



Brihanmumbai Municipal Corporation

Design and Build Contract

Construction of 45m wide Elevated Road from Link Road at Dahisar (west) in BMC limit to Bhayander (West) in MBMC limit (Coastal Road Last Leg)

Volume 3 Employer's Requirements

Volume 3

Employer's Requirements



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VOLUME 3 - EMPLOYER'S REQUIREMENTS

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Volume 3 Employer's Requirements

Section-A GENERAL

Brihanmumbai Municipal Corporation

Mumbai,

Maharashtra, India

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A. GENERAL

A1. INTRODUCTION

This Volume 3, Employer's Requirements is divided into four sections as follows:

- (a) **General:** apply throughout the Contract (Section A).
- (b) **Functional:** include the specific core requirements for the design and performance of the Works (Section B).
- (c) **Design:** apply in respect of responsibilities and obligations relating to the design of the Permanent Works (Section C).
- (d) **Construction:** apply in respect of responsibilities, obligations and other requirements relating to the construction of the Works (Section D).

A2. DEFINITIONS AND INTERPRETATIONS

In addition to the words and expressions defined in the Conditions of Contract (CC), the 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 it as true records of construction of the Permanent Works and which have been given a Notice to Proceed by the Engineer.

"Baseline Programme" means the first Works Programme issued with a Notice to Proceed by the Engineer that is used solely to assess the Contractor's progress.

"Construction Phase": has the meaning identified in Clause A4 of the Employer's Requirements - General.

"Construction Reference Drawings": means those drawings referred to in Clause C2 (8) of the Employer's Requirements Section C - Design in respect of which a Notice to proceed has been issued.

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

"Designer" or "Lead Designer" means the designer (in-house or consulting firm) appointed by the Contractor and Noticed by the Engineer to design the Permanent/Temporary Works.

"Design Checker" or "Lead Design Checker" means a suitably qualified person(s) (in house or consulting firm) appointed by the Contractor to check the design of Permanent/ Temporary Works.

"Definitive Design " means the detailed design fully coordinated and interfaced, complete in all respects based on the Noticed Preliminary Design.

"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 (Section C).

"Design Phase": has the meaning identified in Clause A4 of the Employer's Requirements – General (Section A).

"Employer's Requirements" means the requirements set out in Volume-3 of these Tenderdocuments.

"Final Design" shall be the design calculations corresponding to the as-built drawings and to be submitted together with the as-built drawings.

"Key Personnel" means those persons named or positions so specified in A15-(9) of the Contract or so designated by the Engineer at any time during the Contract.

"Monthly Progress Report" means the report referred to in the General Conditions of Contract (GCC) Clause 4.21 to be prepared by the Contractor, in the form and detail prescribed in Appendix-5 of this Volume 3, and submitted monthly to the Engineer.

"Notice": means a Notice to proceed, as given in writing by the Engineer; refer to Attachment A3 for the general format for providing a Notice to proceed.

"Preliminary Design": means the initial stage of the design phase adequately explaining the design concept.

"Pricing Document and Payment Schedule" means Volume 8 of the Contract document.

"Project" means the Design and Construction of 45m wide elevated road from Link Road at Dahisar (West) in BMC limit to Bhayander (West) in MBMC limit (Coastal Road Last Leg) including all Civil and MEP Works.

"Quality Plan" means the quality plan, setting out the Contractor's means of complying with his obligations in relation to Quality Assurance provided and maintained in accordance with GCC Clause 4.9, in the form and detail prescribed in Appendix 6 of Volume 3 of the Contract.

"Safety Plan" means the safety plan setting out the Contractor's means of complying with his obligations in relation to safety provided and maintained in accordance with GCC Clause 4.8, in the form and detail prescribed in Appendix 17 of Volume 3 of the Contract.

"Specification" has the meaning identified in Clause A5 of the Employer's Requirements - General.

"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.

"Works Programme" means the time-scaled and resource-loaded critical path network, updated from time to time in accordance with GCC Clause 4.14 and Appendix 4 of this Volume

3 of the Contract, depicting activities, durations, sequences and inter relationships that represent the Contractor's work plan, work breakdown, schedule structure for constructing and completing the Works, distributed over the Time for Completion of the Contract, as given a Notice by the Engineer.

"Permanent Works" means the permanent works to be designed and executed in accordance with the Contract.

"Temporary Works" means all temporary works of every kind (other than Contractor's Equipment) required for the execution and completion of the Works and the remedying of any defects.

A3. RELEVANT DOCUMENTS

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

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:

- Employer's Requirements
- Outline Design Specifications
- Outline Construction Specifications
- Indian and other International Standards referenced in this set of tender documents

In the event of a conflict between the Employer's Requirements and any Outline Design or Construction Specification, the Employer's Requirements shall prevail.

In the event of a conflict between any Outline Design or Construction Specification and any other standards or specifications quoted, the requirements of the Outline Design or Construction Specification shall prevail.

A4. PHASES (DESIGN AND CONSTRUCTION)

- (1) The Contractor shall execute the Works mainly in two phases, the Design Phase and the Construction Phase.
- (2) The Design Phase shall commence upon the Commencement Date. This phase shall include the preparation and submission of:
 - (a) The Preliminary Design;
 - (b) The Definitive Design;
 - (c) The Construction Reference Drawings.
 - (d) Construction Methodology

The Design Phase will be completed upon the issue of Notice by the Engineer in respect of the comprehensive and complete Construction Reference Drawings Submission on the last set of the Permanent Works.

- (3) The requirements for the Preliminary Design, Definitive Design and Construction Reference Drawings are stated in Clause C2 of the Employer's Requirements – Design (Section C).
- (4) The Construction Phase for the whole or a part of the Permanent Works shall not commence until the Notice issued by the Engineer 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.

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.

- (5) Notwithstanding Clause A4(4) above, for those elements identified under Clause C2(6) of the Employer's Requirements – Design (Section C), the Construction Phase may commence immediately upon the issue of the Notice in respect of the Definitive Design Drawing in respect of each such element subject to availability of the Site in accordance with the agreed programme. Construction Reference Drawing in such case should follow within two weeks from the date of noticing the Definitive Design Drawings.
- (6) The Contractor shall commission, operate and maintain the facilities specified in Clause 3.10 of Volume 1.

A5. SPECIFICATIONS

In accordance with the provisions of these Employer's Requirements, the Outline Design 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 to proceed from the Engineer it shall become the Particular Specifications and shall take precedence over other Specifications for construction purposes.

A6. SPECIFICATIONS IN METRIC AND IMPERIAL UNITS

- (1) The Contract shall utilise the SI system of units. Codes and Standards in Imperial units shall not be used unless the Engineer has given a Notice.
- (2) Conversion between metric units and imperial units shall be in accordance with the relevant Indian Standards.

A7. WORKS PROGRAMME

- (1) The Key Dates are listed in Appendix 2B to these Employer's Requirements.
- (2) The Contractor shall prepare and submit his Works Programme and three month rolling programmes in accordance with the detailed requirements contained in Appendices 3 & 4 to these Employer's Requirements.
- (3) In compiling the 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 his design with those of Project and other Interfacing Contractors, the assessment 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.
- (4) The Works Programme shall take full account of the Design Submission programme.
- (5) The Employer and the Engineer shall designate a maximum five numbers of their computers for installation, by the Contractor, of software programmes that the Contractor intends to use for the design, programming, production of drawings, etc. All software shall be originals and licensed by the manufacturer and issued and installed at the Contractor's cost.

A8. MONITORING OF PROGRESS

- (1) The Contractor shall submit to the Engineer six copies of a Monthly Progress Report (MPR), as described in Appendix 5 of 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.

- (2) The MPR shall be submitted by the last day of each calendar month. It shall account for all works actually performed from the twenty sixth day of the previous month and up to the twenty fifth day of the current month. The processing of the Interim Payment Certificate (IPC) will only commence after the receipt of the MPR on the due date. Late receipt of MPR will delay the processing of the IPC.
- (3) The MPR shall be divided into two sections. The first section shall cover progress made and current status relating to design, and the second section shall cover progress made and current status relating to construction.
- (4) The MPR shall be signed by the following Key Staff; Project Manager, QA Manager, Safety Manager, and the Engineering Manager (Design), who by signing the MPR shall certify that all information contained in the MPR, as relating to their section of the Works, has been accepted and verified by each signatory as being accurate, honest, true and meets the requirements of the Contract.
- (5) A monthly meeting to monitor the progress of the project shall be convened by the Engineer or his representatives. The Employer may also be present in the meeting. Refer to Clause A18 of this Employer's Requirements Volume 3.
- (6) The Employer / the Engineer shall arrange Quarterly Review Meetings for the Project which the Contractor shall attend and participate in as required. Refer to Clause A18 of this Employer's Requirements Volume 3.

A9. QUALITY ASSURANCE

The Contractor shall establish and maintain a Quality Assurance System in accordance with Appendix 6 of 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.

A10. SOFTWARE SUPPORT

1.1.1 General

- (1) The Contractor shall provide copies of all computer programs and full support to the Employer/Engineer for all computer programs used/proposed to be used, by the Contractor under the Contract, also refer to Clause A7(5) of these Employer's Requirements Section A - General.
- (2) 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 programs directed by the General Consultant/ Engineer.

- (3) The Contractor shall provide all tools, equipment, manuals and training as necessary for the Employer / Engineer to use, maintain and re-configure all of the software provided under the Contract.
- (4) The Contractor shall submit all new versions to the Engineer for a Notice 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:
 - Ensure that all new versions are fully tested and validated on the simulation and development system prior to installation.
 - Ensure that all new versions are fully tested and commissioned once installed on the Site.
 - Deliver to the Employer and the Engineer any new version, together with the updated Operation and Maintenance Manuals.

1.1.2 Software Obligations

- (5) Within 14 days of the installation of any software by the Contractor, the Contractor shall submit to the Engineer for retention by the Employer and the Engineer, two backup copies of the software, which shall include, without limitation:
 - All licenses in favour of the Employer for their use.
 - all source and executable codes;
 - All design documentation relating to the software; and
 - Any specified development tools required for maintenance of the software, including, but not limited to, editors, compilers and linkers.

1.1.3 Error Correction

- (1) When a fault is discovered within delivered software or documentation, the Contractor shall take necessary steps to rectify errors or faults at the earliest.
- (2) The Contractor shall provide written details as to the nature of the proposed correction to the Engineer.
- (3) The Contractor shall notify the Employer promptly of any fixes or patches that are available to correct or patch faults.
- (4) The Contractor shall detail any effect such fixes or patches are expected to have upon the applications.

1.1.4 Training

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

Geotechnical Engineering product and Viaduct and bridge design Software

Sr. No.	Functional Requirement Specifications
1	Ability of 3D parametric modelling for bridge super and substructure
2	Availability of Library of fully prepared parametric bridge cross-sections.
3	Availability of CAD tools for cross section definition.
4	Ability of Laying out of Alignment in plan and elevation
5	Ability of Import of Land XML file to define the alignment, profile and cross-section
6	Ability of exchange of the model with BIM standard formats (DGN, DWG, RVT, IFC, CIS/2)
7	Ability of Automeshing of cross-sections
8	Very Well supports analysis, design and construction of all types of bridges (reinforced, prestressed, concrete, steel, composite, cable stayed, suspension).
9	Very Well supports different types of erection methods (span-by-span, advanced shoring, incremental launching, balanced cantilever, pre-cast segmental).
10	Very well handles linear as well as non-linear advanced static and dynamic analysis.
11	Very Well handles non-linear problems such as Cable sagging, 3rd order large displacements, and non-linear time history.
12	No limitations on geometry, boundary conditions, applied loadings, load combinations and construction stages.
13	Availability of Wizards for typical bridges
14	Ability of modelling the bridge using GUI as well as text input file which can be reused for other similar bridges.
15	Supports International as well as Indian Bridge Standards
16	Performs Working Stress as well as Limit State method of design and checks
17	Performs automatic Camber calculation - The module should create an Excel sheet with the required camber values. The camber line can then be represented numerically or graphically like any other displacement distribution.
18	Capable of Automatic Plan production

Integrated Project Controls System (IPCS)

Features	Required Specification
Capabilities	
Create finite element models	1.) Shall be able to define complex soil profiles/geological cross-sections to structural elements (Ex. Piles, anchors, geotextiles, etc.) and displacements.
	2.) Shall be able to Import geometry data from CAD-files.
	3.) Software should support Pre-Calculation and Input checks to prevents easy mistakes and calculating with wrong input and poor model definitions etc.
	4.) Finite element mesh should be create automatically
API Support	1.) Software should Support Python Scripting
Assess stresses and displacements	1.) Shall be able to model the construction process by activating and deactivating soil clusters and structural elements in each calculation phase with staged construction.
	2.) Shall be able to simulate constitutive models range from simple linear to advance highly nonlinear.
Soil Models	1.) Shall support Soil models like Mohr-Coulomb , Hoek-Brow, hardening soil model, Soft soil , Concrete models etc.
	Shall support atleast one Elasto Plastic model to study Static Liquefaction
Analyze results with post-processing	1.) Shall be able to analyses display forces, displacements, stresses, and flow data in contour, vector, and iso-surface plots in various ways.
	2.) Cross-section capabilities allow for a more detailed analysis of the results.
Dynamic Analysis	1.) Shall be able to simulate Earthquake
	2.) Shall be able to simulate Pile driving & wave propagation to adjacent structure
	3.) Shall be able to perform Liquefaction analysis to predict the safety of critical infrastructure under earthquake loading
Groundwater Flow Analysis	1.) Capable to perform time-dependent groundwater analysis and simulate the unsaturated, time-dependent, and anisotropic behaviour of soil, as well as simultaneously calculate changes in pore pressures and deformation by performing a fully - coupled flow-deformation analysis.
	2. Shall be able to assign time dependent flow boundary conditions

Features	Required Specification
Other Features	1.) shall be able to simulate real life soil lab test like odometer test, triaxial test etc.
	2.) shall support tunnel sequencing to quickly setup your tunnel construction stages
	3.) Support import / Export files to IFC, DXF , .STEP, Pointclouds, ISM etc.
Training on the Software	1.) The software should come with inbuilt online customised training / Expert service for the user.

The project shall include design, procurement, construction, commissioning and handover. Given the national importance of the project, the value and complexity of works, the number of stakeholders involved and the time critical nature of the project, Client is desirous of using a cloud-based digital project management and collaboration platform for effective monitoring of project milestones using an IPCS solution.

The proposed IPCS should support the following high-level goals:

- Single platform for storing and retrieving all project management related information from design to delivery
- Storage and retrieval of all project documentation
- Tracking of issues raised during the course of the project from inception to closure
- Dynamic monitoring of project schedule in terms of timeline and budget
- Dynamic monitoring of project BOQ in terms of budget and earned value
- Digitized quality and non-conformance management
- Automated dashboards, MIS reports, escalations and alerts as and when appropriate so that early warning is available in case of delays and pendency
- Data sharing and collaboration across stakeholders but always with comprehensive data privacy, security and access control in place
- All stakeholders involved in the project including Client, Design Consultants, General Contractor and sub-contractors, PMC, Third party quality audit agency are expected to use this platform for giving and getting information on the project.

1.1.5 System Requirements

To meet the above goals, [Client] is looking to procure an off-the-shelf, commercially available software platform from technology vendors with extensive experience in delivering the platform and services to clients and projects in India. The solution has to be

ready to deploy and go-live within a month of placing the order with the vendor.

The software should be usable by Client, PMC, Consultants, General Contractor, and all sub-contractors, and other stakeholders involved in this project to provide all the project information throughout the duration of the project.

Project information constitutes all information that is generated as part of the project from Engineering, to Procurement, and Construction. Specifically, it assumes that all project information shall be stored in digitized form for easy retrieval during and after the project completion.

The project information stored includes design drawings, RFIs, quality inspections, safety incidents, method statements, approvals, bank guarantees, insurance, RA bills, physical progress, financial (quantity) progress, all project MIS reports, progress photos, quality inspection checklists, all project issues, risks, and meetings and other information that is generated as part of the project.

Since Client is already using an enterprise resource planning (ERP) system, core ERP features such as detailed financial information including funds inflow, purchase/work order details, payments, taxation, human resources (HR) etc. are not required from the IPCS. However, it should be possible to retrieve information from the ERP for use in the IPCS for reports and dashboards.

Features

The system will address the following aspects of project control.

- *Document Management*
 - The system must support full-fledged document management capabilities. These include the following.
 - Ability to define a master document list (from before the physical documents are available, in anticipation of their submission).
 - Support for early reminders and alerts in email and mobile app on document especially regarding deadlines.
 - Ability to enforce different workflows and escalations on documents and folders for different roles and functions.
 - System should provide built in access control so that documents and folders may only be accessed by the appropriate persons.
 - Users should be able to send formal document transmittals.
 - It should be possible to link the documents to the project schedule so that delay analysis on the schedule can account for delays arising from any document related tasks.

- Users should be able to update documents as and when required. These updates may be simple information updates such as a comment, current status etc. or also include uploading of the physical document file itself.
 - The files should be version controlled and older versions should be downloadable from the portal. A document viewer for viewing the files and an upload and download audit log are to be available.
 - Ability to conduct private conversations between Client and other stakeholders in the context of an individual document without exposing the details to other stakeholders.
 - Users should be able to do markups in the documents and see those markups in an inline viewer on the browser
- *Issue Tracking*
 - Typically, many ad hoc issues and matters arise during project execution that need to be addressed expeditiously for successful project completion. These issues and risks need to be tracked and monitored closely so as to not have an adverse impact on the delivery.
 - The system should enable users to create and categorize various issues, and assign them to the responsible persons, groups or organizations.
 - It should support a system of automated reminders and alerts against the issues to ensure timely resolution.
 - It should be possible to link issues to the project plan so that delay analysis on the schedule can account for delays arising from any document related tasks.
- *Meetings Management*
 - The system should be able to digitize all project meetings. These include design meetings, procurement meetings, project progress review meetings, and any other ad-hoc meetings that are done during the course of the project
 - The system should be able to collate issues from the various stakeholders into a comprehensive agenda that can be automatically distributed to all stakeholders before the meeting
 - The system should be able to allow project coordinators to automatically distribute meeting minutes once the minutes are captured in the system
 - The system should have the ability to automate follow up on the open agenda items and help drive it to closure
 - The system should allow for supporting documents for meetings to be distributed along with the meeting minutes.
- *Integrated Schedule and Quantity Tracking (BOQ)*
 - The system should be able to accept a project plan in standard project management software (such as Microsoft Project or Oracle Primavera) format.

- It should also be able to accept the bill of quantities (BOQ) either manually or via spreadsheet (Microsoft Excel etc.) upload or via API access from an ERP system.
 - It should be possible to break down the quantities from the BOQ at the schedule activity level so as to enable detailed and accurate progress tracking in terms of time and cost.
 - It should be able to forecast delays in various milestones based on the project plan, quantities and current progress.
 - System should be able to forecast delays due to delay in project coordination issues, delays in receiving documents etc.
 - System should be able to forecast material requirements and labor requirements in real time based on schedule changes
 - System should generate alerts and notifications based on rules
 - System should allow for changes to the schedule based on progress (or lack of it) and changes to the BOQ as project scope changes during the course of the project.
 - System should be able to project and predict the future end date of the project based on progress (or lack of it) and the associated inter-linked issues and documents
- *Controlled Updates from Site and Approvals*
 - The system should allow for administrators to provide fine-grained access to various activities to individual users. For example, an engineer or contractor may be able to access only the relevant portion of the work breakdown structure (WBS) applicable to them.
 - It should allow for progress update on the activities including any quantity progress if applicable. The update should be possible from a web portal or a mobile application, with support for offline update with subsequent “synchronization” from mobile in case of remote locations. It is expected that the update will be done by contractor’s engineers at the site.
 - In addition, it should allow for the site personnel to create issues linked to tasks that hinder (or enable) progress and allow for that issue to be tracked to closure
 - It should allow the administrator to modify, approve or reject updates from the site and support a workflow for raising questions/issues and closing them when such approvals are done.
 - *Quality Inspections*
 - The system should allow for all the quality inspection checklists to be automatically loaded onto the system using an Excel or equivalent data source
 - The system should allow for quality inspection checklists to be attached to schedule line items so that good quality control measures are established on an ongoing basis during project execution
 - The system should allow for Contractors to submit quality inspection requests electronically, preferably from a mobile interface, from the site to the quality team

- The system should allow for the quality inspection team to fill out the inspections electronically, from a mobile interface, and either approve them or reject them for rework
 - The system should store approved checklists as an electronic document that is retrievable on demand during the project execution
 - Quality inspection status should be viewable by all including the quality team as a set of dashboards and reports
 - System should allow Quality team to raise NCs and Observations, identify root cause and resolutions and have the history of individual NCs be tracked and traced between execution team and quality team
- *Safety*
- The system should allow to capture safety issues, safety audit
 - The system should allow for reportable incidents to be closed through automated follow ups and alerts
 - The system should allow for non-reportable incidents to be captured for future potential analysis
- *Virtual Progress Monitoring on 3D BIM Models*
- Ability to compare real project progress with original schedule, and be visualized in the BIM model
 - Ability for dynamic (time-sensitive) clash detection and reporting
 - Ability to filter the model based on 3D critical path
 - Ability to generate issues and at the issue in the model/element context
 - Ability to visualize available work fronts
 - Ability to have Multi-Project, Multi user access, Multi user authorization.
 - Ability for field engineer to provide update on mobile and for that to be reflected in the model in near real-time
- *Dashboards and Reports*
- The system should have the ability to generate real time reports and dashboards
 - The system should contain standard reports and dashboards such as daily progress report, weekly progress report, daily labor report, monthly progress report, S curves, pendency reports, quality inspection status, quality NC, and Observations status, and other such reports, charts and tables.
 - The system should provide look ahead information on future milestones and tasks
 - These reports and dashboards should be configurable such that each user gets to see their own dashboard per their role in the project organization.
 - It should be possible for automated reports to be sent as and when needed to various stakeholders without needing manual intervention.

- *Interface*

- The system should have a web browser based interface through which it can be accessed from computers.
- The system should also be accessible via smartphone apps on Android phones and iPhones.
- Offline progress and status updates should be supported so as to be effective in areas with poor or nonexistent network coverage.

1.1.6 Deployment Model

The integrated solution must be implemented within 3 months of signing the contract. The solution will be registered on the name of BMC and should be operational for a period of 5 years. The design modelling software system should be available on annual license subscription basis. While IPCS should be in a cloud-based software as a service (SaaS) model where it is hosted and maintained by the Vendor.

1.1.7 Services

Vendor will provide deploy, configure, and customize for the solution as part of implementation services and ongoing technical support and training to ensure smooth rollout and functioning of the platform. Vendor should also be capable of providing customization of reports and dashboards, and integration with other systems such as ERPs, as a service, if required by Client.

1.1.8 Bridge Management System

Procurement and implementation of complete information management and decision support system for the operation of bridges shall be based on Bentley AssetWise Inspections software, a proven Commercial off-the-shelf, cloud-based solution with accessible only via encrypted and secure protocols to ease inspection and management of bridges and other transportation assets through all stages of asset, from fieldwork to office-based reporting and management.

Ability to standardize inspection data and collection, streamlining the data collection process, and the ability to have access to the data from anywhere with Offline and Online access. Software to be accessible through the web application from any computer with an internet connection. No installed software is needed along with intuitive user interface on cloud and as well as on its mobile components with easy to learn by little training, along with Multilevel Security Access for users and audit facility. It should be built on the latest technology like .NET, C#. A robust back-end and front-end should be built with the latest React/Angular LS dynamic web apps.

Ability to store all inspection and maintenance data that is collected on the field, along

with all photographs and documents. Capability to capture, manage, retrieve, and archive all types of document formats, including Microsoft Office (Excel and Word), sketches (TIF), photographs (JPG), video (AVI), PDFs, as well as drawings (DGN) and many other commonly used formats for the respective bridges effectively and efficiently. Ability to create a custom report on the fly as per the user requirement and flexible workflows for managing complex inspection and maintenance processes.

The system to broadly have integrated modules for

Data collection, Everything from the scheduling of future inspections to report creation, data entry and the review and final approval of the reports in the system Sr. Engineers/ Manager's module

Management Module is typically reserved for manager-level access and features advanced dashboard widgets, mapping functionality, configurable reporting, and querying tools.

Maintenance Module, maintenance personnel who are carrying out work on assets outside of the typical inspection cycles. View and update existing maintenance items and create new maintenance items.

Administration Module, for the security, administration, maintenance and configuration of the solution

Broad capabilities of the software to include

- User-defined attribution of structure data including, but not limited to bridge components and subcomponents and culverts. Detailed configuration can include but is not limited to individual elements of piers, spans, abutments, bearings, expansion joints, approach slabs, bridge protection and culvert type.
- The solution shall include the ability to store inventory data on minor and major bridges, culverts, and other structures, information collected from routine and special inspections stored against the individual elements or assembly of elements, such as a bridge deck.
- Data can be stored as detailed structure inventory - including data on individual piers, spans, abutments, bearings, expansion joints, approaches, bridge protection, construction and maintenance history, design capacity, load capacity etc., for all structure types.
- Store detailed inspection data - including individual defects on each defined element, including severity and extent measures.

- Support form-based entry or data import for all structure inventory, attribute, condition, and other data configured for storage for the structure.
- Permit storage of electronic files such as structure inspection photographs, design drawings etc.
- Define and assign matrix-based condition index to structure depending on structure inspection rating of elements and overall condition rating/index used to calculate structure condition indices or others as required by the user.
- Allow for scheduling and tracking structure inspections.
- All structure data, inventory, inspection, condition, and other data for the structure must be compatible with and use the linear location referencing systems and all defined linear and administrative boundaries defined for the network.
- Structures can be represented spatially.
- The spatial representation of structures can use different symbols and colours to represent the structure types, conditions, inspections, or other data associated with the structure.
- Structure modelling and network location to be compatible and integrated with the other capabilities delivered with the solution

A11. INTERFACE MANAGEMENT

The Contractor shall be responsible for coordinating his own design, technical, programming and construction activities and for coordinating these with the design, technical, programming and construction activities of other Project Contractors, Utility Agencies, Statutory Authorities, Public 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 in accordance with the procedures detailed in Appendix 16 of this Employer's Requirements. This coordination is essential in order to minimise abortive works, and to ensure that the project progress in accordance with schedule and to achieve fully coordinated construction of the facilities. Furthermore, the contractor should be aware that, due to the needs of interfacing works, revisions to his designs may be necessary during detailed design and construction stages.

It is the Contractor's responsibility to liaise, coordinate and manage with their Subcontractors. However, the Engineer will oversee, monitor and provide direction with respect to Contractor's interface with the MEP Sub contractor. Interface with Traffic Management Control System (TMCS) Contractor shall be duly carried out.

The Engineer shall oversee, monitor, provide direction and clarification where

required, attends Interface meetings, in conjunction with the Contractor and other Interfacing Parties. The Contractor shall note that the Employer may engage other Contractors, Consultants, etc. from time to time with whom the Contractor shall have to similarly co-ordinate. Such co-ordination responsibilities of the Contractor shall include, but not be limited to, 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 and 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 identified in the Interface Management Plan (IMP) to be developed by the Contractor.
- c) To obtain from the Interfacing Contractors information reasonably required to enable the Contractor to meet the Construction Key Dates as identified in Appendix 2B of this Employer's Requirements.
- d) Where the execution of the Work of the Interfacing Contractors depends upon the site access, management or information to be given to them 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 programme or construct their work.
- e) To co-ordinate access and delivery routes, and ensure that all provisions for access and delivery of plant are co-ordinated with and reflected in the Interfacing Contractor's Delivery Route Drawings. The Interfacing Contractor shall ensure that all plant 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. To co-ordinate with the Interfacing Contractors on attendance.
- g) To attend 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 by recording all matters discussed and agreed at the meeting.
- h) To ensure a clear flow and exchange of information, direction and timings, copies of all correspondence, drawings, meeting minutes, programmes, etc. relating to the Contractor's co-ordination with all of the Interfacing Contractors shall be issued to all concerned parties; four (4) copies shall be issued to the Engineer no later than three (3) calendar days from the date of such correspondence and meetings.

- i) 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 Interfacing Contractors as to the extent of services or information required to pass between them. If such disagreement cannot be resolved by the Contractors, despite the Contractor taking all reasonable efforts, then the decision of the Engineer shall be final and binding on the Contractor.
- j) Where an Interfacing Contract has 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 and documents necessary to enable the Interfacing Contractor to follow on and proceed with their co-ordination.
- k) The Contractor has to include in his Interface Management Plan, as required in Appendix 16, the latest dates for the Contractor to pass information to the Interfacing Contractors in order for them to complete their design submissions to the Engineer. Any claims 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 updating 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.

1.1.9 Dedicated Co-ordination Team

- l) The Contractor shall establish a dedicated co-ordination team, led by a Chief Interface Co-ordinator permanently stationed in Mumbai reporting to the Contractor's Project Manager or Representative. The primary function of the team is to provide a vital link between the Contractor's design and construction teams and the Interfacing Contractors.
- m) 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.
- n) The Chief Interface 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 given due allowance by the Contractor in his design, and construction, of the Works.
- o) 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 turnaround documents to obtain design and

programme data. Turnaround documents shall be issued to the Interfacing Contractors, copied to the Engineer, to be returned by the receiving party within a set time period, giving the current positions on their programme.

1.1.10 Design Interface

- p) The information cut off dates in the Interface Management Plan developed by the Contractor will be critical for the timely completion of the Project. The dates shall be determined to create a time frame during which design interface with the Interfacing Contractors on the Project has to be completed in order for the construction interface to follow. The Contractor shall commence design interface with the Interfacing Contractors as soon as he has been notified by the Engineer that such Interfacing Contract(s) has been awarded. In the case of Utility Agencies and other Statutory Authorities, interface shall commence as soon as possible. Where no design interface date has been established, whether because the Interfacing Contractor has not been identified, or for whatever reason, the Contractor shall liaise with such Interfacing Contractor(s) as soon as they have been awarded.
- q) The Contractor shall immediately upon the 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 Contractors are available. The Contractor shall submit with each of his Design Submissions a joint statement from the Contractor and the relevant Interfacing Contractors 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.
- r) The design interface is an iterative process requiring regular exchange and updating 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 information can be provided in time for the Contractor and Interfacing Contractors to complete their designs to meet their various design submission dates.

1.1.11 Construction Interface

- s) Construction Interface will be necessary throughout the duration of the Works commencing from the time the Contractor mobilises on 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.. Those are to be incorporated at the early stage of the construction up to provision of attendance during testing and commissioning stage.

- t) 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 part thereof, in such order as may be Noticed by the Engineer or in such 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 the failure of the Contractor to co-ordinate the Works as specified.

A12. SURVEY AND SITE INVESTIGATIONS

- (1) The datum used for the Contract shall be Mean Sea Level Datum.
- (2) The co-ordinates used for the Contract shall be based on a coordinate system in WGS84 as shown in the Employer's Drawings.
- (3) The Contractor shall carry out all further site investigations, including surveys, 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.

A13. CLIMATIC CONDITIONS

Mumbai experiences tropical wet and dry climate with high humidity and heavy rainfall during the monsoon season. The designs and plans for the Works must take this into account. The Contractor shall obtain information on the climatic conditions in Mumbai, such as temperature, rain fall, wind, sunshine, relative humidity etc. from the Meteorological Department and/or other Authorities and shall make full provision for the effects of the local weather conditions in his planning, design programming and execution of the Works. The impact of flooding, storm surge, tsunami, wave energy, tidal behavior, etc. shall all be considered in the design. The necessary data shall be collected from the authorised sources.

A14. 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 Employer/ 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 among the Engineer's office, GC's and PMC's Offices by the Contractor. The Contractor shall install such PMIS system within 30 days of the award of work to the satisfaction of the Engineer.

The number and format of the required document submissions is detailed in Attachment A1 to this Section A. The Transmittal Form is given in Attachment A2 to

this Section A and the Document Submission Report, for the obtaining of a Notice to proceed from the Engineer, is given in Attachment A3 to this Section A.

A15. CONTRACTOR'S PROJECT ORGANISATION

- (1) The Contractor shall employ on this Project, a competent team of Managers, Engineers, Technical staff etc. so as to complete the work satisfactorily as per the various requirements of the Contract.

A site control room with "round the clock" radio communication or telephone switch board links with all safety offices, works sites, design offices, site offices, batching plants, casting yards, workshops, fabrication yard, off site offices, laboratories etc.

- (2) Engineer's site offices, testing labs etc. shall be maintained and manned 24 hours a day, seven days a week. Residence and mobile telephone numbers of the Contractor's 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.

- (3) The designations of the various project organisations team members shall be subject to a Notice from the Engineer before adoption so as to avoid any duplication of the designations with those of the Employer or the Engineer.

- (4) The Contractor shall submit his Staffing Proposal to the Engineer for a Notice, which shall include:

1. The Contractor's proposed Staff Organization showing in chart form with the names of his proposed staff for each position;
2. CVs of the Contractor's proposed Key Staff, with adequate details and copies of documentary proof on the qualification and experience (with contract titles, position held and dates) of each staff to substantiate that the proposed staff is competent for undertaking the proposed position;
3. The scope of responsibilities of each staff and the reporting lines between individual staff;
4. The documents that each staff is authorized to sign on behalf of the Contractor.

- (5) The Staff Organization shall cover the Contractor's Key Staff and Specially Required Staff as specified in Sub-clauses A15(8),(9)&(10) below, as well as other working-level staff, with a narrative of the authorities and responsibilities of each staff member in directing execution of the Works on Site, or in deciding technical details of the Contractor's proposals.

- (6) The Contractor shall note that financial penalties can be levied for the failure to employ the Key Staff required by this Clause, refer to Volume 8 for details.

- (7) The Contractor's Staffing Proposal shall include the Key Staff proposed in their Tender submission, unless it is necessary to propose better qualified and more experienced staff in order to meet the requirements of the Contract, in which case the Contractor shall include in the Staffing Proposal an explanation for each change in Key Staff. Any such change in Key Staff shall require a Notice from the Engineer.
- (8) Each member in the Contractor's Staffing Proposal, including the Key Staff and the Specially Required Staff, shall be allocated to this Contract on a full-time basis on Site, until the activities that he is responsible for have already been completed or have to be carried out off-site with the consent of the Engineer. Removals and/or Replacement of Key Staff and the Specially Required Staff shall be in accordance with the following condition/criteria:
- (a) Except as the Employer may otherwise agree, no changes shall be made in the Key Staff and/or the Specially Required Staff. If, for any reason beyond the reasonable control of the Contractor, such as retirement, death, medical incapacity, among others, it becomes necessary to replace any of the Key Staff and/or the Specially Required Staff, the Contractor shall provide replacement Staff with equivalent or better qualification and experience.
 - (b) If the Employer finds that any of the staff have (i) committed serious misconduct or have been charged with having committed a criminal action, or (ii) have reasonable cause to be dissatisfied with the performance of any of the staff, then the Contractor shall, at the Employer's written request specifying the grounds thereof, provide replacement Staff with qualifications and experience acceptable to the Employer/Engineer within stipulated time.
 - (c) The Contractor shall have no claim for additional costs arising out of or incidental to any removal and/or replacement of staff.
 - (d) The Contractor shall note that financial penalties can be levied every time a Key Staff is replaced, refer to Volume 8 for details.
- (9) **Key Staff**
- (a) The Contractor's Staffing Proposal shall include as a minimum the following Key Staff:
- i. Project Manager, who shall be the Contractor's Representative as required in GCC clause 4.3.
 - ii. Construction Manager (Bridges)
 - iii. Construction Manager (Geotechnical)

- iv. Construction Manager (Roads)
 - v. Chief Interface Co-ordinator
 - vi. Engineering Manager (Lead Designer and Technical Support).
 - vii. Engineering Manager (Lead Design Checker).
 - viii. Quality Assurance Manager.
 - ix. Construction Quality Control Manager.
 - x. Safety Manager.
 - xi. Senior Electrical Engineer
 - xii. Senior Mechanical Engineer
 - xiii. Environmental Expert
- (b) The Project Manager shall be authorized to represent the Contractor on all aspects under the Contract and shall bear overall responsibility for the management, coordination and progress of the Contract.
- (c) The minimum qualification and experience required for Key Staff are listed below:

Sr. No.	Key Personnel	Educational Qualification	Experience in Assignments
1	Project Manager	Degree in Civil Engineering preferably with post-graduation degree in Geotechnical/ Structural/ Construction Engineering	Minimum 20 years of professional experience.
			Minimum 15 years of experience in planning, design, construction supervision, contract management and execution of road on Bridge structures and working in marine environment.
			Should have been Project Manager / Team Leader for a minimum of 10 years working on at least three projects. Should have experience in road construction on marine environment and Bridge structures projects in minimum two countries.
2	Construction Manager (Bridge)	Degree in Civil Engineering with post-graduation degree in Geotechnical / Structural Engineering.	Minimum 20 years of professional experience
			Minimum 15 years' experience in the construction of Viaduct, covering Road Bridge, Metro Viaducts.
			Should have been a team leader for road bridge projects for at least 10 years and should have worked in at least three projects in minimum two countries (excluding India).
3	Construction Manager (Geotechnical)	Degree in Civil Engineering and post-graduation degree in Geotechnical / Marine Engineering	Minimum 20 years of professional experience
			Minimum 15 years' experience in the geotechnical, marine works.
			Should have been a team leader in the marine, and geotechnical works for at least 10 years and should have handled at least three projects, in minimum two countries

Sr. No.	Key Personnel	Educational Qualification	Experience in Assignments
4	Construction Manager (Roads)	Degree in Civil Engineering with post-graduation degree in Highway/Transportation Engineering	<p>Minimum 20 years of professional experience</p> <p>Minimum 15 years' experience in construction of multilane highway, interchanges.</p> <p>Should have been a team leader for highway construction works for 10 years</p>
5	Chief Interface Coordinator	Degree in Civil/Mechanical/Electrical Engineering	<p>Minimum 20 years of professional experience</p> <p>Minimum 10 years' experience in interface coordination and management of bridges, interchanges, MEP works, traffic and utility diversions, and road works</p> <p>Should have experience in at least three similar projects in minimum two countries</p>
6	Engineering Manager (Lead Designer and Technical Support).	Degree in Civil Engineering and post-graduation degree in Geotechnical/Structural	<p>Minimum 20 years of professional experience</p> <p>Minimum 15 years' experience in design of Road bridge structure, cut and cover structures, working in marine environment.</p> <p>Should have experience in Highway, road bridge structures, preferable at least two project of 8 lane highway and road bridges in marine environment.</p> <p>Should have adequate experience in design with the aid of latest design software's like AUTODESK CIVIL 3D, OPENROADS, OPENBRIDGE DESIGNER, STAAD PRO, BENTLEY LEAP BRIDGE CONCRETE, SAP, MIDAS, PLAXIS 3D ULTIMATE, ANSYS, ETC.</p>
7	Engineering Manager (Lead Design Checker)	Degree in Civil Engineering with post-graduation degree in Structural / Geotechnical Engineering	<p>Minimum 25 years' of professional experience</p> <p>Minimum 20 years' experience in the design of road bridge structures, with at least ten (10) years' experience in managing design project(s) that included works of a similar nature.</p> <p>Should have adequate experience in design with the aid of latest design software's like AUTODESK CIVIL 3D, OPENROADS, OPENBRIDGE DESIGNER, STAAD PRO, BENTLEY LEAP BRIDGE CONCRETE, SAP, MIDAS, PLAXIS 3D ULTIMATE, ANSYS, ETC.</p>

Sr. No.	Key Personnel	Educational Qualification	Experience in Assignments
8	Quality Assurance Manager	Degree in Civil Engineering/ Degree in Equivalent	Minimum 15 years of professional experience
			Minimum 10 years' experience in administering Quality Assurance programs for civil works of bridges and interchanges and cut and cover structures.
			Should be knowledgeable of, and have experience in, the development and application of ISO 9001 standards for the design and construction of civil works primarily comprises of cut and cover structures, bridge, road Works.
9	Construction QualityControl Manager	Degree in Civil Engineering	Minimum 15 years' of professional experience
			Minimum 10 years' experience in administering Quality Control Programs for civil works civil works primarily comprises of cut and cover structures, bridge, and road works.
10	Safety Manager	Degree in Civil Engineering/ Degree in Equivalent	Minimum 15 years' of professional experience.
			Should have minimum fifteen (15) years' experience in managing the construction of underground civil works with at least 10 years' experience in administering safety assurance programs of cut and cover structures, bridge and civil works of similar scope.
			The Safety Manager shall be knowledgeable of, and have experience in, the development and application of ISO 9001 and OHSAS standards for the construction of civil works.
11	Sr. Highway Engineer	Degree in Civil Engineering preferably with post-graduation degree in Highway/ Transportation Engineering	Minimum 15 years of professional experience.
			Should have minimum 10 years' experience in the construction of road, interchanges and highway works with minimum 4 lanes
12	Sr. Electrical Engineer	Degree in Electrical Engineering	Minimum 15 years of professional experience.
			Should have minimum 10 years' experience in the electrical works associated with road, bridge projects.
13	Sr. Mechanical Engineer	Degree in Mechanical Engineering	Minimum 15 years of professional experience.
			Should have minimum 10 years' experience in the Mechanical works associated with road, bridge project.
14	Environment Expert	Postgraduate in Environment Science/ Management / Engineering/ Technology	Minimum 15 years of professional experience.
			Should have minimum 10 years' experience in the environmental works associated with road, bridge project.

- (d) The Project Manager, Construction Managers and Engineering Managers shall be assisted by engineers and foremen of adequate number and experience for ensuring that the Works will meet the requirements of the Contract from quality, progress, safety and environmental points of view. Without prejudice to the generality of the above, the Contractor's Staffing Proposal shall also include Specially Required Staff as stipulated in Sub-Clause A15(10) below.

(10) **Specially Required Staff**

The Construction Managers shall be assisted by the following staff:

- (i) Bridge Construction Engineer is responsible for the construction of the bridge and interchange structures, and shall have the following minimum qualification and experience:
- University degree in civil/structural engineering;
 - 5 years' experience in construction of bridge and interchange structures.
- (ii) Cut and Cover Structure Construction Engineer is responsible for the excavation and construction of cut & cover structures including pedestrian underpasses, cross drainages and shall have the following minimum qualification and experience:
- University degree in civil/structural/geotechnical engineering or equivalent acceptable to the Engineer;
 - 5 year's experiences in construction of cut and cover structures.
- (iii) Road Construction Engineer
- University Degree in Marine/geotechnical/civil Engineering or equivalent acceptable to the Engineer;
 - 5 year's experiences in road projects involving flexible pavement, rigid pavement and wearing course, and traffic management and traffic diversion works.
- (iv) Utilities and Traffic Diversion Engineer
- University degree in Civil engineering or equivalent acceptable to the Engineer;
 - 5 years' of relevant experience in utility diversion, traffic management and traffic diversion.

A16. TRAINING and TECHNOLOGY TRANSFER

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, control of ground settlements, instrumentation, safety, quality assurance, interface management, etc.

A17. DELETED

A18. MEETINGS

1.1.12 A18.1 General

The Contractor shall participate in meetings as indicated in this section. The Engineer / G.C. shall record minutes of all meetings and distribute them within 5 days of the meeting. Meetings will be chaired by the Engineer.

1.1.13 A18.2 Initial Contract Meeting

The Engineer / GC shall arrange an initial meeting within seven (7) days following the issue by the Employer of the Letter of Acceptance. The meeting shall take place at a location in Mumbai, India, determined by the Engineer.

The agenda of the meeting shall include, but not be limited to, the following:

- (a) Arrangements to be made for execution of the Contract Agreement;
- (b) Submission of bonds, guarantees, undertakings, warranties, insurance policies, certificates, etc. if not already provided;
- (c) Arrival of Key Staff and plant;
- (d) Planned activities for the first 30 days and 60 days after the Commencement Date; and
- (e) Other items as may be advised by the Engineer.

The Contractor shall be represented by all appointed Key Staff.

1.1.14 A18.3 Site Mobilisation Meeting

The Engineer shall arrange a meeting at the Engineer's office prior to the Contractor being given possession of any part of the Site. The agenda shall include, but not be limited to, the following:

- (a) Proposed use of the Site by the Contractor;
- (b) Employer's Requirements;
- (c) Temporary utilities and facilities;
- (d) Mapping and diversion of existing utilities;
- (e) Traffic diversion;
- (f) Pre-conditional surveys including structural audit of existing buildings and structures in the vicinity of the alignment, with reports;
- (g) Security and "housekeeping";
- (h) Land and setting-out survey;

- (i) Programme for establishing work areas, temporary facilities, and Site accommodation for the Engineer;
- (j) Temporary Works; and
- (k) Contractor's initial Three Month Rolling Programme.
- (l) Procurement and delivery dates for major items of plant.
- (m) Material transportation

The Contractor's Key Staff, and those with responsibility for activities on the agenda, shall attend.

1.1.15 A18.4 Quarterly Review Meetings

Quarterly Review Meetings shall be arranged at a time and venue determined by the Employer/ the Engineer to generally review progress and outstanding issues in regard to the Contract and the Project. They shall be attended by the Project Manager and supervisory board members of the Contractor and MEP Subcontractor. The agenda for these meetings will be advised by the Employer/ the Engineer, at least 5 days in advance. The Engineer or his designated representative will chair the meeting, and prepare and distribute the minutes.

Attendance shall be limited to the Contractor's Key Staff Nos. (i) to (vii) as relevant, as listed in Clause A15 (9) (a) of this Section A of Volume 3.

1.1.16 A18.5 Monthly Progress Meetings

Monthly Progress Meetings shall be held throughout the progress of the Works. These meetings shall normally be held at the Engineer's office on the first Monday of the month, following receipt of the Contractor's Monthly Progress Report. Contractor's Key Staff shall attend the Progress meetings. The Engineer shall chair progress meetings, and prepare and distribute the minutes. The Engineer shall prepare and distribute the agenda at least 1 day prior to the meeting which may include, but not be limited to, the following:

- (a) Confirmation of minutes of the previous meeting and matters arising there from;
- (b) Review of design work progress;
- (c) Review of construction work progress;
- (d) Field observations, problems and decisions;
- (e) Identification of issues affecting planned progress;
- (f) Planned activities for the coming period;
- (g) Quality assurance;
- (h) Safety;
- (i) Interface coordination;
- (j) Status of variations, if any;

(k) Design/construction coordination.

The Contractor's Project Manager must attend the Monthly progress meetings; other attendance shall be limited to the Contractor's Key Staff Nos. (ii) to (vii) as relevant, as listed in Clause A15 (9) (a) of this Section A.

1.1.17 A18.6 Weekly Site Meetings

Weekly meetings shall be held on Site to discuss detailed technical and construction issues plus the status of the Contractor's submittals. These meetings shall be chaired by the Engineer or his designated representative, who shall also prepare and distribute the minutes. The Contractor's Key Staff shall attend this meeting with the exception of the Project Manager whose attendance is optional.

Sub-Contractor's representatives shall also attend these meetings when requested to do so by the Engineer.

1.1.18 A18.7 Other Meetings

The Contractor's Key Staff, superintendents and Sub-Contractor's representatives shall attend other meetings as required with the Engineer.

ATTACHMENT A1

REQUIRED NUMBER OF COPIES OF SUBMITTALS & FORMAT REQUIREMENTS

Submittal				No. of Electronic Copies	Reference
	A1	A3	A4		
Initial Programme and Works Programme plus supporting information and narrative		6		2	
Monthly Programme Update		6		2	
Three Month Rolling Programme		6		2	
Three Week Rolling Programme		6		2	
Monthly Progress Report			6	2	
Preliminary and Definitive Designs	2	4		2	
Design Reports			6	2	
Construction Reference Drawings	6	2		2	
Works Drawings	3	3		2	
Method Statements			6	2	
Interface Management Plan			6	2	
As built drawings	8			2	
Materials Submissions (documentation)			6	2	
Operation and Maintenance Manuals			6	2	
E&M Submissions			6	2	
Quality Plan			6	2	
Quality Control Register			4	2	
Reports of Quarterly Quality Audits			4	2	
Materials and Workmanship Test Results/Reports			6	2	
Safety Plan			6	2	
Environmental Plan			6	2	
Traffic Management Submissions			6	2	
Investigation and survey reports.			6	2	
Monitoring, protection and replacement proposal reports.			6	2	
All other submittals	6	6	6	2	As applicable

Notes:

- i) In case of any contradiction between the text and this table then the text shall prevail, unless otherwise instructed by the Engineer.
- ii) Drawings to support A4 text documents shall be of A3 size.
- iii) PMIS system shall be installed within 30 days of the commencement of work and fully operable within three months from the commencement of work. After which at the discretion of the Engineer the number of paper copies to be submitted may be reviewed, except for A1 size drawings.

ATTACHMENT A2 TRANSMITTAL FORM

Volume-3: Employer's Requirements
Section – A: General

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Date: 1-03-2022

Engineer may change the format if required.

Contractor's Logo <input type="checkbox"/>		DOCUMENT TRANSMITTAL <input type="checkbox"/> (Example)				Address <input type="checkbox"/>				
To: Engineer										
Attention : Mr- XXXXXXXX										
Project:						Transmittal number: MCS2-PMC-TN-XX		Sheet N o - 1 of 1		
Component: Bridge						Day	dd			
						Month	mm			
						Year	yy			
S-N	Document-Drawing No-	Description				Revision				
<i>Medium of Drawings:</i>						<i>Size</i>	<i>Number of Copies</i>			
<input type="checkbox"/> Printed Paper		Tracing				A1				
						A3				
Elect-Copy		Photo Copy				A4				
<i>Purpose of Issuance:</i>										
FI - For Information FA - For Approval FR – For Record FT - For Tender FC - For Construction P - Preliminary FR – For Review AB - As Built R – Replacement						FA				
Remarks:										
Issued by: Received by: Date : dd-mm-yyyy XXXX Project Manager XXXX Contractor Cc: Client – 1 Hard Copy GC – 1 Hard Copy + 1 Soft copy Encl: 1 Hard Copy+ 1 Soft Copy Prepared by – initial										

COMMENTS RESOLUTION SHEET(CRS)

REVIEWED DOCUMENT DATA		CRS DATA		
Transmittal / Document Ref:	MCS2-GCC-401-TRANSMIT-XXXXXX	CRS Identification:	MCS2-GCC-401-CR00-CRS-XXXXXX	Revision:
Transmittal / Document Title	XXXXXXXXXX	Status Code:	Notice of No Objection accorded with comments - Revise and resubmit. Work may proceed subject to incorporation of comments.	B
Document Type	XXXXXXXXXX	CRS Prepared by		
Discipline(s) involved	XXXXXXXXXX	CRS Reviewed by	Design Manager	
Location	XXXXXXXXXX	CRS Approved	The Engineer	Sign
Transmittal received date	XX-XX-XXXX			

Disclaimer : Permission to proceed shall not constitute acceptance or approval of design details, calculations, analyses, test methods or materials developed or selected by the Contractor and shall not relieve the Contractor from full compliance with Contractual obligations.

Status codes: A: Notice of No Objection accorded - Work may proceed - B: Notice of No Objection accorded with comments - Revise and resubmit. Work may proceed subject to incorporation of comments - C: Objection - Revise and resubmit. Work may not proceed - D: Rejected - E: Review not required. Work may proceed

No.	Doc/Section/ Page	The Engineer's Comments	Comment made by	Initial Status	Contractor's Response	Responded By	Revised Status
STRUCTURES							
1							
2							



Volume 3 Employer's Requirements

Section-B FUNCTIONAL

Brihanmumbai Municipal Corporation

Mumbai, Maharashtra, India

SECTION B – EMPLOYER’S REQUIREMENTS - FUNCTIONAL

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EMPLOYER'S REQUIREMENTS – FUNCTIONAL

B. 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, installation 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.

B1. GENERAL

- (1) The design and performance of the Permanent Works shall comply with the specific core requirements contained in these Employer's Requirements - Volume 3.
- (2) The design of the Permanent Works shall be developed in accordance with these Employer's Requirements Section B - Functional, the Employer's Outline Design Specifications, the Employer's Outline Construction Specifications, as included in this Contract, other requirements of the Contract and the Contractor's Technical Proposals.
- (3) The Permanent Works shall be designed and constructed to the highest standards available using proven up-to-date state of art good practice. The Contractor's 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 Specifications and Outline Construction Specifications, Volumes 4 and 5 respectively, and shall be carried out employing the procedures established by the Contractor in his Quality, Safety and Environmental and Interface management plans.
- (4) The Contractor shall be responsible for obtaining all necessary approvals from the relevant agencies in the design and construction of the Works.

B2. SCOPE OF WORKS

SCOPE OF WORKS

- (1) The Permanent and Temporary works shall comprise the Design and Construction of all Works and services necessary to complete the Dahisar-Bhayander Road Project as per Contract Outline Design and Construction Specifications and the Employer's Requirements from CH. 0+000 to CH. 4+580 including, but not limited to, the following:
 1. Survey and Investigation including Geotechnical Investigation, Bathymetry Survey Topographic Survey, Hydrographical Survey, Existing Building Survey, Utilities Investigation, Identification of underground structures, Geological mapping, Drainage studies, Seismic studies, Existing Building Survey, Existing

Water Wells Investigation etc., and

2. Site clearance, including tree felling, tree transplanting, and fencing, barricading and securing of the site areas and works areas including all necessary permissions; and
3. Pre-condition surveys, structural audit and reports for, and monitoring and protection of Existing Building Structures, including rebuilding, repair or resolution of any adjacent structures; and
4. Disposal of surplus soil/material/building debris in approved dumping area(s) as per the Employer's Requirements including compaction to the desired levels to the satisfaction of the Engineer. Identification of disposal sites and obtaining necessary statutory approvals will fall within the Contractor's scope of works ; and
5. The Contractor shall be responsible for identifying dumping sites to dispose excavated muck/spoil without any extra cost. The Contractor has to obtain all required permissions from various authorities and a prior Notice/permission from the Engineer for their proposed dumping site as specified. The Employer may direct the contractor to dispose the muck/ spoil to designated sites within 40 KM from the work site. If so directed, the Contractor shall dispose the muck/ spoil to the designated site at no extra cost to the Employer.
The Employer may direct the Contractor to bring/utilise the muck/ spoil of specified quality from designated site within 40 KM from the work site. If so directed, the Contractor has to bring/utilise the muck/ spoil to work site at no extra cost to the Employer.
6. Bridges along the main alignment shall be of 4 + 4 lanes, twin viaduct structure having 18m width each as shown in the Employer's Drawings; and
7. The Design and construction of bridge structures shall include but not limited to viaduct segment, Bearings, Pier cap, pier, pile and pile cap/spread footing, crash barrier, maintenance corridor MS Coated with FRP, Emergency Rescue Area with Office and all other associated enabling civil works for lighting; and
8. Tenderers may modify the span arrangements, duly considering the site constraints. Tenderers may also modify the method of construction of the bridges. These should be explained in their Technical proposal; and
9. Pier protection barriers shall be provided as approved by the Engineer; and
10. Construction of at-grade road using concrete type pavement for carriageway and flexible type of pavement for hard shoulder, if any; and
11. The works related to ground improvement works. The Contractor shall be fully responsible for the design (temporary/ permanent works), construction, testing, monitoring and maintenance of the ground improvement works; and
12. Construction of a temporary jetty shall be as per the requirement of site and the design shall be as per the instruction of Engineer in charge. The temporary jetty

shall be supported on piers and no reclamation is permitted.

13. Bathymetry Survey shall be carried out along the proposed alignment. The area to be surveyed shall extend from the existing coast line to a distance of not less than fifty (50) meters beyond the control line of the proposed work.
14. Survey lines for the bathymetric survey of the creek bed, upon which the revetments will be founded, shall be run along the toe line of the revetments at 5 meter interval. Additional survey lines shall be undertaken, if necessary, to provide a sufficiently accurate portrayal of the creek bed.
15. Appropriate identification, procurement, transportation, stockpiling, testing and monitoring of all of the rock materials and associated quarry products.
16. Supply of all specified materials, providing all labour, equipment and plant.
17. Auxiliary utilities systems for bridges, roads and Control buildings including emergency lighting and power; and
18. Cable trays and ducts for project Contractors in roads and bridges; and
19. Wearing course over bridge and interchange structures; and
20. Drainage channels, sumps, pipes and pumps within roads and bridges sections; and
21. Drainage network along the road, proposed extension of cross drainage across and its connect to existing cross drainage; and
22. Construction of Cross Drainage works, a minimum of 6 nos. of box culverts as indicated in the Employer's Drawings.
23. Underground and above ground ancillary structures like control rooms; and
24. Location, protection, temporary support and reinstatement/ relocation of chartered and uncharted utilities to the satisfaction of the concerned Utility Company; and
25. Deleted.
26. Reinstatement of external works areas in accordance with Volume 3 Section D9; and
27. All Temporary works necessary (including viaduct segment casting yard and batching plants) and equipment, including the segment launching system and equipment; and
28. Water, sewer other utilities and drainage works; and
29. A RCC utility duct of minimum internal size of 2m x 2m shall be provided along the alignment within at-grade section; and
30. MEP, Disaster Management Devices and all other control and safety services within the road, interchanges and bridge structures; and
31. Make all provisions for accommodating the requirements for cable galleries/cable ways/inserts to fix for all the cableways, or equipment at the road, interchanges and bridge structures; and
32. Supply, delivery, installation and functional testing of earth mat and embedded earthing cables; and
33. Monitoring system for all equipment provided by this Contract.; and

34. Design, manufacture, delivery and installation of signage systems; and
35. Operation management and control system including operating procedures; and
36. Design and providing bridge health monitoring system with SCADA and integration with central control room including survey instrumentation, ground treatment, ground and building monitoring, risk analysis, settlement prediction, underpinning and protection to existing buildings and structures wherever required, preventative and corrective actions, pre conditional surveys and reports;
37. Construction and maintenance of the site office at location in the proximity of the Project area for the Engineer's staff complete in all respects as per the details given in the Employer's Requirements to the satisfaction of the Engineer for the duration of Contract, including connection to mains electricity, water, sewerage, drainage, broadband, Wi-Fi and telephone, adequate number of specified version of desktop/Laptop for Employer, landscape, street furniture and two 7 seater air conditioned new vehicles including all for the Employer's 24x7 use. The location and plan of the office shall be discussed and approved by the Engineer; and
38. Construction and maintenance of new and existing roads and diversions, including restoration to original condition; and
39. Removal, storage and reinstatement of road furniture such as street lighting, traffic signals, bus shelters/stands, footpaths / shifting of trees including stone kerbs, Promenades, boundary walls, horticulture works, and any other work to restore the site to its original condition as stated in the Contract as per current standards and site requirements, as and when possible; and
40. Other works as stated in the Employer's Requirements, the Outline Specifications and the Employer's Drawings.
41. All Temporary Works required for the construction of the Works including, but not limited to, traffic diversions to allow uninterrupted flow of traffic in and around the Site, shall be provided by the Contractor at his own cost and remove after completion of permanent works.
42. All Enabling Works required for the construction of the Works including working platforms in mangroves and creek, casting yards, temporary jetty and temporary access roads shall be provided by the Contractor at his own cost and remove after completion of permanent works.
43. Interface with Interfacing Contractor, Traffic Control Management Contractor for road, Interfacing Agencies with whom the Contractor shall co-ordinate all interface requirements at design stage, and during his construction and integrated testing activities.
44. Design and construction of Interchange at Ch. 0+000 (Dahisar End) integrating the existing road network for smooth flow.
45. Design and construction of bridge section from Ch. 0+280 to Ch. 0+650 with bridge expansion for future connection of Versova-Dahisar Link road with project

road.

46. Design and construction of Interchange at Ch. 4+580 (Bhayander End) integrating the existing road network for smooth flow.
47. Design and construction of additional fanning to meet future toll plaza requirements, if any.
48. Design and construction of Bus Terminal cum Multi-level parking from Ch. 0+050 to Ch. 0+150 or any suitable location for 10 buses and 150 ECS (Equivalent Car Spaces) having built up area of minimum 9000 sq.m along with all associated infrastructure. The top floor of the parking shall have beautiful manicure garden as per the instructions of engineer in charge.
49. Design and Construction of Flag Post, Viewing Deck, Space Needle and Parking Platform near Obligatory spans accommodating following:
 - Equivalent Car Spaces (ECS) for Parking: 500
 - Viewing Deck Seating Capacity: 200
 - Kiosk of adequate size: 40-50
 - Food Court Seating Capacity: 600
 - Flag Post Seating Capacity: 40
50. Design and Construction of Flag Post, Viewing Deck, Space Needle and Parking Platform near Obligatory spans shall meet following structural requirements:
 - The foundation for the viewing deck will consist of end bearing piles. The piles will be well socketed in hard rock with proper consideration of socket friction and end resistance. Pile spacing of 3D will be kept to avoid the interference.
 - The piles will be converted into column at higher level. The columns will be suitably tied at intermediate level.
 - Parking Platform will be in RCC with beams spanning in both directions in grid pattern. Deck slab of RCC will be provided on the beam grid.
 - Viewing deck will be a composite structure consisting of steel box plate girder grid. Deck slab will be RCC supported on the steel girder deck.
 - Looking to the difficulties in cast in situ it is proposed to provide precasting technique for beams and deck slab panels.
51. The required permissions for the project not limited to environment clearance, forest clearance, honorable high court clearance including preparation of reports and proposals.
52. The EIA for the Project identified measures to be taken for Environment management plan to be implemented during and post construction. The Said EMP as per the EIA is scrutinized by the Environment Department, Government of Maharashtra / MOEFCC and approved. The Agency shall be responsible for the executing all measures suggested and approved by the approving agency for the project.

- (2) The Contractor shall be responsible for obtaining relevant certificates or clearance from local Authorities & other authorities, if required.
- (3) Tenders shall quote in accordance with the Employer's Requirements, the Employer's Drawings and the Outline Specifications. Instead, for part of the work(s), the tenderers may also quote their own proposal fully satisfying the Employer's Requirements and Outline Specifications of construction and design. The tenderer is expected to explain this in detail in their technical proposal.

B3. ALIGNMENT

- (1) The alignment shall be as shown in the Employer's Drawings. The Contractor shall:
 - (a) Verify and develop a detailed alignment to meet the standard operational and technical criteria referred elsewhere in this Contract.
 - (b) Review the alignment with respect to his own design and construction proposals and shall also ensure that there is no conflict with any existing structures (both underground and above ground) which are to be preserved. Any modification/ revision in the alignment shall be approved by the Engineer.
- (2) The Contractor is not permitted to propose deviations from the horizontal alignment approved from MCZMA and Forest Department and deviations at interface sections; unless for reasons to avoid physical obstructions from third party's foundations encroaching the Works, save that the Contractor shall demonstrate compliance of the proposed deviation with the specified alignment requirements and obtain the Engineer prior consent to propose the deviation.
- (3) The Contractor is permitted to propose minor deviations in vertical alignment to suit his construction proposals, but he must demonstrate that any such deviations do not reduce the technical and operational performance. The Contractor needs to verify the Contract boundaries while proposing any change in vertical and/or horizontal alignment but such deviations shall require a Notice to proceed from the Engineer subject to the following conditions:-
 - There is no extra cost to the Employer.
 - Changes proposed are absolutely essentially to suit the Contractor's specific design.
 - There is no change at the Contract boundaries.

B4. CLEARANCES

- (1) Construction limits:
 - (a) The limits of land for the Works are shown on the Employer's Drawings. The Contractor shall design the Works to be contained totally within

these limits, respecting the regulations concerning construction and property boundaries of the statutory Authorities.

- (b) The limits of land as shown in the Employer's Drawings may undergo changes after Contractor's survey and the Contractor shall make any adjustments necessary to the design to acknowledge the changes to the limits then specified by the Engineer. These adjustments will not constitute any variation.

B5. DESIGN LIFE

The design life of Permanent Works for civil engineering structures including interchange and obligatory span bridge with 80/100m shall be 100 years. However, design life of rigid and flexible pavements may be limited to 30 years and 20 years respectively.

B6. DURABILITY AND MAINTENANCE

- (1) The Permanent Works shall be designed and constructed in such a way that, if maintained in accordance with the Contractor's approved maintenance programme in the Contract, they shall endure in a serviceable condition throughout their minimum lives as described in the Outline Design Specifications.
- (2) 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 roadway.

B7. OPERATIONAL REQUIREMENTS

- (1) The project road shall be designed for design speed of 80km/hr and minimum 60km/hr, except for interchange at Dahisar end of Project Road, wherein design speed shall be adopted in line with applicable IRC codal provisions, but not less than 40Km/hr. Minimum design speed shall be adopted only where site conditions are restrictive and adequate land width is not available.
- (2) The vertical and horizontal alignments shall comply with the conditions laid in paragraph B3 of this Employer's Requirements Section B - Functional.
- (3) Particular attention shall be given to locations where water due to wave surge/ flooding could enter road on at-grade road. Wave study and flooding for a return period of 1 in 100 year shall be considered. In particular,
 - (a) Construction of surface water drainage systems including plinths and ducts shall be provided to obviate any risk of flooding of electrical equipment areas.
 - (b) Plant building and all other points of access to the road at-grade shall be adequately protected against flooding.
 - (c) Equipment rooms and other facilities shall be adequately protected against flooding.

- (4) During construction the Contractor shall be responsible for providing and maintaining adequate wave surge / flood protection to ensure protection of the works and for all adjacent areas, buildings and structures within the vicinity of the works.
- (5) In the design and construction of the Works, the Contractor shall, as a fundamental objective and as a priority, ensure that Road user will, throughout the operational period of the Road, and within the confines thereof, be provided with as safe an environment as is reasonably possible. The Contractor's attention is directed to Clause B18 of these Employer's Requirements – Functional (Section B), concerning the role of a Statutory Body.

B8. FUNCTIONAL REQUIREMENTS FOR ROADS, INTERCHANGES AND BRIDGES

- (1) The road at-grade, bridge along main alignment and interchanges shall have paved 2.00m shoulder and 0.50m edge strip.
- (2) Design and construction of Roads, bridge and interchange structures shall meet the standards and requirements to ensure a smooth riding quality, especially at the location of interface between road at-grade and bridge structure at abutment location, expansionjoints in roads and bridges etc.
- (3) Median shall be as mentioned in Volume 6, employer's drawings.
- (4) Sufficient vertical clearance shall be provided at location of navigational crossings. The span shall also be suitably provided to satisfy navigational requirements. The general arrangement design at these locations shall be approved by the statutory authorities including marine department.
- (5) Bridge/Interchanges spanning a major roadway shall provide full clearance and shoulder bywidths on the road beneath. Allowance for the longitudinal drainage, services and maintenance operations shall be considered and provided where necessary.
- (6) Allowance in span arrangement for future widening of the road beneath shall be included.
- (7) The Merging and diverging of interchange lane with the Project Road main alignment and with the existing roads shall be properly designed and constructed with extra widening, smooth transition without hindrances to the main line traffic at merger/diverge in accordancewith relevant Indian/International standards. The merging and diverging

lanes shown in the tender drawings are indicative and shall be improved as per Standards/Code provisions at no extra cost to the Employer.

- (8) The expansion/movement joints in bridges and interchanges shall be construction in such a manner to avoid bumps and ensure smooth ride.
- (9) The joints at Bridge and pavement, interchange with the existing road shall be matched in such a way to avoid bumps and ensure smooth ride.

B9. FUNCTIONAL REQUIREMENTS FOR POWER SUPPLY SYSTEM

- (1) It also includes providing backup power supply through Diesel Generator Sets at all the auxiliary substations for at least 3 hrs.
- (2) Providing emergency power supply through UPS system.
- (3) Providing lightning protection system, power factor correction units, surge diverters on main switchboard, surge reduction filters, harmonic filters, all plant and distribution boards and related cables and control system.
- (4) Providing lighting system throughout the bridges, approach ramps and roads, control and service buildings including emergency lighting and signages.
- (5) Providing power through panels and cables to lighting system, SCADA and Traffic SCADA, Control building lighting, power.
- (6) The distribution system shall withstand a short circuit in accordance with the design level.
- (7) All individual components should be readily accessible for maintenance and repair.

B10. DELETED

B11. DELETED

B12. FUNCTIONAL REQUIREMENTS OF OPERATIONAL MANAGEMENT AND CONTROL SYSTEM

1. To provide an Operational Management and Control System (OMCS). The OMCS shall integrate the facility management and traffic management system into one supervised and comprehensive operational system.
2. It includes all interfaces to the Emergency Evacuation and Intercommunication System, Telecommunication Systems, Security system, Traffic Control Centre (TCC) equipment, Operational Maintenance System.
3. To provide a Traffic Management and Control System in line with scope covered under Clause 7 of Section 4, Volume 4 to monitor and control all the above systems and

interface to the OMCS.

B13. DELETED**B14. FUNCTIONAL REQUIREMENTS OF ROAD**

The functional parameters as presented here below will be measured at specified positions, frequency and accuracy, and the result of these measurements must meet specified minimum requirements during the execution of the Additional Construction Works after completion of the Initial Construction Works.

- (1) The Permanent Works shall be designed to achieve high aesthetic.
- (2) Surface, above ground structures shall share a common aesthetic that identifies them as component parts of the Road and conveys a civic dignity befitting the city of Mumbai.
- (3) Structures in areas of special historic interest shall be designed to integrate appropriately with existing site features and to convey the architectural theme of the area into the body of the Road.
- (4) Allowance shall be made to identify and implement a design commonality that includes, but is not limited to materials, finishes and components.

B15. ENVIRONMENTAL CONSIDERATIONS

The design of the Permanent Works shall be undertaken with high environmental standards as given in Appendix 17 of this Volume 3. During construction the requirements for Environmental Protection and Impact Mitigation are also given in Appendix 17 of this Volume 3.

B16. URBAN PLANNING FUNCTIONAL REQUIREMENTS

- (1) Submissions for planning approval for underground, ground and above ground Road works are to be made by the Contractor to all statutory bodies as applicable.
- (2) Requests for temporary power supplies for the construction of the works must be submitted, by the Contractor to Electrical Distribution Company.
- (3) 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.
- (4) The Contractor is responsible for obtaining the approval of applications from the relevant Authorities for the design and construction of works. The Employer will provide all possible assistance in trying to obtain any permission.

B17. SAFETY AND SECURITY

(1) Introduction

The objective is to minimize the potential impact on Road users and minimize dependence on technology and equipment when formulating security and safety plans for each facility. Issues may include, but not be limited to, the following;

- (a) Appropriate features to support life, safety and security strategy.
- (b) Conformance with appropriate fire and life safety codes
- (c) Provisions regarding maintaining tenable conditions during evacuation in the event of an emergency.
- (d) Provision of ventilation system as mentioned in B8.
- (e) Provision of power supply and lighting system as mentioned in B9
- (f) Provision of fire detection and protection system as mentioned in B10.
- (g) Provision of operational management and control system as mentioned in B11.

(2) Safety Management Methods Safety involves:

- (a) Hazard Identification and Management
- (b) Quantitative Risk Assessment (QRA)
- (c) Design Review
- (d) Traceability from Initial Design to Acceptance Testing (Safety Certification based Road Safety Audit, Fire Safety etc.)
- (e) A Separate Safety Management and Reporting Function

B18. 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 conjunction with the Mumbai Traffic Police. The Contractor shall comply strictly with the directions of the Traffic Police and the approved plans during construction of his works.

The traffic management plan shall maintain the existing Level of Service on roads in the vicinity of the project site. Design shall provide for a minimum carriageway width required to achieve the above objective. As far as possible, total carriageway width during construction shall be equal to or greater than the existing carriageway width in order to accommodate the additional traffic due to construction activities. To facilitate the above, temporary roads or temporary road decking may be provided where necessary, which must be fully maintained and safe at all times, and shall be approved by the Mumbai Traffic Police. The traffic management plan shall also provide for a minimum of 2m of footpath adjacent to buildings or thoroughfares for all road diversion schemes.

The Contractor should take into account that the construction of the interchange arms, bridge along main span may have to be done in phases to ensure that the traffic management plan provides the minimum requirement of existing traffic lanes and footpaths in each direction.

The wheels of all vehicles shall be washed before leaving site to avoid depositing mud and debris on the adjacent roads.

Also refer to Volume 3 Section D9.

B19. SAFETY CERTIFICATION

The Contractor shall note that, Employer/Engineer/ Jt. C.P of Traffic Department and other associated statutory authorities will inspect the Works from time to time for the purpose of determining whether the Road Phase 1 complies, in terms of operational and infra structural safety, in accordance with the Laws of India. The Contractor shall note that the Notice to proceed of the said department is mandatory for commissioning the system. Notwithstanding other provisions of the Contract, the Contractor shall ensure that the Works comply with the requirements of the said Department in terms of being constructed to the drawings, and shall assist the representatives of said Department in carrying out their inspection duties and also comply with their instructions regarding rectifying any defects and making good any deficiencies.

B20. STANDARDS

- (1) Equipment, materials and systems shall be designed, manufactured and tested in accordance with the latest issue of International and/or National codes and standards. List of codes and standards applicable for use for the Works is given in Volumes 4 & 5.
- (2) 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 a Notice from 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.



Volume 3 Employer's Requirements

Section-C

DESIGN

Brihanmumbai Municipal Corporation

Mumbai,

Maharashtra, India

SECTION C– EMPLOYER’S REQUIREMENTS - DESIGN

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ATTACHMENT C1 : DESIGN CERTIFICATE

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C. DESIGN

C1. INTRODUCTION

- (1) The Employer's Requirements – Section C Design, specifies the procedural requirements for the preparation of the design of the Permanent and Temporary Works. These requirements are subdivided into: **Design Phase, Construction Phase and General Application.**
- (2) 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.
- (3) The Contractor shall engage the Lead Designer who shall undertake and prepare the design of the Permanent Works and Temporary Works. The Lead Designer shall fulfil the requirements given in Annexure 9 of Volume 1. The minimum qualification and experience required for the Engineering Manager of Lead Designer is given in section A 15 (9). The Contractor shall establish an office for his design team near the Site area in Mumbai. The design team shall function from this office and all meetings and discussions relating to design shall be held in this office.
- (4) The Contractor shall ensure that the Lead Designer continues to be represented in Mumbai 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.
- (5) The Contractor shall appoint an external Consulting firm with suitably qualified person(s) to act as the Lead Design Checker. The minimum qualification and experience of the Engineering Manager of Lead Design Checker is given in Section A 15(9). The Lead Design Checker shall not produce any of the permanent works design or temporary works designs nor work directly for or report to the Contractor's Project Manager.
- (6) The Contractor shall ensure that at the end of each month, the Lead Design Checker shall issue a written report to the Contractor's Site office, with a copy to the Engineer, covering the status of all designs checked during the preceding month. The format of the Design Checker's monthly reports shall be one to which the Engineer raises a Notice
- (7) The Lead Design Checker shall undertake design checks on the Contractor's designs. All design documents, drawings, plans, calculations and reports produced by the Contractor and Designer shall be checked by the Design Checker, accompanied by two original copies of a 'Design Certificate' as set out in Attachment C1, signed by all parties when the design is submitted to the Engineer.
- (8) The Contractor shall ensure that, as all designs being complex structures and having the potential to affect the safety, quality and durability of the Permanent Works, the

Lead Designer shall approve in advance the Contractor's proposed materials and erection and removal procedures and the lead designer shall inspect all temporary works at Site before they are put into use.

- (9) The Engineer, and such other parties as he shall give a Notice in writing, shall have full and unrestricted access to the Lead Design Checker, the Lead Designer, and to all persons carrying out the design and checking, and all their data, information, calculations, drawings and records
- (10) The Contractor shall submit his Design Quality Assurance Plan as required in Appendix 6 of this Volume 3, for the design required by the Contract.

C2. REQUIREMENTS DURING DESIGN PHASE

- (1) The principal requirements of the Design Phase are the validation of the Preliminary Design, production of the Definitive Design and the Construction Reference Drawings. It should be clearly understood that the Contractor's technical proposal which forms a part of this Contract, shall only form the basis for further design development into the preliminary and Definitive Design, subject to the compliance of the design with relevant regulations and standards and conforming to the Outline Design Specifications.
- (2) Engineering studies and comparative evaluations shall be performed to ensure that the designs incorporate features to achieve optimum performance and seek to lower future life cycle costs.
- (3) Preliminary Design: The Preliminary Design shall develop and validate the Employer's Tender design and incorporate the Contractor's technical proposal which forms a part of this Contract, developed to sufficiently define the main structural elements. In addition general construction methods and documentation needed to develop the Definitive Design shall be submitted. The Engineer shall review and comment Preliminary Design submissions in accordance with Clause C9 of this Employer's Requirements.
- (4) Definitive Design shall accord with and incorporate the Preliminary Design 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.
 - (e) Shall fully coordinate with adjacent contractor/other interface agencies.

- (5) 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.
- (6) 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.
- (7) 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.
- (8) Preliminary Design submissions will be reviewed and coded in accordance with Clause C9 stated here below.
- (9) Upon the Engineer issuance of Notice with review code "A" or "B" in respect of the Definitive Design Submission in accordance with Clause C9, the Contractor shall incorporate the comments, complete the design in all respects, and proceed with the Construction Reference Drawings. All the Permanent Works shall be covered under the Construction Reference Drawings.
- (10) Construction Reference Drawings shall give full details of the construction of the elements covered by the Definitive Design and shall show in full the works to be constructed.

C3. NOTICE TO DESIGN SUBMISSION

- (1) Preliminary Design and Definitive Design will be reviewed and coded by Engineer in accordance with Clause C9 stated hereafter. A Comment Resolution Sheet (CRS) will be attached, listing the Engineer's comments. Return of hard copy drawings with the CRS at this stage is not mandatory.
- (2) Construction Reference Drawings shall be reviewed by Engineer in accordance with Clause C9 stated hereafter. Comment Resolution Sheet will be attached. Drawings reviewed with review Code 'A' or 'B' will be stamped with Notice to proceed and signed by the Engineer. Two sets of hard copy drawings will be returned to the Contractor.
- (3) Construction Reference Drawings accorded with Code 'B' should be resubmitted after

incorporating the Engineer's comments within 30 days of the receipt of the concerned set of drawings and CRS.

- (4) Contractor may proceed with the work at his risk based on Construction Reference Drawings accorded with review Code 'B', after addressing all comments listed in the CRS.
- (5) For Construction Reference Drawings accorded with review Code 'C' or 'D', CRS will be issued. Drawings will not be returned in these cases along with CRS.

C4. REQUIREMENTS DURING CONSTRUCTION PHASE

- (1) 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.
- (2) 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.
- (3) 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."
- (4) 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.
- (5) 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 C12 herein); and
- (6) Co-ordinated interfaces and 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.
- (7) 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 Notice, 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, relocated, diverted, new or retained.

C5. DESIGN INTERFACES WITH OTHERS

- (1) The Contractor shall co-ordinate all design and installation work with the related work contractors and various Interfacing agencies and Subcontractor as described in Appendix 16 of this Volume 3.
- (2) Appendix 16 contains the requirements of the Interface Management Plan (IMP) to be prepared and implemented by the Contractor. The IMP will identify the mechanism by which the Contractor and the Interfacing Contractors, Interfacing Agencies and Subcontractor will work together to coordinate the design, and construction, of the various elements of the Project works. The Contractor shall review and update the IMP on a monthly basis.
- (3) The Employer and Engineer will hold Project Quarterly Review Meetings (QRM), at three monthly intervals. The Contractor's Project Manager shall attend these QRM and shall report the progress of his works and the state of his interface with other Interfacing Contractors, Interfacing Agencies and MEP Subcontractor and shall provide the Engineer with the necessary assistance and information for conducting the QRM. Refer to Clause A18 of Section A of this Volume 3 Employer's Requirements.

C6. DESIGN SUBMISSIONS C

1.1. PRELIMINARY DESIGN

1.1.1. SUBMISSION General

The Preliminary Design shall develop and validate the Employer's outline design incorporating the Contractor's technical proposal and provide initial design documents for review and shall be sufficiently detailed to show the main elements of the design 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 off site testing recommendation
- f) the submission of specifications proposed for the work
- g) the identification of design codes and standards
- h) the CAD procedures
- i) preliminary design of MEP works
- j) an alignment review
- k) the preliminary construction methodology

- l) the design submission programme (update)
- m) the utility and traffic diversion plans
- n) proposed site surveys, existing building surveys and other field surveys
- o) a review of permanent land requirement
- p) the preliminary ground treatment
- q) the preliminary building and structure protection proposal
- r) the Preliminary Precondition survey proposal
- s) the preliminary monitoring plan
- t) the preliminary geological model
- u) an additional ground investigation proposal
- v) the preliminary reinstatement drawings.
- w) E&M schematics, calculations and control room space requirements

In developing and validating the Preliminary Design the Contractor should note the following constraints;

- (i) The land for the ancillary buildings shall be as per the Employer's Drawings; and
- (ii) The overall width of bridge structure along main alignment and interchanges, approach ramp shall be as per the Employer's Drawings.

1.2. DEFINITIVE DESIGN SUBMISSION

(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 include, but not be limited to, the following:

- (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) provisions and proposals for interfacing with the Interfacing Contractors, Interfacing Agencies and Traffic Management Control contractor;

- (i) utilities to be diverted /protected;
- (j) civil, structural and geotechnical design and erection methods for bridge and interchange viaduct spans.
- (k) Construction sequence and design details of approach ramps, bridge and interchange structures, including substructure and superstructure.
- (l) proposed methods of predicting the ground movements due to work and adjacent to the excavations; and
- (m) 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 under the Outline Design Specifications.
- (n) Traffic or other civic services affected.
- (o) Sump arrangements.
- (p) Cross drainages
- (q) Construction method statement and details for bridges/interchanges on existing roads removal of obstruction and traffic diversion.
- (r) Land filled section
- (s) Landscaping of junctions
- (t) Detailed design calculations supporting all the elements of MEP services, equipment selection and operation procedures.

(2) Drawings

The Definitive Design Submission shall include drawings that shall illustrate the proposed Definitive Design and in particular shall include, but not be limited to, the following;

- (a) elevations and perspectives and landscaping;
- (b) general arrangement of bridges, interchanges, roads, approach ramps, etc.
- (c) Lay out and detailed design drawings of all structural components like substructure, superstructure, bearings, abutment, approach ramps, etc. of bridges and interchanges and the road at-grade.
- (d) layouts and details of structural elements;
- (e) associated fittings;
- (f) slopes and earthworks;
- (g) structural and surface drainage;
- (h) access roads and temporary road works;
- (i) drainage and pumping systems
- (j) Mechanical and Electrical control room layouts, installation details such as lighting, ECS, electric substation and distribution, fire protection.
- (k) provisions for road works, electrical and mechanical services and equipment;
- (l) existing and proposed utilities;
- (l) road works and works related to traffic management including decking.
- (m) Structural Engineering and Mechanical (SEM) drawings

- (n) embedded items
- (o) Cross drainages
- (p) Consolidated Design Drawings
- (q) Viaduct segment launching
- (r) Sump arrangements

(3) Documents

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.

1.3. 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.

1.4. Interface Design Report on Interfacing Contractors

This will include the following:

Details of the design and construction of the Works adjacent to other Contracts
Details of provisions for the Interfacing Contractors, Interfacing Agencies, and Traffic Control Management Contractor for road indicating arrangements for accesses, fixings, casting-in, openings, supports, plinths, decks, manholes, trenches and the like; updated interface management plan relating to design integration and co-ordination.

1.5. Testing and Commissioning Report

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

1.6. 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.

(4) Supporting Documents

The Definitive Design Submission shall be accompanied by the following documents,

which will be considered by the Engineer in his assessment 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.

1.7. 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 pile design, pile socket, safe bearing capacity, cut and cover structure, promenade and associated geotechnical designs. The report shall include the full borehole logs and descriptions of confirmatory boreholes drilled by the Contractor. Socket length shall be based on socket friction & end bearing as per Geotechnical investigations by Successful bidder and as per the relevant codal provisions.

1.8. Report on At-Grade Road works

The report shall provide Design methodology for landfill/embankments, pavement and associated works. Detailed Construction methodology shall be provided including ground improvement works, mobilization plan for plant and equipment, material procurement, transportation & testing, site access plan and monitoring for achievement of design specifications.

1.9. Report on Bridge and Interchange works

The report shall provide Design methodology bridges, interchanges and adjoining pavement structures. Detailed Construction methodology shall be provided covering mobilization plan for plant and equipment, material procurement, casting, transportation, erection & testing and site access plan.

1.10. 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.

1.11. Pre conditional Survey of Existing Structures

A report giving a review of the general condition of all existing buildings and structures along the alignment, 50m on either side of the alignment centre line. The structural record surveys on the buildings and structures within this zone shall be included in this report. Refer to Clause D8 (8) of this Volume 3 for further details.

1.12. Existing Buildings and Structures Impact Assessment Report

An assessment on the risk of damage to the buildings, structures and utilities within the influence zone of bridge and interchange structures, due to the proposed works shall be included in the report. The possible protective measures that can be deployed

shall also be given.

1.13. 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.

1.14. 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 assessment of the Definitive Design.

1.15. Construction / Installation Analysis Report

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

1.16. Construction Method Statement

Various reports which provide 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 assessment of the Definitive Design.

1.17. Works Programme Review

- (i) The Contractor shall, prior to submitting the Definitive Design Submission, review the Works Programme against the current version of the Design Submission Programme.
- (ii) In the event that the Contractor considers that there are any discrepancies or inconsistencies between the Design Submission Programme and the Works Programme, the Contractor shall submit with the Definitive Design Submission his proposed revisions to the Works Programme such that the discrepancies or inconsistencies are removed.
- (iii) The Contractor shall provide details of submissions of the Construction Reference Drawings and 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 Engineer 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 of such information or for the completion of such actions required by the Contractor shall be included with appropriate justification.

1.18. 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, site security and their reinstatement, detailing

the accesses and access facilities.

1.19. Report on Segment casting

A report which provides sufficient information on the proposed methods of casting viaduct segments/girder.

1.20. Report on Segment erection

A report which provides sufficient information on the proposed methodology of erecting viaduct span and associated machinery and installation procedure.

(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 underground and above ground works.
- (b) All works related to the sequence segment erection together with any intervening works.
- (c) Major elements as identified under B2, Section B.

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 changes

Any changes in the design between Tender stage and Design Stage, or Preliminary Design and Detailed Design, if warranted to meet the Employer's Requirements or Outline Specifications or Code provisions or similar, such changes shall be deemed to have been included by the Tenderer in his proposal. The tenderer shall not be eligible for any additional payment for such changes. All such changes require the Notice of the Employer/Engineer.

C7. DESIGN SUBMISSIONS - CONSTRUCTION REFERENCE DRAWING SUBMISSIONS

- (1) 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.
- (2) 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.

- (3) 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.
- (4) The Construction Reference Drawings shall include Combined Services Drawings, Structural Electrical and Mechanical (SEM) Drawings and Consolidated Design Drawings which shall clearly define the scope, interrelationships and provisions for of all aspects of the works.

C8. DESIGN SUBMISSIONS - CONSTRUCTION PHASE

- (1) On the issuance of a Notice in respect of the Construction Reference Drawings the Contractor shall produce the proposed Working Drawings. The Working Drawings shall include the Construction Reference Drawings, which may be supplemented by further drawings developed in accordance with the Construction Reference Drawings such as sitesketches, bar bending schedules, bar reference drawings, fabrication and shop drawings, construction erection sequences, finishes material list with accompanying specification, and the like. All such drawings shall comply with the requirements of the Contract.
- (2) Prior to issue to site of the proposed Working Drawings, the Contractor shall endorse the appropriate original paper drawings as "Good for Construction". The supplemental working drawings shall not be endorsed by the Engineer, unless he specifically states which drawings he will endorse with a Notice to proceed.
- (3) The Construction of the Works shall be strictly in accordance with these Working Drawings.
- (4) The Contractor shall finalise details of the proposed method of construction and submit such finalised details to the Engineer for a Notice. 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.
- (5) 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.
- (6) Hard copies of the As-Built Drawings, endorsed by the Contractor, shall be submitted to the Engineer for a Notice to proceed in accordance with Clause 5.6 of Part I GCC and in electronic format using a commercially available CAD program.

C9. DESIGN SUBMISSIONS - ASSESSMENT PROCEDURES

The Contractor's Design submissions will be assessed by the Engineer within 28 days from the date of submission, or as otherwise stated in Volume 4. The form and detail of the

assessment shall be as determined by the Engineer and according Notice to a submission will not release or remove the Contractor's responsibility for the design under the Contract. The Submission will return along with the Comment Resolution Sheet(CRS), for the obtaining of a Notice to proceed from the Engineer as given in Attachment A3 to Section A of this Employer's Requirements. The submissions will be coded A or B or C or D or E, whose meaning is listed as below.

- (i) Code 'A' – Notice to proceed
- (ii) Code 'B' – Notice to proceed accorded with comments. Work may proceed subject to incorporation of comments
- (iii) Code 'C' – Objected. Revise and resubmit. Work may not proceed
- (iv) Code 'D' – Rejected.
- (v) Code 'E' – Review not required. Work may proceed
 - (1) The issue of a Notice shall be without prejudice to the issue of any future Notices.
 - (2) The Contractor shall, prior to the submission of the Design Data, obtain all required 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.
 - (3) All submissions shall be accompanied by two original copies of a 'Design Certificate' as set out in Attachment C1 hereto and signed by the Contractor, the Lead Designer and the Lead Design Checker.

C10. DESIGN SUBMISSION PROGRAMME

- (1) 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.
- (2) 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 assessment 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 the Project and

Interface Contractors.

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

C11. PROGRAMME FOR SUBMISSIONS DURING THE CONSTRUCTION PHASE

In accordance with Clause A4 of Section A of Volume 3 the Employer's Requirements - General, the Contractor shall identify submissions required during the Construction Phase.

C12. CALCULATIONS

- (1) Unless otherwise required by the Engineer, calculations relevant to the Definitive Design (and Construction Reference Drawings, if required) shall be submitted for assessment with the respective Design Packages or Submissions.

The above calculations shall have been certified by the Contractor's Lead Designer and Lead Design Checker before submitting to the Engineer. The Engineer may require the submission of applicable software including in-house software programmes/ worksheets developed by the Contractor and/or designer, computer input and programme logic for his assessment prior to the acceptance of the computer output.

- (2) 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.

- (3) Similarly, the Contractor shall submit such further calculations as have been prepared in connection with the Construction Reference Drawings.
- (4) 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.
- (5) Copies of EXCEL spreadsheets and computer model data files sufficient to regenerate the model and re-run the analysis should be submitted together with the calculations to the Engineer.
- (6) The Contractor shall submit all calculations necessary to support proposals relating to the construction methods.

C13. DOCUMENT REQUIREMENTS

- (1) Drawings shall be prepared generally to A1 size, but to ISO A0 size where appropriate. Appendix 7 of this Volume 3 defines the Drawings and CAD Standards required for drawing preparation and submittal.
- (2) The Contractor shall submit 6 copies of his design and/or drawings for assessment by the Engineer. After the receipt of a Notice to proceed from the Engineer, the Contractor shall submit 6 copies of design and/or drawing for the use of the Engineer.
- (3) The submission of drawings may be by CAD Media files and Appendix 7 of this Volume 3 specifies the drawing submission requirements for CAD Media files.

ATTACHMENT C1 DESIGN CERTIFICATE

This Design Certificate refers to Submission No. which comprises:

[*Design Package No/the Definitive Design Submission/Construction Reference Drawings Submission No./Technical Submission No.] in respect of:

[description of the Permanent Works to which the submission refers]

The contents of this submission are scheduled in Section A below.

The documents scheduled in Section B below, for which a Notice to proceed has been issued, are of relevance to this submission.

LEAD DESIGNER'S STATEMENT

We certify that:

- (e) the design of the Permanent Works, as illustrated and described in the documents scheduled in Section A below, complies with the Employer's Requirements, local regulations and standards and *[see note 1 below]*;

OR (in the case of a Definitive Design Submission in respect of those elements identified under Clause C2 (6) of the Employer's Requirements - Design):

- 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 Section A below comply with the Employer's Requirements and
[see note 1 below];

OR (in the case of a submission of documents that do not strictly comply with previous documents for which a Notice to proceed has been received):

- a. the design of the Permanent Works, as illustrated and described in the documents scheduled in Section A below, complies with the Employer's Requirements and *[see note 1 below]* except in the following respects:
 - (i) (to be completed by Contractor/Designer)
 - (ii) (etc.)
- (f) A detailed review and design check has been undertaken and completed to confirm the completeness, adequacy and validity of the design of the Permanent Works as illustrated and described in the documents scheduled in Section A below;

(g) all necessary and required approvals relating to the design of the Permanent Works, as illustrated and described in the documents scheduled in Section A below, have been obtained and copies of such approvals are annexed in Section C below;

AND (in the case of a submission covering a part of the Permanent Works only):

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 "Authorised Representative"(for Designer)

Name

Position / Designation Date

LEAD DESIGN CHECKER'S CERTIFICATION

We certify that the Work described in Section A of this certificate has been checked by us, and meets the requirements of the Contract.

Signed by "Authorised Representative"(for Design Checker)

Name

Position / Designation Date

CONTRACTOR'S CERTIFICATION

This Certifies that all design has been performed utilising 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 that the design meets the requirements of the Contract and has been accepted by us.

Signed by "Authorised Representative"(for Contractor) Name

Position/Designation

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 to proceed has been issued.
- (iii) Design Packages Nos. for which a Notice to proceed has been issued if such Design Packages develop and amplify the Contractor's Technical Proposals.
- (iv) The Definitive Design

Section A

Submission no. comprises the following:

Drawings: *(Title, drawing number and revision)* Documents: *(Title, reference number and revision)* Others:

Section B

Documents for which a Notice to proceed has been issued and which are of relevance to this Submission No.

Document:

submitted with

[*Design Package No. /) The Contractor is required to
 the Definitive Design Submission No. /) provide this information in
 Construction Reference Drawings Submission No. /) respect of each document in
 Technical Submission No. /) Section B
 Date of Issue of Notice to proceed)
 (* Delete as appropriate)

Section C

[Contractor to attach copies of necessary and required approvals from statutory bodies, etc..]

SECTION B – EMPLOYER’S REQUIREMENTS - FUNCTIONAL

Document:

submitted with

[*Design Package No. /) *The Contractor is required to*
the Definitive Design Submission No..... /) *provide this information in*
Construction Reference Drawings Submission No. /) *respect of each document in*
Technical Submission No. /) *Section B*
Date of Issue of Notice to proceed)
(* *Delete as appropriate*)

Section C

[Contractor to attach copies of necessary and required approvals from statutory bodies, etc..]



Volume 3 Employer's Requirements

Section-D CONSTRUCTION

Brihanmumbai Municipal Corporation

Mumbai,

Maharashtra, India

SECTION D – EMPLOYER’S REQUIREMENTS-CONSTRUCTION

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D. CONSTRUCTION

D1. CONTRACTOR'S SUPERINTENDENCE

- (1) The Contractor shall submit a Staff Organisation Plan to the Engineer in accordance with Clause A15 of this Volume 3. 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 Project Manager and his site team shall have experience and qualifications 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 Notice, which shall be as a minimum those given in Clause A15 of this Volume 3.

D2. 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, based on the 'Design Certificate' enclosed as Attachment C1 in Section C of this Volume 3, signed by the Lead Designer and the Lead Design Checker, 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.

D3. THE SITE

- (1) Works Areas will be handed to the Contractor soon after the Commencement Date. For the works in the roads, pedestrian walkways, pavements, promenades etc. the respective site can be assessed after a traffic diversion plan is duly approved by the Traffic Police Department and relevant statutory authorities.

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, except that, with a Notice from 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 and shall be removed whenever instructed by the Engineer.
- (5) Entry to and exit from the Site shall be controlled by 24 hour security and shall be only available at the locations for which the Engineer has given a Notice. Notice will only be

given after the Contractor has provided evidence that he has obtained the necessary approvals from the relevant authorities.

Access to the Site

- (6) The Contractor shall make his own arrangements, subject to a Notice from the Engineer, for any further access required to the Site.
- (6) In addition, the Contractor shall ensure that access to every portion of the Site is continually available to the Employer and the Engineer.
- (7) Following the handover of the Works to the Employer, the Contractor will be still responsible for all matters relating to operation and maintenance referred in Clause 3.10 Section of Volume 1 and associated security and safety. Access to the Site shall be in accordance with a set of procedures laid down by the Employer.
- (8) 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 occurs as a result of the use of such access or egress by its employees and sub-contractors.

Survey of the Site

- (9) A survey shall be carried out of the Site to establish its precise boundaries and the existing ground levels within it, as detailed in Clause D4 of Section D of this Volume 3. This survey shall include a photographic survey sufficient to provide a full record of the state of the Site and adjacent areas/buildings before commencing the Works, 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 and in any case prior to the commencement of work in any Works Area. The survey shall be carried out by the Contractor and will require a Notice from the Engineer.
- (10) A Bathymetry survey shall be carried out along the proposed alignment before construction of creek crossing structures. This survey shall include creek bed profile, soil characteristics, characteristics of Tide, wave and surge etc. The area to be surveyed shall extend from the existing shore line to a distance of not less than fifty (50) meters beyond the control line of the proposed structure.

Barricades and Signboards

- (11) The Contractor shall erect barricades with gates around his areas of operations to prevent entry by unauthorised persons to his Works and/or Site Areas and necessary identity cards /permits should be issued to all of his workers and staff by the Contractor. The Contractor shall submit a proposal for barricades/gates around the complete perimeter of all Works areas for which the Engineer shall give a Notice. 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 an annual basis or sooner as required by the Engineer.

No work shall commence in any Works Area until the Engineer has issued a Notice signifying that he is satisfied that the barricades installed by the Contractor are sufficient to prevent, within reason, unauthorised entry. Project signboards shall be erected not more than two (2) weeks, or such other period as the Engineer has given his Notice, after the date for 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.

- (12) A Notice to Proceed from the Engineer shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in position after the completion of the Works shall be repaired and repainted as instructed by the Engineer.
- (13) 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 ownership transferred to the Contractor during the period of the Works. All the fencing, hoardings, gates and signs etc. shall be mopped a minimum of once a week and thoroughly washed once a month.
- (14) 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.
- (15) Hoarding/ barricades can be reused after removing from one place to other locations / sites provided they are in good condition and a Notice is issued by the Engineer.
- (16) Damaged/worn-out barricades /hoardings shall be replaced by the Contractor within 24 hours. The Engineer's decision regarding need for replacement shall be final and binding.

Clearance of the Site

- (17) 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 or better condition as existed before the Works started except as otherwise stated in the Contract.

Casting Yard

- (18) The Contractor has to make his own arrangements for a casting yard/works area(s) and other facilities without any liability to the Employer.
- (19) Upon completion of the Contract the area of land shall be cleared of all debris, structures made by the Contractor, RCC footings and rafts, rubbish and debris, etc. and returned to its original condition before being handing back to the Employer, at no extra cost to the Employer.
- (20) The final Interim Payment Certificate shall only be released to the Contractor after all structures, debris, rubbish, etc. have been removed from the casting yard/works area and the area returned to its original condition.

- (21) A Mechanical Type Washing Plant shall be installed by the Contractor for the use of all vehicles leaving the casting yard area to avoid any contamination or spillage on the connecting roads. The Contractor shall be responsible for providing access into the sites, clearing the sites of vegetation, removing unsuitable materials and placing disposal material with suitable compaction.
- (22) The Contractor has to make his own arrangement for muck disposal site.
- (23) The Contractor shall be responsible for providing access into the muck disposal sites, clearing the sites of vegetation, removal of unsuitable materials and placing disposal material with suitable compaction.
- (24) A mechanical type washing plant shall be installed by the Contractor for the use of all vehicles leaving the muck disposal site to avoid any contamination or spillage on the connecting roads.

D4. SURVEY

- (1) The Contractor shall be responsible for the survey reference points.
- (2) The Contractor shall relate the construction of the Works to the Project Grid. To facilitate this, survey reference points have been established and the Engineer will provide benchmarks and Traverse points in the vicinity of the Site areas.
- (3) 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 carry out detailed survey to check the proposed alignment maintaining vertical and horizontal clearances. In case of any differences from the Employer's drawings or data, the Contractor shall bring these to the Notice of the Engineer immediately and submit his proposals for correction. The Engineer shall either, issue a Notice, modify or ask the Contractor to resubmit the proposals within a period of 14 days. The Contractor shall satisfy himself that there are no further 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.
- (4) 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 recheck every three months, the position of all setting out points, bench marks and the like, for a Notice by the Engineer.
- (5) Upon handover to the Contractor, the survey reference points will become the responsibility of the Contractor. The Contractor shall check the survey reference points every three months to ensure that these survey points continue to remain consistent with

the bench marks.

D5. OCCUPATIONAL HEALTH SAFETY AND ENVIRONMENTAL REQUIREMENTS

The Contractor shall comply with the conditions and requirements stipulated in the Occupational Health, Safety & Environment (OHS&E) Plan contained in Appendix 17 of this Volume 3 - Employer's Requirements and in Sections 1 to 3 of Volume 7 Reference Documents.

D6. OTHER SAFETY MEASURES

- (1) The Contractor shall take all reasonable precautions and select appropriate tools, equipment and installation methods to avoid causing a nuisance arising from his operations and shall minimise inconvenience to the public.
- (2) The Contractor shall prevent dust from rising as a result of his activities and shall take all necessary dust control and suppression measures.
- (3) All Contractor's Equipment used on the Contract shall be fitted with a means of suppressing radio and television interference and shall be operated and maintained in such manner so as to minimise the emission of smoke and obnoxious fumes.
- (4) The Contractor shall be responsible for the security of the Site at all times during the term of this Contract. The Contractor shall control all entry and exit to and from the Site for his personnel, personnel from the Employer, Engineer, Interfacing Contractors, Sub- contractors and suppliers, by pedestrians and for all vehicles. All of the Contractor's personnel shall be required to carry an identity/security card or pass which provides positive photo identification and they shall be required to show the pass when entering or leaving the Site. This shall apply to all personnel on the Site including, but not limited to, the Contractor's staff, all Interfacing Contractors/ Interfacing Agencies, Sub-contractors staff, Suppliers, Consultants, etc. and the staff of the Employer and Engineer. Provision shall be made for issue of visitors' passes for other personnel authorized to enter the Site as visitors. Visitors on Site shall be escorted by appropriate Site based personnel at all times.
- (5) The Contractor shall be deemed to have made allowance in his price and programme for the impact on the Works as a result of any delay due to the provision of access to, and through the site generally, for Interfacing Contractors/Interfacing Agencies and MEP Subcontractor, relocation of temporary works, provision of security, lighting, signage, barriers, complying with all government and local authority regulations, etc.
- (6) No bridge and interchange segment erection methodology shall be used without a Notice to proceed being issued by the Engineer.
- (7) The Contractor shall prepare a detailed Methodology along with specifications of equipment for the bridge and interchange segment erection scheme for submission to the Engineer for a Notice.

D7. 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 Notice.
- (4) The discharge points of the temporary systems shall be as per the Notice 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 commence until the approved arrangements for disposal of the water have been implemented.
- (5) The methods used for keeping the Works free from water shall be such that settlement of, or damage to, new and existing structures does not occur.
- (6) Measures shall be taken to prevent settlement, damage, flotation, etc. to new and existing structures.

Protection of the Works from Weather

- (7) 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.
- (8) Permanent Works, including materials for such Works, shall be protected from exposure to all weather conditions that may adversely affect such Permanent Works or materials.
- (9) During construction of the Works storm restraint systems shall be provided to ongoing construction works, where appropriate. These systems shall ensure the security of the partially completed and ongoing stages of construction 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 throughout the Site.
- (10) The Contractor shall, at all times programme and order progress of the Works and make all protective arrangements such that the Works can be made safe in the event of storms.
- (11) The Contractor is responsible for any damage of work during construction due to tide, wave effect, surge etc. Damage to walls, rock cores, under layers and secondary armour which have not been fully protected with the final armouring is the responsibility of the Contractor.

Protection of the Work

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

D8. DAMAGE AND INTERFERENCE

- (1) Work shall be carried out in such a manner that there is no damage to or interference with:
- (a) Watercourses, drainage systems, water mains, sewerage system, etc.;
 - (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, as approved by statutory authorities, etc...
 - (f) 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 a Notice from 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 the same or better condition as existed before the work started.

Utilities

Refer to Appendix 11 of this Volume 3. Any claims by Utility Agencies due to damage of utilities by the Contractor shall be borne by the Contractor Deposits, if any required for shifting of utilities shall be borne by the Contractor.

Structures, Roads and Other Properties

- (3) The Contractor shall immediately inform the Engineer of any damage to structures, roads or other properties at handover of the site(s) or during the Contract duration.

Access

- (4) Alternative access shall be provided to all premises if interference with the existing access, public or private, is necessary to enable the Contractor's Works to be carried out. The arrangements for the alternative access shall be as agreed by the Engineer and any concerned agency or building management. 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 when it is no longer required, and the ground surfaces reinstated to its original position to the satisfaction of the Engineer. Proper signage and guidance shall be provided for the traffic / users regarding diversions.

Trees

- (5) (a) The Contractor is not permitted to cut or fell any trees without first obtaining approval from the appropriate authorities and then obtaining a Notice from the Engineer. The Contractor shall identify all trees that require cutting or felling and make applications to the appropriate authorities and the Engineer for the necessary works at least 6 months in advance of the required date for the cutting or felling works.
- (b) Tree cutting outside non-permanent works areas should be avoided as far as possible and specific justification needs to be submitted for approval from the appropriate authorities and for Engineer for a Notice before cutting trees in these areas.
- (c) Trees which are found suitable for transplanting, as decided by the Engineer, need to be replanted in an area near to the site (within 1 km) at locations determined by Engineer.
- (d) Maintenance of trees transplanted outside the works area will become the responsibility of the Employer.

Removal of Graves and Other Obstructions

- (6) 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 the Contractor shall not remove them without first obtaining approval from the appropriate authorities and then obtaining a Notice from the Engineer.

Protection of the Structures Above and Adjacent to the Works

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

Pre-Construction Surveys of Adjacent Buildings and Structures

- (8) The Contractor shall submit details of the measures he intends to take to protect those buildings or structures, as potentially susceptible to damage during the construction of the Works, to the Engineer for a Notice for the proposed measures.

Prior to commencing any work within the zone of influence of the buildings and structures, the Contractor shall complete a pre-construction survey to identify and record and structural audit of any existing defects in the building structure and fabric. A separate survey report shall be prepared for each building/structure in the pre-construction stage, in an agreed format, and obtain a Notice from the Engineer.

The report shall include sufficient key plans, sketches, photographs and videos to enable easy

location of existing defects and comparison with possible future ones. Two coloured copies of all of the pre-construction survey reports shall be provided to the Engineer, and a further copy of the appropriate pre-construction survey report shall be issued to the building/structure owner for their information and a signed receipt form/letter acknowledging the owners receipt of such shall be retained by the Contractor.

Also refer to Volume 4 Clauses 3.4.3 and 3.4.4

D9. WORK ON ROADS

Traffic Management Plan

- (1) 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 any traffic disruption/congestion as a result of construction activities by identifying strategies for traffic management on the roads and neighbourhood impacted by the construction activities, which shall be submitted to the Mumbai Traffic Police for their approval and to the Engineer for his Notice to proceed. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract and shall comply strictly with the approved plan during the construction of his works. Also See Volume 5 Section 1 Outline Construction Specification-Road Works
- (2) Traffic Management shall include for the construction of diversion routes, or upgrading of existing roads for diversions, and the maintenance, including cleaning, of the same and the existing roads within 150m of the works for the duration of the Contract.

Principles for Traffic Management

The basis for the Plan shall take the following into consideration:

- 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.
- To make the most efficient use of the restricted area available, whilst minimising disturbance to the general public.
- The design shall maintain the existing Level of Service by providing at least a minimum carriageway width equivalent to the existing number of traffic lanes. To facilitate the same, temporary roads and temporary road decking shall be provided where necessary, which must be maintained at all times, shall be approved by the Mumbai Traffic Police Department and maintained at all times.
- The Traffic Management Plan shall provide for a minimum of 2m of footpath adjacent

to buildings or thoroughfares for all road diversion schemes.

- The Contractor should take into account that the construction of the road and substructure and superstructure which may have to be done in phases to ensure that the traffic management plan provides existing Level of Service by providing a minimum carriageway to the existing number of traffic lanes.

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, including arrangements being implemented by other contractors, to smooth traffic operations and for the safety of both construction workers and road users. The Plan shall consider different measures such as:

- The use of suitable construction sequences and methods for the construction of substructure and superstructure of bridges and interchanges, to reduce the period of disruption to road users;
- proper phasing and timing of traffic signals;
- modifications to intersection geometry;
- changes in lane usage;
- parking prohibitions;
- re-location of bus stops;
- maintenance of existing roads within the vicinity of the Works areas;
- 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;
- at all times scrupulously follow the conditions and directions provided by the Traffic Police Department
- other engineering traffic measures as may be applicable.

Mitigation of Traffic Disturbances

- (1) 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.
- (2) 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.

- (3) 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. The signage required for diversion shall be provided by the contractor.

Other considerations include:

- The minimum lane widths for fast traffic and mixed traffic shall follow the regulations of the different authorities.
- The design shall maintain the existing Level of Service by providing minimum carriageway width equivalent to existing number of traffic lanes with a minimum of 2m of footpath adjacent to buildings or thorough fares or agreed by the Engineer.
- 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.
- The type, size, lighting, painting etc., requirements for barricades, hoardings and fencing shall be as detailed in Volume 5 or as required by the Engineer.
- Access to business premises and property shall be maintained to the extent that normal activities are not seriously disrupted.
- Minimum footpath width shall be 2m, 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;
- The Contractor's temporary traffic management plan shall be coordinated with the works and traffic arrangements of other contractors where these interface with this Contract.

- 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

- (4) The Contractor shall make all arrangements with and obtain the necessary approval from the transport authorities and the Mumbai Police Traffic 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 Mumbai 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.

The Contractor shall take into account in his bid that traffic diversions that will be required in the vicinity of the project site.

Temporary Traffic Arrangements and Control

- (5) 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. Temporary traffic arrangements shall also include but shall not be limited to the construction of temporary foot bridges and/or temporary subways to maintain access for pedestrian access during construction where the existing access is affected by the construction.
- (6) Temporary traffic arrangements and control for work on public roads and footpaths shall comply with the requirements of the Mumbai Traffic Police. Copies of documents containing such requirements shall be kept on the Site at all times. Contractor has to effect the necessary changes suggested by Mumbai Traffic Police from time to time for management of traffic.
- (7) Temporary traffic signs, including road marking, posts, backing plates and faces, shall comply with the requirements of the Mumbai 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.
- (8) Adequate number of traffic marshals shall be deployed for smooth regulation of traffic.
- (9) 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

- (10) The following particulars of the proposed temporary traffic arrangements and control on public roads shall be submitted to the Engineer for his Notice to proceed, 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 Mumbai Traffic Police or any other relevant authorities, including copies of applications, correspondence and approval.
- (11) 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 sections of the barrier. Contractor has to liaise with and agree with the adjacent business proprietors and residents regarding the access to the property and the traffic arrangements.
- (12) 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

- (13) 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.
- (14) 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.
- (15) Surfaced roads on the Site and leading to the Site shall not be used by tracked vehicles unless protection against damage is provided.
- (16) 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

- (17) All street furniture, including signs, stone kerbs, boxes, lights, traffic lights, etc., that has to be removed due to the Contractor's works or temporary traffic arrangements whereby the Contractor shall arrange for their storage, either in the relevant Government Departments or at the Contractor's own works area(s), for which an agreed inventory, including a photographic record, shall be submitted to the Engineer for a Notice. Existing street furniture shall be reused where ever possible, and any street furniture that can't be reused shall be sent to Municipal Godown.
- (18) Temporary diversions, pedestrian access and lighting, signing, guarding and traffic control equipment shall be removed immediately when they are no longer required. Roads, footpaths, street furniture and other items affected by temporary traffic arrangements and control shall be reinstated to their original 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 for carrying out the work, Notice to Proceed shall be obtained from the Engineer. Reinstatement works shall include, but not be limited to,

thefollowing:

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

Responsibility of Contractor in Implementing Traffic Diversion Plan

The Contractor shall implement the traffic diversion plan subsequent to approval of traffic diversion plan by Traffic Police.

Prior to the implementation of any works affecting road and pedestrian traffic, the Contractor shall determine the requirements for the Traffic Diversion Plan schemes and conduct a detailed assessment of the proposed outline Traffic Diversion Plan for Notice to proceed by the Engineer and for approval by Relevant Authorities. The assessment shall include:

- a. A detailed proposal on the construction sequence, programme and outline TDP schemes besubmitted and the impact on traffic;
- b. Estimates of the peak volume of construction traffic that will be generated during each phase of construction, together with plans showing the proposed routing of construction traffic to and from the site;
- c. Additional details of traffic management schemes, including diversion routes, that the contractor intends to implement for construction of the works;
- d. Traffic impact analyses to demonstrate the impact of construction traffic and the contractor'sproposed traffic management schemes on the surrounding road network;
- e. Additional field surveys and studies to establish traffic conditions where appropriate;
- f. All such additional information as may be required for the detailed design of the traffic management schemes;

- g. Construction and liaison with Relevant Authorities with a view to developing a design thatcauses minimal impact and is acceptable to all affected parties; and
- h. Inversion routes' road capacity improvement measures such as parking restrictions, removal of road humps, overhead constraints due to wires and trees, road pavement improvement, junction widening for ease of vehicle turning, signal timing change etc.

The Contractor shall also provide Consultants and the relevant authorities with plans and diagrammatic representations to accompany publicity material related to the approved TDPs. The Contractor shall be responsible for the construction, manufacture, supply, erection, relocation and subsequent removal of all temporary traffic signs, directional signs, bollards,

streetfurniture, street lights, roads and road markings related to the TDP Schemes. All temporary signs required for implementation of traffic diversions and contractor's TDP schemes shall be designed in accordance with the relevant codes of practice such as the Indian Roads Congress, Ministry of Road Transport & Highways and Indian Standards. The contractor shall note that no traffic signal, traffic sign and road marking in the public roads shall be erected, relocated or removed unless authorised by GC, Traffic Police and Relevant Authorities. Furthermore, no roads, lanes or footpaths shall be opened or closed unless authorised by Consultants, Traffic Police and Relevant Authorities.

The Contractor shall protect the works related to TDP schemes from damage until such time as the works have developed sufficient strength to carry normal traffic loads without any damage to those works. The contractor shall also take up maintenance responsibility of TDP Schemes.

The Contractor shall be responsible for the temporary removal of existing signs (regulatory, warning and information type), bollards, street furniture, street lights, associated ducting, road markings, etc. that may affect the TDP schemes. Before any existing pedestrian route is severed or diverted, the contractor shall submit a detailed proposal to the Consultants, for his onward submission to Relevant Authorities for approval. However, obtaining approval of Relevant Authorities on all such Contractor's proposal shall be responsibility of Contractor. The detailed proposal shall include:

- a. The width of the existing pedestrian route;
- b. Pedestrian volumes prior to diversion;
- c. The width of the diverted pedestrian route;
- d. The anticipated pedestrian volume along the diverted pedestrian route; and
- e. Proposed temporary pedestrian direction signs.

The Contractor shall ensure all existing or diverted pedestrian routes within the site are paved, protected, sign posted, illuminated, clean and maintained in good condition to Consultants satisfaction.

Marine transportation

For marine transportation, refer to clause no. D14 (14) of this volume.

D10. SITE ESTABLISHMENT

Engineer's Site Accommodation

- (1) Within 30 days of the Commencement Date, the Contractor shall provide and maintain site accommodation for the Engineer's staff as set out in Appendix 13 and at a location given a Notice by the Engineer. The accommodation shall be retained until 90 days after the issue of a Taking-over certificate for the Works by the Engineer.
- (2) The Contractor shall submit details of the site accommodation layout to the Engineer for a Notice, prior to establishing the accommodation.

- (3) The accommodation shall be cleaned and serviced daily and security shall be provided 24 hours a day, 7 days per week. Full capacity stand-by power shall be available during periods when main power is unavailable. The Contractor shall also provide Uninterrupted Power Supply equipment to the computer facilities provided by the Engineer in the site accommodation.

Site Laboratory

- (4) 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 issued a Notice by the Engineer. Detailed requirements for this laboratory are set out in Appendix 13 of this Volume 3

External Laboratory

- (5) The tests shall be conducted in external laboratories as required. Such laboratories shall be fully equipped and authenticated to carry out the required tests, and duly noticed by the Engineer.

Contractor's Site Accommodation

- (1) The Contractor shall provide and maintain its own site accommodation at locations issued a Notice 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 and shall comply with the requirements of Attachment D1 of this section. Under no circumstances is living accommodation to be provided on the Site. The Contractor shall comply with the requirements of Appendix 8 of this Volume 3.

Latrines and Wash places

- (2) 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 a Notice from the Engineer. The Contractor shall arrange regular disposal of effluent and sludge in a manner that shall be in accordance with local laws/ regulations.
- (3) 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

- (8) (a) The Contractor shall be responsible for providing water, electricity, telephone, sewerage and drainage facilities for the Engineer's site accommodation, Contractor's site offices, structures and buildings and for all site laboratories 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 note the requirements for the supply and provision of power and water services for all Interface Contractors, as noted in Appendix 16 of this Volume 3.
- (c) The contractor shall be responsible for provision of power supply for his works. The Employer cannot guarantee provision of adequate, continuous power supply; however assistance will be given in trying to obtaining the necessary permissions for site generators and the like.
- (9) 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.
- (10) Any operation of the Works that interferes with the inspection of the Works and/or the checking of lines and levels shall be temporarily suspended at the request of the Engineer until the checking is complete.

Submission of Particulars

- (11) The following particulars shall be submitted to the Engineer for his Notice to proceed not more than fifty six (56) days after the Commencement Date 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.
- (12) Drawings showing location of stores, storage areas, concrete batching plants and other major facilities and their access roads/paths shall be submitted to the Engineer for his Notice 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.

D11. 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 cases as described under Clause D3 (8) of these Employer's Requirements – Construction (Section D). He 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 a Notice from the Engineer, erect a security

fence/barricade, with a minimum height of 2m, around the site areas, with only specific points at which entry through the fence/barricade can be effected, and shall provide gates or movable barricades at such points of entry and thereby maintain a twenty four hours a day, seven days a week security guard and such other security personal and patrols elsewhere as necessary to maintain security.

- (2) The Contractor shall maintain all site boundary fences in a 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 his own and his 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 ID 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 ID 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 for issuing passes to any visitors or persons/vehicles belonging to agencies other than Employer/
- (5) Engineer/Interfacing Contractors who may have to visit the site in connection with work.
- (6) The Contractor shall liaise with the Contractors responsible for the other Projects and other Interfacing Contractors 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.
- (7) Security and checking arrangements as felt necessary shall be provided with advice and help of the Police.

D12. 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 project works and shall conduct all necessary factory, site and acceptance tests.
- (2) 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.

- (3) 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.
- (4) 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.
- (5) 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.
- (6) 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.
- (7) Unless a Notice is issued by the Engineer, the personnel engaged on testing shall be independent of those directly engaged in the design or installation of the same equipment.
- (8) All testing equipment shall carry an appropriate and valid calibration labels.
- (9) All tests shall be carried out in the presence of the Engineer's Representatives.

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) Unless agreed otherwise by the Engineer samples taken on the Site shall be selected by, or 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:
 - (d) material previously tested no longer complies with the specified requirements; or
 - (e) 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 a Notice has been issued 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 a Notice.
- (20) Unless agreed otherwise by the Engineer 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 D12 (18) above and particulars of the laboratory proposed shall be submitted to the Engineer for his Notice to proceed 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 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 property.

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;
 - (k) method of testing;
 - (l) readings and measurements taken during the tests;
 - (m) test results, including any calculations and graphs;
 - (n) specified acceptance criteria; and
 - (o) other details stated in the Contract.
- (28) Reports of tests shall be signed by the Project Manager 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.

PRODUCTION TESTS (AT FACTORY)

- (30) Should the Works include any equipment not previously proven in service the Contractor shall undertake a thorough testing of the same at pre-production stage to the satisfaction of the Engineer. The Contractor shall identify any equipment in this category, or equipment that differs significantly from that already in service elsewhere.
- (31) All materials, components, sub-assemblies, unit assemblies (including software, cables and wiring) shall be subject to testing and certification. Notification of these tests shall be submitted to the Engineer thirty (30) days in advance of carrying out any tests, The Engineer will then determine which items, if any, may be accepted based on previous supply or experience.
- (32) Factory Tests shall include but not be limited to:
- Physical inspection
 - Dimension check
 - Electrical check
 - Calibration
 - Output check
 - Operational performance
 - Full Load test
 - Flash-over test
 - Insulation test
 - Soak test
 - Non-destructive test to assess integrity or strength of parts
 - As specified by the manufacturer.
- (33) Where processor based equipment is to be used then the Manufacturing Test shall include also verification of software used in this application.

POST INSTALLATION TESTS (ON SITE)

- (34) During and on completion of the installation, the Contractor shall undertake testing of all cables, wiring and equipment, instrumentation and protection devices, in a progressive sequence and in accordance with the overall testing programme. These tests shall culminate in functional tests to verify the correct operation of all apparatus and, where appropriate, correct response to the respective control commands or monitored function.
- (35) Following satisfactory completion of these Tests, the Contractor shall prepare the installation for official demonstration in the presence of the Engineer.

ACCEPTANCE TESTS

- (36) The Contractor shall prepare and organise a comprehensive programme of acceptance Tests to demonstrate to the Engineer that all systems, sub-systems and

apparatus defined under the Contract meet the specified performance requirements in all respects.

- (37) These Tests shall be conducted by the Contractor in the presence of the Engineer.

D13. 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 showing the information detailed in Appendix 7 of this Volume 3. 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 shall be digital and taken on locations agreed with the Engineer to record the exact progress of the Works. The number and size shall be as required in Appendix 5 (9) of this Volume 3.
- (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 a Notice, 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 information detailed in Appendix 5 (9) of this Employer's Requirements.
- (4) All photographs shall be taken by a skilled photographer using a digital single-lens reflex camera of at least 6 megapixels, whose name and experience shall be submitted to the Engineer for his Notice to proceed. Processing shall be carried out by a competent processing firm to the satisfaction of the Engineer.
- (5) The Contractor shall ensure that no other photography is permitted on the Site without a Notice from the Engineer. The Contractor should be aware of the local regulations and conditions with regard to Photography in some "RESTRICTED AREAS" in Mumbai.

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.

D14. MATERIALS

- (1) Materials and goods for inclusion in the Permanent Works shall be new unless the Engineer has issued a Notice 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 Volume 3. These materials shall be procured only from 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 have received a Notice from 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 Notice shall be kept on the Site by the Contractor in a secure dry storage room and shall not be returned to the Contractor or used in the Permanent Works unless the Engineer has issued a Notice to proceed. The samples shall be used as a means 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 a Notice.

Provision of Earthworks Material and Disposal including Waste

- (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 a Notice. A Notice to proceed will only be given after the Contractor has provided evidence that the Contractor is legally authorized to extract material from the source.
- (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 identified and provided by the Contractor and with the approval of the relevant authorities and having obtained a Notice from the Engineer.
- (8) All excavated material, excluding waste material, bentonite fluid and bentonite contaminated material shall be disposed of at approved sites 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.
- (9) The disposal of waste material, bentonite fluid and material contaminated with bentonite shall be the full responsibility of the Contractor and these materials shall

be disposed of by the Contractor in a location approved by relevant authorities.

- (10) The surplus excavated material (that cannot be used in the Works), shall be treated as Contractor's property. The Contractor shall be free to take away and make use of this surplus spoil (including rock spoil) in the manner he wishes to. However, the method of handling, transportation, place of storage, any processing/reprocessing at a plant (including its location) and its end use shall comply with all the rules and regulations in force including that pertaining to occupational Health, Safety & Environment (OHS&E) etc and as approved by the Employer/Engineer. The Contractor shall submit a detailed proposal to the Engineer for seeking the Employer's/Engineer's approval for the same.
- (11) The muck/spoil that is acceptable and can be used at a later stage in the Works, shall be temporarily stockpiled in a dumpsite as proposed by the Contractor and agreed by the Engineer and the concerned regulating authorities with no extra cost to the Employer. No extra land shall be provided by the Employer for such stockpiling.
- (12) The surplus muck/spoil (soil/spoil/material/building debris), which is not acceptable or cannot be accommodated for use in the Works or cannot be made use of by the Contractor for his own purpose, shall be disposed of at the approved dumping area(s).
- (13) For disposing of the spoil/muck at a muck-disposal site, the Contractor shall take, but not be limited to, the following measures to ensure proper muck/spoil disposal and adequate site rehabilitation:
 - The muck disposal site shall be ecologically restored to the maximum extent possible duly ensuring that the water quality, air quality and the soils and vegetation of surrounding areas are not contaminated.
 - The adequate precautionary measures shall be implemented by the Contractor at disposal site to ensure that there is no possibility of soil erosion and other impacts of loose soils on the local water bodies.
 - The Contractor shall ensure that the muck disposal site will be free from active landslides or creeps and will not have a possibility of toe erosion related slope failure.
 - The Contractor shall ensure that disposal of muck/spoil at muck dumping site shall not lead to flooding being caused in the surroundings.
 - The dumped muck shall be mechanically compacted in layers and properly levelled with suitable safe slopes duly ensuring that proper drainage is provided for to eliminate problems being caused due to lack of or improper drainage. In this respect the Contractor shall submit a detailed method statement to the Engineer for obtaining a Notice to Proceed.
 - To protect the dump from getting disturbing by human and domestic animals activities, fencing shall be provided at the perimeter of the muck/spoil disposal

site. The Contractor shall also establish temporary wind barrier around the dump areas to eliminate air pollution being caused due to wind blowing over the dumping site

- (14) The transportation shall be through creek by barges. This includes all material for construction and construction machinery and equipment. Following measures shall be taken by the Contractor
- Barges, pontoons, etc., used as working platforms, must be fit for purpose, properly constructed and sufficiently stable to avoid tipping.
 - All Barges shall be well maintained and equipped with protection measure to avoid any spillage of the loose material during its transportation
 - The Contractor shall get prior approval of the navigational route and associated transportation logistics from concerned authorities, prior to commencing of the activity.
 - Consideration must be given to the operational limits of such floating plant, which may use for material handling, in terms of wave and current forces as well as operable wind speeds.
- In addition to the measures as stipulated in the Contract elsewhere, the following measures shall also be taken by the Contractor for lorry movement/operations carrying muck/spoil to and from the muck disposal site:
- All dumpers and trucks shall be well maintained and equipped with tarpaulin sheets and hooks for covering of the loose spoil properly during its transportation.
 - The vehicle speeds on unpaved roads shall be restricted to 25 Kmph.
 - The Contractor shall maintain valid PUC – Pollution under Control certificates and maintain proper maintenance records for their fleet ;
 - Wheel wash system shall be installed and operated at the exit of the muck/spoil disposal, so that the muck on the tyres of the trucks is cleaned properly before they move on the roads to prevent dirtying of the public roads.
 - To control fugitive dust emissions arising during material handling, the heights from which muck/spoil is dropped shall be reduced to a practical minimum height.
 - Dumping shall be avoided during the high speed wind, so that suspended particulate matters (SPM) level could be maintained to the acceptable level.
- (15) The Contractor shall note that the muck disposal site location designated for this Contract falls in the semi urban area with reasonable road access. However, if good motorable conditions lack either within the disposal site or its approaches during the course of muck-disposal, any attention needed to these roads to make them worthy of Lorries' movement shall be the Contractor's

responsibility.

- (16) The Contractor is responsible for obtaining the requisite approvals from the concerned local authorities for his Lorries' movement plan and their operation.
- (17) In case the Contractor chooses to recycle the spoil (including the rock spoil) for his own purpose, the temporary storage and processing facilities shall have to be taken care of by the Contractor at his own cost.
- (18) Any Octroi, Royalty, statutory payments/levies or any other charges etc. payable on the spoil/muck for its disposal or recycling (for Contractor's own purpose) shall have to be borne by the Contractor.

D15. PROVISIONS FOR INTERFACING CONTRACTORS

- (1) The Contractor shall carry out all reasonable civil, structural and building works necessary for the project as required by the Interfacing Contractors. These works shall include, but not be limited to, forming holes, casting plinths and trenches, casting in components and forming holes in pre-cast elements, etc...
- (2) The Employer and Engineer will hold Project Quarterly Review Meetings at three monthly intervals. The Contractor shall attend these QRM and shall report the progress of his works and the state of his interface with other Interfacing Contractors and shall provide the Engineer with the necessary assistance and information for conducting the QRM. Refer to Clause A18 of Section A of these Employer's Requirements.

D16. RESTORATION OF AREAS DISTURBED BY CONSTRUCTION

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

All areas affected by the construction work shall be reinstated to their original condition, or better, with new materials, including but not necessarily limited to, sidewalks, parking lots, access roads, adjacent roads, adjacent properties and landscaping. Grass cover shall be provided for any bare earth surface areas, along with proper provisions for surface drainage.

D17. Not Used

D18. DEMOLITION OF EXISTING STRUCTURES

- (1) The Contractor shall be provided the site areas free of legal encumbrances to access, fencing and the undertaking of the works. The Works shall include the demolition of all structures necessary for the construction of the bridges and interchanges and ancillary structures required by the Contract Documents. The structures to be demolished include buildings, boundary walls, water sumps, water

wells, bus stops etc. The buildings to be demolished include, but are not necessarily limited to, those listed in Building Survey reports in Volume 8.

- (2) The Contractor shall be responsible for obtaining the necessary permits and approvals for undertaking the demolition works. These will require the Contractor to undertake a structural inspection of all structures and prepare a demolition method statement. This report should detail the protective hoarding works required prior to the commencement of demolition, the sequence of demolition and any temporary strengthening/protective works required to be added to the structures during the demolition. The Contractor should pay particular attention to the demolition of cantilever structures.
- (3) The Contractor shall ensure that all utilities, drainage and sewerage are properly disconnected before commencing demolition.
- (4) Foundations and underground structures of the existing structures should be broken-down to 2 m below ground level, and voids under this level are to be filled with suitable compacted material.
- (5) Where indicated on the Drawings in Volume 6 the Contractor shall partially demolish, or slice, existing buildings to approximately the line shown. The slice works shall include the demolition of part of the building and temporary sealing of the remaining portion of the building. The final reinstatement of the remaining building shall be undertaken by others. The exact slice line shall be as determined by the Contractor to suit the structural system and functional requirements of the existing and sliced building. The first step of the slicing works shall be a structural and functional survey of the existing building to determine structural limits of the slicing and what modifications are required to ensure functional, including normal and emergency access, drainage and utilities operation of the building. Preferably the remaining portions of the building should remain in operation during the slicing, but where this is proven to be not possible the Employer will arrange the temporary vacation of the building. The Contractor shall prepare a slicing method statement including detailed proposals for the temporary and permanent works required. The works shall include temporary protection hoardings, demolition works, and new building sealing works. The permanent reinstatement shall be done by others.

D19. REINSTATEMENT OF EXTERNAL AREAS

- (1) The Contractor shall reinstate the external areas as affected by the works to same condition as at the date of hand over except where shown differently in the intermodal drawings for each location in Volume 6 or elsewhere in the Contract Document. The extent of reinstatement shall be at least 150m in all directions from the edge of the structure constructed. At the commencement of Works the Contractor shall take an inventory of affected features including a photographic/video record covering the area that will be affected which shall be submitted to the Engineer for Notice. The details of the reinstatement works shall be agreed with the appropriate Authorities and receive a

Notice from the Engineer before the reinstatement works commence.

- (2) Reinstatement works shall include;
 - i. Road, footpath and landscape area pavements,
 - ii. Kerbs, medians, railings, safety rails and other road furniture,
 - iii. Road signage,
 - iv. Road marking,
 - v. Traffic lights,
 - vi. Street lighting,
 - vii. Bus stops,
 - viii. Hard Landscaping including furniture,
 - ix. Soft Landscaping, and
 - x. Boundary walls.
- (3) Except where shown otherwise the reinstatement of the following are not included in the Works;
 - a. Buildings,
 - b. Water wells,
 - c. Water sumps, and
 - d. Trees.
- (4) Contractor should provide assistance to others to transplant or reinstate trees within the works area.

ATTACHMENT D1 CONTRACTOR'S LABOUR CAMP

1. EMPLOYER WILL NOT PROVIDE QUARTERS FOR CONTRACTOR'S LABOUR

The Employer will not provide living accommodation for the use of the Contractor or any of his staff or labour employed on the Works. Living accommodation shall not be established on any land provided to the Contractor by the Employer.

2. PROVISION OF LABOUR CAMP

If necessary the Contractor, shall, at his own expense, make adequate arrangements for the housing, supply of drinking water and provision of bathrooms, latrines and urinals, with adequate water supply, for his staff and workmen directly or through Sub-contractors employed on the Works at the location authorised by the Engineer. No labour camp shall be allowed at any work site or any unauthorised place.

The Contractor at his own cost shall maintain all campsites in a clean and sanitary condition. The Contractor shall obey all health and sanitary rules and regulations, and carry out at his cost all health and sanitary measures that may from time to time be prescribed by the Local/Medical Authorities and permit inspection of all health and sanitary arrangements at all times by the Employer, Engineer and the staff of the local municipality or other Authorities concerned. Should the Contractor fail to provide adequate health and sanitary arrangements penalty will be levied

on the Contractor and the same will be recovered from his running account bills

The Contractor shall at his own cost, provide First Aid and Medical facilities at the Labour Camp and at work sites on the advice of the Medical Authority in relation to the experience, and number of the Contractor's staff and workmen, employed directly or through Sub-contractors.

The Contractor shall at his own cost, provide the following minimum requirements for fire precautions:

- Portable Fire Extinguishers.
- Manual Fire Alarms.
- Water Supply for use by the Fire Service.

The Contractor at his own cost shall provide necessary arrangements for keeping the camp area sufficiently illuminated to avoid accidents to the workers. He should also ensure that electrical installations are done by Trained Electricians. These installations shall be maintained and daily maintenance records must be made available for inspection of the Engineer.

3. CAMP DISCIPLINE

The Contractor shall take requisite precautions, and use his best endeavours to prevent any riotous or unlawful behaviour by or amongst his workmen, and others, employed directly or through Sub-contractors. These precautions shall be for the preservation of the peace and protection of the inhabitants and security of property in the neighbourhood of the Works. In the event of the Employer requiring the maintenance of a Special Police Force at or in the vicinity of the site, during the tenure of the work, the expenses thereof shall be borne by the Contractor and if paid by the Employer, shall be recoverable from the Contractor.

The sale of alcoholic drinks or other intoxicating drugs or beverages upon the work, in any labour camp, or in any of the buildings, encampments or tenements owned or occupied by, or within the control of, the Contractor or any of his employees directly or through Sub-contractors employed on the work, shall be forbidden, and the Contractor shall exercise his influence and authority to secure strict compliance with this condition. The Contractor shall also ensure that no labour or employees are permitted to work at the site in an intoxicated state or under the influence of drugs.

The Contractor shall remove from his camp such labour and their families, who refuse to accept protective inoculation and vaccination when called upon by the Medical Authority. Should Cholera, Plague or any other infectious disease break out, the Contractor shall at his own cost burn the huts, bedding, clothes and other belongings of, or used by, the infected parties. The Contractor shall promptly erect new huts on healthy sites as required by the Employer, within the time specified by the Employer.

4. LABOUR ACCOMMODATION

The Contractor shall provide living accommodation that is equal to or exceeds the minimum criteria established in the following sub-sections, needed to house his staff, workers employed directly or through Sub-contractors. The buildings shall be constructed so as to have a minimum life of not less than the length of the Contract.

- (a) The roofs shall be watertight and laid with suitable non-flammable materials permissible for residential use under local regulations and for which a Notice from the Engineer has been obtained.
- (b) Each hut shall have suitable ventilation. All doors, windows, and ventilators shall be provided with security leaves and fasteners. Back to back units must be avoided.
- (c) The minimum height of each unit shall be 2.10m and shall have separate cooking place.
- (d) Suitable number of common toilets/bath facilities shall be provided.

5. WATER SUPPLY

The Contractor shall provide an adequate supply of water for the use of labourers in the Camp. The provision shall not be less than two gallons of pure and wholesome potable water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks of plastic, metal or masonry shall be provided. The Contractor shall also at his expense make arrangements for the provision and laying of water pipelines from the existing mains wherever available and shall pay for all the fees and charges therefore.

6. DRAINAGE

The Contractor shall provide efficient arrangements for draining away spillage water so as to keep the camp neat and tidy. Surface water shall be drained away from paths and roads and shall not be allowed to accumulate into ditches or ponds where mosquitoes can breed.

7. SANITATION

The Contractor shall make arrangements for conservancy and sanitation in the labour camps according to the rules and regulations of the Local Public Health and Medical Authorities. The Contractor shall provide a sewage system that is adequate for the number of residents in the camp, and which meets the requirements of the Municipality Authorities.

1.1.19 Anti-malaria and other health measures:

Anti-Malaria and other health measures shall be taken as directed by the Executive Health Officer of BMC. Contractor shall see that mosquito-genic conditions are not created, and proper and adequate preventive measures are undertaken. Contractor shall carry out anti-malaria

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measures in the area as per the guidelines issued by the Executive Health Officer of BMC from time to time. In case of default, in carrying out prescribed anti-malaria measures resulting in increase in malaria incidence, contractor shall be liable to pay BMC on anti-malaria measures to control the situation in addition to fine.