

ANNEXURE – 1 APPENDICES

TABLE OF CONTENTS

APPENDIX-01	2
PROGRAMME REQUIREMENTS	2
APPENDIX-02	11
METHOD OF MEASUREMENTS FOR PERMANENT WORKS	11
APPENDIX-03	12
QUALITY MANUAL	12
APPENDIX-04	22
ORGANISATION CHART AND KEY POSITIONS	22
APPENDIX-05	26
PLANT AND EQUIPMENT	26
APPENDIX-06	28
DOCUMENT SUBMISSION AND RESPONSE PROCEDURE	28
APPENDIX-7	32
WORK AREAS	32
APPENDIX-8	33
PROJECT CALENDAR	33
APPENDIX-9	34
DRAFTING AND CAD STANDARDS	34
APPENDIX-10	40
WORKS AREAS & TEMPORARY POWER-SUPPLY	40
APPENDIX-11	45
CURVE AND GRADIENT DETAILS	45
APPENDIX-12	46
UTILITIES	46
APPENDIX – 13	52
OFFICE ACCOMMODATION, EQUIPMENT AND PERSONNEL	52
APPENDIX – 14	53
CONTRACTOR'S SITE LABORATORY	53
APPENDIX-15	57
DELETED	ERROR! BOOKMARK NOT DEFINED.
APPENDIX – 16	57
DELETED	58

APPENDIX-01

PROGRAMME REQUIREMENTS

1.1 General

1.1.1 Construction Programme and project monitoring

1. The contractor shall propose and submit his detailed construction program separately and as per the procedure detailed in the scope of work. Contractor may be asked to schedule and complete the work block wise / area wise in a phased manner fixing priorities to different stretches of the work to give access to other interfacing contracts as mentioned in the Bid documents.
2. The tentative construction program shall be submitted within the period as specified in the Bid document for approval of the Employer as 'Baseline Program'. The base line program shall clearly reflect interface and access dates for other civil / system-wide contracts. The basis of the time schedule for each activity such as productivity of man and machines and time cycle of each activity and resource planning shall be submitted along with the base line program.
 - a. After the work has started, the contractor shall deliver in the first week of every month to the Employer and the Engineer an update of the Construction Program showing changes, if any, in planning or progress scheduling and reflecting the progress of all the activities of the network and the project status as at the end of previous month.
 - b. If the contractor falls behind the approved Construction Program by more than one month, he shall, within fourteen days of the date of such information, submit to the Employer for approval, a revision of the construction program showing the proposed measures, including augmentation of plant, labor and material resources to complete the works on time.
 - c. Whenever the contractor proposes to change the construction program, he shall immediately advise the Employer in writing and, if the Employer / Engineer considers the change a major one, the contractor shall submit a revised program for the approval of the Employer.
 - d. Detailed Network Plan (Works Program): Detailed Network Plan shall be prepared by the contractor for each and every activity within the same time frame and in the same sequence. Activity at this level shall not be more than 15 days' duration, except for summary items like procurement / mobilization etc.
3. The contractor shall select a PC-based broad planning and control software (licensed version of Primavera-P6). The two networks shall be implemented on works as detailed in the Scope of work. The contractor shall supply one original licensed copy of the software selected including manuals and any subsequent versions thereof at no extra cost along with the Baseline program network and detailed network plan and load it on the PC system of the Employer and Engineer so that uniform monitoring of the project is done and any slippages are identified well in time and corrective action taken. The contractor shall also arrange suitable training of the personnel of Employer and the Engineer on the selected software, if required, at no extra cost, as per the directions of the Employer.

The following reports, in agreed formats and frequency, shall be submitted by the contractor at his own cost:

- 1) Progress Reports
 - 2) Material Status Reports
 - 3) Equipment and Manpower Deployment Reports
 - 4) Any other Report desired by the Employer or the Engineer
4. The Employer / Engineer's monitoring team will have access to all the data / information of the contractor, required for the assessment of the progress and monitoring. If necessary, the monitoring team will visit the Vendor / Contractor's works in order to assess the status of critical activities.
 5. Periodic Project Status Review Meetings will be held by the Employer. The contractor shall depute his Engineers / Managers at appropriate level, as decided by the Employer, to attend the Review Meetings with all up to date information in a presentable quickly perusable format.

6. Progress photographs of the major events shall be submitted by the contractor along with the Progress Reports. Video Recording of the progress of works shall be maintained from beginning till completion of work as directed by the Engineer.
7. The contractor shall provide additional inputs whenever the PERT-CPM / network diagram (Primavera) indicates a possible slippage in the completion schedule. Such additional inputs may require supplementing of equipment, personnel, work in excess of the normal work per day, and work in excess of the normal work per week or other resources. Provisions in the relevant Clause of General Conditions of Contract will be applicable in cases of delays due to contractor.

1.1.2 Purpose of Program

- a) The purpose for the requirement of Program (Scheduling) information described in this document is to provide the Engineer with status reports for managing, monitoring and coordinating the awarded contract during the execution within the overall multi-contract project schedule. It describes a series of reports to be submitted by the contractor to the Engineer during the execution of the contract, following the award of Contract.
- b) Contractor shall program his work at all times to meet the Key Dates and the Works Area Hand-over Dates specified in the bid documents and the specified interface periods for the design and installation of the works with those of the Designated Contractors and shall during the progress of the works constantly monitor his progress against the programs described below.
- c) Contractor shall include in all programs his work obligations towards shared access, shared site areas and other coincident or adjacent Works Areas.
- d) The Works Program, and all more detailed or revised versions, shall be submitted to the Engineer for his consent.

1.2 Methodology

- 1.2.1 The computerized Primavera network using the Precedence Diagramming Method (PDM) has been selected by the Employer as the technique for contract management system and in coordinating the multi-contract project. This technique shall also be employed by the Bidder in preparing their Bid submissions and by the contractor in their Construction Stage submissions.
- 1.2.2 Unless otherwise agreed by the Employer, all programs submitted by the contractor shall be produced using computerized Primavera Networks developed implementing the Precedence Diagramming Method (PDM) with Resource Loaded Charts and Tables.
- 1.2.3 Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design, pre- construction, construction, and sub-contracts in executing the Primavera scheduling by PDM. The reports, documents and data shall be provided monthly and shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; work planned to be taken up during next month, shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

1.3 Programme management software

Primavera programming software used shall be Primavera 6.0 v 21.12 programming software shall be used.

1.4 Submissions

- 1.4.1 The contractor shall develop bid Program into the Initial Works Program including an outline Narrative Statement and submit within 28 days of the date of receipt of Letter of acceptance and its more detailed version within 15 days of receiving the Employer's consent to the proposed Initial Works Program.
- 1.4.2 Activities in the initial works program should be arranged as per the Works Break down Structure (WBS) of the work. The WBS of the work would be developed by the contractor in consultation with the Employer / Engineer. Contractor would get the WBS approved by the Employer and the program expert.

- 1.4.3 The first Three Month Rolling Program shall also be submitted along with Initial Works Program within 28 days of the date of receipt of Letter of Acceptance and all subsequent editions shall accompany the Monthly Progress Report. The Monthly Progress Reports shall also include a Program Update as described below. These programs shall subsequently be updated as described below.
- 1.4.4 Following the Employer's consent to Contractor's Initial Works Program submission, the contractor shall make submissions of the Detailed Works Program suitably amended to take into account the programs of Designated Contracts. It is the contractor's responsibility to ensure timely co-ordination with the Designated Contractors to review, revise and finalize his Initial Work Program so as not to affect the progress of Works / and or the works of the Interfacing Contractors. The resubmitted program when approved by the Employer and the program expert shall form the Baseline Program against which actual progress of the Contract shall be reckoned. As the work progresses, it may be necessary to update / revise the Baseline program but such updating shall only be carried out with the prior consent of the Employer / Engineer or when directed by them.
- 1.4.5 For Initial & Detail Work Program submission, one (1) original and six (6) copies each (along with electronic copy) of the following Programs and Reports shall be submitted to the Employer / Engineer:
- i. Program: Baseline Primavera Network
 - ii. Program: Baseline Milestone based Cost Activity Schedule
 - iii. Baseline Schedule Report
 - iv. Narrative
 - v. Baseline Physical Progress 'S' curve
 - vi. Baseline Resource Charts (with Resource levelling)
 - vii. Detailed Method Statement
- 1.4.6 The Employer / Engineer shall review and comment on the Contractor's programs and information submitted. The Engineer will confirm his consent or otherwise of the submissions.
- 1.4.7 The Employer / Engineer shall require the contractor to re-submit within fifteen (15) calendar days if he is of the opinion that the programs and information submitted by the contractor is unlikely to meet the Contract key dates.
- 1.4.8 If in the opinion of the Employer / Engineer, any of the contractor's revised programs or Baseline Schedule Report is not acceptable, it shall be construed as a failure of the contractor to meet a Milestone.
- 1.4.9 Notwithstanding the above, the Employer / Engineer may at any time during the course of the Contract require the contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if" statements. The initial computer-generated report after receiving the Engineer's consent will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.
- 1.4.10 Failure to include any element of work required for performance of the Contract shall not relieve the contractor from completing all works required under the Contract to achieve the original or any extended key completion date.
- 1.5 Works Programme**
- 1.5.1 The Works Programme shall show the contractor's plan for organizing and carrying out whole of the Works.
- 1.5.2 The Works Programme shall be a computerized Primavera network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly time scale.
- 1.5.3 Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:
- (a) Key Dates, and Works Area Hand-over Dates and Interface dates.
 - (b) All physical work to be undertaken in the performance of the Contract obligations, including Temporary Works,
 - (c) The requested date for issue of any drawings or information by the Engineer,

- (d) Procurement of major materials and the delivery and / or partial delivery date on-Site of principal items of Contractor's Equipment,
 - (e) Commissioning date of Contractor's major equipment
 - (f) Any off-site work such as production or pre-fabrication of components,
 - (g) Installation of temporary construction facilities,
 - (h) Interface periods with Designated Contractors or utility undertakings,
 - (i) Design, supply and / or construction activities of sub-contractors,
 - (j) Any outside influence which will or may affect the Works.
- 1.5.4 The Works Programme shall show achievement of all Key Dates, Interface dates and Works Area Hand-over Dates. The Works Program shall also show all Milestones, but the Milestones shall not be taken as imposing any constraints that in any way affect the logic or limit any other dates in the program.
- 1.5.5 Activity descriptions shall be unique, describing discrete elements of work. Any activity creating an imposed time or other constraint shall be fully defined by the contractor.
- 1.5.6 The Works Programme shall be organized in a logical work-breakdown-structure including work stages and phases, and shall clearly indicate the critical path(s).
- 1.5.7 Activity duration shall not exceed 15 days, unless otherwise consented to by the Engineer, except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The contractor shall submit a Program / Project Calendar cross reference clearly indicating the allowance for holidays.
- 1.5.8 The Works Program, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic and hard copy format (time scale logic diagrams in A1 / A3 size, reports in A4 size).
- 1.5.9 Activity Report shall list all activities, and events in the Works Program, sorted by activity identification number. The Activity Report shall include the following for each activity and event:
- i. Activity identification number and description,
 - ii. Duration expressed in Days,
 - iii. Early and late start & early and late finish dates. Planned start and finish dates,
 - iv. Calculated total float and free float,
 - v. Predecessor and successor(s), accompanying relationships and lead / lag duration,
 - vi. Imposed time or date constraints,
 - vii. Calendar.
- 1.5.10 **Narrative Statement**
- The Narrative shall be a comprehensive statement of the contractor's plan and approach for the execution of the Works and the achievement of key dates, handover dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences, launching scheme, resources required including primary item of plant, Construction Equipment required, person responsible, quality checks, inspection and test procedures, tolerances, Temporary Works and the like, risk analysis, etc. for carrying out that activity. It shall fully explain the reasons for the main logic links in the Program and include particulars of how activity duration is established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.
- 1.5.11 **Baseline Physical Progress 'S' Curve**
- The contractor shall also submit a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the Primavera Network Logic Diagram, expressed in percentage terms. This 'S' curve shall be generated from the computerized Primavera Network Logic Diagram.

1.5.12 Baseline Resource Charts

The contractor shall also submit a Resource Charts, generated from the Contractor's Primavera Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project. The Resources shall be properly leveled using primavera VP6 software.

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

1.6 Initial Works Programme

1.6.1 The Initial Works Programme submitted as under Clause 1.4.1 need not include the full details given under Clause 1.5 above. It should be a condensed version with combined activities of longer duration but must show clearly how the requirements of the Contract shall be achieved. Activities in the initial works program should be arranged as per the Works Break down Structure (WBS) of the work. The WBS of the work would be developed by the contractor in consultation with the Engineer. Contractor would get the WBS approved by the Engineer. The outline Narrative Statement shall be in sufficient detail to clearly show the contractor's intention.

1.6.2 Within 15 days of the Engineer's consent to the Initial Works Program, the contractor shall submit to the Engineer an expanded and more detailed version of the Initial Works Program containing all of the information and detail required under Clause 1.4 and 1.5 above.

1.6.3 Such submission shall make use of the Program submitted earlier but refined to include the best estimates of dates for the work of Designated Contracts which has impact on the contractor's program. Such programs shall be amended subsequently to incorporate the actual dates / schedule of the affecting contracts. It is the contractor's responsibility to ensure timely co-ordination with the Designated Contractors to finalize the Initial Program, without affecting progress of the work.

1.7 Works Programme Revisions

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

1.7.2 If at any time the Employer / Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Program, he may request the contractor to submit a proposed revised Program which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the contractor within fourteen (14) days after the Engineer's instruction. The proposed revised Works Program shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions. Revisions should not affect the overall completion of the project.

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

1.8 Three-Month Rolling Programme

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

1.8.2 The Three-Month Rolling Program shall be developed as an Primavera network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on an A4 and time-scaled networks diagrams on an A3 size reproducible media. Tasks in the program shall be derivatives of and directly related to tasks in the approved Works Program.

- 1.8.3 The contractor shall describe the discrete work elements and work element inter- relationships necessary to complete all works and any separable parts thereof including work assigned to sub-contractors within the contract period.
- 1.8.4 Activity duration shall not exceed two (2) weeks unless and otherwise consent of Engineer is granted.
- 1.8.5 Each activity in the Three-Month Rolling Program shall be coded, or described so as clearly to indicate the corresponding activity in the Works Program.
- 1.9 **Three-Month Rolling Programme Revisions and update**
- 1.9.1 The Three-Month Rolling Programme shall be extended forward each month as described under Clause 1.8.1 above. Each submission of the Three-Month Rolling Program shall be accompanied by a Program Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month period in order to achieve progress as per the approved Works Program.
- 1.9.2 If the Three-Month Rolling Program is at variance with the Works Program, the Program Analysis Report shall be accompanied by a supporting Narrative Statement describing the contractor's plan for the execution of the activities to be undertaken over the three- month period, including program assumptions and methods to be employed in achieving timely completion.
- 1.9.3 The contractor shall revise the Three-Month Rolling Program or propose revisions of the Works Program, or both, on a monthly basis to ensure consistency between them.
- 1.9.4 Three-Month Rolling Program (revised) to be submitted on a monthly basis by 5th of every month with respect to the progress achieved by the last day of the previous month. A penalty of ₹. 100,000 /l - (Rupees One Lakh) per instance will become applicable to the contractor for non-submission of the revised Three-monthly rolling program as per above clauses, irrespective of the causes lead to variances if any and the penalty will be **deducted in the subsequent IPC which will be non-refundable.**
- 1.10 **Weekly review**
- Once a week, on a day mutually agreed to by the Engineer and the contractor, a meeting will be held to assess progress by the contractor during the previous week, progress review which will also be attended by the programs Expert and the contractor's Program Engineer. The contractor shall submit a construction schedule listing activity completed and in-progress from the previous week and the activities scheduled for the succeeding two weeks based on the detailed Works Program. Copies of the schedule shall be submitted on A3 sized papers.
- 1.11 **Project Calendar**
- For the Project, the contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and Execution of Works. Official documents shall be transacted during 6 days' week– Monday through Saturday. For Project purposes, a week begins at 00:01 hours on a Monday and ends at 23:59 hours on a Sunday. The completion of an activity or the achievement of an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered week. An access date or activity start date when given as a week number shall be taken to mean 00:01 hours on a Monday of the Numbered week.
- 1.12 **Programming Personnel**
- The contractor shall submit, as part of its Staff Organization Plan, the names and required information for the staff to be employed on Works Programming. The principal Works Programmer shall hold reputable professional qualifications acceptable to the Engineer including at least five (5) years relevant experience in programming civil engineering works. Others in the group shall have at least three (3) years' experiences in such work. The programmers shall be employed by the contractor full time on the Contract until the completion or such earlier time the Engineer may give his consent.

1.13 **Programme and Report Submission Format**

The contractor shall submit one (1) original and six (6) copies and one (1) reproducible (for Programs) of all submissions to the Engineer. All submissions shall be in A0, A1, A3 or A4 size, as appropriate except as may otherwise be agreed by the Engineer. In addition, the computerized program and report shall be submitted in compatible discs. The format for all Program and Report submissions shall be strictly in accordance with the format as stated herein or as requested by the Engineer.

1.14 **Failure to submit Programme**

Failure of the Contractor to submit any programme, or any required revisions thereto within the time limits stated for acceptance by the Engineer, shall be sufficient reason for not making the relevant stage on account payment by the Engineer

The Contractor should actively participate in implementing PMIS & BIM system by Bi-RIDE

2. **Monthly Progress Reports**

2.1 **General**

The contractor shall submit to both the Employer and the Engineer, a Monthly Progress Report, in a format approved by the Employer. The format may be modified any number of times by the Employer and the revised formats shall be followed by the contractor from the date of advice of the same by the Employer. This Report shall be submitted by the end of each calendar month and shall account for all work actually performed from 26th day of the last month and up to and including the twenty-fifth (25th) day of the month of the submission. The above days (i.e., 26th and 25th) may be modified by the Employer. It shall be submitted in a format to which the Employer shall have given his consent and shall contain sections I sub-sections for, but not be limited to, the topics listed in clauses below.

2.2 **Physical Process**

- a) It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.
- b) It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Program.

2.3 **Programme Update (For Entire Project)**

Programme updating shall include

- (a) The monthly Program Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25th) of the month together with estimates of remaining duration and expected activity completion based on current progress. The above day (i.e., 25th) may be modified by the Employer. The Program Update shall be accompanied by an Activity Report and a Narrative Statement. The Narrative Statement shall explain the basis of the contractor's submittal:
 - (i) Early Work and Baseline Submittals - explains determination of activity duration and describes the contractor's approach for meeting required Key Dates as specified in the Contract.
 - (ii) Updated Detail Program Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:
 1. If the Updated Detailed Work Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.
 2. Identify by activity number and description, activities in progress and activities scheduled to be completed.

3. Discuss Variation Order Work Items, if any.

(b) The Program Status which shall: -

- (i) Show Works Program status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.
 - (ii) Be presented as a bar-chart of size A3 or A4 and as a time-related logic network diagram on an A1 media, including activity listings.
- (c) The Activity Variance Analysis which shall analyze activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and I or completed in advance of the Works Program.

2.4 **Three Month Rolling Program**

The monthly issue of the Three-Month Rolling Program.

2.5 **Financial Status**

It should include following

- a) A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.
- b) A spread sheet indicating the status of all payments due and made. c) A status report on status of extra items, if any

2.6 **Status of Claims**

A report on of the status on any claims outstanding. The report shall in particular provide interim updated accounts of continuing claims.

2.7 **Milestones I Key Dates Status**

A report on the status of all milestones I key dates due to have been achieved during the month and forecasts of achievement of any non-achieved key dates and those due in the next month, with explanatory remarks for not achieving them.

2.8 **Resources Status**

2.8.1 The contractor shall submit to the Engineer each month a detailed list by trade classification, of manpower employed during the report period, stock of all major construction materials as also a list of all serviceable major items of construction plant and equipment on site including those which are proposed to be mobilized during the next month.

2.8.2 A report on the status of deployment of all key personnel and other manpower by trade Vis – a - Vis their deployment schedule and explaining constraints if any.

2.8.3 Status of stock of all the major construction material vis -a- vis its requirements for next month.

2.8.4 Status of all serviceable major construction plant and equipment at site.

2.9 **Procurement Report**

2.9.1 A summary of all significant procurement activities during the month, including reasons of delay (if any) and action taken to overcome problems.

2.9.2 A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:

- (a) purchase Order Date – Scheduled / Actual,
- (b) manufacturer / Supplier and Origin,
- (c) letter of Credit Issued Date,
- (d) manufacturer / Supplier Ship Date – Scheduled / Actual,

- (e) method of Shipment,
- (f) Arrival Date in India – Scheduled / Actual.
- (g) Arrival date at site and commissioning date

The report should also explain the delays (if any) in arrivals of the major equipment at site and the actions taken by the contractor to expedite the same and the measures proposed to makeup the time loss.

2.10 Production and testing

It should include following:

- (a) A review of all production and manufacturing activities during the month.
- (b) Summaries of all production and manufacturing outputs during the month together with forecasts for the next month.
- (c) Review of all testing activities (both at site and at the manufacturer's premises) during the month.

2.11 Safety

A review of all safety aspects during the month including safety inspections / audits, reports on all accidents and actions proposed to prevent further occurrence.

2.12 Environment

A review of all environmental issues during past month shall include all monitoring reports, mitigation measures undertaken, and activities to control environmental impacts.

- 2.13** In case of failure of the contractor to make submissions as per section 1.4 herein above, the Employer / Engineer will retain 5% of the due progress payment till the submissions. For non-submission of Monthly Update and Progress Reports as per Clause 2 herein above, the Employer / Engineer will retain 5% of the due progress payment in each case, which shall be released upon submission of the same. In case the submissions are not made in the month it is due, the retained payment would be released only in the next Monthly Running Bill.

APPENDIX-02

METHOD OF MEASUREMENTS FOR PERMANENT WORKS

1. INTRODUCTION

- 1.1 The detailed procedure to be followed for the recording of measurements and for the preparation and passing of contractors Bills for permanent works is set out in the following paragraphs.

2. MEASUREMENT OF WORKS

2.1 General

- 2.1.1 Measurements shall be taken at such intervals as are found necessary or convenient. Generally, one bill will be preferred in a month or as specified in the contract.
- 2.1.2 Entries should be made only in ink, and no entry should be erased or defaced so as to make it illegible. Correction of mistake, if any, shall be made by neatly crossing out the incorrect entry and rewriting and correct words or figures. All such corrections should be initialed by the contractor's Engineer as well as by the Engineer's Representative at site.
- 2.1.3 Format of Record of Measurements sheets and procedure for issue of these measurement sheets will be as decided by Engineer in consultation with the Employer.
- 2.1.4 Before starting the earth work for embankment, cutting, bridge excavations etc., the initial ground levels shall be taken jointly along with engineer.

2.2 Items for which Good-for-Construction GFC Drawing is issued

- 2.2.1 As soon as the Good-For-Construction GFC drawing for a work is issued, the contractor will calculate the details of quantities of various items of PRICE SCHEDULE involved, in a format approved by Engineer, and submit the calculations and schedule of quantities to the Engineer / Engineer's Representative and get them approved for the drawing.
- 2.2.2 Once the schedule of quantities is thus approved, the contractor will submit five copies of the approved schedule to Engineer's Representative in an approved format.
- 2.2.3 The contractor will submit his payment claims based on the approved schedule of quantities along with certification of actual work done as per specifications, drawings and contract conditions and within the tolerances as specified. Measurement will be entered in Record of Measurement Sheet duly signed jointly on each page by contractor's authorized qualified engineer and Engineer's Representative.
- 2.2.4 Abstract of measurement will be prepared by the contractor in the approved form based upon these measurements.

2.3 Items for which Good-For-Construction GFC Drawing is not issued

- 2.3.1 For all such works, whose measurement cannot be calculated from any Good-For- Construction (GFC) drawing, all measurements will be taken by the contractor's authorized qualified Engineer in the presence of the Engineer's Representative at site. These measurements will be recorded on approved form of Record Measurement Sheet and signed jointly by contractor and Engineer's Representative.
- 2.3.2 Contractor will ensure that a properly qualified Engineer is deputed for taking measurements and also that all the measurements taken are witnessed and signed by the Engineer's Representative.
- 2.3.3 All measurements should be recorded at site on the Record of Measurement Sheet in the presence of the Engineer's Representative.
- 2.3.4 Each Measurement Sheet should be signed by the contractor's Engineer as well as by the witnessing Engineer's Representative.
- 2.3.5 Based on the recorded measurement, the contractor shall prepare abstract of quantities in the approved format.

APPENDIX-03 QUALITY MANUAL

Table of Content

1	Purpose	13
2	Scope	13
3	Definitions.....	13
4	Responsibilities.....	13
4.1	Project Directors	13
4.2	Senior Managers	14
4.3	Designers.....	14
4.4	Quality Managers and Officers.....	14
4.5	Section, Site, Discipline Engineers and Foremen.....	15
4.6	Supervisors.....	15
4.7	All Employees.....	15
5	Legal and Other Requirements.....	15
6	Quality Objectives.....	16
7	Quality Standards, Codes and Specifications.....	16
8	Tender and Procurement	16
9	Design and Engineering.....	16
10	Construction	17
11	Commissioning and Handover.....	18
12	Operations and Maintenance.....	19
13	Training	20
14	Closing.....	20
15	Quality Surveillance, Non-Conformities and Improvement.....	20
16	Quality Monitoring and Reporting.....	21

1 Purpose

This document titled 'Construction Quality Guideline' sets the minimum Quality Standards that are to be adopted and implemented across all the projects of the BSRP project Programs. This document only provides an outline and overview of the obligations, the detailed and specific quality requirements are described in Indian Legislation.

2 Scope

- a. This procedure applies to Bangalore Suburban Rail Projects and sub projects at BSRP, project information / records created regardless of format, which includes information generated by the General Consultant, D&B Contractor(s) and 3rd Parties.
- b. Bi-RIDE contracts complete packages. These packages consist in detail engineering, construction / production, quality planning, assurance and control and at last quality verification.
- c. Bi-RIDE requires the fulfilment of the BI-RIDE CMS Quality Policy, the quality objectives and the project quality plan(s) throughout the lifecycle of the contracted work

3 Definitions

Table 1: Definitions

Term	Definition
Bi-RIDE	The Employer and Client
General Consultant	Bangalore Suburban Rail Projects' General Consultant (Egis RAIL, AECOM & LBCPL JV).
The Engineer	The Delegated Client Representative to administer the Contract
Initiator / Originator	The person who starts the process.
Participant	The person who is or may be involved in the implementation of the procedure.
D&B Contractor	The organization contracted by the Employer to carry out the Project D&B works.
3 rd Parties	3 rd party Project stakeholders.
Project Partners	The term 'Project Partners' used throughout this document includes the Client, General Consultant, other Consultants, Contractors, Subcontractor's, Suppliers and anyone else who undertake works on the Bangalore Suburban Rail projects.

4 Responsibilities

4.1 Project Directors

- a. Provide positive leadership on quality issues.
- b. Promote an enthusiastic quality culture that delivers positive commitment to and engages all employees in continuous improvement in quality performance.
- c. Keep abreast of developments of Indian quality legislation and industry standards.
- d. Ensure that a quality management system is implemented within their sphere of responsibility and monitor and review its effectiveness and take necessary improvement action.
- e. Monitor that personnel under their control comply with their individual responsibilities in quality matters.
- f. Ensure that the disciplinary process to address breaches of the quality policy or management system is applied where necessary.

4.2 **Senior Managers**

- a. Senior Managers are people in the organisation at any level above senior supervisor and below director.
- b. Provide positive leadership on quality issues within their area of operation.
- c. Promote an enthusiastic quality culture that delivers positive commitment to and engages all employees in continuous improvement in quality performance.
- d. Implement the business unit quality management system. In particular:
 - i. Identify quality training needs and have the necessary training arranged and when arranged, release those who require training.
 - ii. Make arrangements for quality induction training for all new starters at the workplace under their control.
 - iii. Implement operating procedures, for the planning and control of activities associated with identified risks.
 - iv. Ensure that written method statements, risk assessments and/or quality rules are brought to the attention of management.
 - v. Appoint appropriate personnel to undertake quality duties.
 - vi. Ensure that suitable arrangements are in place for the effective control of changes to planned methods of work.
 - vii. Keep abreast of developments in Indian quality legislation and industry standards.
 - viii. Monitor and review the effectiveness of the quality management system and report deficiencies.
 - ix. Monitor that personnel under their control comply with their individual responsibilities in quality matters.
 - x. Give personnel under their control, including contractors, clear instructions as to their responsibilities to ensure correct working methods.

4.3 **Designers**

- a. Ensure staff, are competent and adequately resourced to address the quality issues likely to be involved in the design.
- b. Consider quality when designing structures, equipment systems, temporary works.
- c. When carrying out the design, provide adequate information about any quality risks associated with the design.
- d. Coordinate activities with that of others to improve the way in which quality is managed and controlled.

4.4 **Quality Managers and Officers**

- a. Provide positive leadership within their area of operation and promote the adoption of best practice.
- b. Promote an enthusiastic quality culture that delivers positive commitment to and engages all employees in continuous improvement quality performance.
- c. Keep abreast of developments in quality legislation and industry standards.
- d. Monitor and report on the effectiveness of the quality management system and progress against the quality performance standards and make recommendations for improvement as appropriate.
- e. Monitor and report on operational quality performance and make recommendations for improvement and monitor to ensure that effective action is taken.
- f. Lead and provide functional management for any quality personnel under their control.
- g. Assist with the identification of quality training needs, and monitor delivery and recording.
- h. Monitor and report on the implementation of the approved quality objectives.
- i. Produce quality performance reports as required.
- j. Promptly alert line and functional management to significant quality issues and where appropriate be involved in the investigation and ensure that the findings are reported.

- k. Review quality reports, identify any trends and ensure that there is an appropriate response to prevent future recurrence.

4.5 **Section, Site, Discipline Engineers and Foremen**

- a. Appreciate the responsibility allocated to individuals within the operative and management structure.
- b. Set a good example and leadership on the site.
- c. Ensure that only trained and authorised workers use plant and equipment and that persons undergoing training do not operate plant and equipment unless closely supervised by a competent person.
- d. Ensure that employees under their control attend quality induction training before working on the site and that they are correctly supervised at all times
- e. Ensure that materials, plant and equipment under their control or brought to site by the subcontractor has any necessary certificates of test, inspection and examination and is safe to use
- f. Ensure that clear instruction and information is given to persons under their control.
- g. Carry out recorded quality inspections of site conditions.
- h. Attend any meeting on quality issues as required and as applicable, co-operate with all personnel on matters of quality.

4.6 **Supervisors**

- a. Supervisors are people at the first level in the organisation that have responsibilities over the work of others.
- b. Provide positive leadership on quality issues for the members of the work team for which they are responsible.
- c. Promote a positive attitude in the workforce and encourage behaviours that protect both people and the environment.
- d. Monitor that personnel under their control comply with their individual responsibilities in quality matters.
- e. Give personnel under their control, including contractors, clear instructions about the required methods of work.
- f. Identify any quality training requirements of personnel under their control and advise appropriate management accordingly.
- g. See that all quality issues are reported immediately to the relevant manager.

4.7 **All Employees**

Set a good personal example on quality issues within your area of operation.

1. **Legal and Other Requirements**

- a. All work is to be undertaken in compliance with the requirements of Indian Law. If no local standard exists or the applicable standard is not specified, the appropriate and compatible internationally recognised standard or code of practice shall be adopted.
- b. The hierarchy of standards is as follows:
 - i. Indian Standards (IN),
 - ii. Euro Norm (EN),
 - iii. British Standards (BS),
 - iv. International Standards and Codes of Practice
 - v. Alternative standards may be proposed if they can satisfactorily be demonstrated that they are equivalent, in all respects, to the defined standards. Where there is a discrepancy or a conflict, the higher or stricter standards shall take precedence. Project Partners are to ensure that all prescribed registers, certificates and records are maintained and available for inspection at the relevant work locations by any authorised person.

2. **Quality Objectives**

- a. Quality objectives must be defined and made available for all internal and external stakeholders. The completion of the quality objectives must be checked on a regular basis and the measures must be adopted accordingly in line with the BI-RIDE's Quality Strategy and to achieve Right the First Time.
- b. These quality relevant objectives (KPI) will be defined by the BI-RIDE's Executive Management and Program Team as appropriate.
- c. Quality goals which are applicable to each program and/or project contract and particular type of work will be defined by the Project Partner with agreement of the Engineer.

3. **Quality Standards, Codes and Specifications**

- a. Quality standards, codes and specifications must be defined during design and engineering by the engineering disciplines (infrastructure and civil works, system/MEP, rolling stock, operation and maintenance) for the different packages.
- b. The program will comply with all pre-defined international codes and standards which satisfies the requirements of ISO 9001:2015 and deliver a state-of-the-art BSRP.

4. **Tender and Procurement**

- a. Quality during tendering and procurement will be ensured by the following measures:
 - i. All tendering documents must fulfil the requirements of ISO 9001:2015.
 - ii. All program partners must be certified according to ISO 9001:2015. The certification must include the scope of services being provided to BI-RIDE and include the specific project location.
 - iii. Basic quality requirements for all tendered parts must be defined (during design and engineering) with documentation by engineering discipline (e.g. infrastructure and civil works, system/MEP, rolling stock, operation and maintenance).
 - iv. Define selection criteria based on selected capabilities and experiences.
 - v. Define pre-qualification in line with BI-RIDE processes and procedures.
 - vi. Detailed quality requirements must be defined by program partners according to the complexity of their scope of supply (to be defined during procurement Process).
 - vii. Potential program partners must provide a provisional quality plan according to the complexity of their scope of supply (to be defined during procurement). This provisional quality plan must be submitted together with the bidding documents.
 - viii. Ongoing improvements of quality requirements (e.g. change of standards) by the BI-RIDE program and potential program partners must be incorporated throughout the project lifecycle.
 - ix. Tendering documents must be approved by engineering discipline, where applicable (e.g. infrastructure and civil works, system/MEP, rolling stock, operation and maintenance).

5. **Design and Engineering**

- a. The contractor must define:
 - i. Design and engineering stages.
 - ii. Review, verification and validation appropriate to each design and engineering stage.
 - iii. Responsibilities and authorities for design and engineering.
 - iv. Inputs, related to the contract requirements, must be defined as there are:
 - v. Functional and performance requirements:
 - Applicable statutory and regulatory requirements.
 - When applicable, information derived from previous similar designs.
 - Other requirements essential for design and engineering.

- b. Design and engineering outputs must:
 - i. Define relevant standards, codes and specifications.
 - ii. Meet the project requirements.
 - iii. Define testing/inspection procedures as appropriate.
 - iv. Provide appropriate information and documentation (e.g. for purchasing,
 - v. Construction/production, testing, training, operation, maintenance etc.).
 - vi. Be reviewed at suitable stages by an independent Design Verification Engineer (DVE) in order to:
 - Evaluate the ability of the results or design and engineering to meet requirements.
 - Identify any problems and propose necessary actions.
- c. Design and engineering changes must be identified and records maintained
- d. Design and engineering changes must be reviewed, verified and validated as appropriate, and approved by DVE before implementation.
- e. Changes must be explicitly mentioned in order to highlight that the initial requirements have been altered.
- f. During testing phase special attention should be paid to changes (of scope or quality requirements) to the project.
- g. All defined quality relevant measures must be integrated in the contractor's Quality Management Plan (QMP).
- h. Design and engineering results must be checked, evaluated and validated by DVE before construction/production begins. These checks, evaluations and approvals must be documented and reported (communicated). The quality of the design work must be validated by the DVE at the end of the contract.

6. Construction

- a. To ensure adequate quality planning during the construction phase the following measures are foreseen:
 - i. Program Partners must have a validated QMP
 - ii. Copy of the contractor's current QMP
 - iii. Schedule showing all foreseen tests/inspections
 - iv. Schedule to perform audits in the contracted work
 - v. Procedure describing the handling of corrective action
 - vi. Procedure describing non-conforming items
 - vii. Process for continuous improvement.
- b. Program Partners must accomplish their work according to their validated QMP and have to:
 - i. Fulfil quality requirements.
 - ii. Accomplish the work according to the relevant standards, codes and specifications.
 - iii. Document and report the accomplished work.
 - iv. Train their personnel and assess their competencies.
 - v. Fulfil the requirements related to the contracted work.
 - vi. Perform and document planned tests/inspections.
 - vii. Deliver as-built-drawings to BI-RIDE.
 - viii. Demonstrate the traceability of all quality relevant issues.
 - ix. Preserve products.
 - x. Control the monitoring and measuring equipment, including documentation.
 - xi. Perform and document internal audits.

- xii. Handle non-conformities according to the related procedure. Nonconformities must be demonstrated to BI-RIDE propositions/solutions resulting from nonconformities
- xiii. Carry out a continuous improvement (corrective and preventive action) with documentation. Solutions resulting from the continuous improvement process must be analysed
- c. The Engineer will, as regularly as deemed appropriate, monitor work samples with a frequency to ensure quality:
 - i. By inspecting the contractor's work on site.
 - ii. Verify the contractor's work according to the QMP.
 - iii. Perform and document planned tests/inspections.
 - iv. Verify the as-built-drawings of the contractor.
 - v. Analyse and approve changes within the contract.
 - vi. Pay special attention to project changes (scope or requirements) during test phase.
 - vii. Perform internal audits for each applicable contract.
 - viii. Analyse non-conformities with the contractor and approve solutions.
 - ix. Analyse solutions resulting from the continuous improvement process of the contractor within the contract and approve them.
 - x. Testing
- d. To ensure adequate quality planning during the test phase the following measures are foreseen:
 - i. Involving of end-user
 - ii. Organisation of test performance
 - iii. Definition of test results
 - iv. Test scheduling
 - v. Definition of any quality procedures during test performance
 - vi. Training of personnel, as required
 - vii. Test documentation.
- e. Performing quality assurance during the testing phase will be guaranteed by the following measures:
 - i. Definition of functions
 - ii. Observance and fitting of new designed functions with documentation
 - iii. Observance and fitting of functions which caused problems during design and
 - iv. Engineering or construction phase with documentation
 - v. Observance and fitting of functions which have been changed or optimised during design and engineering or construction phase with documentation
 - vi. Testing documentation in general.
- f. BI-RIDE contracts complete packages. These packages consist in detail engineering, construction / production, quality planning, assurance and control and at last quality verification.
- g. BI-RIDE requires the fulfilment of the BI-RIDE Quality Policy, the quality objectives and the project quality plan(s) throughout the lifecycle of the contracted work.

7. **Commissioning and Handover**

- a. To ensure adequate quality planning during the commissioning and handover phase the following measures are foreseen:
 - i. Involving of end-user
 - ii. Organisation of commissioning procedures
 - iii. Definition of commissioning results
 - iv. Commissioning scheduling
 - v. Definition of specific quality procedures for commissioning process

- vi. Training of personnel
- vii. Commissioning documentation
- viii. As-built-drawings must be prepared and supplied upon completion.
- b. To ensure adequate quality assurance during the commissioning and handover process a number of measures have to be foreseen. These measures include, but are not limited to a general check of project, project packages and interfaces, including check of:
 - i. Documentation
 - ii. Materials
 - iii. Buildings and installations
 - iv. Electrical equipment
 - v. HVAC equipment (all building services)
 - vi. Earthworks
 - vii. Concrete works
 - viii. Structural works
 - ix. Waterproofing
 - x. Painting and coating
 - xi. Operation processes and procedures
 - xii. Training processes
 - xiii. Regular testing and inspection processes and equipment
 - xiv. Emergency and escape procedures and equipment.

8. **Operations and Maintenance**

- a. Quality planning during operation and maintenance will be guaranteed by adopting the following measures:
 - i. Operation ability must be demonstrated and documented.
 - ii. Operating rules must be defined.
 - iii. Roles and responsibilities must be defined.
 - iv. Operation personnel must be trained, including the certification of the trainees.
 - v. New personnel must be trained according to the job-requirements before starting. Fulfilling of the job-requirements must be demonstrated and documented.
 - vi. All training measures must be planned.
 - vii. Required, adequate documentation (operation and maintenance manual) must be available.
 - viii. Inspections must be planned.
 - ix. Precautionary maintenance must be planned.
 - x. Inspection and maintenance personnel must be trained.
 - xi. Inspection and maintenance tools must be available.
 - xii. Spare parts must be available.
 - xiii. Inspection and maintenance documentation must be available.
 - xiv. Operation and maintenance procedures must be defined.
- b. To ensure adequate quality assurance during operation and maintenance the following measures are foreseen:
 - i. Operational ability procedure
 - ii. Personnel training documentation and planning procedure
 - iii. Inspection planning and documentation procedure
 - iv. Maintenance planning and documentation procedure.

9. Training

- a. To ensure adequate quality planning for the training the following measures are foreseen:
 - i. Operation personnel must be trained according to a pre-defined training schedule with demonstration of the fulfilling (e.g. examination, depending on the job description) of the requirements.
 - ii. Inspection and maintenance personnel must be trained according to a pre-defined training schedule with demonstration of the fulfilling (e.g. examination, depending on the job description) of the requirements.
 - iii. New personnel must be trained according to the job requirements before starting. Fulfilling of the job requirements (e.g. examination, depending on the job description) must be demonstrated and documented.
- b. To ensure adequate quality assurance for the training the following measures are foreseen:
 - i. Personnel ability procedure
 - ii. Personnel training documentation and planning procedure.

10. Closing

- a. To ensure adequate quality planning for the closing process of the contract the following measures are foreseen:
 - i. Operation ability must be demonstrated over a pre-defined period
 - ii. Tests and inspections must be finished and documented
 - iii. Personnel must be trained.
- b. To ensure adequate quality assurance for the closing of the project all previous quality planning, assurance and control measures must be closed. Therefore, all project elements must be checked to ensure the required documentation is available and handed over to BI-RIDE. For example:
 - i. Tendering and Procurement
 - ii. Contracting
 - iii. Design and Engineering
 - iv. Construction
 - v. Testing
 - vi. Commissioning and Handover
 - vii. Operation and Maintenance
 - viii. Training.
- c. A completion list will be implemented and all missing documentation must be compiled within an adequate timeframe. The contract will be closed when BI-RIDE gives a written confirmation of the final acceptance of all deliverables before handover to the operator.

11. Quality Surveillance, Non-Conformities and Improvement

- a. The Quality Manager (QM) must conduct internal audits at planned intervals to determine whether the QMP:
 - i. Conforms to the planned arrangements and to the requirements of BI-RIDE
 - ii. Is effectively implemented and maintained.
- b. An audit program must be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods must be defined. An audit schedule must be prepared.
- c. If non-conforming project execution is detected the following measures are required:
 - i. Take action to eliminate the detected non-conformity
 - ii. Authorise its use, release or acceptance under concession by a relevant authority

- iii. and, where applicable, by BI-RIDE
- iv. Take action to preclude its original use or application
- v. Take action appropriate to the effects or potential effects of the non-conformity, if the non-conforming project execution is detected after beginning of operation.
- d. When non-conforming project execution is corrected it must be subject to re-verification to demonstrate conformity to the requirements.
- e. Records on the nature of non-conformities and any subsequent actions taken, including concessions obtained must be maintained.
- f. The QM must continually improve the effectiveness of the QMS through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and project quality reviews.
- g. The QM must take action to eliminate the causes of non-conformities in order to prevent recurrence. Corrective actions must be appropriate to the effects of the nonconformities encountered and include, but are not limited to:
 - i. Reviewing non-conformities
 - ii. Establish the causes of non-conformities
 - iii. Evaluating the need for action to ensure that non-conformities do not recur
 - iv. Assessing and implementing corrective action
 - v. Recording the results of action taken
 - vi. Reviewing the effectiveness of the corrective action taken.
- h. The QM must determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive actions must be appropriate to the effects of the potential problems, at least:
 - i. State potential non-conformities and their causes
 - ii. Evaluating the need for action to prevent occurrence of non-conformities
 - iii. Set and implement the needed action
 - iv. Records of results of action taken
 - v. Reviewing the effectiveness of preventive action taken.

12. **Quality Monitoring and Reporting**

- a. To ensure the effectiveness of the quality monitoring and reporting BI-RIDE will implement a quality committee who will meet regularly. This quality committee will analyse and report to the management team of the BI-RIDE program the following matters at least (not limited to the list below):
 - i. Minutes of the previous meeting/review of pending actions and decisions
 - ii. Quality key issues
 - iii. Project status
 - iv. Project documentation and reporting
 - v. Inspection and testing
 - vi. Surveillance
 - vii. Non-conformities and improvement
 - viii. Audits
 - ix. Next meeting

APPENDIX-04
ORGANISATION CHART AND KEY POSITIONS

The contractor shall provide the following organization chart for the Works as follows: Head office Organization Chart

1. One organization chart shall be provided for the contractor head office indicating the management and staff structure, with responsible personnel departments described for all aspects of the work.
2. Site organization Chart
3. The contractor shall provide the proposed site organization indicating the proposed structure, staff partners and positions necessary to adequately manage and control the Works.
4. The contractor shall have a competent team of Managers, Engineers, Technical staff etc. so as to complete the work satisfactorily as per various requirements of the contract.
5. The Key Positions (not limited to) and corresponding qualification and experience are as under:
6. **The Contractor shall submit the CV of the Key Personnel for approval of the Employer.**

a) Key Personnel & Staff:

i. For At Grade, ROB & Elevated

S. No.	DESIGNATION	QUALIFICATION	EXPERIENCE LEVEL (FOR SIMILAR WORKS)	MIN. NO. REQUIRED
1.	Project Manager (Team Leader)	Bachelor's Degree in Civil Engineering / Post Graduate Degree in Civil Engineering	Minimum 15 years total experience and 5-year experience in the role of Project Manager in the execution of similar type of work	1
2.	Deputy Project Manager / Construction Manager	Bachelor's Degree in Civil Engineering / Diploma in civil Engineering	Experience level: a) Bachelor's degree in civil engineering Minimum 12 years total experience and 5-year experience in the role of Construction Manager in the execution of similar type of work. b) Diploma in Civil Engineering Minimum 15 years total Experience and 8 years' experience in the role of Construction Manager in the execution of similar type of work	1
3.	Design Manager	Bachelor's Degree in Civil Engineering and Post Graduate Degree in Structural Engineering	Minimum 12 years total experience and 08-year experience in the role of Design Manager/Coordinator in the execution of similar type of work.	1

S. No.	DESIGNATION	QUALIFICATION	EXPERIENCE LEVEL (FOR SIMILAR WORKS)	MIN. NO. REQUIRED
4.	QA & QC Manager	Bachelor's Degree in Civil Engineering/ Diploma in civil Engineering	Minimum 10 years total experience and 8-year experience in the role of QA&QC Manager in the execution of similar type of work	1
5.	Chief Safety and Health Manager	Bachelor's degree in engineering & Diploma in Safety Course	Minimum 10 years total experience and 5-year experience in the role of Chief Safety and Health Manager in the execution of similar type of work	1
6.	Traffic Coordinator	Bachelor's degree in civil / Transportation Engineering	Minimum 10 years total experience and 5-year experience in the role of Traffic Coordinator in the execution of similar type of work	1
7.	Interface manager	Bachelor's degree in civil / Mechanical / Electrical Engineering	Minimum 10 years total experience and 5-year experience in the role of Interface manager in the execution of similar type of work	1
8.	Planning Manager	Bachelor's degree in civil engineering with Knowledge of M.S Project / Primavera / equivalent Software	Minimum 10 years total experience and 5-year experience in the role of Planning Engineer in the execution of similar type of work	1
9.	Geotechnical Engineer	BTech in Civil / M. Tech in Geotechnical Engineering	Experience level: Bachelor's degree in civil engineering Minimum 8 years total experience and 3-year experience in the role of Geotechnical Engineer in the execution of similar type of work. OR MTech in Geotechnical engineering Minimum 6 years total experience and 2 year experience in the role of Geotechnical Engineer in the execution of similar type of work	1
10.	Billing Engineer / Quantity Surveyor	Graduate / Diploma in Civil Engineering	Total minimum experience of 5 years with knowledge of computer and QS for Degree in Civil Engineering OR 8 years for Diploma in Civil Engineering with knowledge of Computer and QS.	1

S. No.	DESIGNATION	QUALIFICATION	EXPERIENCE LEVEL (FOR SIMILAR WORKS)	MIN. NO. REQUIRED
11.	Senior Civil Engineer	Bachelor's Degree in Civil Engineering	Total minimum 7 Years Experience for graduate & 10 years for Diploma in Civil Engineering field/Infrastructure projects.	03
12.	Civil Engineer	Bachelor's degree in civil engineering / Diploma in Civil Engineering	Experience level: a) Bachelor's Degree in Civil Engineering Minimum 5 years in Civil Engineering field/Infrastructure projects. b) Diploma in Civil Engineering Minimum 8 years in Civil Engineering field/Infrastructure projects.	04
13.	Electrical and Mechanical Engineer	Bachelor's degree in electrical / Mechanical Engineering	Total minimum experience 5 Years in relevant field	01
14.	Junior Civil Engineer	Bachelor's degree / Diploma in Civil Engineering	Total minimum experience 4 Years in relevant field.	06
15.	Safety Engineer / Officers	Bachelor's Degree in Civil Engineering & Diploma in Safety Course	Total minimum experience 5 Years	1
16.	BIM Engineer	Bachelor's Degree in Civil Engineering / Diploma in Civil Engineering	Total minimum 10 Years for graduate & 12 years for Diploma in relevant field. (BIM Experience in Metro / Railway / Suburban / Building project implementation is preferable).	1
17.	Environmental Engineer	Bachelor's Degree in Civil Engineering and M. Tech in Environmental Engineering	Total 10 Years & Minimum 4 years in Metro/Railway/ Highway/ Infrastructure works	1
18.	Surveyor	Diploma in Civil Engineering /Survey OR ITI in Land Survey	Experience level: a) Diploma in Civil Engineering/Survey Minimum 5 years in relevant field b) ITI with Minimum 8 years in relevant field.	2

NOTES:

1. The above categories of key positions for Serial No. 1 & 2 shall be deployed within 14 days from the issue of LOA.

2. All other positions minimum required for successful completion of the work which shall be deployed at different points of time as per the progress and requirement and as per the approved detail work program by the Engineer. However, these personnel shall be deployed at site in advance as per requirement and as directed by the Engineer and the decision of Employer in this regard shall be final and binding.
3. The above Manpower deployment plan shall be submitted by the contractor within 7 days of award of work and shall be approved by the Employer.
4. The contractor shall submit the CVs of the above key positions (S.no 1,2, 3, 4 ,5 8, 9, 10) to Employer for approval within 7 days of issue of letter of Acceptance (LOA).
5. The contractor shall deploy resources as per the above-mentioned minimum requirement and also confirm to deploy manpower over and above the minimum numbers indicated above, if the work requires so.
6. The performance of project personnel deployed will be evaluated periodically by the Employer during the contract period. In case the performance of any of the project personnel is not satisfactory, the contractor shall replace them with better or equivalent personnel immediately as per the directions of the Employer.
7. The tenderer may propose any number of names of Personnel for each Key Position. Any of the proposed personnel as approved by the Employer for each key position shall be mandatorily deployed in case of award of work.
8. Non-deployment of the Key personnel as per approved personnel for Sl.no 1,2,5,8 & 15 as per approved manpower plan leads to imposition of Penalty of Rs 1,00,000/- Per Key personnel per month. For other personnel, a penalty of Rs 50,000 / - per person per month shall be levied.
9. The proposed Key personnel shall not be changed till the completion of the work. Under emergent circumstances, in case they are required to be changed, the new incumbent should have similar or better experience and qualification than as required above. These changes are permitted only with the approval of the Employer. Change in key personnel for one time without penalty is permitted. However, for subsequent changes there will be Penalty at Rs 1,00,000 / - Per Key personnel for Sl.No 1,2,5, 8 & 15, unless the change is desired by the Employer.
10. All Key Personnel must be permanently stationed at Bengaluru till the completion of the work.
11. The penalties imposed are non-refundable.

APPENDIX-05
PLANT AND EQUIPMENT

➤ **Key and Critical Equipment's**

• **For At Grade, ROB & Elevated:**

S. No.	Type of Equipment required for the work	Proposed to be Deployed (Minimum)	Remarks
1.	*Piling Equipment Rotary Rig / Hydraulic Rig for soil boring and rock boring including diamond bits for rock boring.	01 nos.	
2.	Piling rig (Tripod) with conventional winch	02 nos.	
3.	Fully Automatic and Computerized Batching Plant -1 no of 30 Cum / hr minimum or equivalent capacity in different configuration at casting yard with a RO of suitable capacity for proper quality of water.	01 nos.	
4.	Concrete boom placers	01 nos.	
5.	Concrete pumps with sufficient pipes	02 nos.	
6.	Transit Mixers	06 nos.	
7.	Crane of suitable capacity for Erection of Precast Boxes	02 nos.	
8.	Cranes in casting yard / site of suitable capacity	02 nos.	
9.	Hydraulic excavator (1 cum bucket)	04 nos.	
10.	Tippers / trucks (10 / 14 cum capacity)	10 nos.	
11.	Dozer of suitable capacity	02 nos.	
12.	Front end loader with suitable capacity	02 nos.	
13.	Vibratory roller 8 I 10-ton capacity	02 nos.	
14.	Smooth wheeled roller 10-ton capacity	01 nos.	
15.	Water tanker of 6000 lit capacity	03 nos.	
16.	Motor Grader	03 nos.	
17.	Back hoe loader of suitable capacity	01 nos.	
18.	Plate Vibratory Roller	04 nos.	

(*) Hydraulic Rigs deployed should have suitable capacity in terms of Torque and RPM to be able to drill through hard rock.

(I) **Other Plant and equipment to be deployed** The Tenderer shall furnish the details of Own basis or Lease or Hire basis for the following equipment.

Sl. No.	Type of Equipment Required for the Work	Proposed to be Deployed (Minimum)	Remarks
1.	250 MT or more capacity suitable cranes for erection of Precast RCC Box/U girder/I-girder and Steel superstructure	02 nos.	
2.	Trailers / MAV for carrying Pier caps and other Precast elements of Suitable capacity as per site requirement	02 nos.	
3.	Man-lift for adequate height	03 nos.	
4.	Crane 5 MT capacity	02 nos.	
5.	Crane 35 MT capacity	01 nos.	
6.	Generators 125 KVA	04 nos.	
7.	Survey equipment's: Total stations and auto level	2 sets	

NOTE:

- Plant and equipment indicated above is minimum to be deployed at appropriate stage of the work. However, depending on the requirement to complete the work within the stipulated completion period the Tenderer shall deploy additional machinery as circumstances warrant at no extra cost. Plant and machinery above shall not be older than 5 years. In case of failure of any plant and machinery deployed at site the same shall be repaired / replaced within 7 days from the time of failure. The tenderer shall submit the copies of ownership of the equipment, in case of hire / purchase, copies of MOU with the supplier / owner of the equipment or shall submit the undertaking for deployment of the above plant & equipment.
- The above type of plant and equipment (but not limited to) may be required for execution of the work. The contractor shall submit the details of plant & equipment to be deployed in the above table within 14 days of issue of LOA to the Engineer for approval.
- Plant and equipment to be mobilized for the work shall be in good serviceable condition.
- The contractor will be penalized as deemed fit by the Employer, in case of any shortage.
- The Equipment listed above are the minimum requirements and the cost of the same is deemed to be included in the quoted price. However, if they are found to be short and not adequate to complete the works as per key dates, then further equipment to be arranged to accelerate the progress of work. Nothing extra shall be paid against additional deployment of the equipment.
- At the time of bidding contractor must demonstrate the possession of required plants & equipment and capability to mobilize within short notice without wasting prime working time.
- All plants and equipment need to be mobilized simultaneously; plants and equipment as required as per the progress of the work shall be brought at site in advance or as directed by Engineer in charge.
- The Bidder shall provide further details of proposed items of equipment using Form EQU in **Section IV, Forms of Tender.**
- Domestic Preference: As per Make in India Policy-2017.

APPENDIX-06**DOCUMENT SUBMISSION AND RESPONSE PROCEDURE****1. PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)**

The contractor shall utilize a PMIS integrating with BIM software such that all documents generated by the contractor can be transmitted to the Employer and the Engineer by electronic means (and vice versa) and that all documents generated by either party or electronically captured at the point of the origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer office at sit and the Employers office by the contractor.

All requisite training and periodical refresher courses of the above PMIS, to all the staff nominated by the Employer shall be organized by the contractor. The same is within the scope of this work.

IFC format (Industry foundation Classes):

IFC list format is a platform neutral format. Hence all / any BIM program used by tenderer should provide files in IFC format for interoperability between different BIM programs.

2. SUBMISSIONS TO THE ENGINEER

The general requirements are as follows:

2.1 PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

- 1) The Employer will provide a web-based information management system of transmittal for formal project correspondence, documents, and information to ensure efficient information management on the Project. Where it is necessary to transmit original signed documents, these shall be acceptable forms of correspondence only when they have been issued via the system first.
- 2) The Employer will provide the Project-wide use of the system during the Design and Construction

Phases and also the Defects Notification Periods.

- 3) The system shall be capable of issuing a list of outstanding responses from the Engineer 7 days before the due date of the response.

2.2 DRAWING AND SPECIFICATION REGISTER

The contractor shall submit drawings and specifications register to the Engineer in electronic copy and hard copy with each submission of drawings and at an interval agreed by the Engineer. The drawings and specifications register shall be in a format submitted for review and agreed without objection by the Engineer and shall include each document reference number, version, date, title and data-file name.

3. RECORDS AND REPORTS**3.1 FORMAT**

Reports and records shall be submitted via the system to the Engineer and shall be in a format agreed by the Engineer. Reports and records shall be signed prior to submission by the contractor's agent or by a representative authorized by the contractor.

3.2 PROJECT DOCUMENT CONTROL PROCEDURE

Within twenty-eight (28) days after Commencement Date, the contractor shall submit via the system a Project document control procedure to the Employer and Engineer for review, which shall include but not be limited to the following:

- 1) A document approval system which shall specify the level of authority for approval of all

documents and material before submission to the Engineer;

- 2) A system of issuing documents to ensure that pertinent documents are issued to all appropriate locations;
- 3) A document change or re-issue system to ensure that only the latest revision of a document can be used; and
- 4) A submission identification system that identifies each submission uniquely by the following:
 - a) contract number;
 - b) discipline;
 - c) Submission number; and
 - d) Revision indicator.

3.3 PROJECT RECORD

Project records will eventually be used by the Employer to manage, operate and maintain the Works after the completion of the Project under construction and for future reference.

3.4 ADEQUACY OF THE PROJECT RECORD

The contractor shall submit the documents as required by the Engineer as Project records in full and on time. The Engineer shall determine the adequacy of the Project record. Any delay, beyond a reasonable limit, is liable for penalty, as deemed fit, by the Employer.

4. SUBMISSION AND RESPONSE PROCEDURE

4.1 GENERAL

Except where specific procedures are given for certain items, all submissions shall be submitted and reviewed according to the procedure laid down in the following clauses.

4.2 PROPOSAL

Each submission shall be accompanied by a brief introduction to explain which sub-system, part or section of the Works to which the submission refers, listing the documents enclosed with the submission and describing in outline how all relevant requirements of the Employer's Requirements are achieved by the proposals.

4.3 SUBMISSION RESPONSE REQUEST

For each stage of submittal, the contractor shall prepare a Submission Response Request (SRR) carrying the date of submission, the submission reference number as defined in Clause 2.2 (4) above, the submission title, the stage of submission (e.g., Technical Design, etc.), and the authorized signature of the contractor's responsible engineer to confirm that, in the opinion of the contractor, the submission:

- 1) complies with all relevant requirements of the Employer's Requirements;
- 2) conforms to all interface requirements;
- 3) contains, or is based on auditable and proven or verified calculations or design criteria;
- 4) has been properly reviewed by the contractor, according to the contractor's Quality Assurance System, to confirm its completeness, accuracy, adequacy and validity; and
- 5) has taken account of all requirements for approval by statutory bodies or similar organizations, and that where required, such approvals have been granted.
- 6) contains 2 (two) properly signed copies of Independent Design Checker Certificate (Form IDCC) and 2 (two) properly signed copies of the Construction Design Pack Certificate (Form CDPC).

4.4 THE ENGINEER'S RESPONSE

The Engineer's response to the submission from the contractor will be made within 21 calendar days of receipt of the submission. If the submission is made later on the Design Submissions Programme, the Engineer may extend the review period depending on the amount of documentation accompanying the submission.

4.5 MONTHLY DESIGN REVIEW MEETINGS

Throughout each Design Stage, the contractor shall attend monthly design review meetings with the Engineer and the Employer. At these review meetings, the contractor shall present information, drawings, and other

documents to the Engineer in respect of all submissions programmed to occur during the following five-week period. The contractor's presentations shall be in sufficient depth to enable the Employer / Engineer obtain a clear understanding of the contractor's proposals and to discuss the methodology and process used in reaching the proposed design solutions.

4.6 **THE ENGINEER'S OBSERVATIONS**

The contractor shall record all of the Engineer's observations and any agreed actions resulting from the Engineer's review meeting and shall address each of these fully before submission of the respective documents for formal review.

4.7 **NOTIFICATION**

If, in the Engineer's opinion, following receipt of a submission, there is benefit to be gained from a meeting with the contractor to clarify or discuss any of the contents of the submission, he will notify the contractor accordingly with not less than 3 days advance notice, and the contractor shall attend at the time and place notified by the Engineer.

4.8 **NOTICE OF NO OBJECTION**

The contractor in respect of the Works or any sub-system, part or section may make no submission thereof unless a Notice of No Objection with Comments has been received for the previous stage of the same Works or any sub-system, part or section thereof.

5 **RESPONDED PROCEDURE**

5.1 **RESPONDED PROCEDURES**

The Engineer will respond in one of the following three ways:

- 1) "Notice of Rejection" (with "A" Comments)
- 2) "Notice of No Objection"
- 3) "Notice of No Objection with Comments" (with "B" or "C" Comments)

5.2 **RESPONSE DEFINITION**

Definition of the Engineer's response:

- 1) "Notice of Rejection" (with "A" Comments):

If, following his review of the submission, the Engineer discovers major non-compliance, discrepancies, or omissions etc. that in his opinion are of a critical nature, the Engineer will issue a "Notice of Rejection" (NOR) with type "A" comments. The contractor shall revise and reissue the submission at the earliest, but not later than 15 calendar days of receipt of "Notice of Rejection" from the Engineer addressing the Engineer's comments. Subsequently the Engineer will respond at the earliest, but not later than 15 calendar days of receipt of the resubmission. Following the issue of a NOR by the Engineer, the contractor is not entitled to proceed to the next programmed stage for that section of the work until all of the Engineer's comments have been fully addressed and a NONO issued. As this is critical in nature, any delay in revising and reissuing by the contractor beyond the limit specified above, is liable for penalty, as deemed fit, by the Employer. The decision of the Employer is final in this regard.

- 2) "Notice of No Objection":

If, following his review of the submission the Engineer has not discovered any non-compliance with the contract the Engineer will issue to the contractor a formal "Notice of No Objection (NONO)". A NONO from the Engineer irrespective of with or without comments does not in any way imply the Engineer's consent of the submission nor does it remove any responsibility from the contractor for complying with the Contract. Issue of a NONO from the Engineer only entitles the contractor to proceed to the next stage of the programmed work.

- 3) "Notice of No Objection" (With Comments):

if following his review of the submission, the Engineer discovers discrepancies or omissions etc. that in his opinion are not of a critical nature the Engineer may issue a "Notice of No Objection" with Comments, (NONOC) the comments will be of either type B or type C as defined below. The contractor shall respond to the comments in accordance with the requirements of Clause 4.3. Following

the issue of a NONOC by the Engineer the contractor is entitled to proceed to the next stage of the programmed work subject to the inclusion of amendments necessary to address the comments.

- 6 **The contractor shall respond to Type B and C comments and get the Engineer's agreement and closure prior to full inclusion in the Final Design.**

6.1 **THE ENGINEER'S COMMENTS**

Definition of the Engineer's comments:

- 1) Type "A" Comments are of a critical nature that renders the submission non-compliant with the Contract, the submission shall be corrected and resubmitted.
- 2) Type "B" Comments are of an intermediate nature that shall be responded, agreed and incorporated.
- 3) Type "C" Comments are of a minor nature or may affect future submissions.

7 **RECORDS**

The contractor shall establish and maintain a place for the storage and archiving of all the documents relating to the Works that are not required to be submitted to the Engineer under Clause 2.

8 **IMPLEMENTATION OF BIM SYSTEM**

- (i) The contractor shall implement BIM system for executing and delivering the services set out in this Agreement. Building Information Modelling (BIM) uses computing power and systems to create 3D models of all kind of buildings and infrastructure, with information about its design, operation and current condition. At the planning and design stage, it enables designers, owners, and users to work together to produce the best possible designs and to test them virtually before they are constructed. During construction, it enables the Employer, contractors, and suppliers to integrate all components, cutting out waste and reducing the risk of errors. In operation, it provides users with real-time information about available services and facility managers with accurate assessments of the condition of assets.
- (ii) Proof checking of all structural designs shall be done using BIM modelling. The contractor shall implement the necessary hardware, software, and provide human resources towards this till the end of DLP. 3D Coordination between all disciplines shall be achieved by incorporating them in a single model.
- (iii) The contractor shall be required to produce, update and present to Employer on a fortnightly basis an integrated 3D BIM model incorporating rail track (Viaduct), topography, architecture, structure, plumbing and all other building services and system wide requirements in design review meetings. These models shall be 3D rendered and shall help in design visualization and clash detection of elements as well as finalization of design.

In addition, contractor shall also provide following individual models:

1. Rail alignment Modelling
 2. Structure design modelling
 3. Terrain modelling
 4. Quantity take-off from BIM model wherever required
 5. Visualization and Animated Walkthrough
 6. Clash detection
- (iv) Final coordinated GFC drawings of all disciplines shall be generated only from the BIM model.
 - (v) The contractor shall develop as built BIM Model up to LOD 500 level and submit the same to Employer at the time of completion of the project. Schedule of BIM implementation Plan and standards to be adhered to, shall be provided after award of contract.
 - (vi) IFC format (Industry Foundation Classes)
- IFC format is a platform neutral format. Hence all / any BIM program used by tenderer should provide files in IFC format for interoperability between different BIM programs.

APPENDIX-7**WORK AREAS**

No land shall be made available by the Employer for casting yard, site offices, and site laboratories. Contractor shall make his own arrangements at his own cost. In case, Railway land/ Govt. land is arranged adjacent to Railway track for casting of I-Girders, necessary land rent /lease charges shall be levied as advised by Railway concerned/ Govt. authority norms /Bi-RIDE norms and the same will deducted from RA bills of the Contractor.

APPENDIX-8
PROJECT CALENDAR

- (1) The Project Weeks shall be commenced on a Monday. A day shall be deemed to commence at 00:01 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week.
- (2) Requirements for the computation of Key Dates are given in **Section-IX / Part-3 (Conditions of Contract & Forms)**.
- (3) A 7-day week calendar shall be adopted for various (Work) programme schedules for scheduling purposes.
- (4) For Project purposes, the presentation shall be in "Week" units.

APPENDIX-9**DRAFTING AND CAD STANDARDS****1. INTRODUCTION**

- (1) The purpose of this document is to define the minimum Drafting and CAD standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the Works.
- (2) By defining a common format for the presentations of drawings and CAD files, the exchange of drawn information is improved and will maximize the use of CAD in the co-ordination process.
- (3) All submissions shall be made to the Employer's Requirement in a format reviewed without objection by the Employer's Requirement and in accordance with the requirements in and as approved by the Employer:
 - (a) the Contract;
 - (b) the Document Submittal Instructions to Consultants and Contractors.
- (4) Paper and drawing sizes shall be "A" series sheets as specified in BS3429.
- (5) The following software latest and update version compatible for use with Mac / Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

Document Type	Electronic Document Format
Text Documents	MS Word,
Spread Sheets	MS Excel,
Data Base Files	MS Access,
Presentation Files	MS PowerPoint or Keynote (Mac) or any other approved by the Employer,
Programmes Ver2.0a	Primavera for Windows or any other approved PIMS, Sure track AutoCAD Graphics CorelDraw / AutoCAD
Photographic	Adobe Photoshop,
Desktop Publishing	Page Maker
CADD Drawings	AutoCAD

- (6) Media for Electronic File Submission
One copy shall be submitted unless otherwise stated in Memory Device.
- (7) Internet File Formats/Standards
 - (a) The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Employer.
 - (b) All the data formats or standards must be supported by Microsoft Internet Explorer version 3 or above running on Windows NT and Windows 10 or the latest.
 - (c) The following lists the file types and the corresponding data formats to be used on Internet.
The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different Data format:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF or JPEG
Computer Aid Design files(CAD)	Computer Graphics Metafile (CGM)
Video	Window video (.avi)
Sound	Wave File (.wav)

- (8) The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless prior consent is obtained from the Employer's Requirement for a different standard:

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Markup Language (HTML)

The hard copy of all documents shall be the contractual copy.

2. GENERAL REQUIREMENTS

2.1 GENERAL

- (1) The Contractor shall adopt a title block similar to that used in the Drawings for all drawings prepared under the Contract. It shall be approved by the Employer.
- (2) Each drawing shall be uniquely referenced by a drawing number and shall define both the current status and revision of the drawing.
- (3) The current status of each drawing shall be clearly defined by the use of a single letter code as follows:
 - P - Preliminary Design Drawing
 - D - Definitive Design Drawing
 - C - Construction Reference Drawing
 - W - Working Drawing
 - B - As-Built Drawing
 - M - As Manufactured Drawing
 - E - Employer's Drawing

2.2 TYPES OF DRAWING

1. 'Design drawings' mean all drawings except shop drawings and as-built drawings.
2. Working drawings are design drawing of sufficient detail to fully describe the works and adequate to use for construction or installation.
3. Site drawings and sketches are drawings, often in sketch form, prepared on site to describe modifications of the Working drawings where site conditions warrant changes that do not invalidate the design.
4. 'Shop drawings' are special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.
5. 'As-built drawings' show the Works exactly as constructed or installed. They are usually prepared by amending the working drawings to take into account changes necessitated by site conditions and described in Site drawings. These drawings shall be completed on a regular basis as the works progress, and shall not be left until completion of the entire works.

3. COMPUTER AIDED DESIGN & DRAFTING (CAD) STANDARDS

3.1 INTRODUCTION SCOPE OF USE

Data input procedures between the Employer / Engineer and contractors must be coordinated, and the key parameters used to form CAD data files must be standardized. The production of all CAD data files shall comply with the following requirements.

3.2 OBJECTIVES

The main objectives of the CAD standards are as follows:

- (a) To ensure that the CAD data files produced for Project are co-ordinated and referenced in a consistent manner.
- (b) To provide the information and procedures necessary for a CAD user from one discipline or external organisation to access (and use as background reference), information from a CAD data file prepared by another discipline or external organisation.
- (c) To standardise the information contained within CAD data files which may be common to more than one discipline such as drawing borders, title boxes, grid lines etc.
- (d) To establish procedures necessary for the management of CAD datafiles.
- (e) To ensure all contractors use 'Model space' and 'Paper space' in the production of their CAD files.

3.3 GENERAL

- (1) To facilitate co-ordination between contractors, it is a requirement that all drawings issued by contractors for co-ordination or record purposes shall be produced using CAD methods. Drawings shall be issued in digital format in addition to the paper copies.
- (2) The intent of the issue of digital information is to aid the related design by others. The definitive version of all drawings shall always be the paper or polyester film copies which have been issued by the contractor or organisation originating the drawing.
- (3) Drawings and drawing packages issued for co-ordination, record purposes or for acceptance shall be accompanied by a complete set of the corresponding CAD datafiles.
- (4) Any contractor or organization making use of the CAD data from others shall be responsible for satisfying him that such data is producing an accurate representation of the information on the corresponding paper drawing which is satisfactory for the purpose for which he is using it. Provided the general principles of this section have been achieved by the originator of the CAD data, contractors making use of the CAD data from others shall not be entitled to require alterations in the manner in which such CAD data is being presented to them.
- (5) In particular, automatic determination of physical dimensions from the data file shall always be verified against the figured dimensions on the paper or polyester drawings. Figured dimensions shall always be taken as correct where discrepancies occur.

3.4 TERMINOLOGY & ASSOCIATED STANDARDS/GUIDELINES

Any terminology used within this section that is ambiguous to the user shall be clarified with the Employer's Requirement. British Standard BS1192 is used in principle as a guide for drawing practice, convention, CAD data structure and translation.

3.5 PAPER DRAWINGS

- (1) For the Project "Paper" drawings are considered to be the main vehicle for the receipt and transmittal of design and production information, typically plans, elevations and sections.
- (2) The Project wide accepted media for the receipt and transmittal of "Paper" drawings will be paper and polyester film of various standard ISO 'A' sizes. The composition of this information shall be derived from a CAD "Model".
- (3) The CAD derived "Paper" drawing composition will reflect a window of information contained within a CAD "Model Space" file together with a selection of information contained within the associated CAD "Paper Space" file.

3.6 CAD DATA CREATION, CONTENT & PRESENTATION

A consistent method of CAD data creation, together with content and presentation is essential. The method of CAD "Model Space and Paper Space" creation is as follows:

- (1) Model Space Files

- (a) Typically, CAD "Model Space" files are required for general arrangement and location plans and will consist of a series of other "Model Space" referenced CAD files covering the total design extents at a defined building level (the number of referenced files should be kept to an absolute minimum). Data contained within a CAD "Model Space" file is drawn at full size (1:1) and located at the correct global position and orientation on the Project Grid / or defined reference points.
 - (b) Each CAD "Model Space" file will relate to an individual discipline. Drawing border / text, match / section lines or detailed notation shall NOT be included within a CAD "Model Space" file. Dimensions shall be included within a CAD "Model Space" but located on a dedicated layer. Elevations, Long Sections and Cross Sections shall also be presented in CAD "Model Space" as defined above, but do not need to be positioned and orientated on the Project Grid.
- (2) Paper Space CAD Files
- (a) "Paper Space" CAD files are utilized to aid the process of plotting "Paper" drawings and are primarily a window of the CAD "Model Space" file. A "Paper Space" CAD file will typically contain drawing borders, text, match or section lines & detailed notation. Once these files are initially set up and positioned the majority of "Paper Drawing" plots at various approved scales are efficiently and consistently generated by displaying different combinations of element verse and symbology contained within the "Paper Space" file and the referenced "Model Space" files.
 - (b) The purpose is to ensure that total co-ordination is achieved between the CAD "Model Space" file and the "Paper Drawing" output during the revision cycle of the design and production process. Duplicated data in "Model and paper Space" files will not be acceptable unless an automatic update link exists between the two data sets. "Paper Space" files are not typically required as part of the CAD Media Receipt from contractors, unless specifically requested.

3.7 CAD QUALITY CONTROL CHECKS

- (1) Random CAD Quality Control Audits will be carried out by Engineer on all CAD media received and transmitted.
- (2) These checks DO NOT verify the technical content of the CAD data received or transmitted (as this is the responsibility of the originating organization), however compliance with Project CAD and Droughting Standards shall be checked.
- (3) In addition, all contractors who transmit and receive CAD data from the Project shall have CAD quality control procedures in place. A typical quality control procedure shall contain CAD data quality checking routines coupled with standards for CAD data transmittal and archiving.

3.8 CAD DATA TRANSFER MEDIA AND FORMAT

When CAD data is received & transmittal between Engineer and the Contractor, the media shall be as follows:

- (a) Data Exchange Format - AutoCAD Release 14 (.DWG) or latest version
- (b) Operating System - Windows Latest version
- (c) Data Transfer Media: Memory Stick/ RW of adequate capacity
- (d) All CDs must be labelled on the data shield with:
 - (i) Name of Company
 - (ii) Project Title
 - (iii) Drawing Filenames (for diskettes only)
 - (iv) CD no.
- (e) All media shall be submitted with a completed Form
- (f) The Contractor must ensure the supplied media is free from virus. SUB-directories on tapes or disks are not permitted. If CAD Data is created using UNIX, archive commands must be unrooted.

3.9 CAD MEDIA RECEIPT & TRANSMITTAL

- (1) CAD Media Transmittal (from the Contractor to Engineer) - this will consist of the following:

- (a) CAD Digital Media
- (b) CAD data sheet
- (c) CAD issue / revision sheet
- (d) CAD Quality Checklist confirming compliance.
- (e) Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).
- (2) The above CAD media will be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by Employer's Representative from all contractors shall be in AutoCAD (Latest version)
- (3) All CAD media received from contractors will be retained by Engineer except for SCSSIdisk (if used) as an audit trail / archive of a specific contractor's design evolution.
- (4) CAD Media Receipt (from Engineer to the Contractor)
 - (a) CAD media should normally be obtained from the respective interfacing contractor(s), but should Engineer issue CAD media it will consist of the following:
 - (i) CAD Digital Media typically contain only CAD "Model Space" files.
 - (ii) CAD data sheet.
 - (iii) CAD issue / revision sheet
 - (b) The above CAD media will be collectively known as the "CAD Media Receipt Set". The CAD data file transmittal format used by Engineer to all contractors will be in AutoCAD (version 14)
 - (c) Each CAD transmittal CD will be labelled with proper disk label as approved by the Engineer/ Any CAD data transmitted without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.

3.10 REVISIONS

- (1) All 'Revisions', 'In Abeyance' and 'Deletions' shall be located on a common layer. This layer can be turned on or off for plotting purposes.
- (2) The following example text indicates the current CAD file revision, i.e., 'Revision [A]'. This shall be allocated to a defined layer on all CAD "Model Space" files, in text of a size that will be readable when the CAD "Model Space" file is fitted to the screen, with all levels on.

3.11 BLOCK LIBRARIES, BLOCKS, & BLOCK NAMES

- (1) All Construction Industry symbols produced as CAD Cells shall typically conform to British Standard BS1192 - part 3.
- (2) All Blocks created shall be Primitive (i.e., NOT Complex) and shall be placed Absolute (i.e. NOT Relative).
- (3) The Contractor's specific block libraries shall be transmitted to Engineer together with an associated block library list containing the filename (max. 6 characters) and block description. The Contractor shall ensure that the library is regularly updated and circulated to all other users, together with the associated library listing.
- (4) All Blocks of a common type, symbols or details should initially be created within a CAD "Model Space File" specifically utilized for that purpose. These files will be made available on request by Employer's Representative.
- (5) Blocks created will typically be 2D unless 3D is specifically requested. In both instances they shall have an origin at a logical point located within the extents of each Block's masked area or volume.

3.12 CAD DIMENSIONING

Automatic CAD Dimensioning will be used at all times. Any dimensional change must involve the necessary revision to the model space file. If the CAD Quality Control Checks find that the revisions have not been correctly carried out, the rejection of the entire CAD submission will result.

3.13 CAD LAYERING

All CAD elements shall be placed on the layers allocated for each different discipline. The layer naming convention to be adopted by the Contractor shall be submitted for acceptance and inclusion within these standards.

3.14 GLOBAL ORIGIN, LOCATION & ORIENTATION ON THE ALIGNMENT DRAWING.

- (1) Location or Plan information in "Model Space" files shall coincide with the correct location and orientation on the Project grid for each specific contract.
- (2) Location plans shall have at least three setting out points shown on each CAD "Model Space" file. Each setting out point shall be indicated by a simple cross-hair together with related Eastings and Northings co-ordinates. The Contractor(s) shall establish the 3D co-ordinates for their respective works, which will then be used by all other contractors including the Contractor.

3.15 LINE THICKNESS AND COLOUR

To assist plotting by other users, the following colour codes will be assigned to the following line thickness / pen sizes.

Colour	Code No	Line Thickness
Red	10	0.18
White	7	0.25
Yellow	2	0.35
Brown	34	0.5
Blue	130	0.7
Orange	30	1.0
Green	3	1.4
Grey	253	2.0

3.16 CAD UTILIZATION OF 2D & 3D FILES

Although the project standard is 2D CAD files, certain disciplines and contractors may use 3D CAD files for specific applications or where the isolated use of 3D aids the design and visualization process (i.e., Architecture, Survey and Utilities). In these specific instances 3D CAD data will only be transmitted if all other users can use this data. If this is not the case, 3D to 2D translation shall be processed by the creator prior to issue.

3.17 CAD FILE NUMBERING

- (1) Contractors CAD File Numbering shall be described in 2.2 above.
- (2) Employer CAD File numbering unlike most of the contractors, Employer will not be required to produce numerous CAD files. This will follow the numbering system Except that the status of the drawing in 2.1(3) shall be "E".

3.18 CAD FILE NAMING CONVENTION - GENERAL

CAD "Model Space" files shall be named in accordance with general drawing conventions. Note: The CAD standards shall be compatible with BIM platform of Bi-RIDE.

3.19 ERP, OSO AND 3D BIM PLATFORM

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

APPENDIX-10**WORKS AREAS & TEMPORARY POWER-SUPPLY****12. INTRODUCTION**

- (1) The Contractor shall provide within the designated principal Works Areas, at locations agreed with the Employer / Engineer, the compounds and facilities for the Employer and the Engineer and other contractors of the Employer defined under Clause 2 of this Appendix.
- (2) The standard conditions applying to the use of any Works Area by the Contractor for its site facilities are given under Clause 2 of this Appendix.
- (3) The Conditions for supply of electricity by the Contractor to Designated Contractors are given under Clause 3 of this Appendix.

13. STANDARD ENGINEERING CONDITIONS

The following standard engineering conditions apply to all Works Areas:

(1) Formation

- (a) The Works Areas shall be formed to the levels that the Employer / Engineer has given his consent. No levels shall be amended without prior consent of the Employer / Engineer.
- (b) The Works Areas shall be surfaced in a manner agreed with the Employer / Engineer, compatible with their intended use, and, in particular, footpaths and roadways connecting facilities shall be clearly defined. Measures shall be taken to the satisfaction of the Employer / Engineer to ensure all areas are properly drained and kept free of static water.
- (c) The removal, diversion or reinstatement elsewhere as may be required of any existing works or installation whatsoever within the Works Areas shall be carried out to the satisfaction of the Employer.

(2) Roads & Parking

- (a) Space shall be provided within the Works Areas for parking, loading / unloading and maneuvering of motor vehicles.
- (b) Any damage done to the adjoining public roads and fixtures and properties (public or private) shall be made good to the satisfaction of the Employer.

(3) Drainage & Sewerage

- (a) All storm or rainwater from the Work Areas including any access roads thereto shall be conveyed to the nearest stream course, catch-pit, channel or storm water drain as required by the Engineer. All temporary and permanent works shall be carried out in such a manner that no damage or nuisance are caused by storm water or rain water to the adjacent property.
- (b) No drain or watercourse shall be used without consent of the Employer.
- (c) Damages or obstructions caused to any watercourse, drain, water-main or other installation within or adjoining the Works areas shall be made good to the satisfaction of the Employer.
- (d) Treatment and disposal of sewage and waste water from the works areas shall be provided to the satisfaction of the Employer.

(4) Buildings

- (a) No permanent structures other than those required for the Permanent Works shall be Temporary permitted on the Works Areas.
- (b) Electricity, water, telephone and sewerage shall be provided by the Contractor, as required, for all temporary buildings.
- (c) No potable water obtained from the Govt. sources shall be used for heating, cooling and humidification purposes, or vehicle washing without the written consent of the Engineer.

(5) Pedestrian Access

Every existing pedestrian access throughout the Works Areas shall be maintained in a usable condition at all times to the satisfaction of the Engineer including lighting, signing and guarding.

(6) Fencing

The Works Areas shall be secured against unauthorized access at all times. In particular fencing or the like shall be maintained, removed and re-erected in the new location wherever and whenever a Works Area is relinquished in stages.

14. APPLICABILITY

- (1) Where the Contractor is required to provide temporary electrical supplies, or to use, extend or expand on temporary supplies installed by others, all such activity shall be executed in accordance with Paragraphs of this Appendix.
- (2) When the Contractor makes use of temporary electrical supplies provided by others he will observe and comply with the requirements of this Appendix.

15. WORK ON SITE

- (1) The contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Employer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring all the necessary equipment on site. The contractor shall not install or operate any temporary site electrical systems until his representative is appointed and has commenced duties.
- (2) The name and contact telephone number of the representative having been reviewed without objection by the Employer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.
- (3) Schematic diagrams and the details of the equipment for all temporary electrical installations shall be submitted by the Contractor, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for his consent.
- (4) All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorized electricians, who are registered as such under the Electricity Ordinance 1990/Electricity (Registration) Regulations 1990.

16. ELECTRICAL GENERAL

Temporary electrical Site installations and distribution systems shall be in accordance with: -

- (1) Indian Electricity Rules
- (2) The Power Companies' Supply Rules;
- (3) Electricity and its subsidiary Regulations;
- (4) IEE Wiring Regulations (16th Edition);
- (5) BS 7375 Distribution of Electricity on Construction and Building Sites;
- (6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and
- (7) BS 6164 Safety in Tunnelling in the Construction Industry. (B) Any other applicable national standards

17. MATERIALS, APPLIANCES AND COMPONENTS

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

18. DESIGN CONSIDERATIONS

- (1) Distribution equipment utilized within the temporary electrical distribution system shall incorporate the following features: -
 - (a) Flexibility in application for repeated use;
 - (b) Suitability for transport and storage;
 - (c) Robust construction to resist moisture and damage; and
 - (d) Safety in use.

- (2) All cabling shall be run at high level whenever possible and firmly secured to ensure they do not present a hazard or obstruction to people and equipment.
- (3) The installation on Site shall allow convenient access to authorized and competent operators to work on the apparatus contained within.

19. **MAINS VOLTAGE**

- (1) The site mains voltage shall be as per the electricity authority, 415V/3 phase 4 wire system.
 - (a) single phase voltage shall be as per the electricity authority, 230V supply.
 - (b) Reduced voltages shall conform to BS 7375. (2) Types of Distribution Supply
- (2) The following voltages shall be adhered to for typical applications throughout the distribution systems:
 - (a) fixed plant - 415V/ 3 phase;
 - (b) movable plant fed by trailing cable - 415V /3phase;
 - (c) installations in Site buildings - 230V /1phase;
 - (d) fixed flood lighting - 230V/1phase;
 - (e) portable and hand held tools -115V /1phase;
 - (f) Site lighting (other than flood lighting) -115V /1 phase; and
 - (g) Portable hand-lamps (general use) -115V /1phase.
- (3) When the low voltage supply is energized via the Employer's transformer, any power utilized from that source shall be- either 415 V. 3 phase or 230 V. 1 phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.
- (4) Protection of Circuits
 - (a) Protection shall be provided for all main and sub-circuits against excess current, under and over voltage, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.
 - (b) Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with: -
 - i) BS 88;
 - ii) BS EN 60898; and
 - iii) BS 7375;
 - iv) Any other appropriate Indian Standards.

9. **EARTHING**

- (1) Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.
- (2) Earthing systems shall conform to the following standards: -
 - (a) IEE Wiring Regulations (16th Edition);
 - (b) BS 7430;
 - (c) BS 7375; and
 - (d) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

10. **PLUGS, SOCKET OUTLETS AND COUPLERS**

Low voltage plugs, sockets and couplers shall be color coded in accordance with BS 7375, and constructed to confirm BS EN 63809 high voltage couplers and 'T' connections shall be in accordance with BS 3905.

11. **CABLES**

- (1) Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.
- (2) For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following specifications appropriate to the duties imposed on it:
 - (a) BS 6708 flexible cables for use at mines and quarries;
 - (b) BS 6007 rubber insulated cables for electric power and lighting; and
 - (c) BS 6500 insulated flexible cords and cables.
- (3) Where low voltage cables are to be used, reference shall be made to BS 7375. The following specifications shall also be referred to particularly for underground cables: -
 - (a) BS 6346 for armored PVC insulated cables; and
 - (b) BS 6708 Flexible cables for use at mines and quarries.
- (4) All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.
- (5) Armoured cables having an over sheath of polyvinyl chloride (PVC) or an oil resisting and flame-retardant compound shall be used whenever there is a risk of mechanical damage occurring.
- (6) For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.
- (7) Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be of a type insulated and sheathed with a general purpose or heat resisting elastomer.
- (8) All cables which are likely to be frequently moved in normal use shall be flexible cables. Flexible cables shall be in accordance with BS 6500 and BS 7375.

12. LIGHTING INSTALLATION

- (1) Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be accordance with BS 7375 and BS4363.
- (2) Voltage shall not exceed 55 V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.
- (3) Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.
- (4) The Contractor shall upgrade the lighting level to a minimum of 200 lux by localized lighting in all areas where required by the Engineer.
- (5) Mechanical protection of luminaries against damage by impact shall be provided by use of wire guards or other such devices whenever risk of damage occurs.

13. ELECTRICAL MOTORS

- (1) Totally enclosed fan cooled motors to BS 4999: Part 105 shall be used.
- (2) Motor control and protection circuits shall be as stipulated in BS 6164. The emergency stops for machinery shall be provided

14. INSPECTION AND TESTING.

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the I EE Wiring Regulations (16th Edition).

15. IDENTIFICATION

Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

16. MAINTENANCE:

- (1) Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.
- (2) All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record kept of the date of issue, date of the last inspection carried out and the recommended inspection period.

17. METERING

The Contractor shall install a separately metered and invoiced supply or supplies of electricity for:-

- (a) Site fabrication facilities;
- (b) Site workshops and work yards; and
- (c) Site offices and stores.

APPENDIX-11
CURVE AND GRADIENT DETAILS

BSRP CORRIDOR

HORIZONTAL AND VERTICAL ALIGNMENT

All the details with regard to the Horizontal and Vertical Alignment are shown on the plan & profile sheets of the drawings provided in tender document.

APPENDIX-12**UTILITIES**

Utilities	
Diversion and Protection of Underground/Overhead Utility Lines	
Additional Conditions for Diversion/Protection of BWSSB Utilities	
Electrical Utilities (BESCOM / KPTCL)	
BBMP Utilities Diversion	
BSNL Utilities Diversion	
Private Telecom / OFC Cable	
General	

DEFINITIONS

1. UTILITIES:

Utilities are defined as public utilities above or below ground and include all live water mains, sewer mains, water wells, power cables, streetlights, transformers, pillar boxes, telephone posts, telecommunication cables, gravity sewers, storm water drains, gas lines which are either shown on the Employer's Drawings (chartered) or identified on site by the Contractor (unchartered).

1.1 Chartered Utilities:

Chartered Utilities are the utilities (as defined above) which are shown on the Employer's Tender Drawings.

1.2 Uncharted Utilities:

Uncharted Utilities are the utilities (as defined above) which are not shown on the Employer's Tender Drawings.

1.3 Responsibility of the Contractor:

- 1.3.1 The Contractor shall make his own enquiries and investigations, including excavating trial holes/pits, to ascertain the existence, nature, location, and size of utilities. A schedule of utility diversions and utilities to remain but to be supported / protected (the utility diversion plan) shall be prepared by the Contractor and submitted.

The Schedule will list out Utilities that:

- i. will be diverted by the Contractor during the course of the Works, and
 - ii. will remain in place and require the use of specific construction protection methods to complete the underground structures around and below the utilities including support of the utilities during construction by the Contractor.
- 1.3.2 The Contractor shall take into consideration the time required for utility diversions into the overall Works Programme for the Contract. However, efforts shall be made to avoid diverting/disturbance of any utility and continue the Works by supporting the same but the required services being provided by these utilities shall be maintained at all the times by the Contractor. Any delay to construction works due to delay in Utility diversion work will be responsibility of contractor, no claims shall be entertained in this regard.
- 1.3.3 The diversion work shall be undertaken by the Contractor as per the approval of the Utility owning Agencies and a notice from the Engineer. Temporary supports and protection by methods proposed by the Contractor and agreed by the Utility Agency shall be provided to the utilities. Permanent supports and protection shall be provided wherever required for the safety and security of the utility service.
- 1.3.4 The Contractor shall immediately inform the Engineer and the Utility Agencies of any
- a) damage to utilities
 - b) leakage of utilities
 - c) discovery of utilities not previously identified
- 1.3.5 When diverting and/or protecting sewerage and storm water lines the Contractor shall ensure that drainage to the site and adjacent areas is maintained at all times and that at no times flooding/overflow or other nuisance occurs
- 1.3.6 The Contractor shall inform the Employer/Engineer of the programme of all works of utility diversion/ protection works and shall take all steps to enable the utility diversions to proceed in accordance with the programme. The Contractor shall maintain close liaison with the Utility Agencies. The Contractor shall set up and manage a Utility Liaison Group of experienced personnel for the duration of the Contract.
- 1.3.7 Records of the existing utilities encountered shall be kept by the Contractor on the Site and a copy provided for the Employer/Engineer. The records shall contain the following details:
- a) location of utility
 - b) date on which the utilities were encountered
 - c) nature and sizes of the utilities
 - d) condition of utility
 - e) temporary or permanent supports provided, and
 - f) Diversions made –Temporary or permanent

- 1.3.8 The Contractor shall include the details (plan, location, ownership, size, and material) of all such utilities on the As Built Drawings.
- 1.3.9 **The diversion of utilities (Charted / Uncharted) shall be covered under the provisional sum given in the Pricing Summary under schedule-F.** The Contractor shall be paid as per the current Schedule of Rates of the respective departments (KPWD, SWR-USSOR, BESCO, KPTCL, BWSSB, BSNL, or any other Govt agency etc.). The priority of reference for deriving rate shall be in the same order as stated above. Until such time as such rate(s) are agreed or fixed, the Engineer, after consultation with the Employer, shall determine the provisional rate(s) to enable IPC to be issued by the Engineer.
- 1.3.10 Temporary diversion of each utility is allowed for one time. If the utility is to be restored, permanent restoration shall be considered in addition to the temporary diversion.
- 1.3.11 NOC & Approval of schemes for Diversion of Utilities from the concerned regulatory /statutory/Local Authority is the responsibility of the Contractor in coordination with Employer, Employer will only assist in getting permission and nothing extra is payable on this account. Similarly, necessary precautions which are specified from time to time by the utility owning agencies shall be followed. Contractor should make his own survey for identification of underground/above ground utilities.

2. **DIVERSION AND PROTECTION OF UNDERGROUND / OVERHEAD UTILITY LINES**

- 2.1 The work comprises of replacement, relocation, diversion and protection of existing subsurface, surface and overhead public utilities viz. sewer mains, water lines, water wells, storm water drains, gully pits including connection pipes, house drains, gas pipe lines, electric and telephone cables, optical fibre cables including their appurtenance structure, O.H. electrical transmission line, electric poles, traffic signals, etc. which will be disturbed due to construction of the metro stations, where applicable.
- 2.2 The Contractor shall effectively protect all public utilities falling within the stations, station entry & exit locations and their immediate adjoining areas or which are likely to be exposed, disturbed or damaged during the execution of the work or in consequence thereof, in such a manner and using such materials as required or specified by the concerned public Utility Agencies and as per instruction of the Engineer, and hold them in proper position without any damage being caused to them during execution of work. Where adequate spaces are not available adjacent and outside the stations, the utilities may have to be hanged within the station-box itself to facilitate the construction work.
- 2.3 The contractor shall provide and lay pipes, water wells, gas mains/gully pit connections/house drains and other electric, telephones, copper telecom cable, optical fibre cables and other cables or any other underground structures or services falling within the station and their immediate adjoining areas which may be found to have been disturbed or damaged due to the Contractor's fault and/or defective and careless workmanship. The decision of the Engineer in this respect shall be binding and final and all costs of rebuilding or repairing of such damaged services or structures as foresaid shall be deducted from the Contractor, if the same is not taken care of within a reasonable time frame, mutually agreed between the Engineer and the Contractor. The claim or penalty imposed by the concerned utility department for the damage of utilities done by the contractor shall be recovered from the Contractor.
- 2.4 The Contractor shall enquire of and collect information from all concerned public Utility agencies, owners, Government Departments and local bodies in connection with the sewer lines, water mains, water wells, cables, wires and any other obstruction either overhead or on ground or underground which may be encountered in the course of execution of the work and which are likely to affect the progress of the work, at his own cost and risk. No idle labour charge will be admissible on account of delay in collecting the above-mentioned information.
- 2.5 The Contractor shall have to excavate trial trenches of suitable sizes for satisfactorily exploring all the underground utilities as required and as instructed by the Engineer before commencement of any permanent work below ground level. All works related to utility identification and preparation of drawings obtaining stake holders approval shall be included in the Contractors quoted price. The time of completion for the project is inclusive of diverting and/or protection (temporary as well permanent) of utilities

3. **ADDITIONAL CONDITIONS FOR DIVERSION / PROTECTION OF BWSSB UTILITIES**

- 3.1 It is the responsibility of the Contractor to get the approval of the proposed water/sewer/storm water/ pipeline etc., diversion/shifting from the concerned Agency/Authority. However, Engineer / Employer may facilitate the co-ordination work with concerned agency for getting the necessary approval.

- 3.2 In case the concerned utility agency/authority maintains a list of registered/approved contractors for undertaking such works and desires such shifting/diversion of pipeline/utility etc. work to be undertaken by such registered/approved contractors, then such shifting/diversion of pipeline/utility etc., shall be carried out by engaging the registered/approved contractors.
- 3.3 In case the Engineers of concerned utility agency intend to supervise the work, the Contractor (or sub-contractors engaged by the Contractor) have to carry out the work as per the instruction of the utility agency during diversion work by the Contractor.
- 3.4 In case of permanent diversion of water/sewer/storm water/pipelines etc., it is the responsibility of the Contractor to carry out such work without affecting water supply/without affecting sewage disposal etc. If required alternative temporary arrangement shall be made by the Contractor without any additional cost.
- 3.5 In case of temporary water pipe/sewer pumping mains (without manholes) diversion (which means divert the pipeline temporary away from station box and brought back to the original position after completion of station work), it is the responsibility of the Contractor either to use the retrieved diverted pipes or new pipes to restore back the original place without affecting the water supply/utility service.
- 3.6 In case of temporary diversion of gravity sewer pipelines with manholes are required, the Contractor, initially before taking up the station work has to ensure that the flow is diverted by laying sewer pipeline and constructing manholes away from the station box and then only divert the flow. After completion of station work, the Contractor shall have to lay again another sewer pipelines and again construct new manholes for restoring back to the original place.
- 3.7 In case of temporary supporting of water/sewer pipelines, if any damages occur during construction period it is the responsibility of the Contractor to rectify the damages to the satisfaction of concerned agency. The cost of the rectification works shall be borne by the Contractor.
- 3.8 It is the responsibility of the Contractor to obtain completion certificate from concerned utility agency for each diversion work. The payment for such diversion work will be made to the Contractor after obtaining completion certificate from concerned utility agency.
- 3.9 The Contractor shall handover all the retrieved material to the stores of the concerned utility agency / concerned department at the Contractor's cost and submit the proof of handing over.
4. **ADDITIONAL CONDITIONS FOR ELECTRICAL UTILITIES (BESCOM / KPTCL)**
- 4.1 The Contractor shall submit the utility diversion programme to Engineer / Employer with diversion justification based on trial pit information.
- 4.2 The Contractor shall submit the diversion plan to Engineer at least 60 (sixty) days in advance of work commencing to obtain approval from Electrical utility agencies. For utility diversion proposals of BESCOM / KPTCL, the Contractor shall submit diversion justification with trial pit information and drawing(s) with the proposed diversion route(s).
- 4.3 The Contractor would submit application of diversion works to electrical utility agencies with diversion plans. The Contractor shall render necessary assistance.
- 4.4 The Contractor shall coordinate with the local officials to assess quantities and specifications of materials required for diversion works. Necessary assistance would be provided by the Employer and the Engineer.
- 4.5 The Contractor shall obtain necessary permission from the concerned departments/agencies to carry out the diversion/shifting works and get necessary permission from Traffic Police Department.
- 4.6 Wherever possible, horizontal directional drilling method shall be adopted at location where utility diversion works crosses roadways and require lane closures for excavation to avoid inconvenience to the traffic.
- 4.7 The electrical utilities diversion/ shifting should be carried out by the Contractors/agencies registered with the electrical utility agencies / KPWD and have the required grade license from the Chief Electrical Inspector to Government. The Contractor should be well acquainted with electrical works so as to maintain the standard. The Contractor shall inform the same to Employer/Engineer for getting consent from the concerned electrical utility agency.
- 4.8 The Contractor shall identify the quantity of materials required for the contract such that the material can be procured by the Contractor in bulk and in advance to the implementation of the utility diversion works. The quality of materials to be procured shall be approved by the concerned utility agency. Materials used for diversion/ shifting shall be of quality conforming to the applicable standard of the electrical utility agency and as per relevant BIS.
- 4.9 The source of materials and the guarantee for the materials to be used shall be submitted to Engineer for

obtaining approval from the concerned utility agency. Any failure of the material within the guarantee period shall be replaced and installed free of cost by the Contractor.

- 4.10 Contractor shall inform the local officers/officials of the concerned utility agency about the diversion works at least 15 (fifteen) days before the execution of diversion.
- 4.11 The diversion / shifting utility work shall be carried out under the direct supervision of officials and the utility agency decision shall be final in this regard. The Contractor shall provide free access to officers/ officials / workman for the purpose of inspection/supervision.
- 4.12 After restoration of regular service completion certificate shall be obtained from the concerned departments/agencies. The regulations for working with utility agencies shall be as follows:
 - a. The diversion/shifting utility work should be carried out without causing any inconvenience to the operation and maintenance of Sub-Station and other departmental works of the concerned utility agency.
 - b. The Contractor shall execute and complete the work strictly in adherence to the time schedule and to the satisfaction of the engineers and adhere strictly the direction of the utility agency in any matter.
 - c. The Contractor shall be responsible to protect the public and the employees of the utility agency against any accident that may arise during the execution of diversion/shifting utility works. The Contractor shall indemnify the Employer for any claims for damages/injuries to the person/property resulting from any such accident. The Contractor shall Compensation Act by the way of obtaining an accident risk type insurance to meet all purpose of relief, failing which or otherwise the Contractor shall be solely responsible for meeting the compensation awarded under the said Act.
 - d. The Contractor shall undertake to ensure free flow of traffic during execution of the diversion/shifting works and shall be responsible for any accident/loss of lives/property. Damage to the other existing utilities during diversion shall be rectified by the Contractor at his own cost.
 - e. The Contractor shall employ qualified technical personnel to carry out the diversion/shifting of utility works.
 - f. The Contractor shall apply well in advance for Line Clearance (LC) for carrying out the joint works/shifting works. Employer would authorise the Contractor to take LC from the concerned utility agency. If needed, Employer would provide assistance to the Contractor to get the LC. LC will be given by the concerned utility agency depending upon exigencies, which have to be strictly adhered to.
 - g. The Contractor shall handover all the retrieved / unused material to the stores of the concerned utility agency / concerned department at the Contractor's cost.
 - h. Contractor to pay the penalty/charges imposed by the utility agency for damage to the utilities on their own.
 - i. The Contractor shall undertake not to revoke the above conditions unit the completion of diversion / shifting works.

5. **ADDITIONAL CONDITIONS FOR BBMP UTILITIES DIVERSION**

- 5.1 Diversion of Storm water drain shall be carried out as per the design, standard and general specifications of BBMP /PWD/concerned Highways Department.
- 5.2 The diversion route for storm water drain shall be approved by BBMP /concerned PWD/ Highways Department.
- 5.3 The invert level of diverting drain shall be maintained on par with upstream/downstream of connecting drains.
- 5.4 The Contractor shall make alternate arrangements to divert and ensure smooth flow of water from upstream side during construction.
- 5.5 The Contractor shall provide the adequate sizes of drain or follow the existing sizes as agreed by the concerned agency.
- 5.6 Diversion of storm water drain shall be carried out through the registered Contractors of BBMP/PWD/Highways Department (if such a list of approved/registered contractors is maintained by the utility agency).
- 5.7 Streetlights shifting shall be carried out as per the specification of BBMP.

6. **ADDITIONAL CONDITIONS FOR BSNL UTILITIES DIVERSION**

BSNL utilities such as copper cable and OFC cables which are likely to be affected to be identified based on trial pit information. Contractor to prepare the diversion plan in coordination with the BSNL utilities agencies and get approval for the diversion plan. Employer/Engineer may provide assistance in this regard. Contractor to assess the required quantities based on the diversion plan. Cables procured to be Quality control checked by the concern wing of BSNL. Contractor to coordinate and arrange for the Quality control check by BSNL

Diversion of BSNL utilities to be done by the BSNL approved subcontractors and the completion certificate to be obtained from BSNL for the utility's diversion done

7. **PRIVATE TELECOM / OFC CABLE**

Private Telecom/OFC/Other cable Contractor to manage the existing private telecom and OFC cables.

8. **ADDITIONAL CONDITIONS FOR GAIL**

GAIL utilities such as Gas Pipelines which are likely to be affected to be identified based on trial pit information. Contractor to prepare the diversion plan in coordination with the GAIL utilities agencies and get approval for the diversion plan. Employer/Engineer may provide assistance in this regard. Contractor to assess the required quantities based on the diversion plan. The materials / items procured are to be checked for Quality control by the concern wing of GAIL. Contractor to coordinate and arrange for the Quality control check by GAIL. Diversion of GAIL utilities to be done by the GAIL approved subcontractors and the completion certificate to be obtained from GAIL for the utility's diversion done.

9. **ADDITIONAL CONDITIONS FOR DIVERSION / PROTECTION OF DEFENCE UTILITIES**

It is the responsibility of the Contractor for diversion / shifting of Defence Utilities including getting the approval of the concerned Agency / Authority. However, Engineer / Employer may facilitate the co-ordination work with concerned agency for getting the necessary approval.

10. **ADDITIONAL CONDITIONS FOR DIVERSION / PROTECTION OF INDIAN RAILWAY UTILITIES**

It is the responsibility of the Contractor for diversion / shifting of IR (Indian Railway) Utilities including getting the approval of the concerned Agency / Authority. However, Engineer / Employer may facilitate the co-ordination work with concerned agency for getting the necessary approval.

11. **GENERAL**

The Contractor shall provide 6 months rolling programme every 3 month.

APPENDIX – 13
OFFICE ACCOMMODATION, EQUIPMENT AND PERSONNEL

Deleted .

APPENDIX – 14**CONTRACTOR'S SITE LABORATORY****1. SITE LABORATORY**

1.1 The Site Laboratory shall be approximately 250sq.m in area. It shall consist of the following accommodation:

- Concrete Laboratory - 01 No. – 60 Sq.m Floor Area
- Soil Laboratory - 01 No. – 30 Sq.m Floor Area
- Office - 02 Nos. – 15 Sq.m Floor Area each.
- Store Room - 01 No. – 10 Sq.m Floor Area
- Kitchen - 01 No. – 10 Sq.m Floor Area
- Toilet, Changing Room & Shower - For Male (Sufficient for 06 persons)

1.2 The remainder of the 250 sq.m shall consist of Storage Area for Concrete Cube Curing Tanks. The Laboratory, Office etc. shall be in one Building, the Curing Tank Storage Building may be in a separate building. If the separate building, it shall be adjacent to the Laboratory building and connected to it by a level, weather proof passageway. In addition, an area of covered hard standing of 50 sq.m for motor vehicles shall be provided adjacent to the Laboratory.

2. STANDARD OF CONSTRUCTION

2.1 The laboratory shall be constructed to the best Engineering practice and as approved by the Employer / Engineer. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be located in areas approved by the Employer / Engineer.

2.2 A Water tank with minimum capacity of 2000 liters shall be installed. Constant water pressure of 15 KPa minimum shall be ensured in each laboratory.

2.3 In the case of sinks used for washing samples, adequate trapping and / or separating devices shall be provided to ensure the proper functioning of the facility.

3. FURNISHINGS AND FIXTURES

The Contractor's site laboratory shall be provided with required furnishing and fixtures.

4. LABORATORY EQUIPMENT

4.1 The laboratory equipment, as listed below, shall be approved by the Engineer. The Contractor shall submit for the Engineer's approval within 2 weeks of the order to commence work the name of the supplier it intends to use for each piece of apparatus together with the relevant catalogue number.

4.2 The layout of the equipment in the testing laboratory shall be as instructed by the Employer / Engineer. The equipment shall be maintained to accuracy appropriate to the required testing methods with routine calibration by an accredited organization as recommended by the appropriate Authority. Equipment shall also be calibrated after maintenance or relocation.

4.3 The Contractor's site laboratory shall be equipped with the following material testing equipment as a minimum. The nature and quality of equipment required for pre-stressing may be varied by the Engineer depending on the detail of the Contractor's Design and Construction methods or for any other reason which he deems to be valid and necessary for the proper control of quality:

Description	Qty / Unit
Liquid limit device (Casa grande type) (01 complete set)	1 set
Grooving Tools	1 No
Evaporating dish	1 No
Spatula 100mm Blade	1 No
Laboratory balance, Capacity 500 g (Sensitivity 0.01 gms.)	1 No
Wash bottle – capacity 500 ml.	1 No
Moisture cans – capacity 50 ml	24 No
Determining Plastic Limit (01 complete set)	
Evaporating dish	1 No
Spatula 100mm Blade	1 No
Glass plate (250 x 250 x 12mm)	2 No
Moisture cans – capacity 50 ml	12 No
Stainless Steel Rods (3mm dia)	2 No
Determining Moisture Content (01 complete set)	1 Set
Micro Oven (capacity 35 ltr – control temperature upto 200 °C)	1 No
Weighing Machine (capacity 200 gm – sensitivity 0.01 gm)	1 No
Lab. Tongs	1 No
Moisture cans – capacity 75 ml with lid.	36 No
Compaction Characteristics (01 complete set)	1 Set
Standard Compaction Mould – 100mm dia	1 No
Modified Compaction Mould – 150mm dia	1 No
Standard Compaction Rammer – 2.5 Kg.	1 No
Modified Compaction Rammer – 4.5 Kg.	1 No
Straight Edge – 300mm long	1 No
Sample ejector for 100mm and 150mm	1 No
Mould Sample tray 60 x 60 x 8 cm	3 No
Wash bottle, 500 ml	2 No
Moisture cans 250 ml	24 No
Density of soil in-place by sand core method (02 complete sets)	2 Set
Sand density cone apparatus 150ml	2 No
Plate, 300mm X 300mm	2 No
Chisel 25mmX 150mm	2 No
Hammer	2 No
One gallons field cans	24 No
Sampling spoons	2 No
Soft hair brush	2 No
Moisture cans	48 No
Sieve Analysis	
Sieve shaker (portable)	1 Unit
Coarse sieves in sizes from 100mm to 10mm (1set Fine sieves #4, #8, #16, #30, #40, #50, #100, #200 each) - (Pans & covers)	
Specific gravity and absorption of coarse aggregate	
Wire basket, 200mm dia Heavy duty suspension balance, 20kg X 1gm with accessory for weight in water	1 Set
Suitable water container	1 No
Unit wt. of aggregate	
Balance, 100Kg cap. with 10gm precision	1 No

Description	Qty / Unit
Tamping rod 16mm diaX600mm long	1 No
Measuring containers (3, 10, 15, 30 ltrs)	1 Each
Flakiness & Elongation	
Flakiness gauge, Elongation Index	1 Set
Soundness Test	
Sodium Sulphate	25 Kg
Soaking Tank	1 No
Balance, Cap. 3Kg, sensitivity 0.1gm	1 Set
Sieves: coarse, Fine	1 Set
Concrete	
Bickets for concrete sampling	12 No
Slump Cone	12 No
Tamping rod	12 No
Base plate	12 No
Mixing pan for concrete	2 No
Scoop for general purpose	2 No
Concrete thermometer	2 No
Concrete cylinder mould, 150 mm * 300mm; 100 mm* 300 mm	10 each
Concrete cube mould, 100 mm cube & 150 mm cube	10 each
Adjustable spanners for Dismantling cube moulds	6 No
Capping set	2 No
Capping compound	
Concrete curing tank with capacity for 270 cubes, temperature controlled, with circulation system drain and lockable cover	5 Nos
Schmidt test hammer	1 No
Compression testing machine (simple hand operated)	1 No
Mould oil Temperature chart recorder	1 No
Miscellaneous	
Vernier callipers to measure up to 200mm, with elongated jaws	5 No
Steel rule, 300 mm long graduated	2 No
Rubber gloves	10 Pair
Cotton working gloves	20 Pair
First aid kit	1 set
Wire brush	6 No
Steel tape, 3m, 5m, 30m	3 each
Ball peen hammer, 1 kg	2 No
Paint scraper. Approx. 100mm wide	8 No
Float, steel Approx.280 x 120 mm	8 No
Sack barrow	1 No
Shovel: Square Mouthed	2 No
Round Mouthed	2 No
24-wheel trolley, heavy duty, approx. 0.7m X 1.0m long Pneumatic tyred type	1 No
Wheel barrow, rubber tyred - Comprehensive tool kit	1 No
claw hammer, multi-grips, spanners (adjustable)	1 No
Type NR Schmidt Hammer and tester with recording device	1 No
Testing Anvil for Schmidt Hammer test (SHT)	1 No

Description	Qty / Unit
Chart recording paper for SHT	10 Pkts
Cover meter for detecting metal objects to depth of 100 mm - below the surface of non-magnetic objects	3 Nos.
Noise meter	1 No
RCPT Testing Machine	1 No
Permeability Testing Machine	1 No

APPENDIX-15

REFER ANNEXURE-8B – 1 APPROVED VENDORS LIST

APPENDIX – 16
DELETED