

Contract NGNC-01: Part Design and Construction of Elevated Viaduct and 5 elevated stations viz NOIDA SEC -122, NOIDA SEC-123, GR. NOIDA SEC-4, ECOTECH-12, GR. NOIDA SEC-2, (excluding Architectural finishing Works and PEB works of stations) from Chainage 0.00 m to Chainage 9605 m of Noida -Greater Noida Metro Rail Project



NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

CONTRACT NO: NGNC-01

E Tender No.: NMRC/Civil/NGNC/123 R1/2020

TENDER DOCUMENTS

VOLUME 3

EMPLOYER'S REQUIREMENTS – GENERAL

**Noida Metro Rail Corporation (NMRC) Limited
Block-III, 3rd Floor, Ganga Shopping Complex, Sector-29, Noida -201301,
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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 Works.
- (d) **Construction:** these apply in respect of duties and other requirements relating to the construction of the Works.

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.

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
- (ii) Employer's Requirements
- (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.

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.

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 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.
- (iv) 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.
- (v) 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.

10.2 IMPLEMENTATION OF BIM SYSTEM

- (i) Civil Contractor shall implement BIM system for executing and delivering the services set out in this Agreement. Building Information Modelling (BIM) uses computing power and systems to create 3D models of all kind of buildings and infrastructure, with information about its design, operation and current condition. At the planning and design stage it enables designers, owners and users to work together to produce the best possible designs and to test them virtually before they are constructed. During construction, it enables NMRCs,

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contractors and suppliers to integrate all components cutting out waste and reducing the risk of errors. In operation it provides users with real-time information about available services and facility managers with accurate assessments of the condition of assets.

- (ii) All station structure designs as well as viaduct designs/proof checking shall be done using BIM modelling. Civil Contractor shall implement the necessary hardware, software and human resources towards this end. 3D Coordination between all disciplines shall be achieved by incorporating them in a single model.
- (iii) Contractor shall be required to produce, update and present to NMRC on a fortnightly basis an integrated 3D BIM model incorporating rail track (Viaduct), topography, architecture, structure, plumbing and all other building services and system wide requirements in design review meetings. These models shall be 3D rendered and shall help in design visualization and clash detection of elements as well as finalization of design.

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

1. Rail Track Modelling
2. Terrain modelling
3. Quantity take-off from BIM model
4. Visualization and Animated Walkthrough
5. Station Plumbing Modelling
6. Clash Detection

- (iv) Final coordinated GFC drawings of all disciplines shall only be generated from the BIM model.
- (v) The contractor shall develop "As built" BIM Model upto LOD 500 level and submit the same to NMRC at the time of completion of the project. Schedule of BIM implementation Plan and standards to be adhered to, shall be provided after award of contract.
- (vi) Implementation of software based billing & labour Management system.

10.3 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.

10.4 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.

10.5 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, Civil Contractors, Utility Agencies, Statutory Authorities, Private Service Providers, Developers, Consultants and other Contractors whether or not specifically mentioned in the contract, that may be working on or adjacent to the site for the purpose of the Project. For the purpose of this Specification, all of the above parties shall be referred to as Interfacing Contractors. The Contractor shall note that there are other contractors, consultants, etc. which the Employer will engage from time to time with whom the Contractor shall have to similarly co-ordinate. Such co-ordination responsibilities of the Contractor shall include the following:
 - (a) To provide all information reasonably required by the Interfacing Contractors in a timely and professional manner to allow them to proceed with their design or construction activities, and specifically to meet their contractual obligations.
 - (b) To ensure that the Contractor's requirements are provided to all other Interfacing 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 in Noida 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 liaise 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

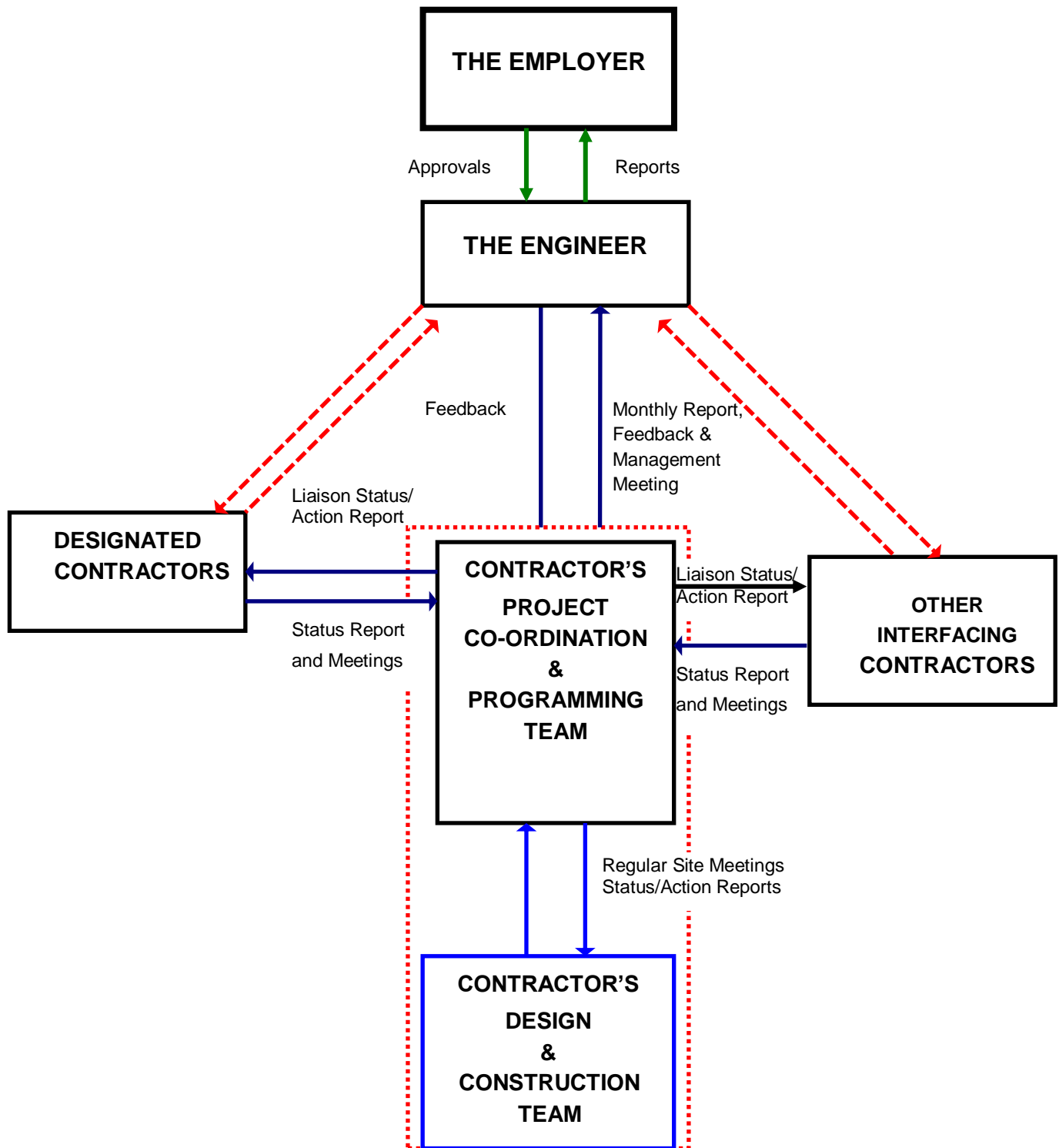
- (i) Construction interface will be necessary throughout the duration of the Works commencing from the time the Contractor mobilises to the Site to the completion of the Works. Construction interface will overlap design interface, involving cast-in and buried items such as pipes for electrical and mechanical 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.
- (ii) 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

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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.

(iii) Auto CAD Operator :-

- (a) The contractor shall provide one experienced Auto CAD operator/Survey along with computer 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 PC, 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.



CONTRACTOR'S ORGANISATION

Figure 1

12. SURVEY AND SITE INVESTIGATIONS

- (i) The datum used for the Contract shall be Mean Sea Level Datum
- (ii) The Contractor shall carry out all further site investigations 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.

13. CLIMATIC CONDITIONS

Noida- Greater 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, Resident Engineer's office, testing labs etc shall be maintained and manned round the clock. Residences of all senior project team members shall also be linked with the control room. Vehicles for emergency use should be on stand-by at the control room around the clock along with one dedicated vehicle 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, water supply.
- (ii) The Contractor shall provide inspection and maintenance manuals for the civil,

structural and building works covering the following areas.

- Viaduct
 - Station Structures (separated into the main structural elements)
- (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 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.

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VOLUME 3

EMPLOYER'S REQUIREMENTS – FUNCTIONAL

**Noida Metro Rail Corporation (NMRC) Limited
Block-III, 3rd Floor, Ganga Shopping Complex, Sector-29, Noida -201301,
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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

- 1.1 The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Employer's Requirements -Functional.
- 1.2 The design of the Permanent Works shall be developed in accordance with these Employer's Requirements - Functional, the Contractor's Technical Proposals and the other requirements of the Contract.
- 1.3 The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date good Engineering practices. The Specification shall in any case not specify standards which, in the Engineer's opinion, are less than or inferior to those described in the 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.
- 1.4 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 DC-01: Part Design and Construction of Elevated Viaduct and 5 elevated stations viz NOIDA SEC -122, NOIDA SEC-123, GR.NOIDA SEC-4, ECOTECH-12,GR.NOIDA SEC-2 , (excluding Architectural finishing Works and PEB works of stations) from Chainage 0.00 m to Chainage 9605 m of Noida -Greater Noida Metro Rail Project.

The total length of viaduct and stations portion is 9605.00 mt.

2.1 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 thereto. Entire scope of work for Viaduct section, Viaduct in stations, emergency siding line, special spans (if any), as shown in General Arrangement Drawing/ General Alignment Drawing (GAD), all track supporting structural works of station area from substructure to super structure (pile , pile cap, pier, pier cap, U girder/track slab etc) considering the load requirements of station's floors (Concourse, Track and PD's) on central piers/track supporting piers, as shown in tender drawing 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.A and 2.1.B respectively.

The Scope of work 2.1 to 2.9 including Notes 1) to 7) (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.

2.1.A VIADUCT & VIADUCT IN STATION, EMERGENCY SIDING LINE, & SPECIAL SPANS AS SHOWN IN GENERAL ARRANGEMENT DRAWING/ GENERAL ALIGNMENT DRAWING (GAD)

- (i) Detailed survey of alignment for execution of work.
- (ii) 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, bearing (Elastomeric), bearing pedestal & crash barrier for all spans (including viaduct in stations) and-other structures.
- (iii) Construction of super structure of standard U-Girder span (27m) and all other spans upto 27 m for straight and for curves of required radius, Pier cap, Bearing (Elastomeric) & crash barrier. The design of standard span U-Girder, shall be provided by NMRC. Also, the reinforcement in the U-Girder, in tender drawing is the minimum reinforcement to be provided. However, in case the contractor assesses that the reinforcement has to be increased then the same shall be provided after approval of NMRC without any extra cost.
- (iv) Design and construction of non-standard spans, I-Girder/T-Girder spans, spans at crossover location and spans in sharper curvature wherever necessary or instructed by engineer.
- (v) Design, construction & erection of special spans over Hindon river (if required). 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 (i.e. span more than 37 m) as per the site conditions / NMRC or civic requirement, which is also included in lum-sum price.
- (vi) 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.
- (vii) Design & Construction of Spherical bearing and seismic restrainers for special spans approved by NMRC including GI brackets for cables laying, walkway, parapets & railing.
- (viii) Design and construction of emergency siding line.
- (ix) Standard spans for viaduct shall be 27 m Twin U-Girder Spans except obligatory spans/ special spans shown in GAD, However, in case of sharper radius, the span configuration shall be as per tender drawing and wide U-Girder may have to be used without any extra cost. The Span arrangements of Viaduct & viaducts in station have to be decided in such a way that pier locations do not disturb the road geometry, ROW, clear carriage width of roads, flow of nallah, utilities and traffic flow. The max. Cantilever permissible is 2.5m.
- (x) All 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.
- (xi) Permanent liners, if required at any location.
- (xii) Pile caps / Open Foundations resting at any depth depending upon the site condition shall include excavation, levelling course, PCC, dewatering, sheet piling/ soldier piling & 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).

- (xiii) 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.
- (xiv) Spherical bearings on continuous spans/special spans including vertical stoppers of same specification on special span.
- (xv) OHE Pedestals with bolts, Parapets, MS railing with Polycarbonate sheet – 6mmthk. (min.) as per tender drawing including epoxy painting on MS railing.
- (xvi) 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.
- (xvii) Crash Barrier as per Tender drawing.
- (xviii) Inserts / dowels for Track plinth (Track plinth is not in the Scope of this work).
- (xix) 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).
- (xx) Earthing arrangement, inserts/ bolts including supporting structure for OHE/signalling masts & PTM water line as per tender drawing in the parapets/superstructure and for other systems as may be required including extra reinforcements required for strengthening these locations.
- (xxi) Drainage for spans 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.
- (xxii) Shape, profile and construction methodology of Piers including Cantilever piers, portal piers and portal beams is to be as per tender drawings.
- (xxiii) Provision for cut-outs in the viaducts required for services in coordination with various system contractors.
- (xxiv) 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.
- (xxv) Detailed survey of the alignment for the viaduct, soil investigation, fixing span configuration avoiding shifting of utilities.
- (xxvi) Demolition/dismantling/Restoration of any structure.
 - (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,

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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.
- (xxvii) 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.
- (xxviii) 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.
- (xxix) During construction at Hindon river location, 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.
- (xxx) Wall, curtain walls of varying heights, drainage system, grills on ramp. All MS structure to be painted with epoxy paint of approved colour.
- (xxxi) Dynamic Integrity test on 100% piles and cross hole sonic integrity test on 25% of piles as per Outline Construction Specification (OCS).
- (xxxii) Preparation of temporary structures/ construction methodology and getting it approved from third party.

NOTES (VIADUCT & STATIONS):-

- 1) Pile foundation shall be of minimum of 1000mm dia with or without permanent liners with hydraulic rotary piling rigs. In stations, for Central Pier Design, Concourse load has to be considered in lump sum Contract.
- 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. and the dimensions of station pier across the alignment not more than 2.20 mt.
- 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.

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- 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.

2.1. A.1 There is possibility of some of the items not getting mentioned in the above list of works of viaduct. Contractors are requested to go through the tender drawings also in details as the works listed in 2.1.A 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 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
- (ii) Site clearance and dismantling of obstructions etc., before commencement of work as specified or as directed;
- (iii) True and proper setting out and layout of the 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

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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.
- (vi) All aspects of quality assurance, including testing of materials and other components of the work, 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 throughout the execution period.
- (ix) Clearing of site and handing over of all the Works, as specified or as directed.
- (x) Maintenance of 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 Construction Depot, 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 same shall be made as per the relevant head of Schedule 'D' and the rates of this 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 elevated structure 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.B SCOPE OF WORK UNDER LUMP SUM PRICE - STATIONS

2.1.B.1 Stations: NOIDA SEC -122, NOIDA SEC-123, GR.NOIDA SEC-4, ECOTECH-12, GR.NOIDA SEC-2.

- (i) Detailed survey of stations for execution of work.
- (ii) Design and construction of all track supporting structural works of station area from substructure to super structure (pile, pile cap, pier, pier cap, U girder/track slab etc) considering the load requirements of other station floors on central piers/track supporting piers.
- (iii) Structural Design of all station building, additional floors within station premises, Ground, Concourse, Platform, Property development, entry/exit structures, corridor, ancillary building i.e. Underground/surface water tank, Pump room & DG room, Lift shafts, escalator pits, staircases as shown in tender drawings.
- (iv) Design of Station building and PD areas of station structure including foundations/substructures, all floors of station building, connecting passage, entry/exit structures, staircases, Ancillary building, lift shafts, escalator pits, concourse, platform and floor above platform etc. The design of PD area is based on maximum FAR permissible in the station locations, by the local authorities.
- (v) The necessary provisions of load imposed in design of stations for connecting of proposed FOB's in stations and design of brackets for supporting FOB..

- (vi) Design of complete foundation structures of station building on piles/open foundation. Minimum dia. of pile shall be 1.0 mt. Construction of Foundations (pile, pile cap etc.) of track supporting structures in station area is covered in Lump sum price.
- (vii) Pile caps / Open Foundations resting at any depth depending upon the site condition shall include excavation, leveling course, PCC, dewatering, sheet piling/ soldier piling & 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 only.
- (viii) Design of all structural works of stations including ground, concourse, platforms, additional floors, columns, beams, tie beams, plinth beams, slabs, staircases, parapets, canopies, 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. Construction of the station building other than the track supporting structures is not covered in lump sum price. They will be paid under respective schedules of BOQ.
- (ix) Design 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.
- (x) Design, providing and fixing of insert plate & bolting arrangement for façade in the station building as per co-ordination with other contractor engaged by the Employer for finishing works. Facade work is outside the scope of this contract.
- (xi) Providing & Fixing GI Brackets along both sides of U-Girders of 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.
- (xii) 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.
- (xiii) 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.
- (xiv) Design & 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.
- (xv) 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.
- (xvi) 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.

- (xvii) Design & 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.
 - (xviii) Crash barriers for track supporting piers.
 - (xix) Inserts / dowels for track plinth (Track plinth in not in the scope of this work) as per tender drawing.
 - (xx) Earthling arrangement for station & ancillary building as per requirement of system contractor.
 - (xxi) Provision for cutouts in the stations required for services in coordination with various system contractors & finishing contractor.
 - (xxii) 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 is 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.
 - (xxiii) Preparation of temporary structures/ construction methodology and getting it approved from third party.
- 2.1.B.2 There is possibility of some of the items not getting mentioned in the above list of works of station. 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.B.3 Any other item of work as may be required to be carried out for completing the construction of station building with all necessary interfaces works with station finishing contractor and system 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.B.4 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.B.5 Inserts/bolts/Supports/Hangers for system contractors & finishing contractor. All system contractor's like OHE, Signalling etc. Structures are excluded from the scope of the work, but civil works required for fixing the 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 Contractor & finishing contractor and the Engineer. The necessary coordination with system contractors, finishing contractor and engineer shall form a part of the work.

- 2.1.B.6 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, finishing, signage, PEB 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 works 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.

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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 Contractor.
- (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, 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.

2.2.2 TRAFFIC MANAGEMENT

The Contractor shall make the detailed traffic diversion plans in consultation with Noida, Greater Noida Authorities traffic police. The work is to be executed with proper liaisoning 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.

- 2.2.3** 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. 65,000 Sq.m (approx) will be made available by NMRC on as is where is basis within 10 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 30 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 24 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).

- (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' &'D')

- (i) Construction of all floors of station building, additional PD floors within station premises, Ground, Concourse, Platform, Property development, entry/exit structures, corridor, ancillary building i.e. Underground/surface water tank, Pump room & DG room, Lift shafts, escalator pits, staircases including foundations/substructures, connecting passage, staircases, lift shafts, escalator pits. Construction of viaduct in station (track supporting structures) from foundation, substructure & super structure is included in lump sum price, schedule A of BOQ.
- (ii) The structure work such as Entry/Exit structures, connecting corridor, Lift shaft & escalator pit from ground to concourse, Ancillary Building i.e. Underground water tank, Pump room & DG room at all stations at Ground floor as shown in tender drawings. There may be some changes at the detailed design stage in drawing. Design of these structures is included in lump sum schedule A of BOQ.
- (iii) Providing & Fixing of Anchor bolts for station roof structure as per co-ordination with other contractor engaged by the Employer for roofing works. Structural roof portal and sheeting work are outside the scope of this contract.
- (iv) Masonry works with Autoclaved aerated cement (AAC) blocks at various level in the structures. The scaffolding/ other arrangements for masonry works, any other works etc. in station, entry/exit structures, corridors, ancillary buildings etc. are included in the lump sum schedule-A of BOQ.
- (v) Tree cutting and (or) transplantation along the alignment after getting permission from forest department/nodal agency.
- (vi) Barricading - Locations where road vehicles / pedestrians are moving, along the Viaduct / Stations / Construction sites 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. Temporary traffic diversion for smooth flow of traffic will be provided during construction including necessary traffic signs. Traffic marshals shall be deployed for the period of diversion to guide the road user and to avoid traffic congestion.
- (vii) Traffic marshals to guide the road users and to avoid traffic congestion.
- (viii) Any horticulture, landscaping, green area etc. damaged by contractor during currency of contract shall be restored back to its original condition under lump sum head of schedule-A of BOQ.
- (ix) 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 to 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 utility. 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 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, Irrigation Department, Forest Department 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 changes 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.
 - (b) Entrances and all other points of access to the stations shall be adequately protected against flooding.
- (iv) 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 60K 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 UP/ Noida and Greater Noida Authority Traffic Police. 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.

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: NGNC-01

E Tender No.: NMRC/Civil/NGNC/123 R1/2020

TENDER DOCUMENTS

VOLUME 3

EMPLOYER'S REQUIREMENTS – DESIGN

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

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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 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.
- (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.

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 and the production of the As-Built Drawings.
- (ii) Working Drawings 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;
 - (c) The calculations (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.
- (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
- (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) preliminary station sizing
- (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 design basis report
- (m) Traffic or other civic service affected.
- (n) Prediction of lowering of water table and its effect on (m)& (n) above.
- (o) Deleted.

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.

(v) AESTHETICS REPORT – DELETED

(vi) STATION PLANNING REPORT – DELETED

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 INTERPRETATIVE REPORT

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

(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) All works related to each of the elevated stations.

- (d) 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 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 and reviewed by the Engineer. The form and detail of the review shall be as determined by the Engineer and will not release or remove the contractor's responsibility for the design under the contract.
- (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/ worksheets 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.

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.

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 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
JE (Design)	Reviewed		
AE/XEN (Design)	Reviewed		
Dy. CE (Design)	Reviewed		

CE (Design)	Reviewed & comments as marked on drawing		
Engineer (CRE)	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: NGNC-01

E Tender No.: NMRC/Civil/NGNC/123 R1/2020

TENDER DOCUMENTS

VOLUME 3

EMPLOYER'S REQUIREMENTS – CONSTRUCTION

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

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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.

(3) DELETED

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.

ACCESS TO OUTSIDE THE SITE

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

SURVEY OF THE SITE

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

BARRICADES AND SIGNBOARDS

- (11) 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 price.
- (12) 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.
- (13) The consent of the Engineer shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in positions after the completion of the Works shall be repaired and repainted as instructed by the Engineer.
- (14) Hoardings, barricades, gates and signs shall be maintained in clean and good order by the Contractor until the completion of the Works, whether such hoardings, fences, gates and signs have been installed by the Contractor or by others and transferred to the Contractor during the period of the Works. All the fencing, hoardings, gates and signs etc. shall be mopped minimum one in a week and washed monthly.
- (15) All hoardings, barricades, gates and signs installed by the Contractor shall be removed by the Contractor upon the completion of the Works, unless otherwise directed by the Engineer.
- (16) Hoarding/ barricades can be reused after removing from one place to other locations / sites provided they are in good condition and approved by Engineer.
- (17) Damage/worn-out barricades /hoarding shall be replaced by contractor within 24 hours. Engineer 's decision regarding need for replacement shall be final and binding and if no action is taken by contractor, the Engineer may get it repaired through other agency and the cost of any repairs will be deducted by the Engineer from any payment due to the Contractor.

CLEARANCE OF THE SITE

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

4. SURVEY

- (1) 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.

6. OTHER SAFETY MEASURES

Site Safety & Health Plan and Site Environment Plan

- (1) The Contractor shall, within **8 weeks** 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.

Explosives

- (6) 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.
- (7) 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.
- (8) 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

- (9) No Launching Girder shall be used without the prior written consent of the Engineer.
- (10) 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.
- (11) 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.
- (12) 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

- (13) 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 Govt. Preservation of Trees Act 1994. 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.

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

9. WORK ON ROADS

(1) Traffic Management Plan

The Contractor shall develop a detailed Traffic Management Plan for the work under the contract. The purpose is to develop a Traffic Management Plan to cope with the traffic disruption as a result of construction activities by identifying strategies for traffic management on the roads and 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 *separated* 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

- (2) 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 field offices for use of NMRC Staff during the contract period at each station location & casting Yard of area not less than 30 sqm at each location with toilet & electricity facility including services for office upkeep, consumable, Furniture , security etc.

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 can not guaranty provision of adequate, continuous power supply however assistance will be given in obtaining the necessary permissions for site generators and the like.
- (6) Access roads and parking areas shall be provided within the Site as required and shall be maintained in a clean, acceptable and stable condition. For lengths of roadway longer than 100 m and 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 its 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 liaise 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 advise 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.

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. PROVISIONS FOR DESIGNATED CONTRACTORS

- (1) DELETED
- (2) DELETED
- (3) DELETED
- (4) DELETED

16. 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, adjacent roads properties and landscaping. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

17. LANDSCAPING

DELETED

18. 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.

Contract NGNC-01: Part Design and Construction of Elevated Viaduct and 5 elevated stations viz NOIDA SEC -122, NOIDA SEC-123, GR. NOIDA SEC-4, ECOTECH-12, GR. NOIDA SEC-2, (excluding Architectural finishing Works and PEB works of stations) from Chainage 0.00 m to Chainage 9605 m of Noida -Greater Noida Metro Rail Project



NOIDA METRO RAIL CORPORATION (NMRC) LIMITED

CONTRACT NO: NGNC-01

E Tender No.: NMRC/Civil/NGNC/123 R1/2020

TENDER DOCUMENTS

VOLUME 3

EMPLOYER'S REQUIREMENTS – APPENDIXES

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

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EMPLOYER'S REQUIREMENTS

APPENDIX 2A

WORKS AREAS

The employer will provide the work areas of Approx. 65000 sq.m. within 10 Km radius of work site as per availability for construction of precast elements of viaduct & stations & stacking Depot. In case the land at above-mentioned locations is not available, land at alternate location/locations will be provided within 25 km from site. All the work areas (land for 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 1 st Batching Plant (production of 1 st batch of concrete)	6	0.01% of total contract value per week of delay for the key date
KD 3	Submission of Definitive Design	10	0.01% of total contract value per week of delay for the key date
KD 4	Completion of 1 st Formwork for precast U – girder element of production line for Engineer's approval	12	0.01% of total contract value per week of delay for the key date
KD 5	Commissioning of 2 nd Batching Plant	12	0.01% of total contract value per week of delay for the key date
KD 6	Completion of 1 st working pile	12	0.01% of total contract value per week of delay for the key date
KD 7	Erection of 1 st 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 3.0 Km in one stretch) to Track contractor for laying track	50	0.01% of total contract value per week of delay for the key date
	(ii) Partial Access of the Viaduct including in stations area for next 3.0 Km (min.) in one stretch to Track contractor for laying track	74	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.)	75	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	75	0.01% of total contract value per week of delay for the key date
KD 10	Completion of entire works as per the Contract.	20 Months	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	Submission of Definitive Design	6	0.01% of total contract value per week of delay for the key date
KD 2	Completion of 1 st Formwork for precast elements i.e. Cross arm, π Girder, Cross beam for Engineer's approval	12	0.01% of total contract value per week of delay for the key date
KD 3	Partial access to finishing contractor in operational rooms i.e. Signalling room, Telecommunication room, ASS, UPS room, DG room, Pump room, U/G Water tank etc. along with permanent staircase		
KD 3.1	For first three stations	60	0.01% of total contract value per week of delay for the key date
KD 3.2	for next two stations	70	0.01% of total contract value per week of delay for the key date
KD 4	Access to lift shaft & Escalator pits (Concourse to Platform)		
KD 4.1	For first three stations	60	0.01% of total contract value per week of delay for the key date
KD 4.2	for next two stations	70	0.01% of total contract value per week of delay for the key date
KD 5	Completion of structure works of one Entry/Exit (Ground to Concourse)		
KD 5.1	For any two stations	60	0.01% of total contract value per week of delay for the key date
KD 5.2	for next three stations	70	0.01% of total contract value per week of delay for the key date
KD 6	Completion of slab, over track and platform levels		
KD 6.1	For any two stations	70	0.01% of total contract value per week of delay for

Contract NGNC-01: Part Design and Construction of Elevated Viaduct and 5 elevated stations viz NOIDA SEC -122, NOIDA SEC-123, GR. NOIDA SEC-4, ECOTECH-12, GR. NOIDA SEC-2, (excluding Architectural finishing Works and PEB works of stations) from Chainage 0.00 m to Chainage 9605 m of Noida -Greater Noida Metro Rail Project

			the key date
KD 6.2	for next any two stations	72	0.01% of total contract value per week of delay for the key date
KD 7	Completion of entire works as per the Contract.	24 Months	0.01% of total contract value per week of delay for the key date

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 (P3) Program - Ver 2.0b or later. Any other compatible system capable of direct file interchange capability with software program used by the Employer - Primavera (P3), Ver 2.0b can be used with Engineer's consent. Scheduling software and relevant instruction manuals, licensed for use in connection with the contract, shall be provided by the Contractor according to the Employer's specifications
- (2) The Tenderer may use a system other than Primavera but will be required to 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, status, updating and revision of all the Programmes during the duration of the Contract. Upon the Engineer's consent of a system other than Primavera, the Contractor shall supply the Engineer with an original licensed copy, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

4. (Not Used)

5. POST CONTRACT AWARD

- 5.1 The Contractor shall develop his Tender Programme into the Initial Works Programme including an outline Narrative Statement and submit within 15 days of the date of the Notice to Proceed and its more detailed version within sixty (60) days of receiving the Engineer's consent to 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 Contractors. It is the Contractor's responsibility to ensure timely co-ordination with the Designated Contractors to review, revise and finalise his Initial Work Programme so as not to affect the progress of Works/ and or the works of the Designated Contractors. The resubmitted programme when approved by the Engineer shall form the **Baseline Programme** against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update/ revise the Baseline programme but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.

- 5.4 For Initial & Detail Work Programme submission, one (1) original and six (6) copies each of the following Programmes and Reports shall be submitted to the Engineer:
- a) Programme: Baseline CPM Network
 - b) Programme: Baseline Milestone based Cost Activity Schedule
 - c) Baseline Schedule Report
 - d) Narrative
 - e) Baseline Physical Progress 'S' 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 are 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.

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 co-ordinated, 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" files 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 through out 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 mid point 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 workyards; 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 7** of the tender documents.

EMPLOYER'S REQUIREMENTS

APPENDIX 11

CONTRACTOR'S SITE LABORATORY

1. SITE LABORATORY

- (1) The Site Laboratory shall be approximately 250m² 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	each 15m 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 250m² 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 50m² 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, (sensitivity 0.01 gms.)	1 No.
Wash bottle, capacity 500 ml.	1 No.
Moisture cans, capacity 50 ml.	24 No.

Determining Plastic Limit (1 complete set)

Evaporating dish	1 No.
Spatula 100mm blade	1 No.
Glass plate 250mmx250mmx12mm	2 No.
Moisture cans, capacity 50 ml.	12 No.
Stainless steel rods, 3 mm dia.	2 No.

Determining Moisture Content (1 complete set)

Micro Oven, capacity 35 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.

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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
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Soundness Test

Sodium sulphate	25 kg
Soaking tank	1 No.
Balance, Capacity 3 kg., Sensitivity 0.1 gm.	1 set
Sieves :Coarse	1 set

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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.

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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.

Employer's Requirement

APPENDIX 12

Schedule of Dimensions

SCHEDULE OF DIMENSIONS FOR STANDARD GAUGE