Fain'nate, Hindcon Chemicals, STP Limited, Chrysa India, Mapei, MYKArment, Tiki Tar Danosa
28	Curing Compound	As approved by Engineer
29	Fly Ash / Ground Granulated Blast Furnace Slag (GGBS) (conforming to IS 16714:2018)	Ashtech India, Jaycee Bulldcorp, Bisla Industries, Shree Ashtech
30	Pre-Coated Profiled Metal Sheeting	Aditya Profiles, Tata Bluescope Steel, APLApollo Building Products Pvt. Ltd.
31	Rock Bolts/Swellex Bolts	Sandvik Mining
32	Glass Fiber Reinforced Polymer (GFRP) Bars (conforming to IS 18255:2023, IS 18256:2023, and IRC:137-2022)	Sandvik Mining, Arc Insulations, Dextra
33	Material Testing	As approved by Engineer
34	Rainwater Harvesting	Water Field Technology

35	Geotechnical Investigation	Scientific Infra, CEG Test House, Shree Balaji Test House, Emmtech, CENGRS, G. Soil & Rock Probe, Sarathy Geotech, SECON, Techpro India, Independent Consultants & Technocrates Pvt. Ltd., Innovato Solution, QA Testing Lab
36	Premix Prestress Cable Grouts	Fosroc, Ultratech
37	Ultrasonic Logging Tubes	MAURER-Sanfield, Dextra
38	Welding Electrodes	Alpha Arc Electrode, Varun Electrodes, Weld Alloy Products, D&H Secheron, Spectra Super Alloys Ltd.
39	Ultrafine Fly Ash	Ashtech India, Ultrafine Mineral and Admixtures
40	Drilling Polymer	Sugam Infra, Innova, Manoj Kumar Kharakia Co., Laviosa, Neel Kanth Chemicals, Trishul, Relemac India, ECO Drilling, Goldy Minerals, Vidhya Enterprises, Drilltech Fluid and Chemicals
41	Anti-Carbonation Coating of RCC Structures	Asian Paints, Godavarl Paints, Falrmate India, Sunanda, Fosroc, STP Limited, Ameetuff Technlcal Paints

Major Architectural Items

Sr. No.	**Major/ Item/ Product**	**Manufacturer/ Supplier**
A	**Flooring**	
A1	Vitrified Tiles (Plain, Designer and Tactile)	H&R Johnson, Kajaria, Oasis (Marbomax Group), Orient Bell Ceramics, Pavit Ceramics, Pelican Ceramics, Qutone Tiles, RAK Ceramics, Restile Ceramics, Royale Touch and Silk Touch Vitrified, Slmpolo, Varmora Granito, Vitero, Sunshine Tiles Co. Pvt. Ltd. (Sunhearrt Ceramik), Karara Ceramics Pvt. Ltd., Hindware, Somany Ceramics Pvt. Ltd., Ambani Vitrified Pvt. Ltd., Mozart Vitrified Pvt. Ltd., Nitco Tiles Ltd.
A2	Ceramic / Porcelain Tiles	H&R Johnson, Kajaria, Oasis (Marbomax Group), Orient Bell Ceramics, Qutone Tiles, Simpolo, Varmora Granito, Somany Ceramics Pvt. Ltd., Hindware, Karara Ceramics Pvt. Ltd., Sunshine Tiles Co. Pvt. Ltd. (Sunhearrt Ceramik)
A3	Raised Floor	Hewetson / Kingspan Access Floors, United Access Floors / United Insulation, AET Flexlblespace India Pvt. Ltd. (FLEXIFLOOR), Universal Building Products Pvt. Ltd. (UNIFLOOR)
A4	Polyurethane Epoxy Coated Flooring	Pldilite, Flowcrete, Cipy Polyurethanes Shalimar Paints, Sika, Hygie Profile (India) Pvt. Ltd., Berger Paints India Ltd., STP Ltd., Ulfcar Chemicals Pvt. Ltd. (DenCoat), RachTR Chemicals Pvt. Ltd., JSW Paints Ltd., Growel (Grauer & Well)
A5	Concrete Pavers, Kerbs and Chequered tiles, Paving tiles, Grass Paver, Plantable Blocks, Hollow Blocks, Retaining Blocks, Slope Stone	Chelsea Concrete, Dalal Tiles, Pave Espania, Sarita Pre Fab, Perfect Tiles, JRC Brickworks Pvt. Ltd., KJS Concrete, Parmeshwart Enterprises

A6	Ceramic or Glass, Mosaic Tiles / Handmade Tile, Mosaic Tiles	Blsazza, GND tiles, Italica Mosaic, Kenzai Ceramic, Mridul Enterprises, Mosaico People Corporation, Raja tiles, Ayush Inter Decor
B	**Finishing**	
B1	Pre-mix Cement Plaster	Birla-Aerocon, Ultratech Cement Ltd., Ambuja Cements, ACC, Trimurti, Pidilite
B2	Emulsion Paints	Aero Paints, AkzoNobel, Asian Paints, Berger Paints, BSC Paints, Godavari Paints, Jenson & Nicholson, Kamdhenu Paints, Nerolac Paints, IMAGICO India Pvt. Ltd. (previously OIKOS India Pvt. Ltd.), Shalimar Paints, Sherwin-Williams Paints, Luxture Surface Coatings Pvt. Ltd., JSW Paints Ltd., Growel (Grauer & Weil), JK Maxx Paints Ltd.
B3	Synthetic Enamels	Aero Paints, AkzoNobel, Asian Paints, Berger Paints, Jenson & Nicholson, Kamdhenu Paints, Nerolac Paints, Shalimar Paints, Sherwin-Williams Paints, Maharani Innovative Paints Pvt. Ltd., JSW Paints Ltd., Growel (Grauer & Weil)
B4	Polyurethane Paints / Epoxy Paints	AkzoNobel, Asian Paints, Jenson & Nicholson, MRF Paints, Nerolac Paints, Shalimar Paints, Sherwin-Williams Paints, Berger Paints India Pvt. Ltd., Ameetuff Technical Paints, JSW Paints Ltd., Growel (Grauer & Weil)
B5	Bonding Coat (for Paint)	Ameetuff Technical Paints, Fosroc, Pidilite, Dr. Fixit, Ultratech Cement Ltd., Growel (Grauer & Weil), Premium Coatings and Chemical Pvt. Ltd.
B6	Texture Paint	AkzoNobel, BSC Paints, Texture Paint, Berger Paints India Pvt. Ltd., Luxture Surface Coating Pvt. Ltd., Ultratech Cement Ltd., JK Maxx Paints Ltd.
B7	Wall Care Putty	Birla (Aditya Birla Group), EBIPL: Evershine, Gyproc wan Putty (Saint-Gobain), HIL Ltd. (Aerocon), JK White, Shalimar Paints, Berger Paints India Pvt. Ltd., Ferrous Crete India Pvt. Ltd., Luxture Surface Coating Pvt. Ltd., Trimurti Wall Care Products Pvt. Ltd., Ultratech Cement Ltd., JSW Paints Ltd., Growel (Grauer & Weil)
B8	Glass (Float / Toughened)	Asahi Float (AIS), Glaverbel, Modiguard, Saint-Gobain, Art N Glass Group Company, Sisecam Glass India Pvt. Ltd.
B9	Fire Rated Glass	FG Glass, Pilkington Glass, Saint-Gobain, Asahi India Glass Ltd. (AIS)
B10	Structural Glazing Fabricators	Permasteelisa India Pvt. Ltd., Alufit India Pvt. Ltd., Shapoorji Pallonji Fab Pvt. Ltd., Innovators Fa□de Systems Pvt. Ltd.
C	**Cladding**	
C1	GRC Products (GRC Screen, Panels, etc.)	Dalal Tiles, Terra firma GRC & Concrete Industries, UniStone Products (India) Pvt. Ltd., Ayush Inter Decor, Everest Composites Pvt. Ltd., Mahesh Prefab Pvt. Ltd.
C2	High Pressure Laminate	Fundermax, Greenlam, Merino, Century Plyboards, Virgo Laminates Ltd., Samrat Plywood Ltd., Stylam Industries, Stonelam Surface LLP

C3	Acrylic Solid Surface	DuPont Corian, LX Hausys HIMACS (previously LG Hausys HIMACS)
D	**False Ceiling**	
D1	Calcium Sliicate Board	Aerolite, Ramco Hilux, Promat
D2	Metal Ceilings	Knauf Ceiling Solutions (previously Armstrong World Industries), Dexune, durlum, Hunter Douglas, Canon Fasteners, SCJ Mascot LLP (Metacll), JC Industries, Royal Kraft (Manraj Ceiling Products), Harsons & Associates (Harsons Green)
D3	Adhesive for Tiles	Araldite, EBIPL: Evershine, Kerakoll, Laticrete, Pldillte, Adhesive for Tiles, Alstone Industries Pvt. Ltd., Ultratech Cement Ltd., Berger Paints India Ltd., Ferrous Crete India Pvt. Ltd., Trimurti Wall Care Products Pvt. Ltd., RachTR Chemicals Pvt. Ltd.
D4	Tiles Joint Filler, Tile Grouts	Ardex Endura (previously Bal Adhesives and Grouts), EBIPL: Evershine, GE.Bayer Silicones, Laticrete, MC-Bauchemie (India), Roff Constructions Chemicals, Ultratech Cement Ltd., Berger Paints India Ltd., Kerakoll, Alstone Industries Pvt. Ltd., Ferrous Crete India Pvt. Ltd.
D5	Polysulphide Sealants (for Stone / Vitrified Tiles)	McCoy Soudal, Pidilite, Slka, 3M, BASF, CICO, Fosroc, STP Ltd., MYK Arment, Berger Paints India Ltd., Ferrous Crete India Pvt. Ltd.
D6	Silicon Sealants	3M, Dow Coming, GE Bayer Silicones, Silicon Sealants, McCoy Soudal, Slka, Alstone Industries Pvt. Ltd.
E	Adhesive, Fillers, and Sealants	
E1	Silicon Water Repellent Solution	MC-Bauchemie, Choksey Chemicals, GE Bayer Silicones, STP Ltd., Wacker Metroark
F	Joinery Woodwork Products	
F1	Plywood	Duroply Sarda Plywood, Century Ply, Greenply Plywood, Swastik Plyboard Ltd. (Swati Ply), Merino, Archldply, Visaka Plywood, Vidya Ply & Board, Greenpanel Industries Ltd., Samrat Plywood Ltd.
F2	Blockboard	Century Ply, Duroply, Sarda Plywood, Greenply Plywood, Merino, Vidya Ply & Board, Greenpanel Industries Ltd.
F3	Laminates	Archidply, Formica Corporation, Greenlam, Merino, Royal Touche Laminates, Stylam Industries, Samrat Plywood Ltd., Virgo Laminates Ltd.
F4	Dry Partition System	Aerocon (HIL Ltd.), Metecno, V-Board (Visaka Industries Ltd.)
F5	Toilet Cubicles and Compact Laminated Doors	Greenlam, Merino, Fundermax, Stylam Industries, Century Panels Ltd.
F6	Pressed Steel Doors Frame	Sen-Harvie Windows Pvt. Ltd., AGEW Steel Manufacturers Pvt. Ltd., SKS Steel Industries
F7	PVC/ WPC / UPVC Doors and Window/Frame	Fenesta, VensterWintrack, Rajshri Plastiwood, AVSL Industries Ltd., Alstone Industries Pvt. Ltd., PWDS Extrusions Pvt. Ltd. (Prominence), SCL (Shani Corporation Ltd.), Encraft India Pvt. Ltd.
G	**Fire Doors**	

G1	Fire Door (Tested as per BIS / BS Standard)	SKS Steel Industries, Slgnum Fire Protections Pvt. Ltd., Bhawanl Fire Protection Systems Ltd., lclean Hollow Metal System Pvt. Ltd., Navalr International Ltd., Sehgal & Sehgal, Shaktl Hormann, Sukritl Doors and Hardware Pvt. Ltd., Trio India, JC Fire Door Corporation, Basic Doors, Kross Innovations Pvt. Ltd., Pacific Fire Controls Ltd.
G2	Fire Door (Tested as per NFPA Standard)	GMP Technicals, Shaktl Hormann
H	**Plumbing**	
H1	Sanitaryware	Cera, Hindware, Parryware, Roca, H&R Johnson (India), Euronlcs Industries Pvt. Ltd., Somany Sanitaryware Pvt. Ltd., Simpolo Vitrified Pvt. Ltd.
H2	Sanitary and Bath Fittings	Hindware, Jaquar, Kohler, Mayur Ocich, H&R Johnson (India), Euronics Industries Pvt. Ltd., Aqua Systems Pvt. Ltd. (JAL- Jupiter Aqualines)
I	**Hardware**	
I1	Frameless Glass Partition Fixtures	Dorma, Dorset-Kaba, Oline, Hafele, Hardwyn, Kich
I2	Spider Fitting / Patch Fittings	Oline, Kich, Ozone
I3	Anchor Fasteners (for Finishing works)	Bosch Fischer, Anchorite Fixing Technology (AFT), Axel India (Trixel), Boun Group, Hiltl India Pvt. Ltd., Hitachi-Mungo, Canon Fasteners
I4	Stone Cladding Clamps	Anchorite Fixing Technology (AFT), Axel India (Trixel), Bosch Fischer, Boun Group, Hiltl India Pvt. Ltd., Canon Fasteners
I5	Door Hardware / Architectural Profiles	Donna, Dorset-Kaba, Oline, Hafele, Hardwyn, Hettich, Ozone
J	**Pipes and A10 Fitting (=< 150 mm dia.)**	
J1	Ductile Iron Pipes	Electrosteel Castings Ltd., Jindal
J2	Cast Iron Pipes, SS Pipes, and Fittings (IS 1536)	HEPCO, NECO, Singhal Iron & Foundry (SKFCI)
J3	GI and MS Pipes (IS 1239 Part-I & 11, IS 3589)	Prakash Pipes, Surya Roshni Ltd., T.T. Swastik, Jindal, Nezone Tubes Ltd., Indus Tubes Ltd.
J4	GI Fittings - Malleable (IS 1879 Part I to X)	K.S., DRP, Unik, Zoloto
J5	UPVC Pipes and Fittings (IS 4985: 1981)	Polypack, Prince Pipes & Fittings Ltd., Finolex, Jindal Plast India, Prakash Pipes, Rex, Supreme, Surya Roshni Ltd., HIL Ltd. (Birla-Aerocon), Fusion Industries Ltd. (Fusion Pipes), AKG Extrusions Pvt. Ltd. (AKG Group), Rajhans Rigid PVC Pipes Industries
J6	CPVC Pipes and Fittings (IS 15778: 2007)	Finolex, Surya Roshni, Ajay, Ashirvad, Astral, Hit Ltd. (Birla-Aerocon), Fusion Industries Ltd. (Fusion Pipes), AKG Extrusions Pvt. Ltd. (AKG Group), Prince Pipes & Fittings Ltd.
J7	Stoneware Pipes and Gully Traps (IS 651)	Lal Chand Anand & Sons, Perfect
J8	RCC Pipes (IS 458)	Daya Concrete, Jain Spun, Pragati
J9	Copper Pipes and Fittings	Mehta Tubes, Mexflow

J10	High-Density (HOPE) Pipes and Fittings	Geberit, TSL Tirupati, Polyethylene, Reliance, Duraline, Prince Pipes & Fittings Ltd., Chamunda Plastics Pvt. Ltd.
J11	Polypropylene Random Copolymer (PPR) Pipes and Fittings	Prince Pipes & Fittings Ltd., Supreme, Uro-Allwin
K	**Water Proofing / Repellents Compound**	
K1	Modified Bituminous Membrane Roof Waterproofing	Asian Paints, BASF, EBIPL: Evershine, Flowcrete, Fosroc, Kemco, Sika, STP Ltd., MYK Arment, Berger Paints India Ltd., Ultratech Cement Ltd.
L	**Metal and Roofing**	
L1	Aluminium Section	Bharat Aluminium Company United/ Vedanta BALCO, Bhoruka, Hindalco, Jindal Aluminium Ltd., Maan Aluminium Ltd., Technorail, MM Metacraft Pvt. Ltd.
L2	MS Hollow Section Pipes	APL Apollo, Hi-Tech Pipes, Jindal, Surya Roshni, Nezone Tubes
L3	MS Tubes/ Sections	APL Apollo, ISPAT, Jindal, Rana Steel, Swastik Pipes, Tata Structura
L4	Prefabricated SS Works / SS Works	Oline, Jindal Stainless (JSL), Kich, Ozone, Koncept Steel Pvt. Ltd., Technorail, Sialkot Shop
L5	Metal Roofs System	Kalzip, Supertech (India) Pvt. Ltd., Tata Bluescope (Metal Coated and Pre-Painted Sheets ZINCALUME COLORBOND)
L6	Polycarbonate Sheets	Danpalon, Lexan (SABIC Innovative Plastics from GE)
L7	Tensile Fabric	Ferrari, Mehler, SRF Ltd.

Note -

1) Once the manufacturer / supplier supplies the product for the project after the approval of the Engineer, all the tests required in OCS are to be performed to ensure the quality of product at work site as per the approval of engineer.

2) In case the manufacturer / supplier does not have a valid document/certificate at the time of usage at site, then the product shall not be allowed for usage at site.

3) The Contractor may also propose equivalent makes/brands for the aforesaid items, subject to submission of complete technical particulars, valid test certificates/reports, and all requisite documents for scrutiny by the Engineer. Such proposed materials shall also be subject to inspection/testing, as deemed necessary, and shall be used only after obtaining prior written approval of the Engineer.

SCHEDULE OF DIMENSIONS

FOR

STANDARD GAUGE

(1435 mm)

(October-2017)

Version -03

NOIDA METRO RAIL CORPORATION LIMITED

Ganga Shopping Complex, Sector-29
Noida -301201 (Uttar Pradesh)

INDEX

Project Directorate Approved on 04/12/17 Railway Board

ASHOK
Chief Engineer
Delhi Metro Rail
Ganga Shopping Centre
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

APPENDIX

Project Directorate Approved on 04/12/17 Railway Board

ASHOK KUMAR GUPTA
Chief Engineer/Consultant
Delhi Metro Rail Corporation Ltd.
Ganga Shopping Complex, Sector-15
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

LIST OF FIGURES

Project Directorate
Approved on
04/12/17
Railway Board

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector
NOIDA (U.P.)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

PREAMBLE

The Schedule of Dimensions for Standard Gauge corridor has been prepared based on following factors:

1. The kinematic envelope and other infringements have been calculated for the 2900mm wide and 4048 mm (pantograph in locked down condition) and 4023 mm (without pantograph) high rolling stock, based on the kinematic envelope calculations. The track and vehicle maintenance shall conform to the clearances indicated therein during the period these stocks are in operation.
2. The clearances are based on the assumption that windows are sealed and doors are closed during movement/operation.
3. Track shall be maintained to the tolerances taken for calculation of Kinematic Envelope.
4. The Structure Gauge indicated in SOD shall not be violated under any circumstances except for platform coping, platform gate, hand railing in back of house of platform edge and related structures.
5. The Kinematic envelope(s) indicated in SOD shall not be violated under any circumstances.
6. The vehicle Kinematic Envelope at a speed of 70 Kmph for the platform area shall be applied within confines of stations. At all other locations, maximum operating speed shall be 80 Kmph and the kinematic envelope corresponding to maximum vehicle speed of 80 kmph shall be used for determining the Structure Gauge and electrical clearances.
7. The evacuation of passengers in between stations shall be done from front & rear emergency doors of the trains, hence no separate walkway is provided. However, space available between the track plinths shall be used as the walkway. The evacuation system shall be legislated by NMRC and evacuation shall be effected under the supervision of NMRC. It shall be ensured that no train operation on the adjacent track will be allowed during evacuation.
8. In case of all at-grade sections and wherever necessary on elevated sections, the sections will be robustly fenced to prevent the access to the track by people.
9. The maximum operating speed through station platforms shall be limited to 70 kmph and the Kinematic Envelope for stations shall not be infringed under any circumstances.
10. No vertical curve shall be provided in platform portion.
11. The SOD is applicable for Ballastless track on main line and ballasted/ballastless track in Depots.
12. No work/work men/Equipment are allowed between vehicle and structure gauge during operation of trains.

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NOIDA METRO

SCHEDULE OF DIMENSIONS

STANDARD GAUGE (1435 mm GAUGE)

INTRODUCTION

The dimensions given in this Schedule of Dimensions are to be observed in all works on 1435 mm gauge (STANDARD GAUGE), unless prior sanction has been obtained from the Railway Board through the Commissioner of Metro Railway safety to execute works which infringe this Schedule of Dimensions

This Schedule of Dimensions is applicable to Elevated and At-Grade sections of Noida Metro which shall be with 25 KV AC Traction system and Over Head current collection. The Rolling Stock shall be 2900 mm wide with sealed windows and doors closed while in motion.

The Schedule of Dimensions (SOD) has been divided into five chapters as under

Chapter-1	----------	General
Chapter-2	----------	Stations
Chapter-3	----------	Rolling Stock
Chapter-4	----------	Electric Traction
Chapter-5	----------	Platform Gate

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CHAPTER-I

GENERAL

1.1 SPACING OF TRACKS

1.1.1 Minimum distance, centre to centre of tracks without any structure between tracks for tangent (straight) track for:

(a) Elevated and At-Grade Sections ..... 3650 mm

Note: See Appendix-1 for minimum track centers on curves.

1.2 CURVES

1.2.1 **Minimum radius of curves (horizontal)**

i) On main running lines

a) Elevated and At-Grade Sections 120 m

ii) Depot and other non-passenger Lines 100 m

iii) At passenger platforms 1000 m

1.2.2 **Check rail/Restraining Rail**

(a) Check rail/Restraining Rail shall be provided on curves on main line where radius is 190m or less. Check rail/Restraining Rail shall not be mandatory for curves in depots, yards and non-passenger lines where speed is less than 25Kmph.

(b) The clearance between check/restraining rail and running rail shall be suitably decided by metro depending upon study of track vehicle interaction.

1.2.3 **Minimum radius of vertical curve** 1500m

1.2.4 **Cant and Cant Deficiency**

a) Maximum Cant on curves = 110 mm
b) Maximum Cant Deficiency = 85 mm

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1.3 GRADIENTS

1.3.1 The maximum grade (compensated) shall be 4%.

Notes:

(i) There will be no change of gradient in transition portion of curve.

(ii) The gradient will be compensated for curvature at the rate of 0.04% per degree of curve

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1.3.2 Maximum permissible gradient on turnout

i) On Ballasted Track	0.25%
ii) On Ballastless Track	3.00%

Note:

(i) There shall be no change of gradient (i.e. vertical curve) on and within 15.0 m (desirable)/3.0 m (minimum) of any turnout on Ballastless track. In case of Ballasted track, there shall be no change of gradient on and within 30 meters of any turnout.

(ii) There shall be no horizontal curve within 15.0m (desirable)/ 3.0 m (minimum) of any turnout on Ballastless Track and 30 meters of any Turnout on Ballasted Track.

(iii) Turnout shall normally be installed on straight track. In exceptional situations, turnout may take off from curve provided that the radius of lead curve (main line as well as diverging line) is not less than 190m. The negotiability of rolling stocks on such turnout must be certified by rolling stock supplier and confirmed through oscillation trial and a suitable speed restriction should be imposed on main and/or diverging line based on track geometry and other considerations, if required. In case of turnout installed on curved track, the minimum distance for commencement of vertical curve or another horizontal curve shall be 15m for Ballastless track. Turnout shall not be laid on transition curve.

(iv) The limit of turnout for above purposes shall be taken from Stock Rail Joint (SRJ) to end (i.e. heel) of crossing for Ballastless track. For Ballasted track, it shall be from SRJ to last common sleeper behind end of crossing.

(v) The maximum permissible gradient on turnout and the location of turnout with respect to vertical/horizontal curves in vicinity shall be confirmed from rolling stock supplier for the negotiability of rolling stock.

(vi) The above stipulations shall also be applicable for turnout to be laid outside station limit, if any.

1.4 BUILDINGS AND STRUCTURES

1.4.1 Minimum horizontal distance from centre of track to any structure (except platform coping, platform screen door and hand railing in back of house of platform edge) for heights above rail level on level/constant grade tangent track shall be as under:

(a) Elevated and At-Grade Sections

	Height from rail level	Horizontal distance from C.L. of track
(i)	Upto 65 mm	1465 mm
(ii)	65 mm to 200 mm	1465 mm increasing to 1640 mm
(iii)	200 mm to 305 mm	1640 mm

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(iv)	305 mm to 930 mm	1640 mm increasing to 1735 mm
(iv)	930 mm to 1095 mm	1735 mm increasing to 1740 mm
(v)	1095 mm to 3310 mm	1740 mm increasing to 1825 mm
(vi)	3310 mm to 3775 mm	1825 mm decreasing to 1546 mm
(vii)	3775 mm to 6250 mm	1546 mm

Also refer to Figure No. NMSG-2

Notes:

i) Extra clearance shall be provided for curves as laid down at para 1.7.
ii) The term 'structure' covers any item including light ones like ladders, isolated posts, cables etc. erected alongside the track.
iii) Minimum lateral clearance for OHE masts for tangent track shall be 2150 mm from Centre line of nearest track.
iv) For passenger platform refer to para 2.2.1 to 2.2.3 of chapter 2.

1.5 KINEMATIC ENVELOPE

a. The Kinematic Envelope for level or constant grade tangent track, refer to:Figure No. NMSG-1 for At-Grade and Elevated Sections.
b. Figure No. NMSG-1A for At-Grade and Elevated Sections at platform.

1.6 STRUCTURE GAUGE

1.6.1 Elevated and At-Grade Sections

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing minimum clearance of 150 mm to Kinematic Envelope for structures above 305 mm above Rail level and minimum electrical clearance of 320 mm from 25 KV live parts conforming to the stipulations in chapter-4 of this SOD.

Refer to Figure No. NMSG-2 for Structure Gauge for outside stations on level or constant grade tangent track.

Note:
Extra clearance shall be provided for curves as laid down at para 1.7

1.7 EXTRA CLEARANCES ON CURVES

Following are the extra clearances considered for curves.

Abbreviations used in para 1.7:

C is the distance between centres of bogies in metres,
C_1 is the coach (vehicle) length in metres,
R is the radius of curve in metres,
Ca is the Cant applied in mm,
h is the height from rail level in mm and
g is the distance between centres of rails in mm

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1.7.1 INSIDE OF CURVE

(A) **Curvature effect**

i) Mid throw at the center of the vehicle = V (in mm) = $125xC^2/R$
ii) Clearance due to gauge widening on curves

For values of items (i) and (ii) above, refer to Appendix-2

Note:

Lateral shift of 26 mm due to nosing is included in Kinematic Envelope for tangent track (and as a result, included in Structure Gauge also) shall be subtracted from the total extra clearance worked out as at para 1.7.1(A)-i &ii above for inside of a curve in case the value of mid throw (V) is equal to or greater than 26 mm. In case the value of mid throw (V) is less than 26 mm, the curvature effect shall be due to widening of the gauge only. (The Mid throw minus 26 mm shall be taken as zero).

Refer to Appendix-2

(B) **Clearance for Super elevation**

(a) Elevated and At-Grade Sections

The lean 'L' due to Cant at any point at height 'h' above rail level is given by:

L = Ca x h/g (all in mm)

For values of Structure Gauge (E_1) for inside of a curve with cant effect only, (as shown in Figure No. NMSG-3, refer to:

(i) Appendix -3 for At-Grade and Elevated Sections

(C) **Clearance for vertical curve (vertical throw)**

Vertical Throw V_1 and V_2 (in mm) for vertical curve shall be calculated as under:

V_1 (with vehicle centre in sag or vehicle end on summit) = $125xC^2/R$
V_2 (with vehicle centre on summit or vehicle end in sag)
= $(125xC_1^2/R)-(125xC^2/R)$
Values of vertical throw due to vertical curves of different radii are given in Figure- NMSG-4

1.7.2 OUTSIDE OF CURVE

(A) **Curvature effect**

i) End throw at the end of vehicle = Vo (in mm)
= $[125xC_1^2/R]-[125xC^2/R]$
ii) Clearance due to gauge widening on curves
iii) Additional nosing due to gauge widening on curves

The values of items (i) to (iii) are shown in Appendix-2

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(B) **Clearance for Superelevation**

(a) Elevated, and At-Grade

The lean 'L' due to Cant at any point at height 'h' above rail level is given by:

L = (-) Ca x h/g (all in mm)

-ve sign indicates relief due to cant or reduction in clearance required.

Note:

Full relief for lean due to cant (Ca) is to be taken into account only for calculation of track spacing without any structure between tracks. In case there is a structure adjacent to track, relief for lean is to be taken into account only if the cant provided is greater than 50 mm and shall be limited to a value = (Ca - 50) x h/g.

Values of Structure Gauge (F_1) on outside of curve with cant effect only (as shown in Figure No. NMSG-3), refer to:

i) Appendix 3 for Elevated and At-Grade Sections

(C) Clearance for vertical curve (vertical throw)

The provisions at para 1.7.1 (C) above shall be applicable in this case also.

1.8 MINIMUM TRACK SPACING ON CURVES

Elevated and At-Grade Sections

The worst case will be when the end of a bogie carriage on the inner track is opposite the centre of a similar carriage on the outer track.

1.8.1 Without any structure between tracks

The minimum track spacing on curves without any structure between tracks shall be the sum of the following:

i) **(E + F)**,
ii) **T_1** (Extra lateral clearance due to curvature on inside of curve
iii) **T_2** (Extra lateral clearance due to curvature on outside of curve
iv) Minimum clearance between adjacent Kinematic Envelopes stipulated is as under:
   a) 300 mm for Elevated and At-Grade Sections.

Where,

'**E**' is the distance from vertical axis of centre line of canted track to canted Kinematic Envelope on inside of curve at a height 'h' (from rail level) for a given cant (Figure No. NMSG-3A) and

'**F**' is the distance from vertical axis of centre line of canted track to canted Kinematic Envelope on outside of curve at a height 'h' (from rail level) for a given cant (Figure No. NMSG-3A).

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Notes:

i) The value of '**F**', calculated from the formula at Figure No. NMSG-3A includes full relief due to cant.

ii) The sum of '**E**' and '**F**' for same height (which are with cant effect only), shall be the maximum of values calculated for various heights from rail level.

For values of **E**, **F**, T_1 and T_2, refer to the Appendices as shown below:

SECTIONS	For E & F	For T_1 &T_2
i) Elevated and At-Grade	3A	2

1.8.2 With a structure between adjacent tracks

The minimum track spacing on curves with a structure between tracks shall be the sum of the following:

i) (E_1 +T_1) Minimum clearance to the structure from centre line of track on inside of curve (for outer track)
ii) (F_1 +T_2) Minimum clearance to the structure from centre line of track on outside of curve (for inner track)
iii) Width of structure between adjacent tracks (measured across the tracks).

Where,

E_1 is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on inside of curve for a given cant,
F_1 is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on outside of curve for a given cant,
T_1 is extra lateral clearance due to curvature on inside of curve and
T_2 is extra lateral clearance due to curvature on outside of curve

Notes:

(i) The values of 'E_1' and 'F_1' for a given cant Ca, shall each be the maximum of values at different heights of structure from rail level. In case the cant provided is greater than 50 mm on inner track, the value of F_1 shall be for the cant of (Ca-50) mm. In case the cant provided is 50 mm or less on inner track, the value of F_1 shall be for ZERO cant.

(ii) Minimum track spacing, so worked out with a structure between the adjacent tracks shall not be less than that calculated as per para 1.8.1 for tracks without any structure between adjacent tracks.

For values of E_1, F_1, T_1 and T_2, refer to the Appendices as shown below:

SECTIONS	For E_1 & F_1	For T_1 & T_2
a) Elevated and At-Grade	3	2

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1.9 DERAILMENT GUARD

(a) Derailment Guard shall be provided on inside/outside of running rail on viaduct as well as At grade section at locations specified by the Metro Railway.

(b) The Lateral Clearance between the running rail and the derailment Guard shall be 210 ± 30 mm. It shall not be lower than 25mm below the top of the running rail and should be clear of the rail fastenings to permit installation, replacement and maintenance.

Note: In case of Double Resilient Base Plate Assembly Fastening System as approved by MoR, the lateral clearance between running rail and the derailment guard shall be 250 ± 20 mm. This fastening system, if used in tunnels having multiple tracks, Metro Administration should ensure that K.E. for adjacent track is not infringed so long as the wheels of any derailed vehicle are within the main rail and derailment guard.

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CHAPTER - 2

STATIONS

2.1 SPACING OF TRACKS AT STATIONS

Minimum spacing of tracks at station on straight and on curve of radius of 1000M and flatter, without any structure between tracks at-Grade and Elevated Stations 3900 mm

2.2 PLATFORMS

2.2.1 Maximum horizontal distance from centre of track to face of passenger platform coping

(i) For elevated/at grade section 1525 mm

2.2.2 Minimum horizontal distance from centre of track to face of passenger platform coping

(i) For elevated/At-Grade section 1520 mm

Notes:

a) Platform faces shall be flared away smoothly from the centre line of the track at either end for a minimum distance of 1500 mm beyond passenger area so as to give from centre of track a minimum dimension:

- 1590 $\pm$ 5 for At-Grade and Elevated Stations

b) For additional clearance for platforms on curves, refer to para 2.7

c) The track access gates at the end of platform upto a height of one meter from top of platform shall not infringe the Kinematic Envelope.

d) Refer Figure No. NMSG - 5.

2.2.3 Height above rail level for passenger platform:

		Maximum	Minimum
(a)	At-Grade	1085 mm	1075 mm
(b)	Elevated	1095 mm	1085 mm

2.2.4 (i) Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping except Platform Gate (PG) 2500 mm

ii) Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping except Platform Gate (PG) 3000 mm

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Notes:

a) The Platform Gates (PG) may be installed at platform as per design of Original Equipment Manufacturer (OEM) of PG but should of having a minimum clearance of 10mm from Kinematic Envelope.

b) The structure on the platform is treated as isolated if the length along the platform length is 2000 mm or less. Any structure having a length exceeding 2000 mm is treated as continuous structure. The clocks/mirrors/CCTV screens etc shall not be considered structures and shall be located at a minimum horizontal distance of 1000 mm from platform edge/coping with minimum height of 2000 mm from top of platform.

c) For platform structure setting-out dimensions at stations, refer to figure No. NMSG – 5 for Elevated & At-Grade Section. No fixed structures should infringe the Structure Gauge except for designated railway operational structures. Designated railway operational structures include platform edges, hand railing in back-of-house platform edge, OHE and its support structure and traction feeding cables and wires. Such designated railway operational structures should not infringe the Kinematic Envelope under any circumstances.

2.2.5 For the structure gauge of At Grade and Elevated section, refer to following Figures.

a) For At Grade and elevated stations NMSG-5

2.3 TRACK GRADIENT IN PLATFORM

(a) Maximum	1 in 400
(b) Desirable	Level

Note:- There shall be no change of gradient in platform track

2.4 INTERLOCKING AND SIGNAL GEAR

Maximum height above rail level of any part of interlocking or signal gear on either side of centre of track subject to the restrictions embodied in Note below shall be as under:

(a) For At-Grade and Elevated Stations

• From C.L. of track to 1330 mm	25 mm
• From 1330 mm to 1465 mm	25 mm increasing to 65 mm
• From 1465 mm to 1640 mm	65 mm increasing to 200 mm

Note:

Except for check rails of ordinary and diamond crossings, or wing rails and point rails of crossings leading to snag dead ends, or such parts of signalling gear as are required to be actuated by the wheels, no gear or track fittings shall project above rail level for a distance of 229 mm outside and 140 mm inside the gauge face of the rails.

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2.5 POINTS & CROSSING

2.5.1	Maximum clearance of check rail opposite nose of crossing	42 mm
2.5.2	Minimum clearance of check rail opposite nose of crossing	40 mm
2.5.3	Clerance between switch rail and stock rail at heel of switch	60± 2 mm
2.5.4	Maximum clearance of wing rail at nose of crossing	46 mm
2.5.5	Minimum clearance of wing rail at nose of crossings.	44 mm
2.5.6	Minimum clerance between toe of open switch and stock rail.	160 mm
2.5.7	Minimum radius of curvature for slip points, turnouts and crossover roads.	140 m
2.5.8	Minimum angle of crossing (ordinary)	1 in 9
2.5.9	Diamond crossing not to be flatter than	1 in 4.5

Note:

a) The above restrictions shall not apply to moveable diamond crossings

b) There must be no change of super elevation (of outer over inner rail) between points 18 meters outside toe of switch rail and nose of crossings respectively, except in the case of special crossing leading to snag dead-ends or under circumstances as provided for in item 2.6 below

2.5.10	Minimum length of tongue rail	9000 mm

2.6 SUPERELEVATION AND SPEED AT STATIONS ON CURVES WITH TURNOUTS OF CONTRARY AND SIMILAR FLEXURE.

2.6.1 **Main Line:**

Subject to the permissible run through speed based on the standard of interlocking, the equilibrium superelevation, calculated for the speed of the fastest train may be reduced by a maximum amount of cant deficiency without reducing speed on the main line.

2.6.2 **Turnouts:**

i) **Curves of contrary flexure**

The equilibrium superelevation (**s**) in mm should be = (1510/127) (V^2 / R)
Where, R = radius of turnout in meters and V is speed on turnout in Kmph.
The permissible negative superelevation on the turnout (which is also the actual superelevation of the main line) may then be = (Cd – **s**) mm

Where Cd = Permissible Cant deficiency

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i) **Curves of Similar flexure**

The question of reduction or otherwise of superelevation on the main line must necessarily be determined by the administration concerned. In the case of a reverse curve close behind the crossing of a turnout, the superelevation may be run out at the maximum of 1 mm in 440 mm.

2.7 ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES

1. The minimum radius of horizontal curve for station platform line is 1000 meters. There will be no superelevation and gauge widening of station on passenger platform lines.
2. Platform located in area shall be fitted with a gap filler wherever necessary to maintain the maximum stepping distance of 75 mm. The gap filler shall be of elastic nature and flexible to allow train contact without any adverse effect on passenger safety and suitability of train.

Note:

The additional clearance for platform on curves is to be provided as shown at Appendix-4.

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CHAPTER-3
ROLLING STOCK

3.1 PASSENGER ELECTRIC MULTIPLE UNITS

S.No.		
1.	(a) Length of the coach body (Maximum including end fairings) (b) The maximum width of the vehicle (c) Height of the coach body (maximum with pantograph in locked down condition)	23000mm 2900 mm 4048 mm
2.	(a) Distance between bogie centre's (b) Maximum distance apart between any two adjacent axles	14750± 350 mm 12900mm
3.	Kinematic Envelope for level tangent track (i) For At-Grade and Elevated Sections (ii) For At-Grade and Elevated Sections at platform	 Figure No. NMSG-1 Figure No. NMSG-1A
4.	Minimum clearance from rail level with fully loaded condition for bogie mounted equipment in worst condition* (*The worst condition means wheels with maximum tread wear and primary springs with maximum deflection) in static condition.	75 mm
5.	Minimum clearance from rail level under fully Loaded condition for body mounted equipment in worst condition* (*The 'worst condition' means deflated secondary air spring wheels with maximum tread wear and primary springs with maximum deflection) in static condition.	102 mm
6	Minimum clearance from rail level, under dynamic condition of fully loaded vehicle for bogie and body mounted equipment with maximum tread wear and primary springs with maximum deflection, with the exception of wheel & attachments. There to (vide note below #) Note: # A tyre or an attachment to a wheel or sand pipes or Wheel/Track Lubrication Nozzle in line with the wheel may project below the minimum height of 50mm from a distance of 51 mm inside to 216 mm outside of the gauge face of wheel.	50 mm
7.	Incline of Tread/Wheel Profile	RDSO wheel Profile to SK 91146 ALT-2 or UIC S1002 Wheel Profile.

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8.	Wheel a) Maximum wheel gauge back to back distance b) Minimum wheel gauge back to back distance	 1360 mm 1358 mm
9.	a) Maximum diameter on the tread measured at 63.5 mm from wheel gauge face for RDSO wheel Profile as per SK 91146 ALT 2 b) Minimum diameter on the tread measured at 63.5 mm from wheel gauge face for RDSO wheel Profile as per SK 91146 ALT - 2 c) Maximum diameter on the tread measured at 70 mm from wheel gauge face for UIC S 1002 profile d) Minimum diameter on the tread measured at 70 mm from wheel gauge face for UIC S 1002 profile	860 mm 780 mm 860 mm 780 mm
10.	a) Minimum projection for flange of new wheel measured from tread at 63.5 mm from the wheel gauge face for RDSO Profile as per SK 91146 ALT-2 b) Minimum projection for flange of new wheel measured from tread at 70 mm from the wheel gauge face for UIC S1002 profile c) Maximum projection for flange worn wheel measured from tread at 63.5 mm from wheel gauge face for RDSO wheel Profile as per SK 91146 ALT-2 d) Maximum projection for flange of worn wheel measured from tread of 70mm from wheel gauge face for UIC S1002 profile	28.5+1 mm -0 mm 28+1 mm -0 mm 34 mm 36 mm
11.	a) Maximum thickness of flange of wheel measured at 13 mm from tip of Flange for RDSO profile as per SK 91146 ALT-2 b) Maximum *q_R of new wheel for UIC S1002 profile c) Minimum thickness of flange of wheel measured at 13 mm from tip of Flange for RDSO profile as per SK 91146 ALT-2 d) Minimum *q_R for flange of worn wheel for UIC S1002 profile * q_R shall be measured as defined in UIC 510-2 for S 1002 wheel profile.	29.4 mm 10.8 mm 25 mm 6.5 mm

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12.	a) Width of wheel for RDSO profile as per SK 91146 ALT-2 b) Width of wheel for UIC S1002 profile	130 mm nominal 135 mm nominal
13.	Floor Height a) Maximum height above rail level for floor of any unloaded vehicle b) Minimum height above rail level for floor of fully loaded normal vehicle	 1130 mm 1100 mm
14.	a) Maximum height of centre coupler above rail level for unloaded vehicle b) Minimum height of centre coupler above rail level for fully loaded vehicle	815mm 740 mm
15.	Maximum length of coach over couplers	23708 mm
16.	Length of rigid wheel base for single bogie	2200 to 2600 mm

3.2 LOCOMOTIVES AND ENGINEERING SERVICE VEHICLES

Other items of rolling stock, viz shunting locomotives, OHE maintenance and inspection cars, emergency re-railing van, track machines, etc., used on Noida Metro System (where these cars would be plying) will conform with the Kinematic Envelope of the Passenger Electric Multiple Units as shown in Figure No. NMSG - 1 for Elevated and At-Grade sections.

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CHAPTER 4

OVERHEAD ELECTRIC TRACTION 25 KV/AC 50 CYCLES PER SECOND

Note: Wherever electric traction is in use, special precautions must be taken to maintain following clearances:

4.1 ELECTRICAL CLEARANCES FOR AT-GRADE AND ELEVATED SECTIONS

4.1.1 Minimum vertical distance between any live bare conductor (overhead equipment or pantograph) and any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.)

	Condition	For Flexible OHE
(i)	Long duration (Static)	320mm
(ii)	Short Duration (Dynamic)	270mm

Note:

A minimum vertical distance of 340 mm shall normally be provided between rolling stock and contact wire to allow for a 20 mm temporary raising of the tracks during maintenance. Wherever the clearance required for track maintenance exceeds 20 mm, the vertical distance between rolling stock and contact wire shall correspondingly be increased.

4.1.2 Minimum lateral distance between any bare live conductor (over head equipment or pantograph) or any earthed structure or other bodies (rolling stock, over bridges, signal gantries etc.)

	Condition	For Flexible OHE
(i)	Long duration (Static)	320 mm
(ii)	Short Duration (Dynamic)	220 mm

4.1.3 Height of contact wire:

Minimum height from rail level to the underside of live Conductor wire

i)	Underbridge (FOB,ROB,Railway Bridge,viaduct).....	4800 mm
ii)	In the open	5000 mm
iii)	At level crossings	5500 mm
iv)	In running and carriage sheds wherever staff are expected to work on the roof of rolling stock.	5200 mm

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Note:

a) On curves, all vertical distances specified in items 4.1.3 above, shall be measured above level of the inner rail, increased by half the super-elevation.

b) Maximum variation of the live conductor wire on either side of the centre line of the track under static conditions:

i) On straight ..... ±200mm

ii) On Curves ..... ±300mm

Note: These limits would not apply to special locations like insulated overlaps and out of run wires.

4.1.4 Maximum width of pantograph collector :

The Kinematic Envelope with the size of Pantograph adopted shall be within the Kinematic Envelope shown at Figure No. NMSG-1

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Chapter- 5

PLATFORM GATE

5.1 PLATFORM GATE SETTING OUT DIMENSIONS:

Minimum Platform Gate Width (clear opening)	2000 mm
Minimum Platform Gate Height from PF level	1500 mm
Minimum Platform threshold offset from track centerline – straight track (Elevated/At Grade)	1520 mm
Minimum Platform gate panel offset from track centerline – straight track (Elevated/At Grade)	1545 mm

Note:

(a) Assumed plus/minus 300 mm stopping accuracy.

(b) Platform gates at stations on curves shall be considered separately taking into account the additional clearance as per Appendix-4.

(c) Platform Gates are considered as designated railway operational structures. Therefore, platform gates may infringe the structure gauge, but does not infringe the station kinematic envelope and having minimum clearance of 10 mm from kinematic Envelope to Platform Gate.

(d) Refer figure NMSG-6.

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Appendix-1

PERMISSIBLE SPEED, CANT AND
MINIMUM TRACK SPACING ON CURVES.

ELEVATED AND AT-GRADE SECTIONS

(REFERENCE: PARA 1.1)

RADIUS OF CURVE	CANT	MAXIMUM PERMISSIBLE SPEED	MINIMUM DISTANCE BETWEEN ADJACENT TRACKS See note (a)
			ELEVATED AND AT-GRADE
metres	mm	kmph	mm
3000 or more	15	85	3650
2800	15	85	3650
2400	20	85	3650
2000	20	85	3650
1600	25	85	3650
1500	30	85	3700
1200	35	85	3700
1000	45	85	3700
800	55	85	3700
600	70	85	3750
500	85	85	3750
450	95	85	3800
400	105	80	3800
350	110	75	3800
300	110	70	3850
200	110	55	3950
150	110	50	4050
150*	0	30	4050
120	110	45	4150
120*	0	30	4150
100*	0	25	4250

Notes:

(a) The track spacing shown in the table above is without any column/structure between two tracks and is with equal cant for both outer and inner tracks.

b) Track spacing shown in Table above is not applicable to stations which should be calculated depending on specific requirement but the spacing should not be less than the spacing stipulated in para 2.1

c) Figure for any intermediate radius of curvature may be obtained by adopting the value for sharper curve.

d) Cant provided is limited to desirable value of 110 mm

e) Maximum cant defficiency is 85 mm.

f) *Curves in depot/workshop are NON transitioned and without any cant.

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APPENDIX-2

EXTRA HORIZONTAL CLEARANCE ON CURVES

(CURVATURE EFFECT)

INSIDE OF CURVE

REFERENCE: PARA 1.7.1

RADIUS (metres)	MID-THROW (28500/R) (mm)	NOSING INCLUDED IN K.E/ STRUCTURE GAUGE FOR TANGENT TRACK (mm)	EXTRA GAUGE CLEARANCE ON CURVES (mm)	EXTRA HORIZONTAL CLEARANCE ON CURVE (mm)	REMARKS
R	(V)	(N)	(G)	(T_1)	
100	285.0	26.0	9.0	268	
120	237.5	26.0	9.0	221	1.0 EXTRA GAUGE CLEARANCE ON CURVES (G) = 9mm for curves sharper than 500m and 5mm for curves with radius of 500m to less than 1000m.
150	190.0	26.0	9.0	173	
175	162.9	26.0	9.0	146	
200	142.5	26.0	9.0	126	
250	114.0	26.0	9.0	97	
300	95.0	26.0	9.0	78	
350	81.4	26.0	9.0	64	
400	71.3	26.0	9.0	54	2.0 T1=V-N+G for V ≥ N and T1= G for V < N
450	63.3	26.0	9.0	46	
500	57.0	26.0	5.0	36	
600	47.5	26.0	5.0	27	
700	40.7	26.0	5.0	20	
800	35.6	26.0	5.0	15	
900	31.7	26.0	5.0	11	
1000	28.5	26.0	0.0	3	
1200	23.8	26.0	0.0	0	
1500	19.0	26.0	0.0	0	
1600	17.8	26.0	0.0	0	
2000	14.3	26.0	0.0	0	
2400	11.9	26.0	0.0	0	
2800	10.2	26.0	0.0	0	
3000 or more	9.5	26.0	0.0	0	

Mid throw (in mm) V = (125 x C^2) /R= 28500/R

Where 'C' is the distance between bogie centers = 14.750+0.350=15.100m **OR** 14.750 - 0.350=14.400 m.

The worst case will be with C=15.100 m

R is the radius of curve in metres.

Mid throw (in mm) V = (125 x C^2) /R= 28500/R

OUTSIDE OF CURVE

REFERENCE PARA 1.7.2

RADIUS (metres)	END-THROW (34635/R) (mm)	EXTRA GAUGE CLEARANCE ON CURVES (mm)	EXTRA NOSING DUE TO EXTRA GAUGE CLEARANCE (mm)	EXTRA HORIZONTAL CLEARANCE ON CURVE (mm)	REMARKS
R	Vo	G	EN	T_2	
100	346.4	9.0	2.3	358	1.0 EXTRA GAUGE CLEARANCE ON CURVES (G) = 9mm for curves sharper than 500m and 5mm for curves with radius of 500m to less than 1000m.
120	288.6	9.0	2.3	300	
150	230.9	9.0	2.3	242	
175	197.9	9.0	2.3	209	
200	173.2	9.0	2.3	184	
250	138.5	9.0	2.3	150	
300	115.5	9.0	2.3	127	2.0 T_2=Vo+G+EN
350	99.0	9.0	2.3	110	
400	86.6	9.0	2.3	98	3.0 EN=Gx0.251986301
450	77.0	9.0	2.3	88	
500	69.3	5.0	1.3	76	
600	57.7	5.0	1.3	64	
700	49.5	5.0	1.3	56	
800	43.3	5.0	1.3	50	
900	38.5	5.0	1.3	45	
1000	34.6	0.0	0.0	35	
1200	28.9	0.0	0.0	29	
1500	23.1	0.0	0.0	23	
1600	21.6	0.0	0.0	22	
2000	17.3	0.0	0.0	17	
2400	14.4	0.0	0.0	14	
2800	12.4	0.0	0.0	12	
3000 or more	11.5	0.0	0.0	12	

End Throw (in mm) Vo= (125 x C_1^2) /R - (125xC^2)/R = 34635/R

Where 'C' is the distance between bogie centers = 14.750+0.350=15.100m OR 14.750-0.350=14.400m .

Worst case will be with C=14.400

'C_1' is length of coach in meters = 22.01 m and 'R' is radius of curve in meters.

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APPENDIX-3

NOIDA GREATER NOIDA METRO

CANT EFFECT ON STRUCTURE GAUGE-HORIZONTAL

AT-GRADE AND ELEVATED

REFERENCE: PARA 1.8.1 & 1.8.2

ALL FIGURES ARE IN mm

Height above rail level measured perpendicular to plane of track →					h= 305				h= 930				h= 3310				h= 3775				h= 6250			
Distance from center line of track to Structure Gauge for tangent track. →					ab= 1640				ab= 1735				ab= 1825				ab= 1546				ab= 1546			
Cant	Angle α Degrees	Sin α	cos α	tan α	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2	E_1	F_1	H_1	H_2
110	4.178	0.073	0.997	0.07	1658	1613	479	240	1798	1663	1109	856	2061	1579	3489	3223	1817	1267	3933	3707	1997	1087	6401	6176
105	3.987	0.070	0.998	0.07	1657	1615	471	243	1795	1666	1101	860	2051	1590	3481	3228	1805	1280	3926	3711	1977	1108	6395	6180
100	3.797	0.066	0.998	0.07	1657	1616	463	246	1793	1670	1093	863	2040	1602	3474	3232	1793	1293	3919	3714	1957	1129	6389	6184
95	3.607	0.063	0.998	0.06	1656	1618	455	249	1790	1673	1085	867	2030	1613	3466	3236	1780	1305	3912	3718	1936	1150	6382	6188
90	3.417	0.060	0.998	0.06	1655	1619	447	252	1787	1676	1077	870	2019	1624	3458	3240	1768	1318	3905	3721	1916	1171	6376	6192
85	3.227	0.056	0.998	0.06	1655	1620	439	255	1785	1680	1069	873	2008	1636	3450	3245	1756	1331	3899	3724	1895	1192	6370	6196
80	3.037	0.053	0.999	0.05	1654	1622	431	258	1782	1683	1061	877	1998	1647	3442	3249	1744	1344	3892	3728	1875	1213	6363	6199
75	2.847	0.050	0.999	0.05	1653	1623	424	261	1779	1687	1053	880	1987	1658	3434	3253	1732	1357	3885	3731	1855	1234	6357	6203
70	2.657	0.046	0.999	0.05	1652	1624	416	264	1776	1690	1044	884	1976	1670	3426	3257	1719	1369	3878	3734	1834	1255	6350	6207
65	2.467	0.043	0.999	0.04	1652	1625	408	267	1773	1693	1036	887	1966	1681	3418	3261	1707	1382	3871	3737	1814	1276	6343	6210
60	2.277	0.040	0.999	0.04	1651	1627	400	270	1771	1697	1028	890	1955	1692	3410	3265	1695	1395	3863	3741	1793	1296	6336	6214
55	2.087	0.036	0.999	0.04	1650	1628	392	273	1768	1700	1020	894	1944	1703	3402	3269	1682	1407	3856	3744	1773	1317	6330	6217
50	1.898	0.033	0.999	0.03	1649	1629	384	276	1765	1703	1012	897	1934	1714	3394	3273	1670	1420	3849	3747	1752	1338	6323	6220
45	1.708	0.030	1.000	0.03	1648	1630	376	278	1762	1707	1004	900	1923	1726	3385	3277	1658	1433	3842	3750	1732	1359	6316	6224
40	1.518	0.026	1.000	0.03	1648	1631	368	281	1759	1710	996	904	1912	1737	3377	3280	1645	1445	3835	3753	1711	1380	6309	6227
35	1.328	0.023	1.000	0.02	1647	1632	360	284	1756	1713	987	907	1901	1748	3369	3284	1633	1458	3827	3756	1690	1401	6302	6230
30	1.138	0.020	1.000	0.02	1646	1634	353	287	1753	1716	979	910	1890	1759	3361	3288	1621	1471	3820	3759	1670	1422	6294	6233
25	0.949	0.017	1.000	0.02	1645	1635	345	290	1750	1719	971	914	1880	1770	3352	3292	1608	1483	3813	3761	1649	1442	6287	6236
20	0.759	0.013	1.000	0.01	1644	1636	337	293	1747	1723	963	917	1869	1781	3344	3296	1596	1496	3805	3764	1629	1463	6280	6239
15	0.569	0.010	1.000	0.01	1643	1637	329	296	1744	1726	955	920	1858	1792	3335	3299	1583	1508	3798	3767	1608	1484	6273	6242
10	0.379	0.007	1.000	0.01	1642	1638	321	299	1741	1729	946	923	1847	1803	3327	3303	1571	1521	3790	3770	1587	1505	6265	6245
5	0.190	0.003	1.000	0	1641	1639	313	302	1738	1732	938	927	1836	1814	3319	3306	1558	1533	3783	3772	1567	1525	6258	6247
0	0.000	0.000	1.000	0	1640	1640	305	305	1735	1735	930	930	1825	1825	3310	3310	1546	1546	3775	3775	1546	1546	6250	6250

REFER TO FIGURE: NMSG-3

E_1=[ab+(h x tan α)] x cos α

F_1=[Ab- (h x tan α)] x cos α

H_1=(Ca/2)+(h / cos α)+(Ab-h x tan α)xsin α

H_2=(Ca/2)+(h/ cos α)-(ab+h x tan α)xsin α

ab=Ab=Distance from center line of vehicle to Structure gauge for Tangent track at height 'h' from rail level

ac=Distance from center line of canted tack to Structure Gauge for Tangent track at height 'h' from rail level.

bc=hxtanα=Lateral increment due to cant (measured along the line parallel to line joining top of rails).

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APPENDIX-3A

NOIDA GREATER NOIDA METRO

CANT EFFECT ON KINEMATIC ENVELOPE-HORIZONTAL

AT-GRADE AND ELEVATED SECTIONS

REF: PARA 1.8.1

Height above rail level measured perpendicular to plane of track →					h= 938				h= 997				h= 1130				h= 2878				h= 3296				h= 4014				h= 4866				h= 5018			
Distance from center line of track to K.E for tangent track. →					ab= 1582				ab= 1584				ab= 1590				ab= 1658				ab= 1658				ab= 1225				ab= 1220				ab= 880			
Cant	Angle α Degres	Sin α	cos α	tan α	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2	E	F	H_1	H_2
110	4.178	0.073	0.997	0.073	1646	1509	1106	875	1652	1507	1165	934	1668	1503	1298	1066	1863	1444	3046	2805	1894	1413	3463	3221	1514	929	4148	3969	1671	862	4997	4819	1243	512	5124	4996
105	3.987	0.070	0.998	0.07	1643	1513	1098	878	1649	1511	1157	937	1665	1508	1290	1069	1854	1454	3039	2808	1883	1425	3456	3225	1501	943	4142	3972	1555	879	4992	4822	1227	529	5120	4997
100	3.797	0.066	0.998	0.066	1641	1516	1091	881	1647	1514	1150	940	1661	1512	1283	1072	1845	1464	3031	2812	1873	1436	3449	3229	1488	956	4136	3974	1540	895	4986	4825	1210	546	5115	4999
95	3.607	0.063	0.998	0.063	1638	1520	1083	884	1644	1518	1142	943	1658	1516	1275	1075	1836	1474	3024	2815	1862	1447	3441	3233	1475	970	4131	3976	1524	911	4981	4827	1194	563	5111	5000
90	3.417	0.060	0.998	0.06	1635	1523	1076	887	1641	1522	1135	946	1655	1520	1268	1078	1827	1484	3017	2819	1852	1459	3434	3236	1462	984	4125	3979	1508	928	4976	4830	1178	579	5107	5002
85	3.227	0.056	0.998	0.056	1632	1527	1068	890	1638	1525	1127	949	1651	1524	1260	1081	1817	1493	3009	2823	1841	1470	3427	3240	1449	997	4119	3981	1492	944	4969	4832	1161	596	5102	5003
80	3.037	0.053	0.999	0.053	1629	1530	1060	893	1635	1529	1120	952	1648	1528	1253	1084	1808	1503	3002	2826	1830	1481	3419	3244	1436	1011	4113	3983	1476	960	4964	4835	1145	613	5098	5004
75	2.847	0.050	0.999	0.05	1627	1533	1053	896	1632	1533	1112	955	1644	1532	1245	1087	1799	1513	2994	2830	1820	1492	3412	3247	1423	1024	4107	3986	1460	977	4958	4837	1128	630	5093	5006
70	2.657	0.046	0.999	0.046	1624	1537	1045	899	1629	1536	1104	957	1641	1536	1237	1090	1790	1523	2987	2833	1809	1503	3404	3251	1410	1038	4101	3988	1444	993	4952	4839	1112	646	5088	5007
65	2.467	0.043	0.999	0.043	1621	1540	1038	902	1625	1540	1097	960	1637	1540	1230	1093	1780	1533	2979	2836	1798	1515	3397	3254	1397	1051	4096	3990	1428	1009	4947	4841	1095	663	5084	5008
60	2.277	0.040	0.999	0.04	1618	1543	1030	904	1622	1543	1089	963	1634	1544	1222	1096	1771	1542	2972	2840	1788	1526	3389	3258	1384	1065	4090	3992	1412	1026	4941	4844	1079	680	5079	5009
55	2.087	0.036	0.999	0.036	1615	1547	1023	907	1619	1547	1082	966	1630	1548	1215	1099	1762	1552	2964	2843	1777	1537	3382	3261	1370	1078	4083	3994	1396	1042	4935	4846	1062	697	5074	5010
50	1.898	0.033	0.999	0.033	1612	1550	1015	910	1616	1550	1074	969	1627	1552	1207	1102	1752	1562	2956	2847	1766	1548	3374	3264	1357	1091	4077	3996	1380	1058	4929	4848	1046	713	5069	5011
45	1.708	0.030	1.000	0.03	1609	1553	1007	913	1613	1554	1066	972	1623	1556	1199	1105	1743	1571	2949	2850	1755	1559	3366	3268	1344	1105	4071	3998	1364	1074	4923	4850	1029	730	5064	5012
40	1.518	0.026	1.000	0.026	1606	1557	1000	916	1610	1557	1059	975	1619	1560	1192	1107	1734	1581	2941	2853	1745	1570	3359	3271	1331	1118	4065	4000	1348	1091	4917	4852	1013	747	5060	5013
35	1.328	0.023	1.000	0.023	1603	1560	992	919	1607	1560	1051	978	1616	1563	1184	1110	1724	1591	2933	2856	1734	1581	3351	3274	1318	1132	4059	4002	1332	1107	4910	4854	996	763	5055	5014
30	1.138	0.020	1.000	0.02	1600	1563	984	921	1603	1564	1043	980	1612	1567	1176	1113	1715	1600	2925	2859	1723	1592	3343	3277	1305	1145	4053	4004	1316	1123	4904	4856	980	780	5049	5015
25	0.949	0.017	1.000	0.017	1597	1566	977	924	1600	1567	1036	983	1608	1571	1169	1116	1705	1610	2918	2863	1712	1603	3335	3281	1291	1158	4046	4006	1300	1139	4898	4858	963	797	5044	5015
20	0.759	0.013	1.000	0.013	1594	1569	969	927	1597	1571	1028	986	1605	1575	1161	1119	1696	1620	2910	2866	1702	1614	3328	3284	1278	1172	4040	4007	1284	1155	4892	4859	946	813	5039	5016
15	0.569	0.010	1.000	0.01	1591	1573	961	930	1594	1574	1020	989	1601	1579	1153	1122	1687	1629	2902	2869	1691	1625	3320	3287	1265	1185	4033	4009	1268	1172	4885	4861	930	830	5034	5017
10	0.379	0.007	1.000	0.007	1588	1576	953	933	1591	1577	1012	991	1597	1582	1146	1124	1677	1639	2894	2872	1680	1636	3312	3290	1252	1198	4027	4011	1252	1188	4879	4863	913	847	5029	5017
5	0.190	0.003	1.000	0.003	1585	1579	946	935	1587	1581	1005	994	1594	1586	1138	1127	1668	1648	2886	2875	1669	1647	3304	3293	1238	1212	4021	4012	1236	1204	4873	4864	897	863	5023	5018
0	0.000	0.000	1.000	0	1582	1582	938	938	1584	1584	997	997	1590	1590	1130	1130	1658	1658	2878	2878	1658	1658	3296	3296	1225	1225	4014	4014	1220	1220	4866	4866	880	880	5018	5018

REFER TO FIGURE NMSG-3A

E=[ab+(h x tan α)] x cos α

F=[Ab- (h x tan α)] x cos α

H_1=(Ca/2)+(h / cos α)+(Ab-h x tan α)xsin α

H_2=(Ca/2)+(h/ cos α)-(ab+h x tan α)xsin α

ab=Ab=Distance from center line of vehicle to K.E for Tangent track at height 'h' from rail level

ac=Distance from center line of canted tack to K.E for Tangent track at height 'h' from rail level.

bc=hxtanα=Lateral increment due to cant(measured along the line parallel to line joining top of rails.

Project Directorate Approved on 04/12/17 Railway Board

ASHOK KUMAR ...

Chief Engineer ...

(ATAL KUMAR RAI) I.A.S
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N.M.R.C.

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Executive Director
N.M.R.C.

APPENDIX -4

ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES
ELEVATED AND AT GRADE SATIONS

REF: PARA 2.7

RADIUS	EXTRA CLEARANCE													
	INSIDE OF CURVE								OUTSIDE OF CURVE					
	AT CENTRE LINE OF BOGIES				AT EDGE OF OPEN DOOR NEAREST TO C.L. OF BOGIES				AT END OF COACH	AT EDGE OF OPEN DOOR, FARTHEST FROM C.L. OF BOGIES				
	MID THROW =28500/R	NOSING	ADDITIONAL CLEARANCE	ADDITIONAL CLEARANCE (ROUNDED OFF TO NEAREST 5 mm) (i)	THROW =28498/R	NOSING = 13x 0.873/11	ADDITIONAL CLEARANCE	ADDITIONAL CLEARANCE (ROUNDED OFF TO NEAREST 5 mm) (ii)	END THROW = 34635/R	THROW =20064/R	NOSING =13x 9.59/11	DIFFERENCE BETWEEN N AND N_2	ADDITIONAL CLEARANCE	ADDITIONAL CLEARANCE (ROUNDED OFF TO NEAREST 5 mm) (ii)
R	V	N	V-N	V-N	V_3	N_1	$V_3 - (N-N_1)$	$V_3 - (N-N_1)$	V_0	V_4	N_2	$N-N_2$	$V_4-(N-N_2)$	$V_4-(N-N_2)$
metres	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	2	3	4a	4	5	6	7a	7	8	9	10	11	12a	12
3000	9.5	13.0	-3.5	0	9.5	1.0	-2.5	0	12	6.7	11.3	1.7	5.0	5
2800	10.2	13.0	-2.8	0	10.2	1.0	-1.8	0	12	7.2	11.3	1.7	5.5	10
2400	11.9	13.0	-1.1	0	11.9	1.0	-0.1	0	14	8.4	11.3	1.7	6.7	10
2000	14.3	13.0	1.3	5	14.2	1.0	2.3	5	17	10.0	11.3	1.7	8.4	10
1800	15.8	13.0	2.8	5	15.8	1.0	3.9	5	19	11.1	11.3	1.7	9.5	10
1600	17.8	13.0	4.8	5	17.8	1.0	5.8	10	22	12.5	11.3	1.7	10.9	15
1500	19.0	13.0	6.0	10	19.0	1.0	7.0	10	23	13.4	11.3	1.7	11.7	15
1200	23.8	13.0	10.8	15	23.7	1.0	11.8	15	29	16.7	11.3	1.7	15.1	20
1000	28.5	13.0	15.5	20	28.5	1.0	16.5	20	35	20.1	11.3	1.7	18.4	20

NOTES:

1. For outside of curve, the difference between clearance required at coach end that at the farthest door edge is less than 25 mm. As half width of coach at ends is at least 25 mm less than that at door locations, additional clearance to be provided is additional clearance required at the farthest door edge (column 12).
2. Values of additional clearances (columns 4, 7and 12) are rounded off to the nearest 5 mm.
3. Negative values of additional clearance are taken as Zero in the columns 4 and 7 with rounded off figures.
4. Extra clearance for curve:

(a) Inside of curve:

$V = (125C^2/R)=28500/R$ with C=15.10 m for the worst case.

$V_3=[(125)x(15.1^2- 4x0.873^2)/R]=28498/R$

$N_1=Nx(X)/(C_1/2)=13 \times 0.873/10.97=1.03$ mm

Minimum distance 'X' for the nearest edge of an open door from centre line of Bogies is 0.873 metre. Higher of (i) column 4 and (ii) column 7 shall be adopted

(b) Outside of curve:

$V_0=(125C_1^2/R)-(125C^2/R)=34635/R$ for coach end with C=14.4 metres and C_1=2x11 metres

$V_4=125x(19.18x19.18-14.4x14.4)/R = 20064/R$ for farthest edge of end door in open position with C1=2x9.590=19.18 metres and C=14.40 metres for the worst case.

N_2=Nosing at the farthest edge of an open door=N x (X)/(C_1/2) =13x9.59/ 11mm =11.3 mm

R=Radius of curve in metres

Maximum distance (X) for the farthest edge of open door from centre line of two Bogies=9.590 M

5. There will be no superelevation on curves in platform Portion.

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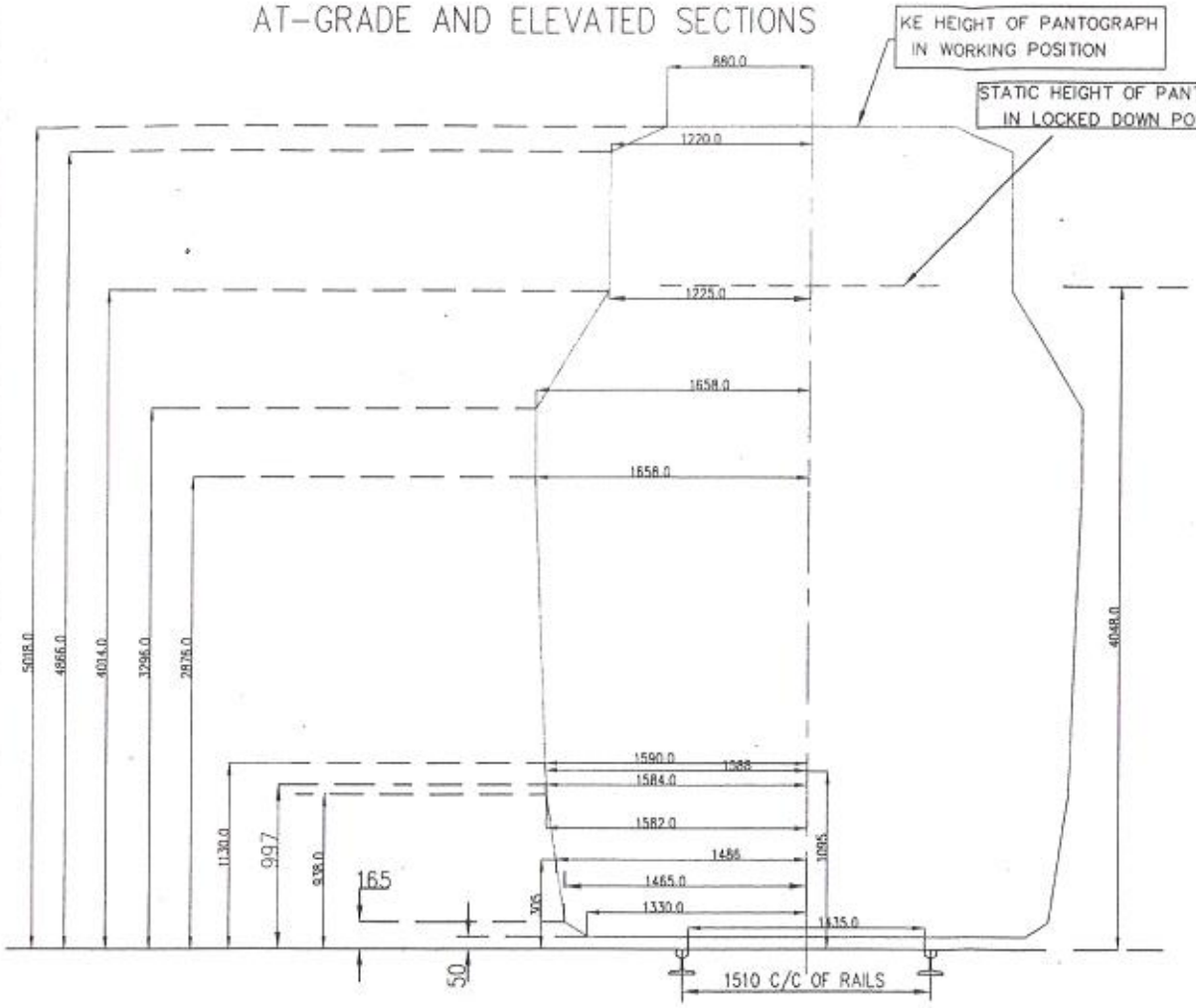
Project Directorate
Approved on
04/12/12
Railway Board

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

AT-GRADE AND ELEVATED SECTIONS



25 kV A.C.TRACTION

NOTES

1. ALL DIMENSIONS ARE IN mm
2. HORIZONTAL AND VERTICAL CLEARANCE DUE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA
3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION
4. THE CONDUCTOR HEIGHT ABOVE RAIL LEVEL SHALL ALSO TAKE IN TO CONSIDERATION PRESCRIBED ELECTRICAL CLEARENCES BETWEEN ALL LIVE OVERHEAD EUIPMENT AND PANTOGRAPH / VEHICLE AND ALL PARTS THEREOF.
5. A TYRE OR ATTACHMENT OF A WHEEL MAY PROJECT BELOW THE MINIMUM HEIGHT OF KINEMATIC ENVELOPE FOR A DISTANCE OF 51 mm INSIDE AND 216 mm OUTSIDE OF THE GAUGE FACE OF THE WHEEL.
5. KINEMATIC ENVELOPE IS VALID FOR OPERATION SPEED OF UPTO 80 KMPH.

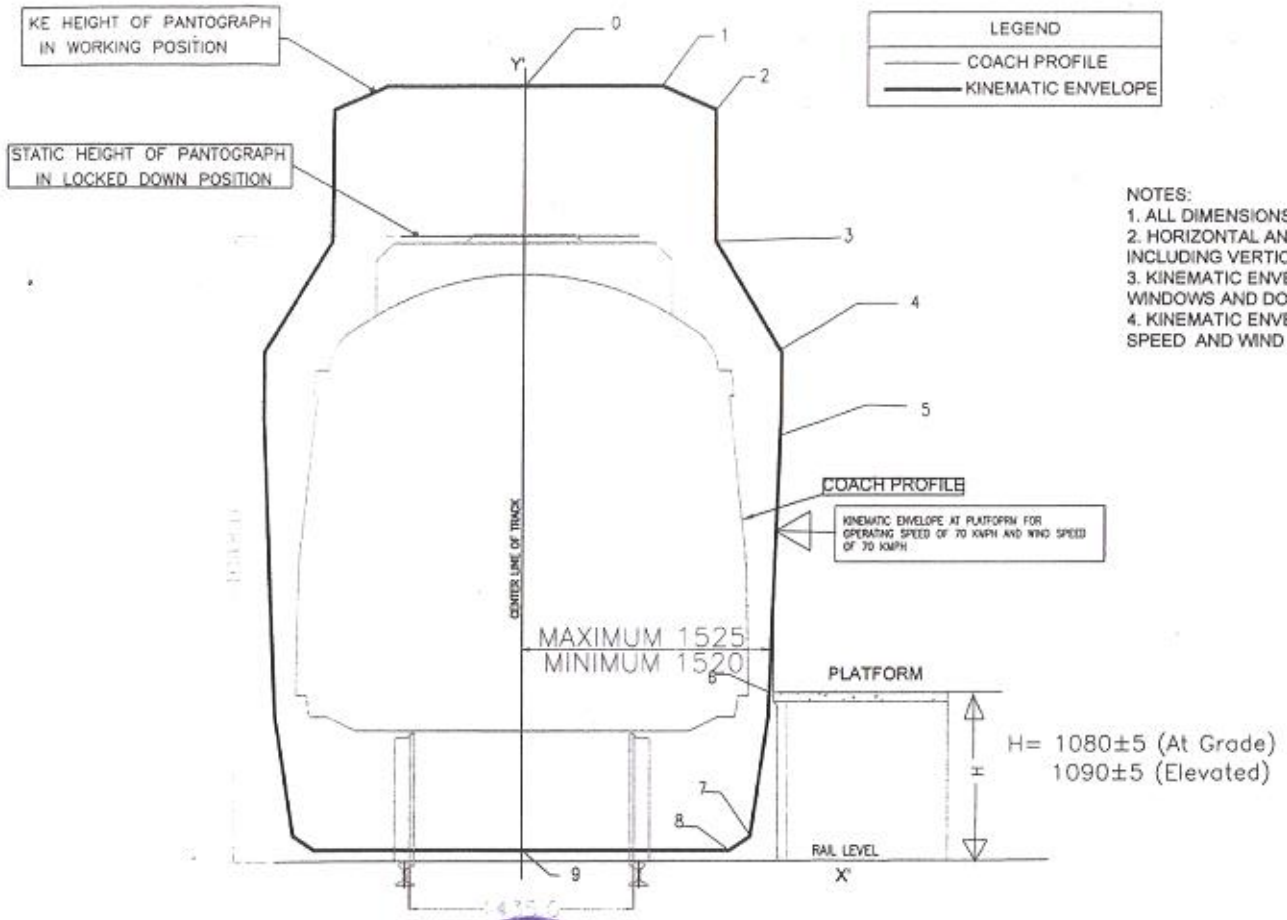
Project Directorate Approved on 04/12/17 Railway Board

KINEMATIC ENVELOPE
AT-GRADE AND ELEVATED SECTIONS
(OUTSIDE STATION)
ON
LEVEL OR CONSTANT GRADE TANGENT TRACK

NOIDA METRO RAIL CORPORATION LTD. ASHOK KUMAR GUPTA Chief Engineer/Consultancy/HQN Delhi Metro Rail Corp. Ltd. Cange Shopping Complex, Sector-29 NOIDA (U.P.)	STANDARD GAUGE (1435 mm)	DATE: 08-07-2016	FIGURE No. NMSG-1
		SCALE: NOT TO SCALE	REF: PARA 1.5

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.



NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. HORIZONTAL AND VERTICAL CLEARANCE DUE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHEN IN MOTION.
4. KINEMATIC ENVELOPE IS VALID FOR FOR 70 KMPH OPERATING SPEED AND WIND SPEED OF 70 KMPH

CO-ORDINATES

	X'	Y'
0	0	5018
1	880	5018
2	1220	4866
3	1225	4014
4	1595	3296
5	1595	2876
6	1515	1090
7	1495	185
8	1330	50
9	0	50

Project Directorate * Railway Board
Approved on 04/8/17

25 kV A.C.TRACTION

KINEMATIC ENVELOPE
AT GRADE/ ELEVATED SECTIONS
ON
LEVEL OR CONSTANT GRADE TANGENT TRACK AT PLATFORM

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NSH
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-15

STANDARD GAUGE
(1435 mm)

DATE: 08-07-2016

FIGURE No. NMSG-1A

SCALE: NOT TO SCALE

Ref Para 3.1(3)(ii) & 3.2

(ATAL KUMAR RAI)
I.A.S
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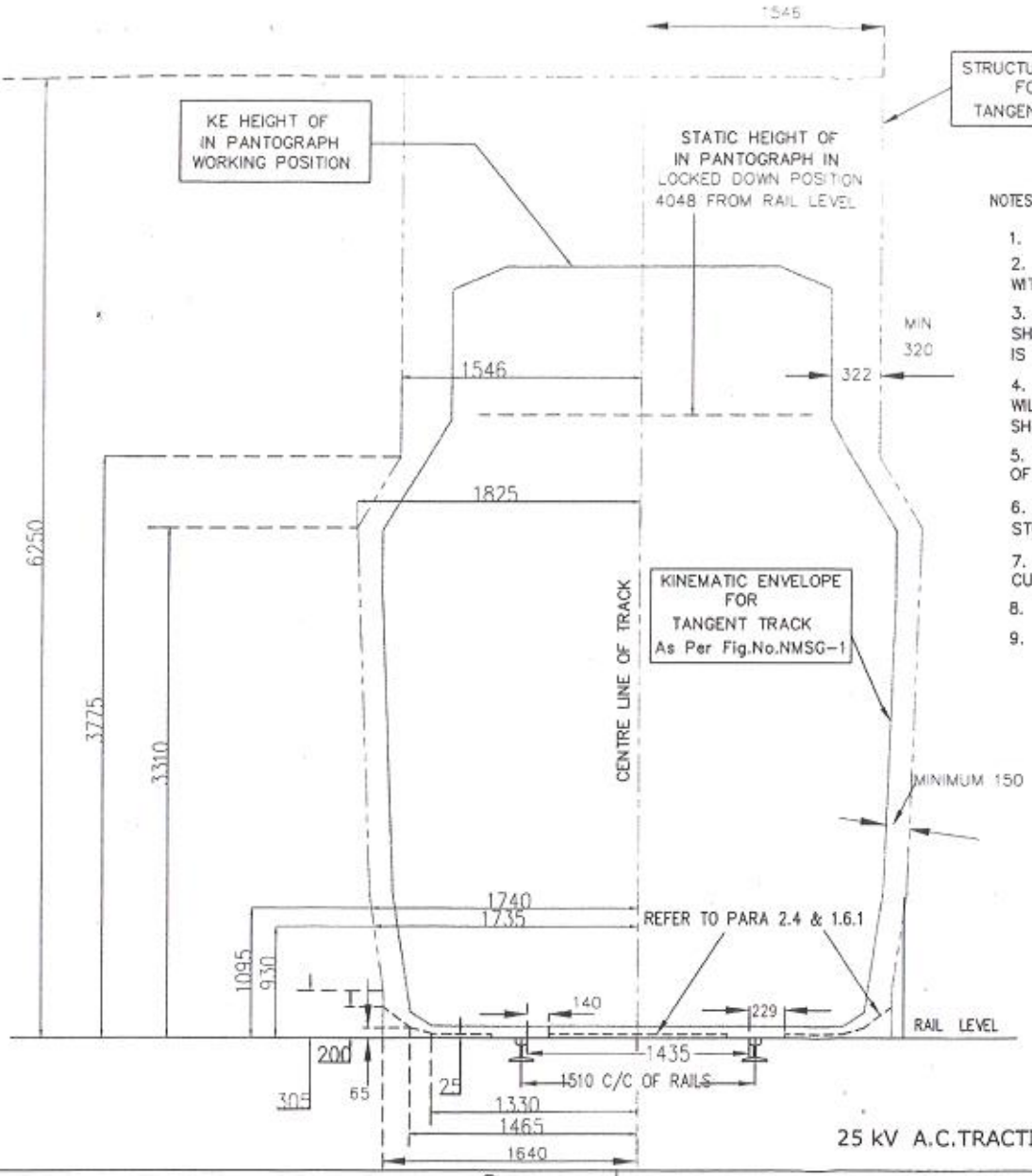
N.M.R.C.

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.



NOTES

1. ALL DIMENSIONS ARE IN mm.
2. THIS STRUCTURE GAUGE WILL ALSO BE APPLICABLE FOR ROBs/FOBs AT STATIONS WITHOUT THE MAST UNDER THE STRUCTURES.
3. WHERE IT IS NECESSARY TO PROVIDE MAST UNDER THE ROB/FOB,THE HEIGHT SHALL BE INCREASED FROM 6250 mm TO 6290 mm. IN CASE THE CONTACT WIRE IS HIGHER, THE HEIGHT OF THE ROB/FOB SHALL BE INCREASED ACCORDINGLY.
4. MINIMUM CLEARANCE BETWEEN KINEMATIC ENVELOPE AND STRUCTURE GAUGE WILL BE AS STIPULATED IN PARA 1.6.1. MINIMUM ELECTRICAL CLEARANCE OF 320 mm SHALL BE MAITAINED BETWEEN 25 KV LIVE PARTS AND THE EARTHED STRUCTURES.
5. MINIMUM LATERAL CLEARANCE FOR OHE MAST WILL BE 2150 mm FROM THE CENTRE OF TRACK.
6. THE KINEMATIC ENVELOPE AND STRUCTURE GAUGE ARE VALID FOR ROLLING STOCK WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
7. HORIZONTAL AND VERTICAL CLEARANCES DUE TO CURVES INCLUDING VERTICAL CURVE AND CANT SHALL BE EXTRA.
8. FOR KINEMATIC ENVELOPE, REFER TO FIGURE: NMSG-1
9. KINEMATIC ENVELOPE IS VALID FOR OPERATION SPEED OF UPTO 80 KMPH.

Project Directorate Approved on 04/12/17 Railway Board

25 kV A.C.TRACTION

STRUCTURE GAUGE AT-GRADE AND ELEVATED SECTIONS (OUTSIDE STATION) ON LEVEL OR CONSTANT GRADE TANGENT TRACK

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
Chief Engineer/Consultancy/NGN
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29,
NOIDA (U.P.)

STANDARD GAUGE
(1435 mm)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

DATE: 08-07-2016

FIGURE No. NMSG-2

SCALE: NOT TO SCALE

REF: PARA 1.6.1 & 1.6.2

(ATAL KUMAR RAI)
I.A.S
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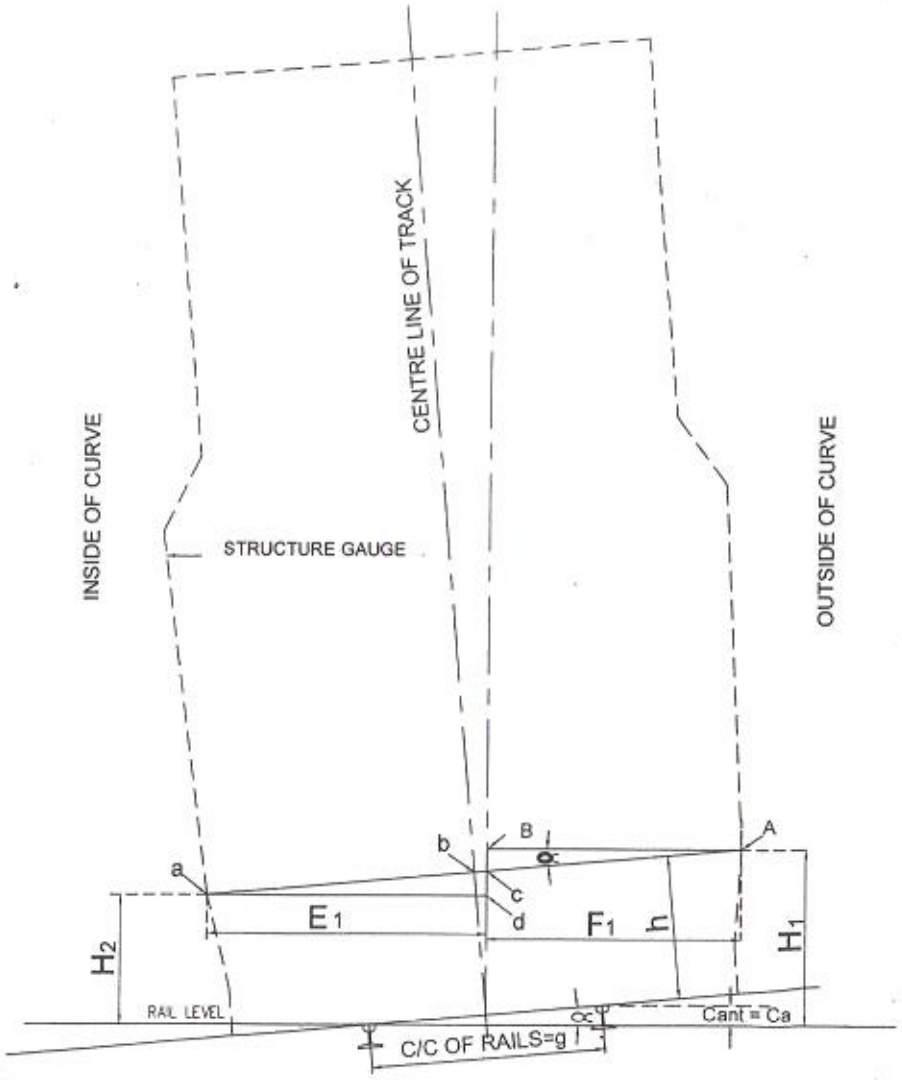
N.M.R.C.



ab=Ab= Distance from centerline of track to Structure Gauge for Tangent Track at height 'h'

$\sin\alpha$ = cant/g

g= 1510 mm

Ca = Cant applied

$E_1 = [ab + (h \times \tan\alpha)] \times \cos\alpha$

$F_1 = [Ab - (h \times \tan\alpha)] \times \cos\alpha$

$H_1 = (Ca/2) + (h/\cos\alpha) + (Ab - h \times \tan\alpha) \times \sin\alpha$

$H_2 = (Ca/2) + (h/\cos\alpha) - (ab + h \times \tan\alpha) \times \sin\alpha$

For values of E_1, F_1, H_1 and H_2, refer to Appendix 3.

NOTES:

STRUCTURE GAUGE FOR AT-GRADE/ELEVATED SECTION HAS BEEN SHOWN AS A TYPICAL FIGURE.

Project Directorate
Approved on
04/12/13
Railway Board

25 kV A.C.TRACTION

EFFECT OF CANT ON STRUCTURE GAUGE

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
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Ganga Shopping Complex, Sector-29
NOIDA (U.P.)

STANDARD GAUGE
(1435 mm)

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

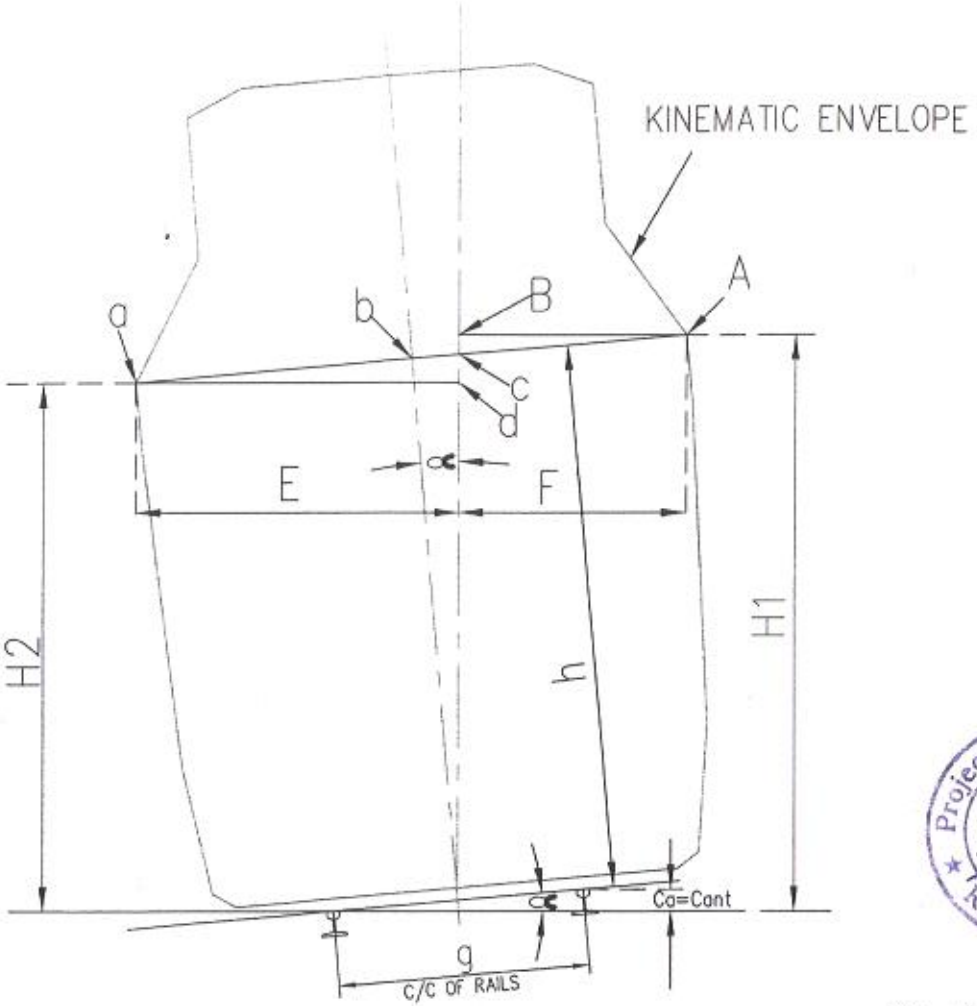
DATE: 08-07-2016

FIGURE No. NMSG-3

SCALE: NOT TO SCALE

REF: PARA 1.8.2

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.



ab=Ab= Distance from centerline of track to Kinematic Envelop for Tangent Track at height 'h'

$\sin \alpha = \text{cant}/g$

g= 1510 mm

Co = Cant applied

$E = [ab + (h \times \tan \alpha)] \times \cos \alpha$

$F = [Ab - (h \times \tan \alpha)] \times \cos \alpha$

$H_1 = (Co/2) + (h/\cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$

$H_2 = (Co/2) + (h/\cos \alpha) - (ab + h \times \tan \alpha) \times \sin \alpha$

For values of E , F , H_2 and H_1 , refer to Appendix 3A .

NOTES:

KINEMATIC ENVELOPE FOR AT-GRADE/ELEVATED SECTIONS HAS BEEN SHOWN AS A TYPICAL FIGURE.

Project Directorate * Approved on 04/12/17 * Railway Board

25 kV A.C.TRACTION

NOIDA METRO RAIL CORPORATION LTD.

STANDARD GAUGE

(1435 mm)

ASHOK KUMAR GUPTA
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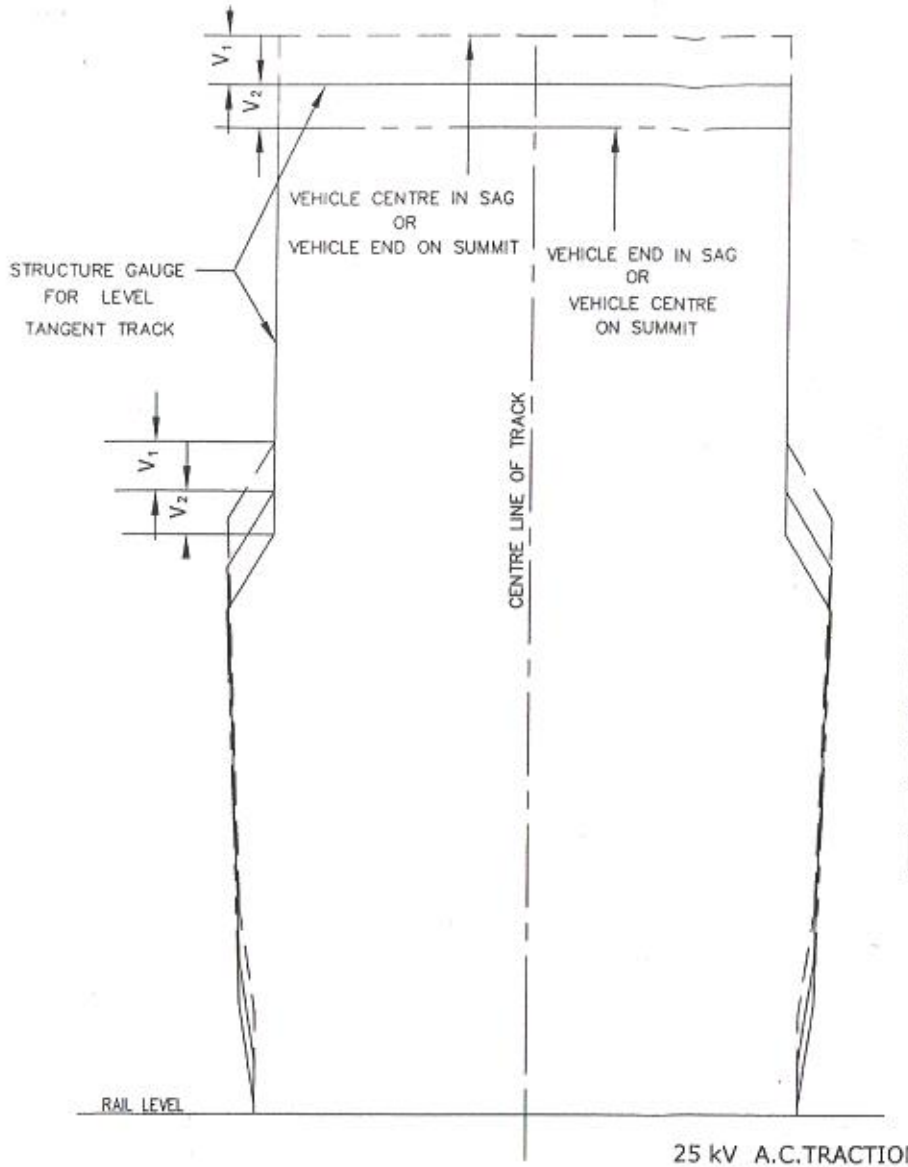
Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29, NOIDA (U.P.)

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.

EFFECT OF CANT ON KINEMATIC ENVELOPE

DATE: 08-07-2016	FIGURE No. NMSG-3A
SCALE: NOT TO SCALE	REF: PARA 1.8.1

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.



25 kV A.C.TRACTION

VERTICAL THROW

RADIUS OF VERTICAL CURVE metres	V_1 mm	V_2 mm
1500	19	22
1600	18	21
1700	17	20
1800	16	19
1900	15	18
2000	14	17
2100	14	16
2200	13	15
2300	12	15
2400	12	14
2500	11	14
2600	11	13
2700	11	12
2800	10	12
2900	10	12
3000	10	11

NOTE:

1. THE FIGURE IS TYPICAL AND WILL APPLY TO ELEVATED AND AT-GRADE SECTIONS.

Project Directorate
Approved on
04/12/17
Railway Board

EFFECT OF VETRTICAL CURVE ON STRUCTURE GAUGE

NOIDA METRO RAIL CORPORATION LTD.

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Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29,
NOIDA (U.P.)

STANDARD GAUGE

(1435 mm)

DATE: 08–07–2016

FIGURE No. NMSG-4

SCALE: NOT TO SCALE

REF: PARA 1.7.1(C)&1.7.2(C)

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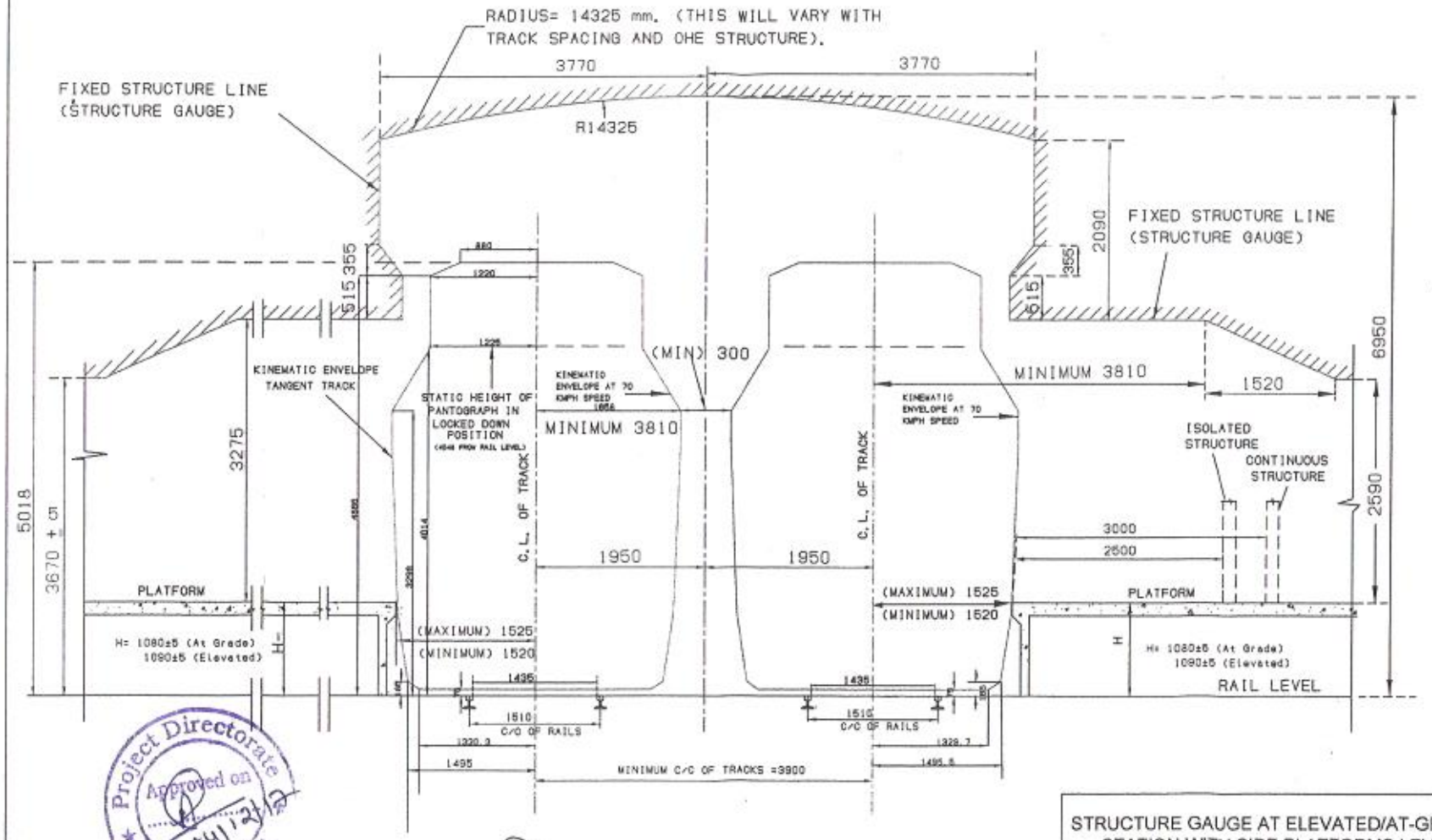
N.M.R.C.

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.

NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. CLEARANCE FOR CURVE SHALL BE EXTRA. HOWEVER THE TRACK CENTRES AT STATION WILL NOT INCREASE WITH CURVES OF RADIUS OF 1000 M AND ABOVE.
3. STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION
4. OHE IS SUSPENDED FROM CEILING BY DROP ARM.



Project Directorate
Approved on
04/12/16
Railway Board

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Executive Director
N.M.R.C.

25 kV A.C.TRACTION

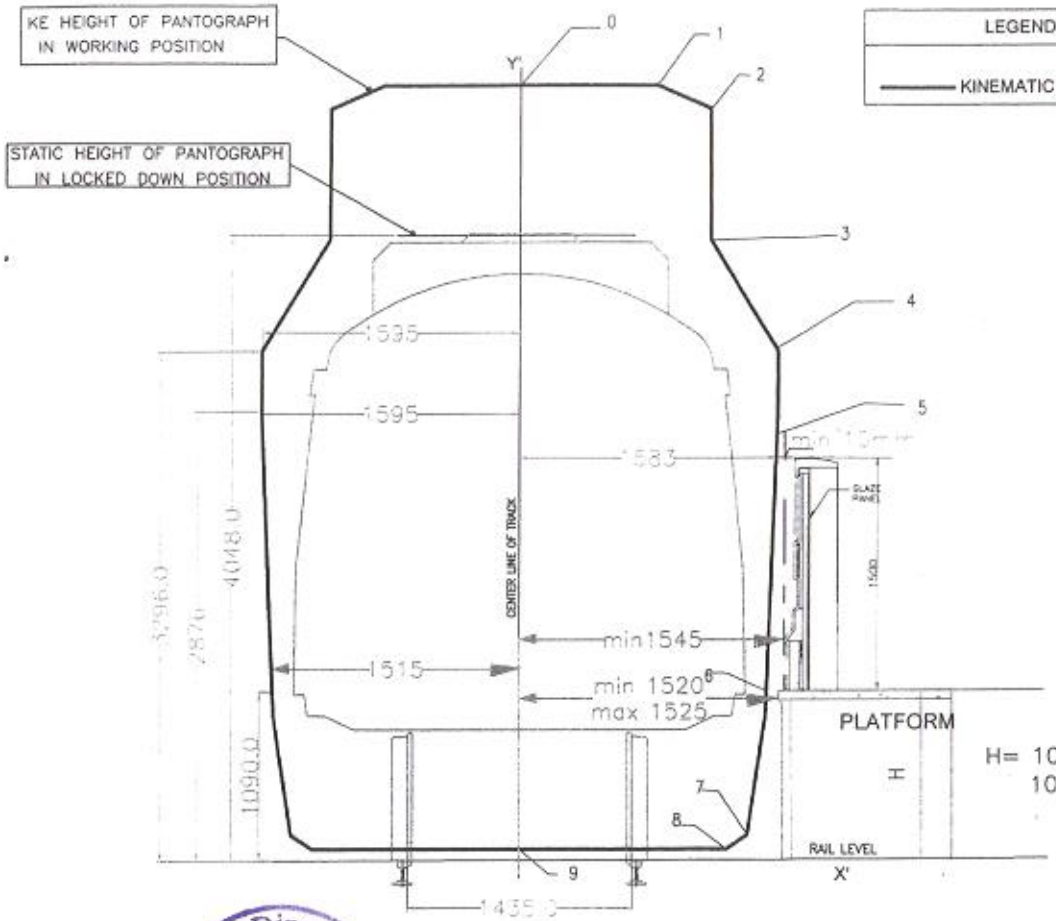
STRUCTURE GAUGE AT ELEVATED/AT-GRADE STATION WITH SIDE PLATFORMS LEVEL OR CONSTANT GRADE TANGENT TRACK

NOIDA METRO RAIL CORPORATION LTD.

STANDARD GAUGE
(1435 mm)

DATE: 08–07–2016	FIGURE No.NMSG-5
SCALE:NOT TO SCALE	REF: PARA 2.2.5

(ATAL KUMAR RAI)
I.A.S
Executive Director
N.M.R.C.



NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. HORIZONTAL AND VERTICAL CLEARANCE DUE TO CURVES, INCLUDING VERTICAL CURVES AND CANT SHALL BE EXTRA.
3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHEN IN MOTION.
4. KINEMATIC ENVELOPE IS VALID FOR FOR 70 KMPH OPERATING SPEED AND WIND SPEED OF 70 KMPH
5.THE LOCATION OF PLATFORM GATE SHOULD BE FIXED SUCH THAT ITS MINIMUM CLEARANCE FROM KE AT ALL LOCATION IS 10 MM.

H= 1080±5 (At Grade)
1090±5 (Elevated)

CO-ORDINATES

	X'	Y'
0	0	5018
1	880	5018
2	1220	4866
3	1225	4014
4	1595	3296
5	1595	2876
6	1515	1090
7	1495	185
8	1330	50
9	0	50

Project Directorate Approved on 04/12/2017 Railway Board

25 kV A.C.TRACTION

PLATFORM GATE ELEVATED & AT GRADE (STATION PLATFORM) ON LEVEL OR CONSTANT GRADE TANGENT TRACK

NOIDA METRO RAIL CORPORATION LTD.

ASHOK KUMAR GUPTA
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Delhi Metro Rail Corp. Ltd.
Ganga Shopping Complex, Sector-29,
NOIDA (U.P.)

STANDARD GAUGE
(1435 mm)

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.

DATE: 08-07-2016

FIGURE No. NMSG-6

SCALE: NOT TO SCALE

Ref Para 3.1(3)(ii) & 3.2

(ATAL KUMAR RAI) I.A.S Executive Director N.M.R.C.

Employer's Requirement APPENDIX 13

IGBC Green Mass Rapid System (MRTS)

To ensure IGBC Green Mass Rapid System (MRTS) Certification of the stations, the civil contractor shall ensure and provide the data as per the format of the Employer's Requirement, which ever are relevant to the contract.

IGBC Green Mass Rapid System (MRTS)- Documents

Sr.No.	List of Data required from Civil
1	Soil test report & if soil is fertile, preserve 20 cm of top soil, Evidence of soil preservation. If soil is not fertile, photographs before the construction.
2	Landscape agreement copy with horticulture contractor and species of landscape plants.
3	1. Tree survey report containing: -
	a. Number of trees to be felled.
	b. Name of species required to be felled.
	c. Number of trees lying in construction site.
	2. Permission letter to fell trees as given by Forest Deptt.
	3. Copy of letter from Forest Deptt. Regarding number and species of saplings to be planted by them.
4	1. SRI value of the material of non-roof areas such as entry pathway of station & entry/exit structure.
	2. Parking area of the station should be shaded with existing tree cover/ newly planted sapling for the next 5 years. Or
	3. Shaded parking, Shading should be done with high SRI.
5	Letter from IL&FS for amount of C&D waste diverted from construction site.
6	One page writes up on disposal of sanitary waste.
7	Traffic management plan along with diversion plan if any.
8	1. Station flush out calculation for UG Station.
	2. For elevated station door and window should be kept open for one week to ensure proper ventilated rooms should be flush-out with exhaust fan for 24 hours.
9	For material module, material matrix, completely filled in have to be provided to NMRC, it constitutes all the construction material, finishing materials and paints, adhesives & coatings details such as quantity, specifications, per unit cost supplier name &manufacturer. (Please see attachment named as material matrix). Material matrix can be filled contract wise.
10	Letters from manufacturer & Format of letters as given
11	Drawing in auto CAD format as listed
12	Site photograph as listed

IGBC Green Mass Rapid System (MRTS) - Formats

MATRIX OF CIVIL MATERIAL
Project: NMRC (Structural)

Sr.No.	Civil Material Description	Supplier	Manufacturer	Specification	Total Quantity	Unit	Rate per Unit	Total Cost Of the Material	Distance of manufacturer From site (See Flag C)	% of Recycled content in material (see flag C)
1	Cement			E.g. OPC/PPC/ Slag						
2	RCC			M15/M30/ M35						
3	Reinforcement Steel			TMT/FE500						
4	Bricks			Fly ash bricks/Clay bricks						
5	Structural Steel			TMT/FE500						
6	Other if any									

IGBC Green Mass Rapid System (MRTS) - Formats

MATRIX OF CIVIL MATERIAL
Project: NMRC(Interior)

Sr.No.	Civil Material Description	Supplier	Manufacturer	Specification	Total Quantity	Unit	Rate per Unit	Distance of manufacturer From site (See Flag C)	% of Recycled content in material (see flag C)	Total Cost of The Material
1	Aluminium window and ventilator Frames/Doors									
2	Coarse Sand									
3	Fine Sand									
4	Stone Aggregates									
5	Granite Stone									
6	Commercial Ply Board									
7	White Cement									
8	Glass									
9	Kota Stone									
10	Wood Based Flush doors ply boards used									
11	Anchor Fastener									
12	Poly Carbonate Sheet									
13	Vitrified tiles									
14	Vitrified Poroclien tactile Tile									
15	Ceramic tiles									
16	Calcium silicate board ceiling									
17	Stainless steel Grade 304									
18	Float Glass									
19	Single/Double Leaf Door Shutter									
20	Steel Doors									
21	Door Closer/Floor springs for Normal Doors									
22	Other if any									

IGBC Green Mass Rapid System (MRTS) - Formats

MATRIX OF CIVIL MATERIAL
Project: NMRC(Structural)

Sr.No.	Civil Material Description	Supplier	Manufacturer	Total Quantity	VOC Value	Total Cost Of the Material
	Sealants					
1	Silicon Sealant					
2	Polysulphide Sealant (flooring)					
	Water Proofing					
3	Into Floor hardtop(flooring)					
4	WC Water Proofing					
5	Liquid polymer membrane					
6	Primer					
7	Red Oxide zinc cremate Primer					
8	Wax Plaster					
	Paints					
9	Paint Acrylic emulsion paint					
10	Synaptic enamel Paints					
11	Epoxy paint					
	Adhesives					
12	Fevicol /Vamicol					
13	Ceramic tile adhesives					
	Agrifiber Product					
14	Commercial Ply Board					
15	Others if any					

IGBC Green Mass Rapid System (MRTS)- Formats

		Letter Attached	
Sr.No.	List of letters Required from Manufacturer	Yes	No
1	Letter for recycled content in construction material for the following:		
	RCC		
	Stainless Steel		
	Reinforcement Steel		
2	Letter for material which are manufactured within a distance of 400 km from project site for the following materials:		
	Bricks		
	Coarse & Fine Aggregate		
	Kota Stone		
	Granite		
	Concrete		
	Stainless Steel		
	Glass		
	Reinforcement Steel		
3	Letter for low VOC paints, sealants and adhesives, glazing sealants, tile adhesives, interior paints.		
4	Letter starting the flush and flow rates for the water fixtures installed at stations		

IGBC Green Mass Rapid System (MRTS)- Formats

		Plan Attached	
Sr.No.	**List of Drawings**	**Yes**	**No**
1	Site management plan (Ground level plan in which all the envt. & safety measures taken at site are marked.		
2	Tree survey drawing along with marking of tree to be cut and protected.		
3	Landscape Dwg. of Station		
4	Rain water harvesting auto cad dwg. for drainage plan and piping & dwg. Highlighting pit on ground level plan for stations and viaduct as well. Supporting calculation for the same is also required.		
5	Dwg. for construction waste management plan.		

IGBC Green Mass Rapid System (MRTS)- Formats

Sr.No.	List of Photographs	Photos	Yes	No
1	Site barricading			
2	Wheel wash Facility / Grating/Manual cleaning			
3	Water sprinkling			
4	Workers wearing PPEs			
5	Stacking of fresh material			
6	Covering of excavated soil with tarpaulin or green net			
7	Tree protection at site			
8	Safety signage's			
9	Diesel storage area with drip tray			
10	Drinking water facility for workers			
11	Sanitary facilities for workers			
12	Rest room for workers			
13	Canteen facility			
14	Air monitoring			
15	Noise monitoring			
16	Waste Segregation (Colored bins)			
17	Electrical equipment covered at site during civil construction and finishing			
18	Covering of HVAC ducts underground station			
19	Fresh material yard			
20	Scrap yard			
21	Work scheduling charts/doc (sample attached)			
22	Good house keeping			
23	Keep Construction pathway free from interruption			

IGBC Green Mass Rapid System (MRTS) – Formats

(On the letter head of Manufacturer/Supplier)

To whom it may concern

This is state that our product Bricks, which is been supplied to xxxxxxxxxx is produced at our manufacturing facility located at xxxxxxxxxx which is xxxxxxxxxx km from the project site.
And the raw materials required for this product is been extracted from the location xxxxxxxxxxx which is xxxxxxxxxxx km from the project site.

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) – Formats

(On the letter head of Manufacturer/Supplier)

To whom it may concern

This is state that our product Coarse sand, which is been supplied to xxxxxxxxxx is produced at our manufacturing facility located at xxxxxxxxxx which is xxxxxxxxxx km from the project site.

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

To,

Indian Green Building Council
CII-Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post
Near Kothaguda Cross Roads
Ranga Reddy Dist.
Hyderabad – 500 084

This is to declare that entry and exit structures for NGNECC-01 stations are finished up with xxxxxxxxxx material whose SRI values is xxxxxxxxxx which is less than MRTS benchmark values.

Bench mark values are
Minimum SRI value of 78 for Low-sloped roof (slope <2:12)
Minimum SRI value of 29 for Steep -sloped roof (slope >2:12)

Thank you

Name:

Signature:

Designation

Company Stamp and Seal

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product Aluminium Frames; supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product Glass; supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product Aluminium window and frames and doors supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product structural steel supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product Reinforcement Steel supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product RCC supplied to NMRC NGNECC-01 contract site is have following recycled content (Percentage of fly ash mixed is as follows:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product Cement supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) - Formats

(On the letter head of Manufacturer)

To whom it may concern

This is state that our product Bricks/ACC Blocks supplied to NMRC NGNECC-01 contract site is having the following properties:

Pre consumer Recycled Content: xx%

Postconsumer Recycled Content: xx%

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) – Formats

(On the letter head of Manufacturer/Supplier)

To whom it may concern

This is state that our product Reinforced Steel, which is been supplied to xxxxxxxxxx is produced at our manufacturing facility located at xxxxxxxxxx which is xxxxxxxxxx km from the project site.

And the raw materials required for this product is been extracted from the location xxxxxxxxxxx which is xxxxxxxxxxx km from the project site.

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) – Formats

(On the letter head of Manufacturer/Supplier)

To whom it may concern

This is state that our product Granite Stone, which is been supplied to xxxxxxxxxx is produced at our manufacturing facility located at xxxxxxxxxx which is xxxxxxxxxx km from the project site.

And the raw materials required for this product is been extracted from the location xxxxxxxxxxx which is xxxxxxxxxxx km from the project site.

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)

IGBC Green Mass Rapid System (MRTS) – Formats

(On the letter head of Manufacturer/Supplier)

To whom it may concern

This is state that our product Fine Sand, which is been supplied to xxxxxxxxxx is produced at our manufacturing facility located at xxxxxxxxxx which is xxxxxxxxxx km from the project site.

Date:

Authorised Signatory

Name of the Signatory

Designation of the Signatory

(Company Seal)