

SECTION-VII

EMPLOYER'S REQUIREMENTS

GENERAL INFORMATION

AND

SCOPE OF WORK

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1 Contractor's Organisation and Superintendence**1.1 General**

- 1.1.1 The Contractor shall staff the Project with manpower sufficient to achieve the Time for Completion date stated in the Key Dates.
- 1.1.2 Throughout the design and execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.
- 1.1.3 Superintendence shall be given by a sufficient number of persons having adequate knowledge of Hindi/Kannada and the English language, and any other language as may be appropriate, of the operations to be carried out (including the methods and techniques required and the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.
- 1.1.4 The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations.

1.2 Organisation chart

- 1.2.1 Within 30 days of the Commencement Date the Contractor shall submit to the Engineer for review and approval a mobilisation plan and organisation chart detailing the proposed management, design and technical staff organisation for the Contract.
- 1.2.2 This organisation chart shall cover all aspects of the Contract and define the functions, responsibilities and authorities of each person represented.
- 1.2.3 Lines of reporting and responsibility of subordinates shall be included in the chart.

1.3 Key Personnel

- 1.3.1 Key Personnel shall be directly employed by the Contractor.
- 1.3.2 After the Commencement Date the Contractor shall submit names, qualifications and experience of all Key Personnel, as detailed in clause 1.3.6, for approval by the Engineer and Employer.
- 1.3.3 The Contractor shall ensure that all the Contractor's personnel of are approved by the Engineer and Employer. Deployment is to be done as per the approved mobilization plan.
- 1.3.4 The Contractor shall not remove or replace any Key Personnel without the prior approval of the Engineer and Employer. Any substitute Key Personnel shall be suitably qualified and experienced for the duties of the position to which the Contractor intends to appoint them. Any changes or additions to either the organisation or Key Personnel shall be submitted for approval to the Engineer and Employer.
- 1.3.5 The Contractor shall ensure that there is a minimum deployment period of two weeks for new Key Personnel.
- 1.3.6 Key Personnel shall have the minimum qualifications and experience as described in the table below;
- 1.3.7 The Employer may designate other positions as Key Personnel or reduce the number of such positions at any time during the Contract.
- 1.3.8 The mobilisation plan shall show the qualifications and experience of all staff and shall show the Contractor's management structure and state clearly the duties, responsibilities and authority of each member of staff.
- 1.3.9 The mobilisation plan shall be updated and resubmitted to the Engineer for review and approval of Employer whenever there are changes to the Contractor's staff.
- 1.3.10 The Contractor's Representative and personnel shall have experience appropriate to the type and magnitude of the work under the Contract and shall possess relevant university degrees or equivalent qualifications appropriate to their individual duties.

- 1.3.11 The Contractor shall employ Engineers, foreman and supervisors in connection with each trade who are suitably experienced in that trade. The engineers, foreman and supervisors shall be present at all times when that trade is being undertaken and shall directly supervise the personnel carrying out the tasks. The Contractor shall submit details of the qualifications and experience of any specialist staff identified in addition to those listed above that it proposes to use in the major disciplines required to construct the work under the Contract.
- 1.3.12 Minimum level of Shift In-charge should be Senior Engineer (having B.E/B. Tech in Civil Engineering) with 5 years of relevant field experience in Metro& Railway activities. In this connection, Diploma with 5 years' experience in relevant field will be considered equivalent to degree.
- 1.3.13 "Minimum total experience post qualification (years)" means total experience of work in any Infrastructure construction related to predominantly Civil engineering projects including all other elements of MEP etc.
- 1.3.14 "Minimum Experience in the specified field" means the experience of work mentioned in the Column (2) of table 1.3.6.

1.4 Deleted

1.5 Subcontractors and Suppliers

- 1.5.1 For all Subcontractors and Suppliers, the Engineer's approval shall be obtained prior to mobilisation unless otherwise instructed by the Engineer with respect to Section 5 & Section 7 (CC & PCC).
- 1.5.2 The Engineer's prior written approval of any subcontractor, supplier or any lower tier subcontractor or supplier shall be obtained on a case by case basis and as required by the Engineer.
In the first instance the Contractor shall submit the following information to the Engineer for review;
- a. Name of Subcontractor or Supplier;
 - b. Registered, Corporate and Site office details as applicable;
 - c. Scope of work or supply;
 - d. Approximate value of the subcontract or material/equipment purchase;
 - e. Relationships in the supply chain if not direct, i.e. purchase through a 3rd party;
 - f. Relevant work experience details of subcontractor including documentary proof;
 - g. Proof material/equipment from a supplier has been used on a Metro rail / railways project in India.
- 1.5.3 The Contractor shall provide full details of all Subcontractors, vendors and sub-vendors, including as a minimum those chosen for:
- a. Utility diversions
 - b. Piling and Foundations
 - c. Civil works
 - d. Pre-Engineered Building works
 - e. Architecture works
 - f. Mechanical, Electrical & Plumbing
 - i. Electrical works including Lighting, HVAC, Diesel Generators, and Pumps etc.
 - ii. UPS and Batteries
 - iii. Switch Gear and Distribution Panels
 - iv. Fire Life Safety Systems
 - v. Building Automation Control Systems
 - vi. Public Health Engineering (PHE) works

1.6 Health and Safety Staff

- 1.6.1 Within 30 days of the Commencement Date, the Contractor shall as a minimum appoint at least the

following number of full-time health and safety staff and at all times comply fully with Indian Law. The Contractor shall confirm monthly the strength of their Health and Safety team on the Contract.

1.6.2

As a minimum the Contractor shall comply with the following;

- a. The Contractor shall appoint one (1) full-time Health and Safety Manager {Key Personnel} who shall be submitted to the Engineer for review. The health and safety manager shall meet the minimum requirements in accordance with current Indian Law and standards.
- b. The Contractor shall appoint one (1) full-time Deputy Health and Safety Manager who is capable of performing all of the duties of the health and safety manager during their absence. The Deputy Health and Safety must meet the requirements in 1.6.1.a.
- c. The Contractor shall appoint competent health and safety officers and support staff in sufficient numbers to ensure the effective function of the health and safety discipline within the Contractor's organisation. The Contractor shall appoint and deploy full time on the Site.
 - i) One (1) health and safety officer for each and every 50 persons employed at the Site.
 - ii) For less than 50 persons employed at the Site, a minimum of one (1) health and safety officer shall be present on Site during all working hours each day throughout the Contract period.
 - iii) This requirement is in addition to the health and safety manager and the deputy health and safety manager.
- d. The Contractor shall ensure that each Subcontractor employed on the Site appoints suitably qualified health and safety staff to ensure the effective function of the health and safety discipline within the Subcontractor's organisation;
 - i) The Subcontractor shall appoint and deploy full time on the Site one (1) health and safety officer for each and every 50 persons that they employ at the Site.
 - ii) Any Subcontractor that employs more than 100 persons shall appoint a health and safety manager in addition to their health and safety officers.
 - iii) The Subcontractors Health and Safety team shall comply fully with the Contractors Health and Safety systems and shall directly report to the Contractors Health and Safety Manager.
- e. Health and safety officers shall have no other duties, either on-Site or off-Site, other than health and safety duties, and shall be exclusive to one Site.

1.7 Records of Contractor's Personnel

1.7.1 The Contractor shall submit monthly to the Engineer details showing the number of each class of Contractor's Personnel, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

1.7.2 The Contractor shall submit monthly to the Engineer a certified payroll for their direct employees and for their subcontractors.

1.8 Responsibility Matrix

1.8.1 The Contractor shall submit within 60 days of the Commencement Date a Management and Supervision Responsibility Matrix (RACI) confirming roles and responsibilities in a format to be agreed with the Engineer.

1.9 Festivals and Religious Customs

1.9.1 The Contractor shall in all dealings with his staff and labour have due regard to all recognised festivals, days of rest and religious or other local customs.

1.10 Burial/Cremation of the Dead

- 1.10.1 The Contractor shall make all necessary arrangements for the transportation to any place as required for the burial and death rituals or cremation of a body, of any of his employees who dies whilst working on the Contract.

1.11 Disorderly Conduct

- 1.11.1 The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

1.12 Housing of Labour

- 1.12.1 The Contractor, shall, at his own expense, make adequate arrangement for the housing, supply of drinking water and provision of bathrooms, latrines and urinals, with adequate water supply, for his staff and workmen directly or through Sub-Contractor's employed on the works at the location authorised by the Employer.
- 1.12.2 No labour camp shall be allowed at any work site provided by the Employer or any unauthorised place.
- 1.12.3 The Contractor at his own cost shall maintain all sites and welfare facilities in a clean and sanitary condition. The Contractor shall obey all health and sanitary rules and regulation, and carry out at his cost all health and sanitary measures that may from time to time be prescribed by the Local/Medical Authorities and permit inspection of all health and sanitary arrangements at all times by the Employer, Engineer and the staff of the local municipality or other Authorities concerned. Should the Contractor fail to provide adequate health and sanitary arrangements, these may be provided by the Employer and the cost recovered from the Contractor.
- 1.12.4 The Contractor shall at his own cost, provide First Aid and Medical facilities at the Labour Camp and at work sites on the advice of the Medical Authority in relation to the experience, and number of the Contractor's staff and workmen, employed directly.
- 1.12.5 The Contractor shall at his own cost, provide the following minimum requirement for fire precautions:
- Portable Fire Extinguishers.
 - Manual Fire Alarms
 - Water Supply for use by the Fire Service.
- The Contractor at his own cost shall provide necessary arrangements for keeping the camp area sufficiently illuminated to avoid accidents to the Workers. He should also ensure that electrical installations are carried out by Trained Electricians. These installations shall be maintained, and daily maintenance records must be made available for inspection of the Engineer.
- 1.12.6 On completion of the Contract, unless otherwise agreed with the Employer, the temporary camps, housing provided by the Contractor shall be removed and the site accommodation reinstated to its original condition, all to the approval of the Engineer.

2 Commercial, Cost, Risk & Change Management**2.1 General**

- 2.1.1 The Contractor's organisation shall include commercial resources to undertake the Contractor's commercial and contractual administration for the work under the Contract. The Contractor's commercial duties and obligations shall include, but are not limited to the following items.

2.2 Change Management

- 2.2.1 Change Management Plan

- a. Within 45 days of the Commencement Date the Contractor shall issue to the Engineer for review, a Change Management Plan {CMP} and documented processes for change management demonstrating compliance with the change management requirements of the Contract.
- b. Within 60 days of the Commencement Date the Contractor shall implement a comprehensive and robust system and processes for change management.

2.2.2 Variation Proposals

All variations will be dealt in accordance with Clause 13 GCC & PCC.

2.2.3 Variation Reporting

- a. The Contractor shall submit a Monthly Variation Report in a form approved by the Engineer.
- b. The Variation Report shall:
 - i. Detail all Variations instructed to date with appropriate referencing and descriptions,
 - ii. Record actual and anticipated costs incurred and an estimate of the amount of such work completed, expressed as a percentage; and
 - iii. Contain details of cost proposals in preparation and those which have been submitted to the Engineer for consideration in advance of a variation being instructed.

2.3 Commercial Management

2.3.1 Cash Flow Reporting

- a. The Contractor shall submit a projected monthly cash flow analysis for the work under the Contract to the Engineer, within 30 days of the Commencement Date.
- b. Accompanying the Baseline Programme the Contractor shall submit for the approval of the Engineer, a cash flow analysis to support the Programme.
- c. The cash flow analysis shall detail the anticipated amounts to which the Contractor considers he will be entitled to have certified monthly as the work under the Contract is progressed. It shall be aligned with the Programme, work and cost breakdown structures. It shall be for the Engineer's information only and shall not form the basis for certification assessment.
- d. An updated cash flow report shall be included in the Monthly Progress report. This report shall align with and be adjusted according to the actual progress of the work under the Contract, the proposals to undertake remaining work under the Contract, and any Variations instructed by the Engineer.

- 2.3.2 All invoices shall be submitted with substantiation and certification to permit the Engineer to process payment. Certification of work shall include the Quality Manager's written confirmation, as required by Self-Certification, that the work in question is in full compliance with the Employer's requirements and the Contractors design.

2.4 Risk Management

2.4.1 The Contractor shall ensure that:

- a. A risk management system is established, compliant with ISO 31000, implemented and maintained;
- b. The performance of the risk management system is to be reported to the Contractor's management for review and as a basis for improvement identified;
- c. The performance of the risk management system is reported to the Engineer for review, and
- d. A risk management plan {RMP} shall be submitted to the Engineer for approval within 60 days of the Commencement Date.

2.5 Commercial, Contractual and Cost Management Reporting

- 2.5.1 The Contractor shall submit a monthly Contract Price assessment in a format approved by the Engineer. The assessments shall show the Contract Price adjusted to incorporate the effects of instructed variations and cost proposals in preparation or submitted to the Engineer in respect of potential Variations.
- 2.5.2 The Contractor shall indemnify the Employer, the Employer's Personnel, and their respective consultants in accordance with Section 5 & 7 (CC & PCC).
- 2.5.3 The Contractor shall report cost in WBS and CBS format as mandated by the Engineer.
- 2.5.4 Monthly Reports shall include, but not be limited to, the following features:
 - a. change control;
 - b. project controls;
 - c. cost management.
- 2.5.5 All reporting shall be in a format compatible with the Employer's Project Management Information System PMIS.

3 Planning, Programming and Progress Management

3.1 Project Management

- 3.1.1 The Contractor shall provide effective project management of all Contract activities for the work under the Contract. It is a prime responsibility of the Contractor to manage the work under the Contract to achieve the requirements of the Contract, meeting all the timelines without delays.
- 3.1.2 The Contractor shall fully cooperate with the Engineer in coordination with all parties involved with the project, not only limited to the designer(s) of interfacing works, other Project Partners (Contractors and Designers), private developers and concerned local statutory authorities.

3.2 Software

- 3.2.1 The Contractor shall implement and use a computerised system to plan, execute, maintain and manage the planning, design, pre-construction, construction, testing and commissioning of the work under the Contract throughout the Contract period.
- 3.2.2 The Contractor shall use Primavera Project P6, the version is to be confirmed and approved by the Engineer, software for Programme management or as directed otherwise by the Engineer.
- 3.2.3 The Contractor shall provide and supply 2 Nos. (two) licences each of the Program management software Primavera (P6) to the Engineer with relevant installation and operation manuals free of cost for use in connection with and for the duration of the Contract.
- 3.2.4 The Contractor shall comply with all the protocols related to the access to and the security of the Employer and Engineer's computer networks and intranet. The Contractor shall provide all tools, equipment, manuals and training as necessary for the Employer and Engineer to use, maintain and re-configure all of the software provided under the Contract. All software used by the Contractor shall be original and licensed by the supplier.

3.3 Programmes

- 3.3.1 The Contractor shall prepare and submit his works programme and three month Rolling Programmes in accordance with the detailed requirements contained in Appendix-01 of Annexure VII-1 to the Employer's Requirements.
- 3.3.2 The Key Dates are defined in **Contract Data of Section 9.**
- 3.3.3 The Key dates are mentioned in terms of the time period in number of days reckoned from the commencement date of the Work, and the deliverables for each Key Date shall be achieved by the midnight of the Key Date mentioned. If the Key Date is not achieved as per Contract data, delay damages shall be applicable.
Each Key date includes number of stages for completing the activities these stages are interrelated

- with flow of activities which may be required in a sequential order; few of the activities/sub-works may be independent to other activities/sub-works which can be programmed for simultaneous or parallel execution. For the purpose of effective monitoring and implementation, certain intermediate stages have to be identified for each Key date.
- 3.3.4 Interfacing with relevant Project Partners and other agencies for achievement of Key Dates shall be the responsibility of Contractor.
- 3.3.5 The Contractor shall develop a detailed, logical method of executing the work under the Contract and shall provide programmes which shall reflect the detailed planning of works to be undertaken. In compiling all programmes and in all subsequent updating and reporting, the Contractor shall make provision for the time required for coordinating and completing the design, procurement, construction, testing, commissioning and integrated testing of the works, including design co-ordination, the review of procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or license is required prior to the execution of any work. The Design Submission Programme shall be integrated in to the overall works programme.
- 3.3.6 The Contractor shall submit the Work Breakdown Structure (WBS) to the Engineer for approval.
- 3.3.7 The Contractors programme(s) shall be realistic, achievable and shall fully reflect the Employer's requirements, and they shall be accompanied by detailed supporting plans.
- 3.3.8 Programme activities shall be discrete items of work, which when combined, produce definable elements and components leading to Milestones, Key Interface and Sectional Completion dates and clearly identify the completion obligations of the Contractor.
- 3.3.9 Any programme activity creating an imposed time or other constraint shall be fully defined by the Contractor.
- 3.3.10 Activity descriptions shall clearly convey the nature and scope of the Works. Programmes shall consider the activities of preceding, concurrent, adjacent, and follow on parts and sections of the work under the Contract as well as utility service diversions, new utility installations and connections, and any other activity that may affect the progress of the work under the Contract.
- 3.3.11 Milestones, Key Dates, Key Interfaces, Sectional Completions and Taking-Over Dates shall be an integral part of all programmes and all activities. Sequencing and interrelationships required to achieve each of these dates shall be shown on the programme.
- 3.3.12 The programming shall not impose constraints which in any way affect the float or limit the achievement of Key Interface, Sectional Completion or Taking over Dates.
- 3.3.13 The critical path shall be clearly identified in the programmes, and it shall be fully described in the accompanying programme narrative.
- 3.3.14 The Contractor's prime point of contact for all matters relating to planning, programming and progress management shall be the Engineer.
- 3.4 Baseline Programme**
- 3.4.1 Within 28 days of the Commencement Date, the Contractor shall submit the initial 'Works Programme' for review and comment by the Engineer/Employer. The Initial Works Programme shall;
- be fully compliant with the Milestone, Key Interface and Taking Over Dates,
 - provide full programme details for the first twelve (12) months of the Contract, and
 - outline details for the remaining period of the Contract.
- 3.4.2 Further, subsequent to the approval of Initial Works Programme, the Contractor shall submit to the Engineer for review and approval a fully comprehensive Primavera Project P6 based, resource and cost loaded Detailed Works Programme (Baseline Programme). The Initial Programme shall be used as the basis for preparing the Contractor's Detailed Works Programme (Baseline Programme). In identifying all design, procurement, construction, installation, fitting out, testing and commissioning activities and associated interfaces, the Detailed Baseline programme shall include:
- a programme showing key design, procurement, manufacturing and construction elements and

shall include activity sequences taking into consideration all the interfaces with other project contracts.

- b. key plans showing the zones/location mentioned in the programme;
- c. narrative explaining contract components, areas, zones methodology, sequence of construction, logistics, temporary facilities, safety and security, traffic and utility diversions, planning, permits and licences, interface management with other construction packages, contractual milestones, imposed constraint dates and any assumptions;
- d. a work breakdown structure (WBS) shall be in accordance with the Contract and for review by the Engineer;
- e. an activity coding system as defined by the Engineer;
- f. cost accrual coding as defined by the Engineer;
- g. the critical path of the work under the Contract;
- h. a planned progress S curve derived from budgeted cost loaded on to the schedule cumulative and monthly cash flows;
- i. long lead item material and equipment delivery schedule;
- j. forecasts of all Milestone dates, Key Interface Date, Sectional Completion dates and Taking Over dates;
- k. time chainage diagrams, fully in compliance with the Detailed Baseline Programme.

3.5 Programme Submissions

3.5.1 All submissions of programmes and schedules shall include the actual progress of work and a forecast for the remaining work. Actual progress shall be stated in terms of;

- a. completed Milestones, Key Interface, Sectional Completion and Taking Over Dates (as defined in the Schedule of Payments) with the corresponding earned value (Earned Value reports along with Actual Cost to Date, Cost to Completion, Schedule and Cost Variances);
- b. percentage completions of activities commenced but between Milestones, Key Interface, Sectional Completion and Taking Over Dates; and
- c. remaining duration and actual start and finish dates for each activity in the work under the Contract.

3.5.2 The Engineer shall review those Contractor's programme submissions that are in compliance with CC/PCC. If the Programme fails to comply with the Contract or to be inconsistent with actual progress, the Contractor shall amend the programme considering the Engineer's comments and/or requirements and resubmit the Programme in accordance with CC/PCC.

3.5.3 Failure to Make Submissions

Failure of the Contractor to submit any Programme, or any required revisions within the time limits stated shall be sufficient reason for default that the Contractor is not performing the work required in a timely manner, and the Engineer may retain any payment due to the Contractor.

3.6 Construction Update Programme

3.6.1 The Detailed Works Programme shall be updated by the Contractor and submitted monthly in the Monthly Progress Report as a Construction Update Programme, or as required at any time by the Engineer. Reproducible electronic copy, PDF and .XER File of the Construction Update Programme shall be provided each month to the Engineer.

3.6.2 The Contractor shall produce and submit a summary level report on the Monthly Construction Update Programme for the Engineer's review. This report shall contain the following information as a minimum planning requirement:

- a. activity description planned and remaining duration;
- b. planned and actual percentage progress, calculated from quantity of works completed;
- c. start and finish dates (original);

- d. current early start and early finish dates;
 - e. forecast finish dates as on data dates;
 - f. actual start and actual finish dates;
 - g. contractual and monitoring milestone dates and other key dates (original, plan and actual);
 - h. long lead and critical material milestone dates;
 - i. a programme for Authorities' Approvals;
 - j. main interface dates;
 - k. for all items covered under provisional sums and all variations or other items to be paid under schedules of rates: quantity to complete, actual quantity achieved and remaining quantity to be completed; and an 'S' curve showing actual and planned percentages of progress; and
 - l. in submitting the Detailed Monthly Construction Update Programme and all updates to it, the Contractor shall ensure that it meets with the requirements of the Contract.
- 3.6.3 The Contractor shall fully cooperate with the Engineer in the review of the Contractor's programmes, schedules, and any sub-programmes below the Construction Update Programme
- 3.6.4 The Contractor shall also provide sub programmes completely consistent with, but at a more detailed level than included in the Monthly Construction Update Programme, including:
- a. design, procurement and manufacturing sub programme;
 - b. construction and installation sub programme;
 - c. fitting out sub programme;
 - d. testing and commissioning sub programme.
- 3.6.5 These sub-programmes shall be updated and issued monthly to the Engineer.
- 3.7 Supplementary Programmes List**
- 3.7.1 The Monthly Construction Update Programme and sub programmes shall be supplemented by the following, in a format to be agreed with the Engineer:
- a. Three (3) month rolling programme;
- 3.8 Effects on Programme of Delays and Change**
- 3.8.1 The Contractor shall report any potential or actual delays which may affect the sectional key Dates or overall completion to the Engineer in a timely manner and recommend suitable measures to overcome the identified issues.
- 3.9 Record Keeping and Progress Reporting**
- 3.9.1 **Record Keeping:** The Contractor shall ensure that adequate records are kept of all activities, particularly site activities, including daily site activity records. The Contractor shall ensure that all progress reporting to the Engineer is consistent with these records and shall make these records available to the Engineer on request, in order to examine them and verify submitted reports.
- 3.10 Progress Reporting**
- 3.10.1 All progress reports to be approved by the Engineer shall be delivered in a format agreed by the Engineer, and in both electronic and hard copy.
- 3.10.2 Monthly Progress Reports and Dashboards shall be prepared by the Contractor and submitted to the Engineer in four hard and one digital copy.
- 3.10.3 The first Monthly Progress Report shall cover the period up to the end of the first calendar month following the Commencement Date. Monthly Progress Report shall be submitted monthly thereafter, each within seven (7) days after the last day of the period to which it relates. Cut-off reporting dates, and if deemed necessary revised submission dates, shall be agreed and confirmed by the Engineer.
- 3.10.4 Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the Completion Date stated in the Taking-Over Certificate for the Works.

- 3.10.5 Each Monthly Progress Report shall include (in addition to any other information mandated by the Employer's Requirements):
- a. charts and detailed descriptions of progress, including each stage of design, Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection, testing, commissioning and trial operation;
 - b. photographs showing the status of manufacture and of progress on the Site;
 - c. for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of;
 - d. records of the Contractor's Personnel and Equipment;
 - e. copies of quality assurance documents, test results and certificates of Materials
 - f. list of Variations, Notices and Claims (Employer and Contractor);
 - g. safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations, and details of any changes to health and safety and/or environmental management procedures to be adopted to mitigate any breaches in procedures identified over the reporting period;
 - h. comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.
- 3.10.6 The Contractor shall issue to the Engineer a Weekly Report and a Dashboard 7th of every month, which shall include a 15-day look-ahead programme. The content of the Weekly Report and Dashboard shall be proposed by the Contractor and approved by the Engineer.
- 3.10.7 The Contractor shall issue to the Engineer a Daily Dashboard Report before 10.00 AM the following working day. The content of the Daily Dashboard Report shall be proposed by the Contractor and be approved by the Engineer.
- 3.10.8 **Progress Review Meetings**
- a. Biweekly meetings will be held to review and monitor the progress of the project work, and they shall be convened by the Engineer. The Contractor's representative and if necessary, representatives of all interfacing Project Partners shall attend the meetings. The Employer may also be present at the meetings.
 - b. Quality, Health and Safety, Environmental and Design workshops/meetings will be held biweekly, or as deemed necessary by the Engineer, to ensure open transparent communication with regards to issues and progress of the Works.
 - c. The Contractor shall conduct separate meetings with interfacing contractors and stakeholders as necessary to clarify technical aspects of the systems and their requirements.
 - d. A quarterly Progress Review meeting will be held with the Employer. All the members of the Contractor (single company /JV) who are holding power of attorney for representing their firm(s) must be present at this meeting.
 - e. The Contractor shall prepare draft minutes recording all matters discussed and decisions recorded at all the meetings within 48 hours for the Engineer's review. These minutes shall be approved by the Engineer.
- 3.11 **Exception Reporting**
- 3.11.1 Where matters arise, which are urgent or deviate substantially from the latest report the Contractor will not wait until the next monthly report but shall prepare a specific 'Exception Report' concerning the new situation and submit this to the Engineer.
- 3.12 **Visuals Reporting**
- 3.12.1 Photographs
- 3.12.1.1 Following award of the Contract the Contractor will engage a professional photography service to carry

out the following for the work under the Contract:

- a. Colour photographs shall provide a fair representation of the progress of the work under the Contract.
- b. A minimum of 48 photographs per month/each Depot shall be submitted as a bound booklet to the Engineer, along with a digital copy of the same.
- c. Photograph locations shall be proposed by the Contractor and confirmed by the Engineer.
- d. Photographs shall be taken using a high-resolution digital camera and picture files and shall be provided in raw data format. The resolution, minimum 24 megapixels, of photographs shall be sufficient for clarity when photographs are enlarged to A4 size. All photographs shall be time stamped by the camera.
- e. Each monthly set of photographs shall be accompanied by an index indicating the subject, date, locations and directions in which the photographs were taken.
- f. The Contractor shall provide six hard and two soft copies (on a DVD/Data card) of the photo booklet and of each selected photograph.
- g. The photographs, electronic format and albums shall become the property of the Employer.
- h. The photographs shall be taken by a professional photographer who shall be proposed by the Contractor and approved by the Engineer.

3.12.2 **Recording of DVD**

3.12.2.1 The Contractor shall submit video recordings of the project which shall have Hindi/Kannada and English audio commentary.

3.12.2.2 Every month, the Contractor shall submit a 30-minute full high-definition Drone video (5K Camera) recording, one with audio commentary in Hindi/Kannada and a second in English, of the work under the Contract to the Engineer as part of his Monthly Progress Report. In addition, Contractor shall submit a 30-minute full high-definition video (1080P) recording, one with audio commentary in Hindi/Kannada and a second in English, of the work under the Contract to the Engineer as part of his Monthly Progress Report. Upon completion of the work under the Contract, the Contractor shall provide a professionally edited full high-definition video (1080p) to the Engineer showing progress through the period of the Contract. The video shall be a minimum length of 20 minutes and cover the design, construction, manufacture and installation of all major components of the work under the Contract.

3.12.2.3 All videos shall be produced by skilled video camera person with professional equipment.

3.12.2.4 All videos shall present a comprehensive record of the manufacture and construction of the work under the Contract to a non-technical audience and the Contractor shall provide any visual aids or graphical representations required to illustrate particular points, in liaison with the Engineer.

3.12.2.5 Original video clips and all videos produced from them shall become the property of the Employer. The Contractor shall be responsible for the safe archiving of the original video materials during the progress of the work under the Contract and shall transfer this complete archive with the as-built documents.

3.12.3 **Site webcams**

3.12.3.1 Within 60 days of commencement of the work by the Contractor shall propose a system to the Engineer for approval to provide live monitoring at each Depot site on a 24-7 basis. This shall be done by installing at least Eight video cameras for each Depot capable of capturing live high-resolution video and a high-resolution time-lapse camera {capturing every 15 minutes} for archiving and documentation purposes at locations to be agreed with the Engineer. A secure password internet log-in access to the site webcams shall be provided to Engineer/Employer.

4 Health and Safety Management

4.1 Compliance

4.1.1 The Contractor shall fully comply with the requirements of CC, PCC, and Section 8C.

4.1.2 Employer's Health and Safety Policy and Manual. Compliance with the Employer's requirements shall

- not relieve the Contractor of any of their statutory duties, obligations or responsibilities under the Contract or Law.
- 4.1.3 The Engineer reserves the right to order the immediate removal and replacement of any item of Contractor's equipment or personnel, which is deemed to be in an unsafe condition or who carries out a serious safety violation.
- 4.1.4 The Contractor shall document and implement a self-certifying Health and Safety Management System (HSMS) that shall remain in effect during the execution of the work under the Contract.
- 4.1.5 The Contractor's HSMS shall be in compliance with OHSAS 18001.
- 4.1.6 Within 28 days of the Commencement Date, the Contractor shall submit the following for review by the Engineer:
- a. health and safety policy;
 - b. health and safety plan;
 - c. health and safety manual.
- 4.1.7 For any amendment to the HSMS documentation, the Contractor shall as soon as practicable prepare and submit the proposed amendment for review by the Engineer prior to implementation.
- 4.1.8 The Contractor shall provide and enforce at all times the wearing of efficient safety helmets and work shoes and, where necessary, eye goggles, ear protectors, safety harnesses and other personal protection equipment for all personnel.
- 4.1.9 Fire Safety Regulations and other requirements pertaining to fire safety included in the Contract shall be observed at all times.
- 4.1.10 The Contractor shall ensure that all gases, fuels and other dangerous goods are stored and handled in a safe manner and in accordance with the statutory regulations pertaining to their storage and handling.
- 4.1.11 The Contractor shall be responsible for obtaining any requisite licenses.
- 4.1.12 No operation involving ionizing or electro-magnetic radiation shall be carried out without the approval of a safety officer.
- 4.1.13 The Contractor shall ensure that all personnel and members of the public are properly protected from the effects of any radiation emitted from the project site. All radiation areas shall be prominently posted with appropriate signs and exclusion barriers.
- 4.1.14 The Contractor shall provide adequate stand-by generating plant, equipment and spares for illumination of the site of the Works at all times to ensure the safety of project personnel, the Works and the public.
- 4.1.15 High standards of housekeeping shall be established. All materials shall be stored in an orderly and safe manner. Rubbish and debris shall be disposed of daily.
- 4.1.16 Measures shall be taken to prevent mosquito breeding within the works area, or areas to which the Contractor has access, which shall include the following:
- a. Empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point in accordance with the environmental regulations in force and shall be removed regularly; and
 - b. Standing water shall be treated at least once every week with environmentally friendly materials which shall prevent mosquito breeding.
 - c. To avoid mosquito breeding the any Contractor's plant or other equipment and facilities that may retain water shall be stored, covered in such a manner that water shall not be retained or treated as deemed necessary.
 - d. Posters in English, Kannada, and Hindi languages drawings attention to the danger of permitting mosquito breeding shall be displayed prominently on the site.

4.2 Legislation, Codes of Practice

- 4.2.1 The Contractor shall, in performing the Contract, comply with all applicable Indian Laws including:

- a. all current and future enactments, codes of practice and safety guides (specifications or other government bodies' requirements);
 - b. when interfacing with stakeholders, the Contractor shall comply with their requirements.
- 4.2.2 These documents are the minimum standards to be achieved by the Contractor and do not relieve the Contractor of liability to comply with all relevant Indian Laws. Where there is a discrepancy in the documents, the higher or stricter standards shall take precedence.

4.3 Management Responsibility

- 4.3.1 The Contractor shall be fully responsible for the safety of the Site, for the Works, their personnel, Subcontractors' personnel, the public and all persons directly or indirectly associated with the Works under the Contract, on or in the vicinity of the Works.
- 4.3.2 The Contractor shall be fully responsible for submitting reports, notices and information to all stakeholders where there is a statutory requirement to do so.

4.4 Subcontractors

- 4.4.1 The Contractor and all Subcontractors, and any person authorised by the Contractor to be on the Site, shall comply in every respect with the provisions of the Contractors health and safety management system.
- 4.4.2 The Contractor shall ensure that proper and adequate provisions are included in all Subcontracts placed by him, and in all Subcontract documentation.
- 4.4.3 The safety standards of any proposed Subcontractor are to be assessed by the Contractor prior to the placing of any subcontract.

4.5 Breach of Health and Safety Obligations

- 4.5.1 Serious or repeated breaches of the health and safety statutory regulations, rules of the Site, or other disregard for the health and safety of any person, are reasons for the Engineer to exercise their authority to require the removal from the Site of any person employed by the Contractor or subcontractor.
- 4.5.2 The Engineer shall have the right to order the suspension of any or all of the Contractor's and subcontractor activities where it is deemed that to continue such work activity or activities may pose a hazard to the safety of persons or property.
- 4.5.3 Where the Engineer orders a suspension of the Contractor or subcontractor work activities the suspension shall continue until the Contractor has satisfied the Engineer that corrective action has been taken to eliminate the hazard that was the subject of the suspension.
- 4.5.4 For all serious safety violations, the Employer reserves the right to penalise the Contractor on the recommendation of the Engineer. These penalties shall be determined and recovered at the Employer's discretion dependant on the severity of the incident, including but not limited to the conditions indicated **Section -8C SHE. Part-V Penalty & Awards.**
- a. 'Grievous' injuries shall be taken as injuries as defined in Section 320 of the Indian Penal Code, as confirmed below: -
 - i. Emasculation.
 - ii. Permanent privation of the sight of either eye.
 - iii. Permanent privation of the hearing of either ear.
 - iv. Privation of any member or joint.
 - v. Destruction or permanent impairing of the powers of any member or joint.
 - vi. Fracture or dislocation of a bone or tooth.
 - vii. Any incident which endangers life, or which causes the sufferer to be, during the space of twenty days, in severe bodily pain or unable to follow ordinary pursuits.
 - b. Major Accidents shall be defined as;

- i. An incident involving the loss of life;
- ii. Ten or more multiple injuries;
- iii. Explosion or fire resulting in on-site or off-site emergencies;
- iv. The release of toxic chemicals resulting in on-site or off-site emergencies;
- v. Spillage of hazardous chemical resulting in on-site or off-site emergencies;
- vi. Damage to utility services and equipment leading to an outage or process stoppage;
- vii. A definable adverse effect to the public, unplanned closure of trafficked roads or the environment.

4.6 Contractor's Documentation

4.6.1 Within 28 days of the Commencement Date, the Contractor shall submit a copy of their health and safety policy and plan plus their draft health and safety manual for approval by the Engineer. The Contractor's health and safety manual shall be developed to reflect the progress of the Works and shall establish the required health and safety processes in advance of each of the phases.

4.6.2 The Contractor shall provide their Subcontractors with copies of the relevant health and safety documentation throughout the project. This shall include plans, manuals, safety risk assessments, hazard logs and method statements as appropriate. THE Contractor shall monitor the Subcontractors comply with all the documentation.

4.6.3 Health and Safety Plan (HSP)

- a) The Contractor shall devise and implement a health and safety plan to fully comply with the requirements of the Contract.
- b) The HSP plan shall include a policy statement signed by the Chief Executive Officer of the Contractor (or other senior company officer) declaring that occupational health and safety shall be given the highest practicable priority in all aspects of the Contract and in the discharge of their contractual obligations.
- c) The HSP plan shall include and confirm as a minimum:
 - i. identification of personnel responsible for health and safety management and reporting, with their responsibilities.
 - ii. training and competency assessment for staff and Subcontractors;
 - iii. procedures and forums for identifying health and safety risks and issues;
 - iv. specific requirements of the Site and other work Sites;
 - v. requirements of the Contractor's corporate Health and Safety Management System.
 - vi. adequate mandatory induction and training is provided to personnel working on, and using, the Site;
 - vii. access is only available to authorised personnel and registered visitors:
 - viii. all personnel must attend an induction covering:
 - ix. All personnel on the Site must be identified by means of a prominently displayed identification card (provided by the Contractor), which shall be in a tamper-proof format reviewed by the Engineer and shall include the following information:
 - Company Logo
 - Company Contact Info
 - Cardholder Name
 - Cardholder Photo
 - Cardholder Signature
 - Cardholder Title
 - Card holder ID Number
 - Issue/Expiration Date
 - x. each visitor to the Site is registered and managed.

4.7 Job Hazard Assessments (JHA's)

- 4.7.1 The Contractor shall carry out a detailed JHA's (health and safety risk assessments) covering the occupational health and safety aspects of the work under the Contract. All detailed JHA's shall be submitted to the Engineer 14 days prior to the commencement of work on site.
- 4.7.2 The documentation arising from the detailed JHA shall contain a comprehensive schedule of all perceived risks and the proposed resolution or mitigation measures necessary to reduce these risks to a minimum. The findings of the assessment shall be incorporated into the HSP and relevant method statements. The nature of the work under the Contract environment dictates that the JHA requires regular reviews and updates. JHA's shall be included as part of all method statement submittals.
- 4.7.3 The Engineer reserves the right to request the Contractor to conduct a JHA and document a method statement for hazardous works as and when deemed necessary.

4.8 Contractor's Safety Arrangements

4.8.1 Co-ordination of Work Activities

- a) The Contractor shall ensure that Work is coordinated so that the activities of one group of workers do not affect the safety of another group.
- b) Daily meetings shall be held to coordinate the Work activities, with permits to work issued where and when required.

4.8.2 Permit to Work

- a. The Contractor shall implement a permit to work procedure that facilitates the control of hazardous works, as identified during the risk assessment.
- b. The permit to work procedure for the work under the Contract shall be submitted to the Engineer for review within 45 days of the Commencement Date.
- c. The permit to work procedure is critical to the well-being of all persons who participate in the work under the Contract and the public. The Contractor shall ensure that any amendments to this procedure are communicated to all persons involved in or around the work under the Contract.

4.8.3 Safety Inspections

- a. The Contractor shall conduct dedicated Site safety inspections once a week as a minimum, which shall be attended by the Contractor's most senior Site staff and safety management.
- b. A brief report of the inspection shall be made and issued to the Engineer. The report shall include the actions taken to resolve any problems or shortcoming discovered during the inspection. The report shall be made available for audit purposes, and shall be discussed at safety meetings.
- c. A comprehensive health and safety inspection check-list for the use of the Contractor's Site staff when inspecting the Site is to be formulated by the Contractor and submitted for review by the Engineer.
- d. The checklist shall indicate the standard to be achieved on any particular aspect of health and safety and be compiled in such a way that allows the inspector to enter their actual findings for instant comparison and subsequent rectification.
- e. When completed the checklist shall be kept for record purposes and be made available to the Engineer for audit purposes.
- f. A grading system is to be established which grades the area inspected as either acceptable or unacceptable.
- g. Where an area receives a grading of unacceptable, immediate action is to be taken to rectify the problems raised, and a further audit shall be conducted after 7 and 14 days to assess the conditions.
- h. The Contractor is to advise the Engineer of the date of the safety inspections. The Engineer may send a representative to assess the thoroughness of the inspection.

4.8.4 Engineer Safety Audits

- a. The Engineer may conduct safety audits to confirm the effectiveness of the Contractor's health and safety management system.
- b. The outcome of the Engineer's audit will be graded as either acceptable or unacceptable.
- c. Where the Contractor receives a grading of unacceptable, immediate action is to be taken by the Contractor to rectify the problems raised. A follow up audit shall, if necessary, be conducted by the Engineer within 30 days to assess whether satisfactory remedial action has been taken.
- d. The Contractor shall continue to be audited, every 30 days, until such times as a grade of acceptable has been achieved.

4.8.5 Internal Safety Audits

- a. The Contractor shall regularly, at periods not greater than 30 days, conduct internal safety audits on both the health and safety management system and the physical Site conditions. The audits shall be performed to the same criteria and using the same grading and benchmarking as the Engineer's audits.
- b. The audits shall be conducted by person(s) who are qualified and competent to carry out safety audits. The documentation generated by the audit process, including score sheets, shall be made available to the Engineer for audit purposes.
- c. The audits shall include the work of subcontractors.
- d. The Contractor shall advise the Engineer of the date of all the audits. The Engineer may send a representative to assess the thoroughness of the audit.

4.8.6 Reporting of Accidents, Incidents and Dangerous Occurrence

- a. Within 45 days from the Commencement Date and before any construction work commences on site the Contractor shall submit to the Engineer an Emergency Escalation Tree. The Emergency Escalation Tree shall be in compliance with the Employer's Health and Safety Manual.
- b. The Contractor shall notify the Engineer immediately of any incident, dangerous occurrences or accidents, which results in death, serious bodily injury, or incapacity or damage to the Employer's property (see table below for severity). Initial notification may be verbal but shall in any event be followed by a preliminary written report, in a format reviewed by the Engineer, within 24 hours of the occurrence/accident and a detailed written report shall be submitted within seven (7) days.
- c. The Contractor shall report all incidents to the Engineer and Employer and relevant authority, or other stakeholders as required. The format and mechanism for this reporting shall be confirmed by the Engineer.
- d. The Contractor shall submit at the end of each week a list of persons who are on sick leave following an accident on the Contract to the Engineer.

Minor (Level 1)	Significant (Level 2)	Major (Level 3)	Fatal (Level 4)
Near Miss	Lost Time Incident (LTI) (between 1 - 3 days)	Major Incident	Multiple Fatalities
No Treatment	Dangerous Occurrence	LTI > 3 days	
First Aid	Occupational Disease	Major Pollution	
Medical Treatment	Violence at Work	Utility Strike with Outage	
Property Damage	Third Party Hospital		
Minor Pollution	Significant Pollution		
	Utility Strike no Outage		
			Fatality

4.8.7 Monthly Reports

- a. The Contractor shall submit a Monthly Health and Safety Report separate to the Monthly Progress Report. Prior to submission, the Contractor's Representative and Health and Safety Manager shall endorse the Site safety report.
- b. The Monthly Health and Safety Report shall comprehensively address all relevant aspects of health and safety and shall contain certain standard forms and information as directed by the Engineer, for statistical analysis.
- c. The Contractor shall submit reports or accident analysis, in the agreed format, as and when required by the Engineer.
- d. The Contractor will be required to provide safety performance data (Key Performance Indicators) as required by the Engineer, in order to measure the Contractor's compliance with all applicable Laws, Contractor's health and safety manual and health safety plan.

4.8.8 Emergency Procedures and Facilities

- a. The Contractor shall establish and implement emergency procedures. The Contractor shall prepare a Security and Emergency Plan, which is to be submitted to the Engineer for approval.
- b. The Contractor shall submit within 45 days an Emergency Call-Out Escalation Matrix. The format of the Emergency Call-Out Escalation Matrix shall be approved by the Engineer. The Emergency Call-Out Escalation Matrix shall be updated monthly and included in the Monthly Health and Safety Report.

4.8.9 First Aid Facilities

- a. The Contractor shall provide first aid provisions in accordance with Indian Law. Arrangements for transporting the injured (ambulance, stretcher, etc.) shall be provided. Plans for the provision of trained first aid personnel shall be reviewed by the Engineer.
- b. Provisions shall include trained personnel and facilities appropriate to the Site conditions. First aider competency shall be demonstrated by attendance and certification at a licensed establishment for at least one day for basic first aider and three (3) days for advanced first aiders.
- c. Trained first aid personnel shall be in attendance at all times at the Site during working hours.
- d. The Contractor shall maintain a register of all persons receiving first aid treatment. Records shall be in a comprehensive format and submitted weekly to the Engineer, and where necessary to the relevant authority, and shall be retained for audit purposes.
- e. First aid kits, as required by the relevant authority, shall be made available in all Site vehicles.
- f. First aid kits shall be made available where work under the Contract is in remote areas.

4.8.10 Site Transport and Equipment

- a. The Contractor shall ensure that all Site vehicles are regularly maintained and kept in a safe condition with fully working brakes, reversing horns, lights, exhaust, windscreen, windows and doors, and the like.
- b. Each vehicle, piece of equipment or machinery shall be uniquely and clearly identified and registered for maintenance purposes.
- c. When directed by the Engineer, the Contractor shall remove any vehicle from the Site that is not up to the standards required.
- d. All Contractors' Equipment used on the Works shall be less than five (5) years old at the commencement of the Contract. If the Contractor proposes to use any equipment older than five years old, they shall first seek the approval of the Engineer before mobilisation on site.

4.8.11 Work over Public Areas

All activities requiring lifting, launching, or otherwise working over public areas, shall be performed in accordance with a method statement which shall be submitted to the Engineer for review and comment.

4.8.12 Site Security

- a. The Contractor shall take all necessary practicable precautions to prevent trespass onto the Site, whether it is intentional or unintentional.
- b. The Contractor shall provide Site security on a 24/7 basis and this shall include lighting, signage and security personnel for the protection of the work under the Contract so as to prevent theft and/or damage to plant, equipment vehicles or materials.

5 Quality Management

5.1 Compliance

- 5.1.1 The Contractor shall comply with CC/PCC and Appendix III Employer's Requirement part-1.
- 5.1.2 The Contractor shall document and implement a self-certifying Quality Management System (QMS) that shall remain in effect during the execution of the work under the Contract.
- 5.1.3 The Contractor's QMS shall be in compliance with ISO 9001.
- 5.1.4 The Contractor's QMS documentation shall include but not be limited to the following:
 - a. quality manual;
 - b. quality plans;
 - c. quality procedures and work instructions;
 - d. forms and templates;
 - e. guidance notes;
 - f. inspection and test plans (ITP's);
 - g. request for inspections (RFI's);
 - h. compliance plan.
- 5.1.5 The overall philosophy for quality in all aspects of the work under the Contract shall embody a 'Right First Time' culture and of continuous improvement via the methodology of **plan, do, check, act cycle** as confirmed in ISO 9001. In particular, the Contractor shall provide evidence that the following areas of quality management are detailed within the QMS:
 - a. management responsibility;
 - b. promote a 'right first time' approach;
 - c. minimise reliance on inspection;
 - d. continuous improvement;
 - e. customer satisfaction is achieved.
- 5.1.6 Within 28 days of the Commencement Date, the Contractor shall submit the following for review by the Engineer:
 - a. quality policy;
 - b. quality manual;
 - c. quality plans.
 - i. Design quality plan
 - ii. Manufacturing Quality Plan
 - iii. Construction Quality Plan
- 5.1.7 For any amendment to the QMS documentation, the Contractor shall as soon as practicable prepare and submit the proposed amendment for review by the Engineer prior to implementation.

5.2 Contractor's Documentation

- 5.2.1 **Quality Manual**

The Contractor's quality manual is to be regularly updated to reflect changes to work practices and/or changes to policy and legislation. The proposed changes are to be submitted to the Engineer for review prior to inclusion and implementation.
- 5.2.2 **Quality Plans**
- 5.2.2.1 Quality plans shall be based on those outlined by ISO 10005:2018 and shall define all measures necessary to meet the requirements of the Contract at all appropriate phases of the work under the

Contract.

5.2.3 Inspection and Test Plans (ITP)

30 days prior to the Commencement Date of all major work activities requiring test and/or inspection the Contractor shall produce and issue to the Engineer for approval a draft outline of the ITP(s) for the work activity. Each ITP shall identify the quality objectives and include, without limitation:

- i. the personnel responsible for undertaking and certifying the inspection and/or testing;
 - ii. the procedure or instructions for the inspection and/or testing;
 - iii. the test method or a reference to the relevant standard of testing;
 - iv. the inspection and/or testing required prior to commencement of an activity;
 - v. the inspection and/or testing during an activity and its frequency;
 - vi. the inspection and/or testing required to complete an activity;
 - vii. all hold points;
 - viii. all witness points;
 - ix. any notices or other documents to be given to the Engineer in relation to witness points and hold points;
 - x. the compliance criteria;
 - xi. the method of analysis of test data;
 - xii. the procedure for correction or disposal of any work which fails the compliance criteria;
 - xiii. examples of the documentation to be used for reporting the results of inspections, tests and the analysis of test data;
 - xiv. examples of the documentation to be used for recording the status of inspections and tests;
 - xv. the procedure for the distribution, filing and storage of inspection reports, test reports and reports on analysis of test data.
- a) The Contractor shall plan, perform and record all quality control activities to ensure that all work is performed in accordance with the QMS documentation reviewed by the Engineer and in compliance with the requirements of the Contract.
 - b) The Engineer may require the Contractor to carry out further additional inspections and/or tests as are in their opinion appropriate.

5.2.4 Quality Management Staff

The Contractor shall appoint competent Quality Engineers and support staff in sufficient numbers to ensure the effective function of the Quality Management discipline.

5.2.5 Reports of Inspections, Tests and Trials

The Contractor shall supply reports of each inspection and/or test. Such reports shall show the results of all the inspections and/or tests carried out and shall certify that the work has been inspected and/or tested in accordance with the requirements of the Contract and in compliance with the requirements of the Contract.

The Contractor will ensure that inspections requiring ongoing monitoring and improvement to ensure minimal rework and right first time are implemented.

Each report of inspection and/or test shall be signed by a representative of the Contractor who has the necessary authority.

The Contractor shall ensure that a signed copy report of any on and off-Site inspection/test is filed in his records within a reasonable time period, and no more than 30 days.

Lab Tests for Soils:

Conducting various Laboratory tests on soil, UDS samples, at any Laboratory Testing Facility accredited by NABL or any other accreditation body which operates in accordance with ISO/IEC 17011 and accreditation in compliance with ISO/IEC 17025 for testing and calibration scopes, including preparation of soil samples to determine the properties of soil, all complete as per specifications

Lab Tests in Rock:

Conducting various Laboratory tests on rock samples, at any Laboratory Testing Facility accredited by NABL or any other accreditation body which operates in accordance with ISO/IEC 17011 and accreditation in compliance with ISO/IEC 17025 for testing and calibration scopes, including preparation of rock samples to determine the following properties of rock, all complete as per specifications

A fully equipped laboratory for concrete quality testing shall be established on site along, with laboratory technicians and support staff. Testing machines shall be periodically calibrated in accordance with Indian Standards requirements.

5.2.6 Quality Control Register

- a) The Contractor shall provide and maintain at all stages of the Work a quality control register or registers to identify the status of inspections, sampling and testing of the Work, and all certificates. These registers shall be maintained as current at all times.
- b) The Contractor shall submit monthly digital summaries based on each quality control register to the Engineer. Each quality control register shall show the type and amount of certification received and the sampling, inspection, and/or testing undertaken on each element of the work under the Contract during the previous month. The summaries shall identify and demonstrate the compliance of such certification, sampling, inspection and/or testing with the requirements of the Contract and shall identify any item which does not conform to the requirements of the Contract, including:
 - i. a list of the certificates received for each batch of manufactured goods or materials incorporated in the work under the Contract and compare this against the certification required by the Contract and the Contractor's quality plans;
 - ii. a list of the inspection, sampling and testing activities undertaken by the Contractor on each element of the work under the Contract and compare these activities against the amount of inspection, sampling and testing required by the Contract and the Contractor's quality plans;
 - iii. the results of each report of inspection and/or test and any required analysis of these results and compare these results against the acceptance criteria;
 - iv. reference to any actions proposed by the Contractor to overcome any non-conformities identified by the Contractor and by the Engineer; and
 - v. a nonconformity register to indicate the status of all nonconformities.

5.3 Quality Management System Information

- 5.3.1 The Contractor shall make available a copy of quality bulletins in each of his site offices, workshops, canteens and site notice boards. All bulletins shall be translated into languages, which are understood by labour engaged by the Contractor or subcontractors. Posters in Hindi, Kannada, English, and other languages understood by the workers to draw attention to quality polices shall be displayed prominently in relevant areas of the Site.
- 5.3.2 The Contractor shall ensure that QMS matters are given a high degree of publicity to all persons on the Site.
- 5.3.3 The Contractor will ensure all quality documents including records must be available upon request from the Engineer.
- 5.3.4 The Contractor shall make available on the Site a complete and up to date set of QMS documentation including but not limited to policies, procedures, guidance notes, work instructions templates, forms, etc.
- 5.3.5 The Contractor shall also keep a working stock of all necessary forms, ensuring the latest version is available, as required by the QMS.

5.4 Audits

- 5.4.1 The Contractor shall ensure that audits of all the activities in each quality plan are carried out at quarterly intervals, or at such other intervals as the Engineer may require, ensuring the continuing suitability and effectiveness of the quality system. Reports of each such audit shall be submitted promptly to the Engineer.
- 5.4.2 The Contractor shall submit for review by the Engineer details of qualifications and experience of personnel assigned to carry out audit and inspection and testing activities.
- 5.4.3 Upon receipt of a Corrective Action Request (CAR), Non-Conformance Report (NCR), or similar as a result of a quality audit, the Contractor shall submit to the Engineer for review a proposed corrective and preventative action plan as required.
- 5.4.4 Quality audits may be conducted by the Engineer to ensure the continuing suitability and effectiveness of the Contractor's QMS.
- 5.4.5 Internal Audit
The Contractor shall continuously monitor the performance of the QMS and shall specifically include in each monthly progress report:
- a) the status of all QMS documentation;
 - b) an up-to-date audit schedule and status;
 - c) an up-to-date non-conformity register providing the status of all non-conformities identified by the Engineer and the Contractor;
 - d) any other items as instructed by the Engineer.

5.5 Quality Control Requirements

- 5.5.1 The Contractor shall prepare and maintain a list of quality control points which establish the criteria for control of each major component or activity during design, construction, manufacture, installation and commissioning, in accordance with the quality requirements of the Contract.
- 5.5.2 Before being brought to the Site, any goods proposed by the Contractor shall be assessed by the Contractor for their compliance with the Employer's Requirements.
- 5.5.3 Formal records of quality control inspection shall be retained by the Contractor, and be accessible to the Engineer as and when required.
- 5.5.4 The identification and storage of goods on Site shall be controlled such that the quality control status can be readily understood.
- 5.5.5 The Contractor shall give the Engineer reasonable notice, generally seventy-two (72) hours, of when relevant work will be inspected and/or tested by the Contractors QC team.
- 5.5.6 The Engineer may elect to witness inspections and/or tests by the Contractor in relation to all quality control points. Witness by the Engineer shall not discharge the Contractor of the responsibility to provide compliant product, nor shall it preclude subsequent rejection by the Engineer.

5.6 Notice of Place of Manufacture and/or Source of Supply

- 5.6.1 The Contractor shall notify the Engineer of the places of manufacture and/or the source of supply of all goods to be incorporated into the work under the Contract.
- 5.6.2 The Contractor shall give reasonable notice (which shall not in any event be less than 30 days) to the Engineer before the start of any manufacturing and/or the supply of goods.

5.7 Quality Training

- 5.7.1 The Contractor shall submit the material for the quality induction training to the Engineer, prior to conducting quality training sessions.
- 5.7.2 The Engineer has the right to request the Contractor's quality training records.
- 5.7.3 The Contractor shall keep records of such training for quality audit purposes. Upon completion of their training, the Contractor's site staff shall sign a copy of their assigned safety responsibility statement,

- which shall be kept by the Contractor for audit purposes.
- 5.7.4 The Contractor is to report the number of QMS training sessions and employees trained each month, at the QMS Committee meeting and in the monthly report.
- 5.7.5 Design Management. Design Management.
- 5.8 Contractors Compliance and Obligations**
- 5.8.1 The Contractor shall comply with all Legal requirements and the Employer's Requirements.
- 5.8.2 Whilst work under the Contract is being performed, one complete set of the Employer's Requirements, the Design Documents and other written information supplied by the Employer, the Engineer, the Contractor, any Subcontractors or consultants shall be kept by the Contractor at the Site or other location approved in writing by the Employer and shall be available at all times for reference by the Employer, the Engineer and any persons nominated in writing by either of them.
- 5.8.3 During the manufacture or assembly of any significant part of the work under the Contract away from the part of the Site where the Works are to be constructed, a set of the drawings and written information relevant to that part of the work shall be kept by the Contractor at the place of manufacture or assembly and shall be available for reference by the Employer, the Engineer and any persons nominated in writing by either of them.
- 5.8.4 All design work by or on behalf of the Contractor shall be prepared by qualified designers who are engineers or other professionals who comply with the criteria (if any) stated in the Employer's Requirements, and they shall be known as the Designer. The Designer shall have experience, which shall be as stated (if any) in the Notice Inviting Tender of Section I. Unless otherwise stated in the Contract, on award of the Contract the Contractor shall submit to the Engineer for consent the names and particulars of the Designer.
- 5.8.5 The Contractor shall warrant that he, his designers, any design subcontractors or other consultants have the experience and capability necessary to design the Works to the relevant standards. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer at all reasonable times, until the expiry date of the relevant Defects Notification Period.
- 5.8.6 Biweekly Design Workshops will be arranged to monitor design progress, agree key element parameters and to promote transparency in the design process. The Contractors and Designer Key Personnel related to design shall attend the Design Workshops until such time the Engineer deems the frequency can be increased or they are no longer required.
- 5.9 Design Submittal**
- 5.9.1 The Contractor shall send all design submittals to the Engineer under the cover of a Transmittal Form. The Transmittal Form shall be sequentially numbered and signed in accordance with the Document Control Index. A separate Transmittal Form shall be used for each submittal.
- 5.9.2 The Contractor shall provide supplemental information with each submittal in sufficient detail to completely explain the subject of the design submittal.
- For designs that are on the Programme Critical Path the Engineer shall respond as per CC/PCC. Where designs are not on the Programme Critical Path the Engineer shall use his best endeavours to respond within a reasonable time so as not to delay the progress of the Works. These review periods shall commence the day after the Engineer receives a Contractor's Document and the Contractor's notice. This Contractor's notice shall state that the Contractor's Document is considered ready, both for review in accordance with this Clause and for use. The Contractor's notice shall also certify that the Contractor's Document complies with the Contract, or the extent to which it does not comply. The Engineer may, within the review period, give notice to the Contractor that a Contractor's Document fails (to the extent stated) to comply with the Contract. If a Contractor's Document so fails to comply, it shall be rectified, resubmitted at the Contractor's cost and reviewed. If the Contractor's Document complies with the Contract, the Engineer shall issue a Notice of No Objection (NONO), unless expressly stated in the Contract that he shall approve or review the Contractor's Document. Design

submittals will be reviewed by the Engineer who will respond with one of the following comments:

- a. In the case of a Contractor's Document which has been submitted for the Engineer's review the Engineer shall issue a Notice of No Objection (NONO) to the Contractor indicating that the Engineer does not object to the Contractor's Document,
- b. or a statement of No Objection with Comments (NOWC) and confirmation whether work may commence on the acceptance the Contractor will close out the Engineer's comments,
- c. or shall issue a statement that the Contractor's Document fails (to the extent stated) to comply with the Contract.

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5.16 BIM 3D and CAD Data

5.16.1 The Contractor shall comply with the Employer's Requirements and Technical Specifications for BIM and CAD Manuals.

5.16.2 Within 45 days of Commencement Date, the Contractor shall submit CAD and BIM Manuals, which shall be in compliance with the Employer's requirements.

5.16.3 The design shall be carried out on a common BIM 3D (shared information model in a common data environment) platform and shall be clash free.

5.16.4 For each of the Depot the Contractor shall provide, and update when requested by the Engineer, construction time sequencing in the model to permit time-lapse construction and walkthrough video to be prepared from commencement to completion.

5.16.5 Access to the 3D BIM model common platform shall be made available to the Engineer, and a monthly update, 3D BIM Model and PDF, shall be submitted by the Contractor to the Engineer.

5.17 Manufacture, Construction and installation

5.17.1 The Contractor shall not proceed with the manufacture, construction or installation of any work contained within a design submission unless it has been approved by the Engineer.

5.18 Working (Shop) Drawings (Structural, MEP and Architectural)

5.18.1 For construction purposes the Contractor shall prepare working drawings, shop drawings and schedules. The working drawings shall correspond to the final design drawings, the final CSD, SEM, RCP and SRS drawings.

5.18.2 The Contractor shall provide samples and mock ups, including; piers, pier cross heads, electrical containment, pipe work, major architectural finishing elements (flooring, walling, glass, balustrades, doors, barriers etc.), as required by the Engineer, at least 28 days prior to the construction or fabrication of the part of work under the Contract to which they are related. The Contractor shall submit to the Engineer for approval a programme for the planned mock-ups within 90 days from the Commencement Date.

5.18.3 The structural reinforcement drawings together with the bar bending schedules shall be regarded as

shop drawings. These drawings and schedules shall be certified by the Contractor.

5.19 As-Built Drawings and Calculations

5.19.1 The Contractor shall maintain contemporaneously all records necessary for the preparation of as-built drawings. As-built drawings shall be produced progressively as elements of the works are completed. As built drawings shall be verified and certified by the Designer.

5.19.2 The as-built drawings and models shall be endorsed by the Contractor as true records of the construction of the work under the Contract. One complete set of as-built drawings shall be submitted, in both hard copy and electronic formats, complete with calculations, to the Engineer.

5.20 As Built Survey

5.20.1 The Contractor at his own cost provide a detailed survey of the completed works, which shall include a topographical survey, locations of all piers, road realignment, finished deck levels.

5.20.2 Information Management. Information Management

5.21 General

5.21.1 The Contractor shall comply with the standards of the Employer's Project Management Information Systems (PMIS), in respect of information management.

5.21.2 The Contractor shall submit an Information Management Plan describing how the Contractor shall create, collect, store, search, manage and distribute information within 45 days of the Commencement Date for review by the Engineer.

5.21.3 The Information Management Plan shall:

- a. include system architecture and process to describe how the Contractor will provide information to the Engineer in a controlled, efficient, transparent, auditable and timely manner;
- b. contain information on workflow, metadata, Contractor's approval process and status;
- c. be compatible with the Contractor's BIM/CAD/GIS/SMP and Engineering Content Management (ECM) Plan;
- d. reference the Contractor's Electronic Document Management System (EDMS) document management plan;
- e. detail how data and information will flow between the Contractor's BIM/CAD ECM environment to the Contractor's document control EDMS environment;
- f. detail how assigned authority is controlled through workflows and permissions to ensure any sign-off function will only be presented to the correct authority; and
- g. detail how object data from the BIM Model will populate areas in the Configuration Model.

5.22 Project Management Information System (PMIS)

5.22.1 The Contractor shall ensure data, metadata and information formats are compatible with formats required for PMIS reporting in accordance with Employer's Requirements.

5.23 Electronic Document Management System (EDMS)

5.23.1 The Contractor shall use an EDMS which is compatible with the Employer's web- based EDMS, to coordinate and control the document flow (create, process, storage, retrieval and distribution) of electronic and paper documents in a secure and efficient manner.

5.23.2 All the Contractor's Documents shall be controlled via the EDMS system for the work under the Contract.

5.23.3 These requirements cover all types of documents including, but not limited to:

- a. management plans, procedures, method statements;
- b. quality plan and documentation covering norms, standards quality control register etc.
- c. design documentation covering preliminary and definitive designs, construction reference drawings, shop drawings etc.

- d. design models;
 - e. mock-ups;
 - f. as-built drawings;
 - g. operation and maintenance manuals, safety manual, training manual
 - h. engineering calculations;
 - i. reports: - progress, investigation & survey, construction, test & commissioning, technical and non- technical;
 - j. time: programmes, schedules and cost;
 - k. certification documents for safety, technical clearance and opening of metro & Railway line for carriage of passengers.
- 5.23.4 The Contractor's EDMS shall;
- a. provide a storage and backup infrastructure to prevent data loss and provide data recovery mechanisms;
 - b. provide a single, controlled source for each document;
 - c. provide an efficient search and retrieval of specific documents;
 - d. provide measures to control restricted access to program documents and provide access to all documents to all team members;
 - e. identify document development and approval processes that promote quality and consistency;
 - f. provide clarity regarding which version of a deliverable is the latest version;
 - g. provide a clear record of deliverables;
 - h. enable quick and direct propagation of changes;
 - i. provide an accurate and complete archive of documents to the Employer; and
 - j. Access of Contractor's EDMS to Employer and Engineer.
- 5.23.5 The Contractor shall submit an Electronic Document Management Plan within 60 days of Commencement Date for review by the Engineer, detailing how the Contractor shall implement and maintain a web-based EDMS. The Electronic Document Management Plan shall give an overview of the EDMS strategy and shall include a permissions matrix mapped to roles and responsibilities, workflow, systems architecture, resilience and disaster recovery.
- 5.24 Records**
- 5.24.1 The Contractor shall ensure that records are kept and traceable to the material, equipment or services to which they relate. Those records shall include, but are not limited to:
- a. calculations, specifications and drawings;
 - b. certificates verifying the characteristics and quality of the Goods;
 - c. tools and equipment calibration records;
 - d. surveillance, inspection and test results;
 - e. acceptances of processes, procedures and personnel for manufacturing, construction and installation;
 - f. non-conformance reports and corrective or preventive actions and their closeout;
 - g. specification waivers and concessions;
 - h. design review reports;
 - i. quality audit reports.
- 5.24.2 A record is any significant item of information received or created in the course of the Contract and maintained on any media for use at a later time.
- 5.24.3 The Contractor shall retain all records relating to the Works (including copies of all original documents delivered to the Engineer) for a period of five (5) years after the date of the last Performance Certificate issued for the Works, or for a longer period where required by applicable Laws.
- 5.24.4 Retention media can be hard copies, microfilm and/or electronic media. All records shall be stored in a storage facility suitable for the type of media being stored. All storage media shall be indexed and

- clearly labelled to identify the contents.
- 5.24.5 Records shall be stored electronically, unless otherwise required by applicable Laws.
- 5.24.6 Records shall be held in a suitable records storage facility until their destruction date. The storage facility shall meet the following minimum requirements:
- a. the storage facility shall be constructed and maintained so as to prevent degradation or destruction of records by insects, rodents, weather conditions, fire, theft and deterioration by environmental conditions.
 - b. a system shall exist by which all of the Engineer's records are indexed (according to contents, organization, reference number, entry date and destruction date) so that they can be located within a reasonable time;
 - c. access to all records shall be controlled.
- 5.24.7 Complete reports of the inventory shall be provided by the Contractor when requested by the Engineer. A security system shall be maintained to preclude the entry of unauthorised personnel into the storage area and to guard against larceny and vandalism.
- 5.24.8 Equipment and software shall be available to read, view and print records in storage.
- 5.24.9 The Contractor shall notify the Engineer where the records are being held. The Engineer may perform a periodic audit check of the Contractor's storage facility to ensure all documents are being kept and stored correctly.
- 5.25 Document Submittal Register**
- 5.25.1 The Contractor shall provide to the Engineer a document submittal register (DSR) of all contract deliverables within 30 days of the Commencement Date for approval by the Engineer.
- 5.25.2 The DSR shall be kept up to date by the Contractor and issued to the Engineer with the Contractor's monthly report and or as otherwise instructed by the Engineer.
- 5.26 Document Submissions**
- 5.26.1 All correspondence reference numbers shall be generated in accordance with the Employer's File Naming Conventions and Metadata Requirements.
- 5.26.2 Copies of correspondence relevant to the execution of the work under the Contract and not of a confidential nature received from or despatched to government departments, utility undertakings, stakeholders and other contractors shall be submitted to the Engineer via EDMS for information as soon as possible but in any case, not later than 7 days after receipt or despatch.
- 5.27 Electronic Submissions and Software to be provided**
- 5.27.1 Design documents for Engineer review shall be submitted in digital format. Native formats of all final submissions shall be provided in addition to PDF copy.
- 5.27.2 Any commercial or proprietary software can be used for analysis and design provided the same is validated with manual computations or other standard software in multiple scenarios.
- 5.27.3 The Contractor shall provide and supply 2 Nos. (Two) certified licensed copy of the following Program management software.
- a. Primavera P6 Verrision 22.12 or latest version scheduling software.
- 5.27.4 The Contractor shall provide and supply to Employer/Engineer with a Certified licence 2 (Two) copies, including manuals and approved training of the software and subsequent versions thereof at no extra cost for any design (civil, MEP and Architecture) and native drawing software they use to the Engineer to allow review of the design. The Contractor shall provide and supply.
- a. Drawing software (AutoCAD or similar)
 - b. BIM model software (Bentley Revit or similar) as defined in Employer's requirements
 - c. Asset management software (Maximo or similar) compatible with the 3D BIM software

- 5.27.5 d. Proprietary design (civil/structural, MEP and Architecture) software used for computation
The Contractor shall supply one certified copy of the software they use for Interface and Requirements Management.

6 Stakeholder and Communication Management

6.1 Stakeholder and Communication Management Plan {SCMP}

- 6.1.1 Within 45 days of the Commencement Date, the Contractor shall submit to the Engineer for review an SCMP.
- 6.1.2 The Contractor shall include all stakeholders as part of the SCMP.
The SCMP shall define the engagement of all external stakeholders, including the authorities required to participate in the review, approval and issue of design and construction permits, as well as the residents, business and developers affected by the work under the Contract. The external stakeholders shall include but not limited to:
- a. Statutory Authorities;
 - b. Utility Owning Agencies;
 - c. Public Service Providers;
 - d. Developers; and
 - e. Resident Welfare Associations, Non-Governmental Organisations (NGO), Industry Associations, etc.
- 6.1.3 The SCMP shall include a communications matrix and details of distribution methods and responsibilities.
- 6.1.4 The Contractor shall submit a monthly status update of all stakeholder communications and agreements.

6.2 External Communications

- 6.2.1 The Contractor shall not issue or verbally disclose any information, publication, document or article for publication in any media, print or digital, without prior approval of the Engineer, who may place conditions on its approval.
The official language of formal communications is English, excepting for communication in Kannada with government bodies, as necessary.

7 Construction, Manufacturing, installation and Logistics

7.1 Method Statements

- 7.1.1 The Contractor shall submit to the Engineer for review comprehensive method statements for all planned construction activities.
- 7.1.2 Method statements shall be submitted a minimum of 30 days in advance of the work commencing to allow for adequate time for Engineer review and resubmission as necessary and further review.
- 7.1.3 Prior to any activity for which a method statement is required, the Contractor shall have obtained the Engineer's approval to its method statements for such activity.
- 7.1.4 Prior to the commencement of all major work elements the Contractor shall call a Readiness Review to brief the Contractors and Engineers site construction teams on the construction methodology.
- 7.1.5 The method statements shall clearly identify the Contractor's proposed methods and sequence of working, including programme details and shall include but not be limited to:
- a. personnel;
 - b. method and sequence of the work;
 - c. proposed methods of temporary support where required to ensure the safety of the work under the Contract, addressing prevention of deterioration of the excavation due to exposure;
 - d. programme for the work;
 - e. traffic diversion schemes;

- f. a comprehensive construction risk assessment report prior to the commencement of the construction work under the Contract and detailed Work Specific construction risk assessment reports prior to the commencement of particular elements of the work under the Contract;
- g. proposals for protection of adjacent structures and ground treatment where appropriate;
- h. instrumentation for monitoring the work, particularly monitoring of adjacent structures, utilities and adjacent ground where appropriate;
- i. locations and method of stockpiling excavated fill material where appropriate;
- j. reinstatement work inclusive of road works, drains, box culverts, and ancillary structures where appropriate;
- k. noise and vibration monitoring, including attenuation proposals where necessary;
- l. methods for the collection, storage and disposal of all waste, including procedures for safe handling, storage and disposal of toxic waste;
- m. identification of checks to be carried out, details of the QA/QC records that will be submitted to the Engineer;
- n. a staff supervision/responsibility matrix for the various elements of the work.

7.2 Survey

7.2.1 Before the Contractor commences the setting out of the Works, the Engineer will provide reference drawings showing the position of survey points and benchmarks, together with the co-ordinates and/or level assigned to each point, that were used in developing the Employer's Reference Drawings, which have been provided for information only. The Contractor shall comply with GC Clause 4.7 and verify the accuracy of the information.

7.2.2 The Contractor shall design the Works to comply with vertical and horizontal clearances confirmed in Employer's requirements.

In case of any differences from the Employer's drawings or data, the Contractor shall bring these to the notice of the Engineer immediately and submit his proposals for correction/modification of the alignment. The Contractor shall satisfy himself that there are no further conflicts between the data given and the survey control/reference points & benchmarks established by him and all the conflicts (including with the survey data of adjacent Contractors) shall have to be satisfactorily resolved by this contractor. All such proposals for correction prepared by the Contractor and all such rectifications work undertaken by the Contractor to resolve / eliminate all such differences / discrepancies / conflicts in survey data of the Employer / adjacent contractor and the Contractor shall not entitle for any claims or extension of time. All the necessary works in this regard shall be done by the Contractor without any cost or time implications to the Employer.

7.2.3 The Contractor shall establish and provide all subsidiary setting out points, monuments, towers and the like which may be necessary for the proper and accurate setting out and checking of the Works.

7.2.4 The Contractor shall carefully protect all the survey reference points, benchmarks, setting out points, monuments, towers and the like from any damages and shall maintain them and promptly repair or replace any points damaged from any causes whatsoever.

7.2.5 The setting up of the accurate survey reference points and maintaining them shall be the full responsibility of the Contractor. The Contractor shall check the survey reference points every three months to ensure that these survey points continue consistent with the benchmarks.

7.2.6 All levels given on the Contractor's Documents shall refer to a project height datum, which shall be confirmed by the Engineer. The project height datum shall be clearly defined and indicated on the design drawings.

7.2.7 All coordinates given on the Contractor's Documents shall be based on the project coordinate system, which will be confirmed by the Engineer. The project coordinate system shall be clearly defined and indicated on the design drawings.

7.2.8 The Contractor shall relate the construction of the work under the Contract to the coordinate system

- and height datum.
- 7.2.9 The Contractor shall maintain a common survey interface with adjacent Work Packages, and shall make available accurate survey information for setting out subsequent work under the Contract by other Project Partners.
- 7.2.10 The Contractor shall be wholly responsible for the setting out of the Works, and certify it is in full compliance with the Employer's requirements and their Design. The Contractor shall have a third party check the setting out of the Works to ensure at handover the alignment is compliant with the Employer's requirements.
- 7.2.11 Prior to handover to Project Partners the Contractor shall carry out a wriggle joint survey along with Engineer to confirm clearances are in compliance with the Project Schedule of Dimensions. The Contractor shall provide a Clearance Report which shall be endorsed by Project Partners as applicable.
- 7.3 Contractor's Equipment**
- 7.3.1 All Contractor's Equipment used on the Works shall be less than five (5) years old at the commencement of the Contract. If the Contractor proposes to use any equipment older than five years old, they shall first seek the approval of the Engineer/Employer before mobilisation on site.
- 7.3.2 All Contractor's Equipment used on the Works shall have a valid certificate of operation provided by a recognised licensing authority.
- 7.3.3 Contractor Equipment operators shall hold a valid appropriate operator licence.
- 7.4 Removal of Temporary Works and Facilities**
- 7.4.1 On the issuance of the Taking-Over Certificate, or earlier if directed by the Engineer, the Contractor shall remove all Temporary Works and facilities and reinstate the Works to the original existing conditions to the satisfaction of the Engineer.
- 7.4.2 Reinstatement means replacement to match the original condition unless otherwise stated. The Contractor shall also remedy any defect caused by the Contractor during the course of the work under the Contract.
- 7.5 Temporary Traffic Management**
- 7.5.1 The Contractor shall provide all necessary expertise to plan, design, implement, operate and maintain a temporary traffic control in accordance with the requirements of all relevant Laws and the Employer's requirements.
- 7.5.2 A comprehensive temporary traffic management scheme shall be installed and operated by the Contractor to facilitate the construction of the work under the Contract. Temporary traffic management schemes shall ensure that minimum disruption is imposed on the traffic in the vicinity of the work under the Contract and ensure safe and efficient management of traffic for all work conditions and at all stages of construction.
- 7.5.3 The Contractor shall produce detailed temporary traffic management schemes to suit their method and sequence of work for approval by the relevant statutory authorities.
- 7.5.4 The Contractor shall prepare a complete traffic management scheme for the work under the Contract that considers any wider impact of modifications to the existing road network. This will include an advance traffic signals & signing strategy, forewarning drivers of construction works and associated diversions.
- 7.5.5 The Contractor shall undertake traffic surveys on roads affected by the traffic diversions, in particular at junctions currently experiencing high demand or operating close to capacity, both prior to undertaking the diversion to establish a baseline, and following a settling-in period of the new diversion. These shall be used to monitor the traffic impact of the work under the Contract. All temporary diversions shall be maintained by the contractor.

7.6 Demolition of Structures

- 7.6.1 The Contractor shall demolish and dispose of all resultant demolition materials for all structures including buildings, drains or any other structures, to facilitate the construction of the work under the Contract.
- 7.6.2 The Contractor shall backfill any part of the void created with suitable material and reinstate the area to match with the surrounding ground level.

7.7 Disposal of Excavated and Contaminated Materials

- 7.7.1 The Contractor shall carry out regular testing to confirm the classification of materials to be disposed. The laboratory at which the testing is to be carried out shall be subject to the review of the Engineer. Prior to taking any sample for testing, the Contractor shall obtain the Engineer's agreement that the sample is representative of the material to be disposed.
- 7.7.2 The Contractor shall submit to the Engineer for approval an Excavated and Contaminated Materials Disposal Plan within 60 days of Commencement.
- 7.7.3 Where excavated soil or imported fill fail to meet the requirements for fill material only because of excessive moisture content, the Contractor shall dry it so that it meets the requirements for fill material.
- 7.7.4 The Contractor may propose and implement methods to treat waste to render it acceptable as fill material acceptable.
- 7.7.5 The Contractor shall ensure that materials in each of the defined categories are segregated during excavation and kept so thereafter. Where materials from different categories are mixed together the resulting mixture shall be considered as waste.
- 7.7.6 The disposal of waste and contaminated material shall be entirely the responsibility of the Contractor.
- 7.7.7 The Contractor shall maintain a record of all materials disposed of the Site.
- 7.7.8 The Engineer shall have access to these records at any time and may instruct the Contractor to obtain, at the Contractor's cost, independent verification of the size of loads carried by any or each vehicle.
- 7.7.9 If the Contractor identifies contaminated material a specific disposal plan shall be submitted to the Engineer for review. Excavation works of any works leading to the production of contaminated excavated material for disposal shall not proceed until a successfully reviewed plan is in place.
- a. The plan shall include the Contractor's proposals for additional and ongoing environmental sampling and testing, including the programme of sampling and details of the testing facility.
- b. The plan shall outline procedures for action in the event that contaminated material is encountered. These shall include all health and safety aspects and materials handling and transportation.
- 7.7.10 The Contractor shall submit to the Engineer for review their proposed method of disposal of any bentonite slurry waste and bentonite contaminated excavated material, including the methods of transporting bentonite slurry waste and bentonite contaminated excavated material on public roads.
- 7.7.11 A Mechanical Type Washing Plant shall be installed by the Contractor for use of all Vehicles leaving the Casting Yard or any other work area of the Contractor to avoid any spillage on any connecting roads. The Contractors shall ensure any material spillage deposited on roads is immediately removed so as to minimise impact on the public and other road users.
- 7.7.12 All incoming and outgoing haulage trucks used to move material shall have sealed tailgates and a cover to prevent dust and debris escaping.

7.8 Restoration of Areas Disturbed by Construction

Any areas disturbed by the construction activity, either inside or outside the Project Right of Way or Site Areas, shall be reinstated by the Contractor to their original condition, or better, with new materials. These shall include but not necessarily limited to sidewalks, parking lots, access roads, adjacent roads, adjacent properties and landscaping. Grass cover shall be provided for any bare earth

surface areas, along with proper provision for surface drainage.

7.9 Manufacturing

7.9.1 Management

The Contractor shall establish procedures and controls that govern the procurement, integration, manufacture and testing, quality assurance and delivery of plant, equipment and spares to be supplied under the Contract. This shall include the administration and supply of spare parts and warranty in accordance with the Contract. The Contractor's Manufacturing Management Plan shall be submitted to the Engineer for an approval within 45 days of the Commencement Date.

7.9.2 Procurement and Subcontract Management

The Contractor's management system and procedures shall establish and employ a procedure for materials procurement and Sub-contracting, sufficient to assure technical, administrative, quality and contractual controls consistent with those of this Contract. The Contractor's management system shall be auditable for materials sources, lot number, serialised equipment, etc. Sub-contract amendments shall be employed whenever contractual changes are made either bilaterally or unilaterally by the parties involved. Prior approval of the Engineer shall be taken for the make of all equipment and accessories.

7.9.3 Manufacturing and Production Management

The Contractor's manufacturing and production management system shall encompass all points of receiving, raw material and components processing, fabrication, assembly, test and all points of in-process inspections. The Contractor's Manufacturing Management Plan shall contain:

- a. a brief description of all inspection hold points and test points, and a correlation with the programme schedule;
- b. a list of all Sub Contractors; and
- c. a delivery schedule of each item of equipment to match installation plan, together with Manufacturer's Qualification: The equipment manufacturer shall show at least ten year of continuous and current experience in the design, assembly, and testing of similar equipment as being offered complying with the Contract Specifications.

7.10 Equipment installation

7.10.1 Equipment installation Plan and Programme

The Equipment Installation Plan shall confirm how the Contractor proposes to organise and carry out the installation and complete the whole of the Works by the given Key Dates.

The Contractor shall submit the Plan for approval to the Engineer 90 days prior to the start of installation on site the Contractor shall attend weekly planning meetings with the Engineer to finalise the Work detail, commencing 4 weeks prior to the start of installation on site.

The complete installation is to be carried out as per Coordinated installation Programme (CIP) agreed by all interfacing Contractors and approved by the Engineer.

7.10.2 Contractors' Resident Staff

The Contractor shall ensure that a qualified representative of the manufacturer is available on-site for the duration of the on-site Works during normal working hours and installation period and on-call to arrive on site within 30 minutes at all other times. The manufacturer's representative shall support the Contractor's Representative during the installation and Testing phase of the Works. The Contractor's Representative shall have sufficient authority to progress the Contractor's work on Site. The Contractor's Representative shall be competent and qualified to act on behalf of the Contractor, and Provide upon request information that may include:

- a. Current progress of the Works;
- b. Planned work for the next 5 weeks;
- c. Audit and inspections reports;

- d. Health and safety information; and
- e. Documents and records pertaining to the Works

7.11 Storage, Shipping and Delivery

- 7.11.1 The Contractor shall provide and maintain acceptable storage facilities for the Contractor's Equipment, temporary works, Employer's equipment, plant, materials and any other things intended to form or forming part of the work under the Contract.
- 7.11.2 The Contractor shall prepare, protect and store all Contractor's Equipment, temporary works, Employer's equipment, plant, materials and any other things intended to form or forming part of the work under the Contract. This shall act to safeguard them against loss or damage from repeated handling, from climatic influences and from all other hazards arising during shipment or storage on or off the Site.
- 7.11.3 The Contractor shall notify the Engineer 14 days in advance of any expected shipment date and give further notification of the actual shipment date and routing when such information is subsequently established. This shall complement the inspection requirements prior to delivery as specified herein.
- 7.11.4 Packing lists and quality certificates for all materials and equipment shall be issued monthly to the Engineer as part of the Quality Register.
- 7.11.5 Any part of the goods to be supplied under the Contract which is damaged in transit shall not be considered as delivered until repairs or replacements have been made and all necessary spare parts or items have been delivered to the Site.
- 7.11.6 The Contractor shall remove temporary fittings required for shipment and re- assembly of equipment and shall complete this prior to the equipment or parts thereof being inspected and before they are considered delivered.
- 7.11.7 An item shall be considered delivered when all damage has been repaired and all documentation and post-delivery preparation have been completed to the satisfaction of the Engineer.

7.12 Logistics

- 7.12.1 The construction involves extensive works and to prevent major traffic congestion, construction vehicle movement shall be reduced to a minimum.
- 7.12.2 The Contractors' responsibilities shall include development of a detailed logistics plan, processes and procedures for the Project:
 - a. Provision of information related to the transport of all plant, materials, equipment, goods, and labour to the Employer and to relevant stakeholders and Authorities to assist with coordination; and
 - b. Acquisition of all permits and approvals from the relevant stakeholders and authorities required for the transport of all items related to construction including material sourcing, storage, manufacture, treatment and disposal.

7.13 Key Materials Stocks and Supplies

- 7.13.1 Buffer Stocks
 - 7.13.1.1 In order to minimize the risk of key material shortages during execution of the Works, the Contractor shall maintain, either on-site or off-site, a minimum of two-month rolling buffer stock of the following key materials:
 - a. Cement – for incorporation in cast in situ and/or precast concrete;
 - b. Aggregates – for incorporation in cast in situ and/or precast concrete;
 - c. Reinforcement Steel - for incorporation in cast in situ and/or precast concrete;
 - d. Stressing tendons and fixings.
 - 7.13.1.2 For the purposes of monitoring of the Contractor's compliance with the rolling buffer stock requirement, the Contractor shall supply a supplementary program. This shall be updated and aligned with the

Contractor's Programme. It shall also include but not be limited to the key raw materials.

- 7.13.1.3 The Contractor shall provide monthly reports to the Engineer, which confirms compliance with the Employer's rolling buffer stock requirement.
- 7.13.1.4 All costs associated with the material storage in the buffer stock, including but not limited to any transportation costs, shall be borne solely by the Contractor. Maintenance of the material buffer stocks includes, but is not limited to, protection of stockpiles from weather conditions, stockpile management processes, procedures, and storage facility plant and equipment.
- 7.13.1.5 Any request by the Contractor for approval of key materials from international markets shall contain in minimum the following:
 - a. proof that the local markets are unable to meet the required demands;
 - b. method for utilising internationally sourced key materials in supplementing key materials supply from the local market;
 - c. assurance of internationally sourced key material compliance and compatibility with local market key materials, particularly related to effects and impacts on blended materials / products properties for consistency and conformance.

8 Site Management

8.1 Access to the Site

- 8.1.1 The Contractor shall be given access to the Site in accordance with the Contract. On taking access the Contractor shall inspect the Right of Way and take a photographic survey confirming the condition which shall be submitted to the Engineer/Employer.
- 8.1.2 Entry to and exit from the Site shall be controlled by the Contractor.
- 8.1.3 The Contractor shall ensure that access to every portion of the Site which is in its possession or to which it has access is continuously available to the Employer and Engineer.
- 8.1.4 The Contractor shall be responsible for ensuring that any access or egress to the Works is controlled so that there is no disturbance to members of the public or damage to public or private property occurs as a result of the use of such access or egress.
- 8.1.5 The Contractor shall provide a means of distributing loads imposed by Contractor's Equipment and traffic and prevent damage to roads and utilities.
- 8.1.6 The Contractor shall maintain access to all roads and side roads within the Site throughout the Works. Access to all existing buildings, car parks and other accesses shall be similarly maintained.
- 8.1.7 Existing pedestrian routings and road crossings, and their existing widths, shall be maintained at all times.

8.2 Site installation

- 8.2.1 The following particulars shall be submitted to the Engineer for approval not more than 30 days after the Commencement Date:
 - a. Drawings showing the formation works and the layout at all sites for the Contractor's offices, project signboards, principal access and other major facilities required, together with all service utilities.
 - b. Drawings showing the details to be included on the project signboards and diversion boards.
 - c. The Contractor shall submit to the Engineer for review a plan of intended use of the Works areas and the layout of each proposed Site facility.
- 8.2.2 Drawings showing locations of stores, storage areas, concrete batching, Contractor's Equipment and other major facilities and their access roads/paths shall be submitted to the Engineer for his review as early as possible, but in any case, not less than 30 days prior to when such facilities are intended to be constructed on the Site.
- 8.2.3 The Contractor shall be responsible for forming the Works areas, constructing all temporary access roads, services including water and power supply for the Works, and drainage and for maintaining the

- Works areas. All Temporary Work used in the construction of the temporary facilities or Permanent Works shall be such that they can be easily removed before Taking Over of the Works.
- 8.2.4 Road works, sewer and drainage work and utilities diversions required may extend beyond the Contract limits. Requirements of other relevant authorities shall be deemed to be included in the Works.
- 8.2.5 The use of ground anchors shall be avoided as far as possible. For any ground anchors or other Temporary Work used in the Works that encroach beyond the Works areas boundary, the Contractor shall seek the permission of and satisfy all requirements of the relevant statutory authorities and stakeholders.
- 8.2.6 The Contractor shall take note that the Works areas shown on the drawings are indicative and approximate. The actual extent of such areas and the layout of the Contractor's facilities shall be agreed and confirmed with the Engineer through Site surveys conducted by the Contractor before taking possession of the Site. The Engineer reserves the right to adjust the boundary of these areas to suit Site conditions.
- 8.2.7 The Contractor may also use Works areas for storage of construction materials subject to obtaining all necessary approvals. The Contractor shall take all necessary safety precautions to ensure that such activities do not pose a hazard. Barriers and signage shall be erected by the Contractor to serve as proper demarcation and warning.
- 8.2.8 Where the Works area is not served by an access road, the Contractor shall construct access roads as required. The Contractor shall survey the Site and propose the road alignment for the Engineer's review prior to its construction. Complete details of access roads and the integration with the existing or temporary traffic management system shall be submitted to the relevant authorities for approval prior to commencing the Works.
- 8.2.9 If additional Works areas are necessary, the Contractor shall be responsible for seeking, at his own cost, any additional Works areas that may be required.
- 8.3 Site Conditions, Maintenance and Clearance**
- 8.3.1 All Temporary Works which are not to remain on the Site after the Completion of the Works shall be removed prior to Completion of the Works or at other times instructed by the Engineer. The Site shall be cleared and reinstated to the lines and levels and to the same or better condition as existed before the Works started except as otherwise stated in the Contract.
- 8.3.2 Housekeeping is a basic requirement and good housekeeping shall be maintained at all times. The Contractor's responsibility for good housekeeping shall include, but is not limited to:
- a. the wheels of all Site vehicles shall be washed before leaving Site to avoid depositing mud and debris on the adjacent roads; and
 - b. the Contractor shall ensure all roads adjacent to the Site entry gates are kept clean and free from any mud or debris from the Works.
- 8.3.3 Prior to taking over of the Works or any Section, the Contractor shall undertake full clearance of all rubbish and waste and full cleaning of all of the parts of the Works.
- 8.3.4 The Contractor shall provide latrines and wash places for the use of Contractor's Personnel and all other persons who will be on the Site. The size of latrines and wash places shall accord with the numbers of persons entitled to be on the Site, which may necessitate their location on structures. Where necessary there shall be separate facilities for males and females. The capacities and layout shall be subject to review by the Engineer. The Contractor shall arrange regular disposal of effluent and sludge in a manner that shall be in accordance with local laws/regulations.
- 8.3.5 The Contractor shall be responsible for maintaining all latrines and wash places on the Site in a clean and sanitary condition, ensuring that they do not pose a nuisance or a health threat. The Contractor shall also take steps and provisions as deemed necessary or as directed by the Engineer to ensure that vermin, etc. are controlled at all times.

8.4 Site Utilities

- 8.4.1 The Contractor shall be responsible for providing water, electricity, telephone, sewerage and drainage facilities for the Engineer's Site offices, Contractor's Site offices, structures and buildings and for all Site laboratories and all such services that are necessary for satisfactory performance of the Works. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant civil and utility authorities for the facilities.
- 8.4.2 The Contractor shall meet the requirements for the supply and provision of power and water services for all Interfacing Parties which shall be on a chargeable basis.
- 8.4.3 The Contractor shall be responsible for power provision on the Site during Construction.

8.5 Site Traffic Management and Transport Safety

8.5.1 Traffic Management Plan

The Contractor shall develop a detailed Traffic Management Plan for the work under the contract. This Traffic Management Plan shall be submitted within 45 days from the Commencement Date. The purpose is to develop a Traffic Management Plan to cope with the traffic disruption as a result of construction activities by identifying strategies for traffic management on the roads and neighbourhoods impacted by the construction activities. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract.

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

- a. To minimize the inconvenience of road users and the interruption to surface traffic through the area impacted by the construction activities;
- b. To ensure the safety of road users in the impacted area;
- c. To facilitate access to the construction site, and to maintain reasonable construction Progress; and
- d. To ensure traffic safety at each construction site.

The Contractors Traffic Management Plan shall confirm the arrangements to be made for accommodating road and pedestrian traffic at individual construction sites and continuously along the alignment, for smooth traffic operations and for the safety of both construction workers and road users. The Plan shall consider different measures such as:

- a. Proper phasing and timing of traffic signals;
- b. Modifications to inter section geometry;
- c. Changes in lane usage;
- d. Parking prohibitions;
- e. re-location of bus stops;
- f. reducing width of foot paths and median
- g. right-turn prohibition;
- h. work site access management;
- i. Minimizing the duration of any road closure;
- j. reversible lane operations;
- k. Modification of roadway alignment affected by the construction, which shall be in conformance with the requirements and regulations defined by the relevant authorities; and may include widening of roads, Construction of temporarily new road etc.;
- l. Other traffic engineering measures as may be applicable.

8.5.3 The Contractor shall manage the vehicular and pedestrian right of way during the period of construction. The Contractor shall include local traffic diversion routes and assess traffic impacts caused by the construction in the affected areas. Signage layout shall be included to ensure that adequate motorist information will be provided for traffic diversions. Where it becomes necessary to close a road or inter section, or supplementary lanes are required to satisfy the traffic demands,

traffic diversion schemes to adjacent roadways shall be developed with quantitative justifications. The Contractor shall co-ordinate with all relevant authorities.

8.5.4 The Contractor shall be responsible for all on-Site traffic management. Vehicular routes shall be segregated from pedestrian traffic wherever possible and clearly marked.

8.5.5 The Contractor shall be responsible for provision of access to emergency services including but not limited to police, fire services, ambulance, civil defence and other authorities.

8.6 Contractors Responsibilities

8.6.1 The Contractor shall restrict his workforce from entering the Site(s) of other Contractors in and around the vicinity of the Works and taking all necessary precautions to prevent any trespassing and damage arising from nuisance of any kind.

8.6.2 The Contractor shall confine the work activities including storage of construction materials, movement and packing of equipment, machinery and plant within the allocated Works areas.

8.6.3 The Contractor shall execute his work in such a manner as to cause minimum inconvenience to the public and other contractors.

8.6.4 The Contractor shall control its workforce and those of the Subcontractors to ensure that workers do not loiter in public areas or facilities and do not intimidate local residents.

8.6.5 The Contractor shall make suitable provisions for and shall control vehicles to the Works areas. This shall ensure that roads are not blocked and there is no disturbance to the community.

8.6.6 The Contractor shall:

- a. confine his use of the areas of the Site for purposes reviewed by the Engineer who reserves the right to extend, amend or restrict the uses to which areas of the Site will be put;
- b. refrain from depositing rubbish or causing nuisance or permitting nuisance to be caused and except where reviewed by the Engineer, depositing earth on or removing earth from areas of the Site;
- c. on issuance of the Taking-Over Certificate, or earlier if directed by the Engineer, remove all Temporary Works except where permitted and reinstate the areas of the Site to the extent, standards and details indicated in the Contract or as proposed by the Contractor and reviewed by the Engineer;
- d. refrain from obstructing manholes, utility access points and the like;
- e. refrain from felling trees, refrain from depositing earth around the trunks of trees and protect all trees remaining on Site.

8.6.7 Work other than that necessary for completion of the Works shall not be carried out on Site.

8.6.8 Unless otherwise stated, the Contractor shall pay all rates and charges of any nature whatsoever arising out of his use of the Site and all Works areas provided therein under the Contract.

8.7 Services and Facilities for the Employer and Engineer

8.7.1 The Contractor shall provide all facilities and the services for such facilities for the exclusive use of the Employer, Engineer and any other parties directed by the Employer, on the Site or at other locations very near to the work area agreed with and to the satisfaction of the Engineer as per **Appendix-VI** of Employer's Requirements.

8.7.2 Engineer Offices

The specifications, equipment and other requirements of Project offices & Site offices are given in detail in **Appendix-06**.

NOTE: All the requirements of offices, furnishings, equipment, appliances, tools, maintenance standards, personnel – including their qualifications and expertise, are designed for effective execution and close monitoring of the progress and quality of work.

- a) The Employer/Engineer Office shall be located no further than 50m walking distance, from the Contractor's Project Office.

- b) The Contractor shall provide a minimum temperature and humidity controlled (air-conditioned) Engineer office as shown in the table below, which shall, except otherwise stated, be fully fitted, furnished and equipped. The purpose of the offices is to provide adequate office accommodation for those members of the Engineer's personnel involved in the daily inspection and examination of the work under the Contract and the auditing of the Contractor's activities.
 - c) The offices shall include a fully equipped kitchens complying with regulatory requirements, suitable for the preparation of hot and cold food and drinks relevant to the intended number of occupants. The kitchen will as a minimum be provided with a refrigerator/freezer of minimum 500 litre capacity, a microwave, water boiling equipment, dishwashing facilities etc.
 - d) Toilet facilities shall comply with regulatory requirements and as a minimum shall comprise separate male and female toilets on the basis of a male to female ratio of 9:1. Both male and female toilet facilities shall have a minimum of one shower unit, and the Contractor shall provide a changing area and clothes lockers.
 - e) A room with seating is to be provided for drivers.
 - f) The Contractor shall provide the main Contract office with 24-hour security services.
 - g) All office facilities shall have electronically controlled access cards (RFID) & biometric entry.
 - h) Deleted
- 8.7.3 Deleted
- 8.7.4 **Services**
- The Contractor shall provide services to all offices and buildings provided for the use of the Employer and the Engineer. The services shall include signage, maintained access roads, allocated covered car parking spaces, standard 240V voltage electricity, lighting, telephone lines, internet connections, air conditioning and heating, water supply, sewage disposal and waste disposal, fire detection/alarm system and the like.
- 8.7.5 The building(s) shall be cleaned daily and shall regularly maintained with 365/24/7 working. Sanitary facilities shall be regularly supplied with consumables such as, but not limited to, lavatory paper, disinfectant, soap, detergent and paper towels.
- 8.7.6 Signage shall clearly identify the offices and building(s). The size, colours and style to be adopted shall be agreed with the Engineer. Schematic plans shall be used to orientate visitors.
- 8.8 Office Equipment and Services for the Engineer**
- 8.8.1 The Contractor shall maintain all equipment and provide all required consumables (ink, cartridges, toner, paper, etc.) throughout the whole duration of the Contract.
- 8.8.2 The Contractor shall provide telephone services which shall be restricted to national calls (within India) only, except for the Engineer's room which shall have international call facility, and the Contractor will pay the related telephone bills.
- 8.8.3 The Contractor shall provide high speed internet connection to support the facilities and pay both the Internet Service Provider fees and the user costs for internet connections.
- 8.8.4 Water cooler with RO filter for potable water and two water fountains including a supply of potable water bottled by a reputable and registered water supplier.
- 8.8.5 The Contractor shall provide all electrical power required for Employer's and Engineer's facilities and pay all electrical bills.
- 8.8.6 The Employer's offices, equipment therein, consumables, maintenance and security services shall be provided for the whole period of the Works (including the Defects Liability Period), at which time the Offices and all furniture and fittings therein shall revert to the Contractor and the sites thereof shall be reinstated by the Contractor. All moveable equipment detailed and any other equipment provided by the Contractor under an Instructed Variation Order, shall be handed over to the Employer.

9 Interface Management

9.1 Interfaces

- 9.1.1 The Contractor, in the delivery of the work under the Contract, shall coordinate the work under the Contract with the works of project Interfacing Parties and with external stakeholders who are affected by the Works. Such interfacing and coordination activities require the implementation of interface management techniques to efficiently manage interfaces that can be either design or construction related.
- 9.1.2 An outline Project Interface Matrix and Interface Requirements are listed in Appendix XIII for the guidance of the Contractor.

9.2 Interfacing Parties

- 9.2.1 "Interfacing Parties" or "Project Partner" shall be defined as:
Any Authority, other contractor employed by the Employer on the Project, consultants performing design services on the Project (such as but not limited to adjacent civil works contractors, station contractors, system-wide contractors, track work contractors, depot contractors and rolling stock suppliers), or in the case of the Employer, only to the extent of any Project contract not yet awarded to another contractor or consultant employed by the Employer; who interface with the Contractor in the execution of the work under the Contract.
- 9.2.2 The Contractor shall be responsible for his work on the Site and shall coordinate all activities {design and construction} with those activities of other contractors on the project, to the extent specified in the Employer's Requirements or as required by the Engineer from time to time.
- 9.2.3 The Contractor shall provide a fully coordinated and interfaced design for the Works.
- 9.2.4 The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:
- a. the Employer's Personnel and the personnel of any Authority;
 - b. Interfacing Parties;
 - c. Stakeholders;
- who may be engaged in executing, on or near the Site, or elsewhere in the Project work not included in the Contract.

9.3 Interface Management Plan

- 9.3.1 Within 45 days of the Commencement Date the Contractor shall submit for the Engineer's approval, an Interface Management Plan (IMP) that will describe how the Contractor will develop and maintain the IMP throughout the Time for Completion of the Works.
- 9.3.2 The IMP will identify as a minimum:
- a. the Contractor's organisation responsible for Interface Management;
 - b. the roles and responsibilities of the individuals performing interface management;
 - c. the interface coordination processes and procedures to be implemented that will ensure design and construction interfaces are identified, managed, controlled and validated throughout the delivery of the Works.
- 9.3.3 The Contractor shall produce the following working documents that will form part of the Interface Management Plan (IMP):
- a. The IMPP (see Clause 12.4);
 - b. Responsibility of the Contractor;
 - c. Interface Management System;
 - d. Responsibility Interface Matrix and Interface Sheets;
 - e. Interface Register;
 - f. Coordinated Design Interface Programme;
 - g. Design control interface documents.
- The IMP shall conform with the Employer's Requirements.

9.4 Interface Management Plan & Programme (IMPP)

- 9.4.1 The IMPP will be submitted by the Contractor to describe the sequencing and timing of each of the Interfacing Contractors' scope of work, clearly describing the interdependencies for all stages of the work between the Contractor's work and that of the Interfacing Contractors and complementing the Interface Management Plan, whilst complying with all Key Dates stated in the tender document.
- 9.4.2 The IMPP shall be structured to detail each of the primary zones of interface and the principal elements of the design and of the works requiring interfacing contribution from others. This IMPP shall also be related to the Contractor's Works Programme and shall show the sequences and timing agreed with the Interfacing Contractors to the necessary degree of detail to clearly illustrate each of the interfaces to be undertaken.
- 9.4.3 Targets to receive or supply information shall also be shown, with due allowance being given for the design process of others. Information relating to Contractual Key Dates and information exchanges dates shall be shown for both the Contractor and the Interfacing Contractors to demonstrate a matching of design processes. A record of these interfaces, with current status and agreed dates for information transfer, site inspections, access, occupation, handover, etc. shall be maintained.
- 9.4.4 The Interface Management Plan & Programme (IMPP) shall be a process driven programme in a format to be agreed with the Engineer. The IMPP shall incorporate the Key activities from both the Interfacing Contractor's and Contractor's Works programmes that will enable the Contractor to demonstrate that any Interface is being correctly managed and will result in fully co-ordinated design/construction/ installation of works.

9.5 Responsibilities of the Contractor

- 9.5.1 The Contractor shall take all necessary steps to ensure that the work under the Contract is coordinated and integrated with the works of the Interfacing Parties and shall comply with any directions which the Engineer may give for the integration and/or coordination of the work under the Contract with the work of the Interfacing Parties.
- 9.5.2 The Contractor shall adopt a proactive approach in seeking out interface issues and their solutions and shall identify the Interfacing Parties and their related requirements.
- 9.5.3 The Contractor shall communicate, coordinate and exchange information directly with Interfacing Parties. Information necessary to fulfil the Contractor's interface obligations shall be directly requested and obtained from the Interfacing Parties, and receipt acknowledged. Conversely, the Contractor shall provide directly to the Interfacing Parties information within the Contractor's scope that is required by them.
- 9.5.4 By exception, the Contractor shall provide the Engineer in writing with details of any issues of significance encountered in obtaining necessary information and or lack of cooperation from any Interfacing Party. The Engineer will review the matter and direct the Contractor and the Interfacing Party or Parties as to the required action.
- 9.5.5 The Contractor shall provide all information reasonably required by the stakeholders in a timely and professional manner to allow them to proceed with their design and construction activities.

9.6 Interface Management System

- 9.6.1 The Contractor shall develop an Interface Management System {IMS} in close coordination with the Engineer and shall offer the use of proven interface management processes and tools suitable for a railway infrastructure program of the size and complexity of the project.
- 9.6.2 The Contractor shall establish and maintain the IMS to include the methodologies and procedures to achieve a fully coordinated design covering all aspects of interface requirements including; identification, management, control and validation.
- 9.6.3 The Contractor's IMS shall include as a minimum;

- a. the development and maintenance of an Interface Register (database)
 - b. a Coordinated Design Interface Programme (CDIP).
- 9.6.4 The Contractor shall provide the Engineer with access to the IMS and or specific details of any interface item or interface specification, at any time.
- 9.6.5 The Contractor's IMS shall include the use of BIM processes to confirm design and construction coordination in the delivery of the work under the Contract. The output from these processes shall be used to demonstrate engineering assurance in accordance with the Employer's Requirements for Systems Assurance.
- 9.7 Responsibility Interface Matrix and Interface Sheets**
- 9.7.1 The Contractor shall coordinate his design and construction of the Works with all stakeholders.
- 9.7.2 The Contractor shall develop a Responsibility Matrix to show levels of detail of each interface, as required by his IMS.
- 9.7.3 The Contractor shall submit to the Engineer Interface Sheets to be consistent with his Design Documents in accordance with his Interface Management System.
- 9.7.4 The Responsibility Matrix and Interface Sheets shall identify the responsibilities of the various parties concerned with a particular interface or interfaces. The parties shall be as follows:
 - a. 'Lead' indicates that the Interfacing Party is responsible for leading the interface coordination, accommodating the design requirements of 'Interface 1' and / or 'Interface 2' parties etc. into their works and/or systems;
 - b. 'Interface 1' indicates that the interfacing party is responsible for the exchange of information necessary to specify the interface. Information exchange shall include, but not be limited to, design requirements, scheduling requirements and coordination drawings;
 - c. 'Interface 2' indicates that the interfacing party is responsible for the exchange of information necessary to specify the interface. Information exchange shall include, but not be limited to, design requirements, scheduling requirements and coordination drawings.
- 9.8 Interface Register**
- 9.8.1 The Contractor shall create and maintain an Interface Register (database). The Interface Register shall contain specific information about all interfaces, including identification, category, description, location, interface type and status.
- 9.8.2 For consistency Interface Registers shall use a common format as agreed with the Engineer.
- 9.9 Coordinated Design Interface Programme (CDIP) and Report**
- 9.9.1 The Contractor shall prepare a CDIP in the form of a logic linked Gantt chart. The purpose of the CDIP is to monitor and support the management of key design interfaces to ensure timely information exchange between the Contractor and the Interfacing Parties.
- 9.9.2 The status and summary information of all key interfaces between Interfacing Parties and the Contractor shall be included as part of the CDIP document and compiled into a report.
- 9.9.3 Information recorded for each interface shall include, but not be limited to:
 - a. interface description;
 - b. interface location;
 - c. status, indicating whether the interface is closed (meaning the design is completed and mutually agreed) or in progress.
- 9.9.4 The Contractor shall update the CDIP and Report on a continuous basis. Updates of the interface management documents shall be issued monthly to the Engineer for his information.
- 9.9.5 The format of the CDIP and Report shall be submitted, as part of the Interface Management Plan.
- 9.9.6 A design control interface document(s) (DCID) shall be created for each design interface. The document shall identify design inputs from all interfacing parties and will be used to demonstrate a

coordinated design between all Interfacing Parties.

9.10 Interface Management Software (IMS) and Reporting

- 9.10.1 All interface documents shall be available in electronic format. The Contractor shall use software specifically designed for handling interface management information exchange as part of his IMS.
- 9.10.2 The Contractor's software (DOORS based, e.g. Comply-Pro or similar) shall be approved by the Engineer, and the data shall be made available to the Engineer at all times.
- 9.10.3 The Contractor shall provide and supply one copy of the software they use for Interface Management.

10 Testing and Commissioning

10.1 General

- 10.1.1 The testing, inspection and commissioning are the final steps in order to prove the quality control process of each stakeholder (Contractor(s), Engineer, and Employer). The tests objectives are to check that the design requirement (functional performance, operational and technical) of the sub-system(s) and of the global transport system are achieved and respected. The Contractor shall prove that all sub-systems are compliant with the Employer's Requirements and specifications, including interfacing with Systems sub-systems. The Engineer shall check that the global transport system is compliant with the overall system performance objectives and requirements. The test process will lead to the overall transport system acceptance.

10.2 Test Plan & Procedure

- 10.2.1 Within sixty (60) days of the Commencement Date, the Contractor shall present for the approval of the Engineer an Inspection, Test and Commissioning Plan (ITCP) showing in as much detail as available the tests anticipated to ensure a safe and reliable operation of the Works and the integration of the Works with the rest of Phase 1 works together with an indication of the periods in which the various stages of testing will be carried out. The ITCP shall:
 - a. Identify the date on which the Contractor proposes to conduct each of the listed tests;
 - b. Describe the nature and purpose of each test;
 - c. State the location at which the test is to be conducted;
 - d. subsystem testing schedule;
 - e. Integrated Testing and Commissioning schedule;
 - f. Identify the interfaces with other Contractors that will require their attendance and/or support;
 - g. Identify the Contractor's requirements for the Engineer's staff to operate equipment during Integrated Testing and Commissioning and Trial running; and
 - h. Confirm safety and security deployment and safe notice and/or training for all participants.
- 10.2.2 Testing procedures shall be in accordance with the Employer's Requirements.
- 10.2.3 The Contractor shall perform all necessary testing and commissioning activities in order to ensure satisfactory operation of the completed Works and compliance with the Employer's Requirements. Tests shall be witnessed by the Engineer.
- 10.2.4 The Contractor shall identify the witness, inspection and hold points as required by the Contractor, the Engineer or both. The Engineer has the option to attend or otherwise any schedule tests as per CC/PCC.
- 10.2.5 For inspection and testing of the equipment that interfaces with other contracts, the Contractor shall coordinate with interfacing parties regarding the timing and place of the tests and the arrangements to be made for measuring or assessing parameters affected by the interface.
- 10.2.6 The manufacturers and places of manufacture, testing and inspection for the various items of equipment shall not be varied without the prior review of the Engineer.
- 10.2.7 All costs associated with testing shall be borne by the Contractor, including any expenses incurred due to re-testing caused by defects or failure of equipment to meet the requirements of the Contract

- in the first instance wherever the location may be.
- 10.2.8 The Contractor shall submit a schedule of tests to the Engineer for review, giving full details of all tests to be carried out under the Contract with standards or limits to be achieved, not less than 60 days before the tests are due to be carried out.
- 10.2.9 No tests shall be carried out until the schedule has received approval from the Engineer. The schedule may be submitted in stages.
- 10.2.10 The Contractor shall submit testing procedures to the Engineer at least 60 days prior to conducting any test.
- 10.2.11 Test procedures shall unambiguously show the extent of testing covered by each submission, the method of testing, acceptance criteria, the relevant drawing (or modification) status, and the location.

10.3 Test Instrumentation

- 10.3.1 All test instruments used during the testing and commissioning phases shall have been subjected to calibration tests in accordance with industry standards.
- 10.3.2 Calibration test certificates shall be supplied to the Engineer for a Statement of No Objection in duplicate and shall be signed and dated clearly identifying the type of test equipment, serial number, date of calibration test and expiry date of the calibration period. All calibration checks shall be undertaken prior to testing and, if required by the Engineer, shall be repeated afterwards.
- 10.3.3 All test instrumentation shall carry a self-adhesive calibration identification label which clearly identifies the serial number of the equipment, the date when calibrated and the expiry date of the calibration

10.4 Testing and Commissioning Stages

The list below gives broadly the tests leading to the Transit System acceptance of the works:

- a) Factory Acceptance Tests (FAT): These generally apply to equipment, sub-assembly, items of supply and are conducted at the factory before dispatch. FAT tests include;
- i. Unit tests
 - ii. Type tests
 - iii. Routine tests
 - iv. Functional and operational tests
 - v. Integration tests
- b) Tests before Completion;
- i. installation Tests (IT): Visual inspection of all the equipment within the identified commissioning lot together with all equipment, cable and earthing tests to demonstrate that the equipment has been installed in accordance with the design and that it is safe to be energised with permanent power
 - ii. Partial Acceptance Tests (PAT): Test of components and sub-systems, to prove functionality and compliance with the specifications based on the equipment contained within a defined commissioning lot
 - iii. System Acceptance Tests (SAT): Test of components, sub-systems and systems alone, to prove functionality and compliance with the specifications. This testing phase combines all identified commissioning lots of one primary system.
- c) Tests after Completion
- i. System Integration Tests (SIT): Tests to prove the functionality of the different systems together, in particular the technical interfaces between the different primary systems
 - ii. System Performance Tests (SPT): To prove the overall inter-operability of all independent pre-commissioned systems. This includes the proof of compliance with the overall system specifications
- d) Trial Running
- i. Official Review by KRIDE,

- ii. Approval by Statutory Authorities,
- iii. Integrated testing and commissioning
- iv. RDSO and the Commissioner of Railway Safety,
- v. Regular Revenue Service verification and service trials,
- vi. RAMS Demonstrations.

10.4.1 Testing and Commissioning activities shall be divided into three areas, covering Civil, MEP and Architecture. The Civil and MEP Testing and Commissioning activities will be undertaken during the construction phase, and the Architecture Testing and Commissioning activities will be covered during the initial design phase. The Testing and Commissioning activities relating to these areas are described further in the following section.

10.5 General Testing

10.5.1 Prior to construction, all materials shall be tested and certified by the manufacturer before being delivered to site. Certifications of testing shall include all reports of inspections and/or tests and submitted to the Engineer for approval.

10.6 Mechanical, Electrical and Plumbing Testing and Commissioning

10.6.1 If a permanent power supply is not available during any step of the testing and commissioning activities, it is Contractor's responsibility to provide temporary power of adequate size to carry out the Testing and Commissioning activities. Para 11.4.2 may also be referred.

10.6.2 It shall be necessary for the purposes of commissioning to delineate the testing and commissioning into phases, as previously stated in Clause 13.4.

10.6.3 At the end of each test phases the Contractor shall provide the test results to the Engineer. Any deficiencies and or deviations from the reviewed detailed design for the installation, testing and performance of the equipment and/or system shall be confirmed.

10.7 Mechanical, Electrical and Plumbing Certification

10.7.1 The Contractor shall provide the following certification for MEP installation s;

Timing	Stage	Test		Certificate
Test before Completion	Stage 1	Factory Acceptance Test	FAT	FAT
Test before Completion	Stage 2	installation Test	IT	installation Release Notice (IRN)
Test before Completion	Stage 3	Partial Acceptance Tests	PAT	Pre-Commissioning Certificates (PCC)
Test before Completion	Stage 4	System Acceptance Tests	SAT	Partial Acceptance Certificates (PAC)
Test on Completion	Stage 5	MEP System Integration Test	SIT	Acceptance Certificates (AC)
Test After Completion	Stage 6	System Performance Test	SPT	Certificate of Completion Test (CoCT)

10.8 Test Reports

10.8.1 The Contractor shall submit to the Engineer a copy of a test reports no later than 14 days after completion of each test, whether witnessed by the Engineer or not.

10.8.2 Attendance by the Engineer of any tests or inspections shall in no way relieve the Contractor of his Contractual obligations.

10.9 Commissioning Co-ordination

- 10.9.1 The Contractor shall appoint a Commissioning Manager nine months prior to testing and commissioning commencing to co-ordinate all activities of the commissioning schedule, so that installation, testing, and commissioning of the system is carried out without hindrance and in a safe and satisfactory manner.
- 10.9.2 The Contractor shall submit details to the Engineer for approval of the proposed MEP Testing and Commissioning Manager before commencement on site.

11 Operating and Maintenance Manuals, Record Drawings

11.1 General

- 11.1.1 The Works shall not be considered to be completed for the purposes of taking-over (Taking Over of the Works and Sections) until the Engineer has received final operation and maintenance manuals in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works and any other manuals specified in the Employer's Requirements for these purposes.
- 11.1.2 The Contractor shall supply to the Engineer provisional operation and maintenance manuals in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works (i.e. the Civil, Plant, systems, subsystems, equipment etc.).
- 11.1.3 The Contractor shall submit to the Engineer the operation and maintenance manuals with data sheets from the Original Equipment Manufacturer (OEM) for the equipment, systems or sub-system with their delivery to the site.
- 11.1.4 A comprehensive alphabetical list of suppliers, manufacturers, agents and distributors of all proprietary articles provided and incorporated into the work under the Contract. This list shall include trade names, business names, addresses, telephone and facsimile numbers, email addresses, websites etc.; six (6) copies in a durable loose-leaf binder, complete with index and alphabetical dividers shall be provided to the Engineer.
- 11.1.5 All manuals shall be provided in hard copy and electronic format, in both Hindi/Kannada and English language, in a format to be agreed with the Engineer (which must allow the Employer to clearly document future changes). Six (6) properly bound oil and dirt resistant hard copies shall be provided. The material for the hard copies shall be agreed with the Engineer.

11.2 Record Drawings and As-Built Records

- 11.2.1 The Contractor shall prepare, and keep up-to-date, a complete set of "As-Built" records in hard copy and digital format of the execution of the Works, showing the exact As-Built locations, sizes and details of the work as executed. Weights of assemblies shall be shown on the Drawings. These records shall be kept on the Site.
- 11.2.2 All As-Built drawings shall be checked and endorsed by the Designer(s) respectively.
- 11.2.3 The Contractor shall obtain the consent of the Engineer as to the size, the referencing system, and other relevant details of the As-Built Records.
- 11.2.4 Prior to the issuance of any Taking-Over Certificate the Contractor shall supply all the As-Built Records.
- 11.2.5 Three hard copies and one digital copy shall be supplied to the Engineer prior to the commencement of the Tests on Completion.
- 11.2.6 The electronic format of the As-Built drawings will be confirmed by the Engineer.

11.3 Maintenance Drawings

- 11.3.1 The Contractor shall provide such drawings as may be required for the operation and maintenance the Works (i.e. the Civil, Plant, systems, subsystems, equipment etc.) to the Engineer.
- 11.3.2 Information contained on the drawings shall include but not be limited to:

- a. sizes of all fixtures;
- b. manufacturers code drawing and reference numbers;
- c. wiring diagrams to appropriate standards, including internal wiring of sealed unit items;
- d. appropriate standards;
- e. setting dimensions and tolerances.

11.4 Spare Parts Lists

- 11.4.1 The Contractor shall submit spare parts lists and illustrated parts lists to the Engineer at least 60 days prior to conducting any of testing and commissioning activities. Cost of spare materials supply shall be included in the Quoted price.
- 11.4.2 If required by the Employer, the Contractor shall supply minimum Five (5) percent spare materials for Granite; Vitrified Tiles; raised flooring and false ceiling beyond the DNP period.
- 11.4.3 The Contractor shall supply spare parts for Mechanical, Electrical and Plumbing installations during the DNP as per Original Equipment manufacturer (OEM) catalogues and supplier recommendations and as approved by the Engineer.
- 11.4.4 Within 60 days of Commencement of DNP, the Contractor shall prepare and submit the list of likely spares and the OEM details including sources and approximate quantities of Spares assessed for one-year requirement to be maintained by the owner/Employer after the completion of DNP. This list is to be submitted as required in the format accepted by the Engineer.

12 Employer Training

12.1 Operations and Maintenance Training Requirement

- 12.1.1 The Contractor shall provide comprehensive training to employees of the Employer's Operations and Maintenance (O&M) team and the Engineer's personnel. The training shall confirm technical matters on each O&M activity according to the intended function, as well as providing training for personnel who will become trainers in the intended functions.
- 12.1.2 Within six months of the Commencement Date the Contractor shall submit to the Engineer a Training Plan to provide a detailed explanation of the training philosophy, objectives and methodology for the Employer's O&M team such that personnel on completion of training shall have the knowledge and/or skills required to perform the intended functions.
- 12.1.3 The Contractor shall provide training in classroom suitable for required training. It may be at site or at the Employer's location.

12.2 Operations and Maintenance Training Objectives

- 12.2.1 The content, timing and duration of the training programme shall be such that:
 - a. personnel trained by the Contractor will be able to operate and maintain the equipment/systems in the designated manner with maximum reliability and economy;
 - b. trainers trained by the Contractor shall be competent to train personnel to be able to operate and maintain the equipment/systems.
- 12.2.2 Training objectives in terms of minimum standards to be achieved by each trainee shall be clearly defined by the Contractor for each trainee post, including the future trainers.

12.3 Selection of Operations and Maintenance Trainees

- 12.3.1 The Contractor shall submit to the Engineer for review, 60 days before the commencement of the proposed training, the range of staff, including the service's instructors, for which training is recommended.
- 12.3.2 The Contractor shall submit measurable selection criteria for entry to each trainee post, indicating the minimum standards required:
 - a. qualification and/or educational standards;
 - b. basic skills and knowledge levels, any special aptitudes necessary such as manual dexterity;

- c. oral and written ability.

12.4 Operations and Maintenance Training Methods

The training shall be planned and carried out in a manner suitable for the intended occupation, and shall consist of:

- a. formal off-the-job theory and practice,
 - b. practical on-the-job follow-up experience.
- 12.4.1 The Contractor shall demonstrate that the trained staff and instructors have achieved the minimum standards established for each trainee post.
- 12.4.2 The Contractor shall provide one original and five coloured copies of the Training Manual for use by the Employer for conducting in-house training.
- 12.4.3 The Contractor shall submit training programmes and syllabi and measures for monitoring the progress of both the training programmes and individual trainees to the Engineer for review not later than six (6) months after Commencement Date. Programmes shall clearly show commencement and completion dates and the number of trainees for each training course. The programme shall clearly identify whether the training is off-the-job theory or on-the-job.
- 12.4.4 Syllabi shall clearly indicate:
- a. course title and objectives;
 - b. course content or attachment objectives;
 - c. location of training course and/or attachments;
 - d. methods of training.
- 12.4.5 Methods for monitoring progress shall relate to:
- a. theoretical tests;
 - b. practical tests;
 - c. progress reports.
- 12.4.6 Records of trainees' progress shall be kept up-to-date and made available for examination when required to do so.
- 12.4.7 Copies of individual trainees' records showing all test results and reports of progress shall be issued to the Engineer on completion of each training course or attachment.

12.5 Contractor's Operations and Maintenance Training Staff

- 12.5.1 The Contractor shall ensure that qualified staff are provided for all off the job formal theoretical and practical training.
- 12.5.2 Where the trainees are attached to the Contractor (or his Subcontractors) for the purposes of gaining job experience, all such trainees shall be properly supervised and monitored by a qualified training supervisor to ensure that each trainee has the best opportunity to benefit from the theoretical and practical experience.

12.6 Operations and Maintenance Training Locations

- 12.6.1 The training shall be carried out at such locations where the greatest benefit for trainees may be gained. This may be in Country, at places of manufacture, assembly or testing, or at such other locations as may be necessary.
- 12.6.2 The Contractor shall be responsible providing all the logistics for the training of the Employers staff which shall include but not limited to classrooms facilities, projector, handouts, training tools and material, etc.

12.7 Operations and Maintenance Training Equipment

- 12.7.1 In general, the Contractor shall use plant and equipment specifically set aside for training purposes. However, he may use as may be agreed with the Engineer, plant and equipment being erected, tested or commissioned for the training, when no other such plant or equipment is available. The Contractor

- shall not use spare parts that are to be used as work under the Contract for this purpose.
- 12.7.2 The supply of plant, equipment and materials shall be sufficient both for the persons trained by the Contractor and for those to be subsequently trained.

12.8 Administration

12.8.1 The Contractor shall:

- a. be responsible for the general welfare of trainees under their control;
- b. submit procedures which will enable him to control, and to repatriate where necessary, those trainees not found to be responding to training as a result of:
 - i) aptitude;
 - ii) discipline;
 - iii) incorrect selection;
 - iv) any other cause.

13 Systems Assurance

13.1 General

- 13.1.1 The Contractor shall apply systems assurance throughout the life cycle stages listed in EN 50126, including design, construction, manufacture, installation, testing and commissioning and Defects Notification Period, to enable the Employer to achieve safety certification for an operational railway.
- 13.1.2 The Ministry of Railways and RDSO have the responsibility for safety certification and technical clearance of the BSRP System. An on-line procedure for the Safety Certification and Technical Clearance of IR / BSRP/ Metro Systems has been issued by RDSO for guidance to Administrations and Project Partners.

13.2 System Assurance Activities

- 13.2.1 The Contractor's system assurance activities shall include but not be limited to the following:
- a) methods of operation;
 - b) Reliability, Availability, Maintainability, and Safety (RAMS) considerations;
 - c) maintenance regimes;
 - d) required competence levels of Employer's Personnel O&M staff;
 - e) human factors including ergonomic studies that have been carried out.
- 13.2.2 Analyses shall consider the system/sub-system in normal operation and in specific emergency or degraded conditions for which the system/sub-system is being designed.
- 13.2.3 Hazard identification and safety analyses shall be conducted to identify and record all reasonably foreseeable hazards in the operation of the work under the Contract and assess the risk that each hazard represents to its operation.
- 13.2.4 Prior to completion of each design stage (DS1 and DS2), the Contractor shall provide a list of key safety issues, Reliability Critical Items List (RCIL) and Safety Critical Items List (SCIL) to the Engineer for review.
- 13.2.5 The Contractor shall demonstrate that the apportioned RAMS targets at sub- system and equipment level are met or bettered.
- 13.2.6 The Contractor shall submit for the Engineer's review an engineering safety validation plan, including but not limited to:
- a) the list of safety field verifications and validations for systems/ subsystems/ equipment during construction, manufacturing, installation and systems interfaces integration testing;
 - b) the schedule of safety field verifications and validations;
 - c) the purpose of each verification and validation;
 - d) the acceptance criteria by reference to any related safety study;
 - e) the recommended method of testing, including the processing of key software safety issues in verification and validation;

- f) the plan for witnessing the results of verification and validation;
 - g) the recommended format of the engineering safety validation report;
 - h) the submission list of the Contractor's test reports;
 - i) the recommended assessment procedure with respect to deficiencies in the verification and validation results.
- 13.2.7 The Contractor shall carry out a design safety review, RAMS review and analysis of any design changes and shall submit the updated design systems assurance deliverables to the Engineer for review.
- 13.2.8 The O&M manuals and related documentation produced by the Contractor shall include all the necessary details required by the Employer to maintain the achievement of the RAMS targets at the system level.
- 13.2.9 The Contractor shall commence the use of the Failure Reporting Analysis and Corrective Action System (FRACAS) prior to any factory or site acceptance tests and report to the Engineer on a monthly basis.
- 13.3 Requirements Management**
 - 13.3.1 Within 60 days of the Commencement Date, the Contractor shall submit to the Engineer for review, a Requirements Management Plan {RMS}.
 - 13.3.2 The Contractor shall implement a Requirements Management System (RMS) that shall remain in effect during the execution of the work under the Contract. The Contractor shall submit the RMS documentation for review by the Engineer.
 - 13.3.3 The Contractor's RMS shall clearly identify requirements that have a direct impact on safety and performance.
 - 13.3.4 The Contractor shall supply one copy of the requirements management software to the Engineer for the Engineers sole use, together with training in its use for four (4) people. The Contractor may use Dynamic Object-Orientated Requirements System (DOORS) or similar software for the RMS.
 - 13.3.5 The Contractor shall provide evidence to the Engineer that there are regular reviews of the performance of the RMS and that actions are implemented to address improvement opportunities as and when they are identified.
- 13.4 Configuration Management**
 - 13.4.1 Within 60 days of the Commencement Date, the Contractor shall submit to the Engineer for review, a Configuration Management Plan {CMP}.
 - 13.4.2 The Contractor shall implement configuration management throughout the duration of the Works.
 - 13.4.3 The Contractor shall use and maintain an automated and integrated software package to perform configuration management functions for the Works.
 - 13.4.4 The Contractor shall supply one copy of the configuration management software to the Engineer for the Engineers sole use, together with training in its use for four (4) people.
 - 13.4.5 RAMS target: The Contractor shall ensure the RAMS target for operation critical items achieves 99.94%, i.e. the replacement can be completed in the planned maintenance period between 1am and 6am.

13.5 Systems Assurance Deliverables

13.5.1 The key systems assurance deliverables shall include but not be limited to the items listed below at the indicated times for submission. All system assurance deliverables shall be submitted to the Engineer for review.

Sr. No	System Assurance Deliverable	Submission Timing
1	Preliminary hazard analysis report	90 days from Commencement Date
2	Hazard log	90 days from Commencement Date
3	Reliability, Availability and Maintainability Analysis {RAM} Plan	90 days from Commencement Date
4	Fire and life safety report	Along with DS1 & DS2
5	Quantitative risk analysis report including Fault Tree Analysis (FTA)	Along with DS1 & DS2
6	System and subsystem hazard analysis	Along with DS1 & DS2
7	Interface hazard analysis report	Along with DS1 & DS2
8	Operations and support hazard analysis	Along with DS1 & DS2
9	Safety critical items list	Along with DS1 & DS2
10	Safety Failure Modes, Effects and Criticality Analysis (FMECA)	Along with DS1 & DS2
11	Hazardous materials list	Along with DS1 & DS2
12	Recommended spare parts and special tool list	Along with DS2
13	Operations training plan	Along with DS2
14	RAM demonstration report	Upon completion of testing and commissioning of the Works
15	Operations and maintenance plan	Along with DS1 & DS2
16	Electromagnetic Compatibility (EMC) Plan	Along with DS1
17	Preliminary EMC Hazard Analysis	Along with DS1
18	EMC Hazard Log	Along with DS1
19	System EMC Requirements	Along with DS2
20	Earthing and Bonding Plan	Along with DS1
21	EMC Hazard Analysis	Along with DS1
22	EMC Demonstration Report	Upon completion of testing and commissioning of the Works
23	EMC Safety Case	Upon completion of testing and commissioning of the Works

14 Environmental and Sustainability Management

14.1 General

- 14.1.1 The Contractor shall fully comply with CC/PCC and 8C of Employer's Requirements. Compliance with the Employer's requirements shall not relieve the Contractor of any of their statutory duties, obligations or responsibilities under the Contract or Law
- 14.1.2 The environmental welfare of all personnel engaged in the work under the Contract, the general public, the avoidance of damage to property, and the prevention & mitigation of adverse impacts on the environment, cultural heritage and social values is of paramount importance to the Employer. The Contractor shall ensure that all operations are conducted in such a manner as to minimise to acceptable levels or eliminate the negative risks to the environment and where opportunities exist, maximise the beneficial factors to the environment.
- 14.1.3 'Environment' shall be defined as 'The biosphere which includes the living beings whether human, animal or plant and all the surroundings, such as air, water and soil, and all it contains, such as solid, liquid or gas substances or radiation, and any installation s built by man and industries or inventions created by man.'
- 14.1.4 The Contractor shall implement an environmental management system that complies with all applicable Laws and standards.
- 14.1.5 The Contractor's environmental management system shall comply with the requirements documented within EN ISO 14001 Environmental Management Systems, which is the minimum standard to be adopted by the Contractor. This standard does not relieve the Contractor of their liabilities under the applicable Laws and where there is a discrepancy in the documents, the higher requirement will take precedence.
- 14.1.6 The Contractor's overall philosophy for environmental management shall embody a culture of continuous improvement via the plan, do, check, act cycle as documented by EN ISO 9001. The Contractor shall regularly review the performance of the environmental management system, and implement improvement actions as and when required, providing evidence to the Engineer of the same.
- 14.1.7 The Contractor shall facilitate Depot DDC to obtain as per IGBC Green Factory Building Rating.

14.2 Personnel

- 14.2.1 The Contractor shall ensure that their staff that are responsible for the Site environment are adequately trained regarding environmental management and are provided the necessary authority to suspend any work where there is imminent risk of an environmental impact.
- The Contractor shall set up an environmental team to execute the environmental requirements
- To lead his environmental team, the Contractor shall deploy an Environmental Manager who shall be responsible for environmental control, pollution monitoring, and record keeping and be available to the Employer for resolution of environmental issues.
- The duties of the Contractor's environmental team shall include (but not limited to)
- To monitor the various environmental parameters as required by the Manual
 - To inspect, investigate and audit the work methodology with respect to environmental mitigation and control
 - To anticipate environmental issues before they arise and plan for their mitigation
 - To audit and prepare audit reports, weekly/monthly reports on site environmental conditions for submission to the Engineer.
 - To maintain records for obtaining "IGBC Green Factory Building Rating ".

14.3 Breach of Environmental Obligations

- 14.3.1 Serious or repeated breaches of the statutory regulations for the environment, or other disregard for the environment, may be reasons for the Engineer to exercise their authority to require the removal

- from the Site of any employee of the Contractor or a Subcontractor.
- 14.3.2 Once removed, such person shall not be re-employed on the Contract.
- 14.3.3 The Engineer shall have the right to order the suspension of any or all of the Contractor's activities where it is deemed that to continue such activity or activities may have an adverse impact on the environment.
- 14.3.4 Where the Engineer orders a suspension of the Contractor's activities, such suspension shall continue until the Contractor has satisfied the Engineer that satisfactory corrective action has been taken to eliminate the impact that was the subject of the suspension.
- 14.4 Environmental Management System Manual (EMS Manual)**
- 14.4.1 The Contractor shall submit a copy of their EMS manual and an Environmental Management Plan to the Engineer for approval within 28 days of the Commencement Date.
- 14.4.2 The Contractor is responsible for all acts of his Sub-contractors and shall ensure that their Subcontractors follow and comply with the Contractor's EMS Manual, Environmental Management Plan plus Project Environmental Risk assessments and Method Statements.
- 14.4.3 The Contractor's EMS manual shall contain the procedures required for carrying out the work activities on the work under the Contract. The EMS manual shall be regularly reviewed and up-dated to reflect changes to work practice and changes to legislation. Copies of proposed changes are to be submitted to the Engineer for review prior to inclusion and implementation.
- 14.5 Environmental Management Plan (EMP)**
- 14.5.1 The Contractor shall devise and implement an Environmental Management Plan in accordance with the Employer's EIA Report and Employer's Requirements / Environmental Management Manual, which address the conditions and proposed work activities for the construction phase of the work under the Contract.
- 14.5.2 The EMP shall include a policy statement signed by the Chief Executive Officer of the Contractor (or other senior officer) declaring that environmental management shall be given high priority in all aspects of the Contract and in the discharge of their contractual obligations. The Contractor's policy shall be aligned to the Employer's environmental policy.
- 14.5.3 The EMP shall also set out in detail the approach that will be adopted in dealing with the potential environmental impacts from the various different construction activities. The EMP shall address all the potential impacts (both positive and negative) outlined in the EIA Report and shall follow the EMP outline contained in Employer's Requirements and Environmental Management Manual. The Contractor shall submit an EMP for review by the Engineer 28 days prior to the commencement of the construction activities.
- 14.6 Risk Assessments**
- 14.6.1 The Contractor shall carry out a detailed Environmental Risk Assessment, which shall address the environmental aspects of the work under the Contract.
- 14.6.2 The environmental risk assessment shall be submitted to the Engineer for approval within 60 days of the Commencement Date or at a date agreed with by the Engineer.
- 14.6.3 The findings of the assessment shall be incorporated in the EMP along with relevant method statements, and other documents as required.
- 14.7 Environmental Inspections and Monitoring by the Contractor**
- 14.7.1 The Contractor shall conduct dedicated site environmental inspections at least once a month or more frequently as circumstances dictate which are to be attended by the Contractor's Environmental Manager and (or) the Contractor's Representative.
- 14.7.2 A brief report of the monthly inspection shall be made and shall include the actions taken to resolve any problems or shortcoming discovered during the inspection. The report shall be made available for

- audit purposes and be discussed at the relevant meetings.
- 14.7.3 A comprehensive environmental inspection checklist for the use of the Contractor's Site staff when inspecting the Site is to be formulated by the Contractor and submitted for review by the Engineer.
- 14.7.4 The checklist shall indicate the standard to be achieved on any particular aspect of environmental management, and be compiled in such a way that allows the inspector to enter their actual findings for instant comparison and subsequent rectification.
- 14.7.5 When completed, the checklist shall be kept for record purposes so that it is available to the Engineer for audit purposes.
- 14.7.6 A grading system shall be established which grades the area inspected as either; 'acceptable' or 'unacceptable'.
- 14.7.7 Where an area receives a grading below 'acceptable', necessary action is to be taken to rectify the problems raised and a further inspection shall be conducted after 7 and 14 days to assess the conditions.
- 14.7.8 The Contractor is to advise the Engineer of the date of the monthly inspection. The Engineer may send a representative to assess the thoroughness of the inspection.
- 14.7.9 The Contractor shall undertake all necessary environmental monitoring including the setting up of all monitoring Depots to comply with the requirements of all environmental legislation, and regulations. The minimum requirements for locations of monitoring Depots are indicated in the EIA Report. Output data from the monitoring Depots shall be provided to the Engineer in the monthly reports.
- 14.7.10 The monitoring and audit requirements, including monitoring locations are given in the Employer's EIA Report.
- 14.8 Environmental Audits by the Contractor**
- 14.8.1 The Contractor shall conduct regular (at least every three (3) months) internal environmental audits on both the environmental management system and the physical site conditions. The audits shall be performed to the same criteria and using the same grading and benchmarking as the Engineer's audits.
- 14.8.2 The audits shall be conducted by person(s) reviewed by the Engineer who are qualified and competent to carry out Environmental audits. The documentation generated by the audit process, including score sheets, shall be made available to the Engineer for performance measurement purposes.
- 14.8.3 The audits shall include the work of Subcontractors of all levels.
- 14.8.4 The Contractor shall advise the Engineer of the date of all the audits. The Engineer may send a representative to assess the thoroughness of the audit.
- 14.9 Reporting of Environmental Incidents**
- 14.9.1 The Contractor shall notify the Engineer immediately of any environmental incident. Initial notification may be verbal but shall in any event, be followed by a preliminary written report, in a format that has been reviewed by the Engineer, within 24 hours of the incident. A detailed written report shall be submitted within three (3) days.
- 14.9.2 The Contractor is required to report all incidents to the Engineer and relevant authorities.
- 14.10 Monthly Reports**
- 14.10.1 The Contractor shall be fully responsible for submitting reports, notices and information to relevant authorities where there is a statutory requirement to do so.
- 14.10.2 The Contractor shall provide environmental performance data as required by the Engineer to a scope and frequency determined by the Engineer, to measure the Contractor's compliance with all applicable Laws, other enactments, the Contractor's EMS manual and Environment Management Plan.
- 14.10.3 The Contractor shall, as part one of each monthly progress report, submit a Site environmental report. Prior to submission, the Contractor's Representative shall endorse the Site environmental report.

- 14.10.4 The environmental report shall comprehensively address all relevant aspects of environmental management.
- 14.10.5 The Contractor shall submit reports or incident analysis, in an agreed format, as and when required by the Engineer.
- 14.10.6 Monthly Report content shall include monitoring of;
- a. Batching and Crushing Contractor's Equipment
 - b. Air Quality Management
 - c. Site Water Quality Management
 - d. Site Noise Management
 - e. Waste Management
 - f. Socio-economic Management
 - g. Ecology Impact Management
 - h. Housekeeping Management
- 14.11 Sustainability**
- 14.11.1 The work under the Contract shall be constructed to achieve a minimum of IGBC Certification as per prevailing IGBC Green Factory Building Rating.
- 14.11.2 All temporary traffic management shall be in accordance with the logistics concepts detailed in the Logistics and Supply section of the Employer's Requirements.
- 14.11.3 The Contractor shall investigate ways to mitigate potential negative impacts by understanding the additional burdens the project will place on existing infrastructure and using appropriate design strategies to reduce it. The Contractor shall work with the appropriate municipal agencies to explore potential new transportation infrastructure.
- 14.11.4 The Contractor shall identify the basic amenities and their proximity to BSRP depots and address how the Depot layout and Site design can be done to ease accessibility. This shall include consideration of the position of entrances, walkways and roads etc., and the location of existing amenities and services. A field survey shall determine the range of amenities, services and facilities accessible from the proposed Site.
- 14.11.5 The Contractor shall control the amount of exterior lighting features than can create light pollution. The Contractor shall review and consider lighting ordinances and bylaws relevant to the Site. The approach taken shall address how to minimise exterior lighting, avoid upward lighting, and use efficient and shielded fixtures.
- 14.11.6 The Contractor shall work with other Stakeholders and other municipal agencies to provide bus/taxi stations at the BSRP Depot to have a complete network of mass transit systems.
The Contractor shall collect store and remove solid and harmful waste in accordance with Legal requirements. Furthermore, the Contractor shall identify potentially harmful materials that may be present in the project and have in place appropriate management practices. Additionally, the Contractor shall develop drainage and run-off strategies to minimise potential sewer and waterway contamination by treating or separating harmful materials. Strategies and approaches may include point-source control at drain locations as well as filtration and treatment systems on a building or cluster level.
- 14.11.7 The Contractor shall mitigate the project's impact on existing or future adjacent buildings with respect to shading and daylight access. The Contractor shall conduct simulations to determine the potential amount of shade and shadows that will fall on adjacent Sites. The design shall address how the proposed building's location, orientation and height can minimise the obstruction of daylight.
- 14.11.8 The Contractor shall minimise rainwater runoff, by providing proper rainwater harvesting system as described below. Specifically, the Contractor shall address how the project can collect, store, and treat all water that falls on the building and pavement. Plants and trees shall be allowed to absorb rain that falls directly onto landscaped areas. Handling the rainwater may require several types of systems and

- the approach taken shall address how to create a comprehensive, integrated water management system.
- 14.11.9 Rain Water Harvesting (RWH)
Rain Water Harvesting shall be provided for the catchment area of the Depots. A minimum of Eight RWH pits shall be provided at each Depot and one at every span. The Contractor shall design the RWH catchment system to be of sufficient capacity to ensure there is no overflow from the pit. The Contractor shall submit the RWH system design for the Engineer's review.
- a. The system shall be designed to perform effective ground water recharge and it shall require minimum maintenance.
 - b. The following IS codes (latest version) shall be complied with;
 - i. IS 2800 – Code of practice for construction and testing of tube wells
 - ii. IS 11189 – Methods for tube-well development
 - iii. IS 12818- (PVC-U) screen and casing pipes for bore/tube-wells
 - iv. IS 4097 – Gravel for use as pack in tube-wells
 - c. All connections made for rain water harvesting system shall be leak-proof and watertight.
 - d. The testing of the ground water recharging system, including the monsoon period, shall be carried out to the satisfaction of Engineer.
- 14.11.10 The Contractor shall establish adequate energy demand performance levels for the proposed Depot or depot building design. This shall reduce the energy needs for the building to maintain adequate thermal comfort conditions. The approach taken shall address all building design features that have a major impact on the energy demand.
- 14.11.11 The Contractor shall develop a strategy for establishing adequate energy delivery performance levels for the systems that serve the building. The approach taken shall address all the features of building systems that have a major impact on energy delivery and consumption.
- 14.11.12 The Contractor shall design buildings and their supply systems which will minimise the use of fossil fuels. The designs shall address all building and system features as well as their connections to the delivery networks that consume primary energy sources.
- 14.11.13 The Contractor shall develop and implement a strategy for encouraging the design of buildings and their supply systems and networks that minimise CO2 emissions. The strategy shall outline how to achieve those standards by addressing system features at all supply network scales that impact the generation of CO2.
- 14.11.14 The Contractor shall develop a strategy for encouraging the design of buildings and their supply systems and networks that minimise oxides of Nitrogen, Sulphur di-oxide and dust emissions. The design shall outline how to achieve those standards by addressing system features at all supply network scales that impact the generation of Mono-nitrogen oxides, sulphur oxide and dust. Consideration shall be given for specifying efficient equipment and fixtures, reusing rainwater and grey water for non-potable applications, installing and using water sub-metering facilities, and using efficient landscape irrigation techniques. Reducing water consumption may require several types of these systems and the design approach shall address how to integrate those systems into a comprehensive solution. The solution shall address using water efficiently and recycling water where possible.
- 14.11.15 The Contractor shall identify products and materials available from within the region and determine which of these products and materials can be used during the project development. The Contractor shall also consider and document the weight and the source of the building materials.
- 14.11.16 The Contractor shall where required provide a comfortable environment with negligible fluctuations in temperature and humidity to ensure the health and comfort of the users of BSRP depots. The Contractor shall determine the environmental conditions required for users, programmes, and spaces in the project. Furthermore, he shall address how active conditioning, passive conditioning, or a combination of both can work with the building design and building envelope.

- 14.11.17 The Contractor shall use indoor materials with low VOC emissions and avoid materials and mechanical systems that can emit harmful contaminants. The Contractor shall identify the emission rates of specified materials and how to effectively mitigate any harmful emissions.
- 14.11.18 The Contractor shall develop and implement a strategy for encouraging effective natural ventilation in conjunction with mechanical systems. The Contractor shall address how to create cross ventilation, the number, location and type of windows, and the type and degree of user-control. The strategy shall also determine the ways in which natural ventilation and mechanical ventilation systems will work together to meet heating and cooling demands while reducing energy consumption.
- 14.11.19 The Contractor shall develop a design approach for ensuring occupant well-being and comfort through the use of mechanical ventilation systems. Ventilation rates and air quality levels shall meet the minimum compliance requirements of accepted standards. The Contractor shall address the location and protection of fresh air intake vents, the type and degree of user-control, and the ease of maintenance and service. The design approach shall also include how to integrate natural ventilation strategies with the mechanical ventilation system.
- 14.11.20 The Contractor shall develop and implement a strategy for reducing hazardous particulates and chemical or biological contaminants in the indoor air. This may include physically isolating areas that may generate harmful contaminants, providing adequate barriers between isolated areas and adjacent spaces, and using dedicated exhaust systems to mitigate the potential hazards of airborne contaminants. The Contractor shall identify potential sources of hazardous contaminants and determine what containment and control measure will be required.
- 14.11.21 The Contractor shall develop a design approach for preventing and controlling glare within buildings. The design may include physical measures such as light shelves, blinds, louvers, fins, shades or tinted glazing to control glare. Consideration shall be given to the special arrangement of the building interiors to minimise discomfort from excessive glare and contrast.
- 14.11.22 The Contractor shall ensure there are adequate illumination levels for the visual comfort and well-being of building users. He shall address how to use daylight to reduce the energy needed for electrical lighting, and include the potential use of automatic lighting control systems to further reduce energy consumption.
- 14.11.23 The Contractor shall include a strategy for developing designs that reflect the cultural identity and traditions of India and Karnataka. The design approach shall address how Site design, building form, material palette, and overall aesthetic quality can reference the culture and heritage of India. Furthermore, the proposed building design must not degrade the cultural character of any existing buildings on adjacent properties. When designing the features and components of the new building, consideration shall be given to existing building fabrics.
- 14.11.24 The Contractor shall maximise the procurement of construction-related products and services from within the region in order to support Indian national economy. The Contractor shall investigate the regional availability of products and services and develop a plan to use and employ local companies and firms where possible.
- 14.11.25 The Contractor shall develop and implement a strategy for installing energy sub-metering facilities to monitor and evaluate energy system performance and consumption during building operations. This shall include metering and monitoring of major energy systems in conjunction with data logging to provide for continued accountability of energy consumption over the building's lifespan. The strategy shall include the types of building systems to be monitored, the best method for installing, using, and servicing the monitors, and ways in which the data will be interpreted and used.
- 14.11.26 The Contractor shall be required to install an effective leak detection system for all water and wet areas, including the buildings.
- 14.11.27 The Contractor shall be required to develop and implement a strategy for the collection, storage, and removal of recyclable materials. He shall design sufficient sorting and storage spaces for the anticipated recycling materials produced by the project. These spaces shall be properly isolated and

ventilated. Consideration shall be given to the location of these services so as to be proximal to other waste handling services.

- 14.11.28 The Contractor shall install a Building Automation System (BAS) that controls and monitors major building systems including cooling, ventilation, and lighting. The Contractor must also develop a preventive maintenance plan. The plan shall ensure that components are tested and calibrated at intervals recommended by the BAS manufacturer.

15 SCOPE OF WORK

15.1 Brief Scope of work

The work content against the items (as per BOQ) of the work involves **Construction of Depot at Soladevanahalli** including Architectural, MEP for Stabling Yard, Stabling Yard office, Workshop Bay, Workshop office, Inspection Bay, Administration Building, Depot Stores, AWP, AWP control room, WTP control Room, ETU and PWL building, Access control building , Design of Temporary Works (Scaffolding, Staging etc.), Traffic Management, Utility Shifting, boundary wall, external utilities and All Associated Works.

- a) This contract is for BSRP depot comprising mainly construction of Repair bay, inspection Bay, stabling bay, pit wheel lathe, deck entry structure, Auto coach wash plant, RSS / TSS / ASS area, Entry / Exit & Time office, vehicle parking area, rain water harvesting system, STP, ETP, Overhead & under Ground water Tank, PHE works, architectural finishing work of buildings, E&M works, retaining wall, boundary wall works.
- b) Works to be performed shall also include all general works preparatory to the construction of depot and works of any kind necessary for the due and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and technical specifications, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all as per Contract document.
- c) Supply of all materials, apparatus, plant, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment, accommodation and sanitation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, provident fund, fees, royalties, duties or the other charges arising out of the works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.
- d) The work content in this contract consists of, but not limited to, furnishing all labors, materials, equipment, tools, plants and necessary machinery as required to completely execute all the works relating to Construction of Depot.
- e) The work is to be constructed and maintained as per BOQ, Technical Specification, relevant Codes, and specifications of MORTH, CPWD, KPWD, drawings, best engineering practices and/or as directed by the Engineer.
- f) The works for all buildings/facility in line with accessibility/Inclusion codes and or have considered gender-related aspects shall be constructed as designed by DDC appointed by the Employer.
- f) **"Standards guaranteeing a level of quality or performance equivalent or superior to those indicated in the Tender Documents, will also be accepted".**

15.2 The Scope of Civil, Structural & PEB Works:

The scope of works shall, inter-alia, include the following but not be limited to:

- a. The bidder must visit site and acquaint himself with the local conditions before quoting. Site clearance which includes removal of debris, unserviceable soil, marshy soil, dismantling of any temporary structure, small shed etc. All the trees and hoarding/buildings coming in the way of construction of depot shall be cleared by contractor. Cutting of trees & branches and transplantation of trees shall have to be done by the contractor for which payment will be made under relevant schedule of payment in pricing schedule. Permission from local government authorities concerned for cutting/transplantation will be arranged by the Employer.
- b. True and proper setting out and layout of the works, bench marks and provision of all necessary labour, instruments and appliances in connection therewith.
- c. Geotechnical investigation bores as required by Engineer / Employer;
- d. Trenching for identification of utilities for re-location & diversion of utilities if encountered;
- e. Conducting plate load test.
- f. Any leftover works for demolition are to be undertaken by the Contractor the payment for the work will be made out of Schedule of BOQ.
- g. Provision of foundation works for different structures of depot including pile foundation/open foundations & rafts for columns/piers/walls (wherever required) up to the minimum founding depths in accordance with the actual soil parameters as obtained from detailed sub-surface exploration as specified or directed. The Construction methodology is required to be approved by Engineer / Employer before carrying out the works.
- h. Providing and constructing size stone masonry in foundation.
- i. Earthwork excavation, Construction of embankment, backfilling earth in layers and compacting/consolidating each layer as per the specifications.
- j. Provision of Cast-in-situ vertical bored piles including provision of M.S liner if necessary as directed by the engineer.
- k. Conducting load test on piles like initial vertical and lateral load test, static routine vertical and lateral load test, dynamic load test, Non-destructive tests for Integrity testing etc.
- l. Provision of cast-in-situ RCC piers, columns, beams, slabs, staircases, lift wall, parapets, water tanks, retaining wall etc with allied works.
- m. RCC Precast boundary wall panels, drain, cable duct, platforms etc.
- n. RCC flooring using fixed form paver and allied works like vacuum dewatering.
- o. Mild Steel works such as Ornamental security Grill Gate, Rectangular poles, Block pipe for chain link fencing, railing, grills works for rolling shutters etc.
- p. Provision of Chain link fencing including vertical steel poles & framed steel structure & RCC pedestals etc.
- q. Casting of RCC precast panel wall and fixing in position by stitching the RCC precast panel with vertical columns for boundary wall works, including provision of punched tape concertina coils over the boundary wall.
- r. Providing and fixing pull and push type rolling shutters.
- s. Providing and fixing stainless steel hand rails.
- t. Structural steel work Such as staircases of Overhead tanks, UG tanks and Pump rooms and Inspection chamber frames, chequered plate covers, edge angles, Cable Trench, gratings, frames, guard bar, ladder, railings, brackets, gates and similar works.

- u. Fabrication, supply and erection of Structural steel work (PEB). Installation of roofing sheet and rain water gutter.
- v. Installing and fixing in position holding down bolts including making necessary templates as per approved drawings/ as per requirement. Grouting of anchor bolts with non-shrink compound. Supplying, pouring and packing non-shrink grout under base plates of columns, trusses etc.
- w. Construction of road, footpath and laying of kerb stones etc., along with allied works such as Road marking, Painting lines, dashes, arrows etc., Road stud, Retro-Reflectorised Traffic Signs, Direction and Place Identification Signs, Overhead Signs, Traffic Blinkers, Rubber Rumble strips, Traffic cones etc.
- x. Providing and laying heavy-duty interlock pavers.
- y. Provision of expansion joint.
- z. Horticulture Works.
- aa. Any other item of work as may be required to be carried out for completing the construction of depot, as specified in drawings including all necessary interface works with infrastructure contractors, track laying contractor, system contractors, etc. in all respects in accordance with the provisions of the Contract and/or to ensure the structural stability and safety during and after construction.
- bb. Contractor shall submit detailed work methodology for every item of works which shall be approved by Engineer before carrying out the works.

15.3 Scope of Architectural Works

The scope of works shall, inter-alia, include the following but not be limited to:

- a. True and proper setting out and layout of the works, bench marks and provision of all necessary labour, instruments and appliances in connection therewith as specified and as directed.
- b. The Construction methodology is required to be approved by Engineer / Employer before carrying out the works in Depot.
- c. Construction of Masonry wall with solid concrete blocks with 400 x 200 x 200mm size and 400 x 200 x 100mm size as specified and directed by Engineer.
- d. Wood works for doors, windows, clerestory windows, ventilators etc.
- e. Provision of GRP Doors, fire doors and GI doors with all the necessary fittings and fixtures.
- f. Aluminum works in doors, windows, ventilators, louvers, partitions, shutters etc.
- g. Structural glazing works.
- h. Flooring, wall cladding, skirting, dadoing, staircase works with cement concrete, granite, Vitrified glazed tiles, vitrified unglazed anti-skid tiles, Ceramic tiles, acid and / or alkali resistant vitrified tiles etc.,
- i. Providing and fixing high cavity Unitile raised access flooring system.
- j. Providing Wall lining butch work with Dhoolpur stone.
- k. Providing and laying cinder concrete on terraced roof or sunken slabs.
- l. Water proofing works for roof slab, Toilets Sunk Portions, UG water tank, sumps etc.
- m. Finishing works such as plastering painting and polishing.
- n. Provision of false ceiling work.

15.4 PHE - Scope of work

The scope of works shall, inter-alia, include the following but not be limited to:

- i. Work under this contract shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the schedule of quantities and/or shown on the plumbing drawings.
- ii. Without restricting to the foregoing, sanitary installations shall include the following:
 - a) Sanitary Fixtures.
 - b) Soil, Waste, Rainwater and vent pipes.
 - c) Water supply (Internal & External)
 - d) External Sewerage system & Rainwater harvesting system.
 - e) Sewage and effluent treatment and disposal
 - f) making connection from existing Municipal water supply network g) making connection of Stormwater Drain/Sewer line with existing municipal network.
 - g) All water supply, sanitary line for the external & internal portion of building/shed to be executed as per the approved drawing.
 - h) Laying of pipes in the depot area for sewer line and effluent line, including constructing inspection chambers as per approved drawing.
 - i) All types of fixtures/fittings of water supply & sanitary, shall be executed with the standard brands approved by Employer.
 - j) Internal and external drainage system including rain/storm water disposal system.

15.5 ETP & STP Scope of work

The scope of works shall, inter-alia, include the following but not be limited to:

- a. Scope of work includes planning, designing and execution and commissioning of Effluent Treatment Plant and Sewer Treatment Plant for the depot buildings/sheds.
- b. Contractor shall plan and design the ETP & STP in accordance with the relevant IS codes, NBC and complying the norms of Pollution control board (PCB) and other codes and get the requisite approvals from PCB and other statutory bodies.
- c. Contractor shall design the ETP/STP as per the capacity mentioned in the BOQ and submit the design & drawing after peer review/ vetted from the expert agency/ institution approved by the Engineer / Employer.
- d. Contractor shall prepare and submit the drawing (3 sets) for ETP and STP showing all the details like size, location, gradient, levels, capacity of tanks and pumps along with the electrical cable layout and location of panels etc., for approvals prior to execution of works.
- e. All mechanical/ electrical pumps of various capacities, electrical cables, electrical panels, pipes etc., shall be of standard brands and necessary approval for such brands shall be obtained from Engineer / Employer prior to installation.

15.6 E & M Works: Detailed Scope of work shall be as per Employer Requirements- General Specification E & M

15.7 Structural elements, shape and form

The bidder to note the different structural elements in shape and form, and structural configuration in plain. The structural elements may be skew, tapered, curved etc. The bidder shall include these factors while quoting his rates. All the above are to be covered in the quoted rates and nothing extra shall be payable towards this. The GFC drawings shall be final for this.

15.8 Stability of the elements

During construction, the stability of each element must be ensured until the connections through which the stability is achieved, are fully operative. This might require temporary supporting, bracing etc. This is contractor's responsibility and no extra payment is to be made.

15.9 Stability of the Structure

The overall stability of the structure must be ensured during each phase of construction. This might require special provisions. This is contractor's responsibility and no extra payment will be made.

15.10 Scope of Design work (Permanent work)

Design for the permanent work is not under scope of this work, which is "construct only". The necessary details of the same as required by DDC or other designated contractors of system-wide contracts will have to be furnished by the contractor well in time for the subject bid and necessary interfacing and coordination to be done with them as outlined in the Interfacing Work of Scope of Work.

16 TEMPORARY WORKS

Traffic barricade with reflective tapes/lights and other necessary traffic signages should be provided wherever required so that safety is ensured during day and night continuously. Temporary traffic diversion for smooth flow of traffic during construction including necessary traffic signs boards, repairs to the diverted route/service lanes, if required, restoration of diverted route to original condition etc. shall be done by contractor at his own cost.

Contractor shall also provide any temporary support for the utilities (charted or uncharted), wherever required, at no extra cost to Employer.

The above listed works are only brief but the actual scope of work shall be as specified in the concerned document and/or as specified or directed by the Engineer.

16.1 Design for Temporary Works

The Design should cover all the items pertaining to all temporary works, traffic/road diversion scheme, form work, casting and stacking yard, staging, launching/erection scheme for girders / beams, precast works etc and/or transportation scheme for various structural elements and materials to be transported to and from site during construction period.

The Contractor shall himself formulate a practical and viable scheme for design/ fabrication of shuttering, casting, curing, testing and launching/erection of girders / beams / PEB structure and all other structures. The bidder should, along with the bid, specify the scheme that he proposes to adopt for carrying out all the works including fabrication, transportation, stacking and erection of steel structure/PEB structures and casting, curing, stressing, testing and launching/erection of girders / beams etc.

The contractor shall formulate the erection scheme, design the staging, including all necessary temporary structure, prepare fabrication drawings in accordance with relevant provision of applicable IRC standards and submit the same to the Engineer for approval with third party certificates. These works will be executed only after the approval has been obtained from the Engineer.

16.2 DRAWINGS

1. The Drawings furnished with the bid Documents are tender drawings may require change at the time of actual execution of works based on actual site conditions. Drawings furnished with the Bid Documents show the level of works based on available soil investigation data. These may require change at the time of actual execution of works based on actual site conditions.

2. Tender drawings represent Employer's proposal based on planning & design. Detailed working drawings will be given for construction of work progressively subsequently to the successful bidder.

17 GFC Drawings:

17.1 Requirement.

The GFC drawings requirement shall be informed in advance by the contractor based on his Three month rolling Programme.

17.1.1 Errors, Omissions and Discrepancies in Specifications and Drawings

- a. It shall be the responsibility of the Contractor to promptly bring to the notice of Engineer any error, omission fault, defects or discrepancy in the contract documents, specifications and drawings for the work which are discovered while reviewing the contract documents or in the process of execution of the works and obtain his orders thereon. In case any feature of the work is not fully described and set forth in the drawings and specifications, the Contractor shall forthwith apply to the Engineer for further instructions, drawings or specifications. Responsibility of the Correctness of the details in the Good for Construction drawings issued by Engineer / Employer lies with the contractor. Any omissions, errors, discrepancies in the drawing shall be brought to the notice of the engineer immediately for issue of revised drawings.
- b. Only stated dimensions are to be taken and not those obtained from scaling drawings.
- c. In case of errors, omissions, faults, defects and/or disagreement on the drawings or between the drawings and specifications the following principles shall be followed.
 - i. As between the written description or written dimensions on the drawing and the corresponding one in the specifications, the former shall apply.
 - ii. As between the written description of the item in Bill of Quantities and the detailed description in the specification of the same item, the former shall prevail.
 - iii. The drawings on a large scale shall take precedence over those on a smaller scale; and
 - iv. Drawings approved as construction drawings from time to time shall supersede corresponding drawings previously approved.

The Contractor shall follow the instructions of the Engineer on this matter.

17.2 Meaning and intent of specifications and Drawings:

If any ambiguity arises as to the meaning and intent of any portion of the specifications and drawing or as to execution or quality of any work or material, or as to the measurement of the works, the decision of the Engineer thereon shall be final subject to the appeal (within 7 days of such decision being intimated to the Contractor) to Engineer/Employer who shall have the power to correct any errors, omissions, or discrepancies in the specifications, drawings, classifications of works or materials and whose decision in the matter in dispute or doubt shall be final and conclusive.

17.3 Responsibility for Specifications, Design and Drawings

a) Specifications

MORTH / CPWD / KPWD Specifications / other Specifications / Codes viz. IS, IRS, IRC, DSR etc. shall be maintained by the contractor at site throughout the project period for reference. Standards ensuring guarantee to a level of quality or performance equivalent or superior to those indicated will also be accepted. Reference to trademarks or other specific designations that is necessary to explain the nature of the products required means that any other product of equal or superior quality or performance is also acceptable, subject to prior approval of the Engineer to be obtained in writing for adopting the new standards which are not provided in the contract.

b) Drawings for Permanent Works:

- i. Preliminary Drawings showing general dimensions & details elaborating the scope of work (not based on detailed design) are supplied along with the bid documents. These drawings are broadly indicative of the work to be carried out. These drawings are not "Construction Drawings" and details indicated therein are for general guidance only and shall be modified by the Engineer, to incorporate additional details as per design, and as described in the Specifications and the Bill of Quantities.
- ii. The Permanent Work shall be carried out in accordance with the "Good for Construction" (GFC) drawings as would be issued to the Contractor by the Engineer duly signed and stamped. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing Engineer's signature and stamp. Similarly, the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Engineer/Employer in writing. Construction drawings shall be supplied progressively depending on the progress of work by the contractor during execution of work well in time for each activity.
- iii. The contractor cannot claim as a matter of right that all Good for Construction drawings (GFC drawing) shall be issued soon after award of contract. GFCD/Advance copies required for the next three month's work shall ordinarily be given by the Employer for his planning, procuring etc. The GFCD will be released as and when it is required without any delay to the successful Bidder after the issue of Letter of Acceptance and as specified in other sections of contract document.
- iv. The "Good for Construction" drawings which shall be issued to the Contractor by the Engineer after the award of work shall delineate the extent of work to be done by the Contractor.
- v. No deviation shall be made from these drawings by the contractor without a written authorization of the Engineer.

c) Design, Drawings and Specifications for Temporary/ Ancillary works.

- i. Contractor's proposal for erection of all Ancillary and Temporary works shall be in conformity with the proposals submitted along with the bid and / or as approved by Engineer.
- ii. The contractor would design all the Ancillary and Temporary works including temporary supports, false work, formwork, staging scheme etc. and will submit the same and related working drawings to the Engineer for approval, after getting checked by an independent third- party designer. Bar Cutting and bending schedule for the reinforcement, shop drawings for fabrication work etc. shall also be prepared by the Contractor and submitted for Engineer's approval. Bend correction/Bend deduction shall be effected in bar bending schedule as per standard norms in consultation with the Engineer.
- iii. Shop Drawings
 - (a) Based on "Good for Construction" drawings issued by the Engineer the Contractor shall prepare shop/fabrication drawings to scale as specified, indicating the required details. The shop drawings shall be prepared before execution of work, after taking actual site dimensions and all existing and proposed services/structures etc.
 - (b) Shop/Fabrication drawings submitted by the Contractor shall be in sufficient detail to indicate the type, size, arrangement, breakdown for packing and shipment, the external connections, fixing arrangements required, the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required between various portions and any other information specifically called for.

- (c) All reference points shall be in relation to the levels and locations, given in the Architectural and Services drawings duly cross-checked on site and confirmed. All locations and levels should be indicated with respect to grid and reduced levels with respect to the Bench Mark adopted for the Project and indicated in the drawings issued by the Engineer.
- (d) The Contractor shall verify the dimensions of all the necessary structural, architectural, Mechanical, Electrical & Plumbing (MEP) Services and other elements, relevant to the system being done, before proceeding with the preparation of the shop drawings and proceeding with the physical work at site and make suitable adjustments to accommodate within the spaces available.
- (e) Approval of Engineer of any such proposal I drawings shall not relieve the contractor of his responsibility of sufficiency of completion of the works
- (f) Drawing Management
 - a) The Contractor shall submit all such drawings for Temporary I Ancillary works and shop drawings to the Engineer well in advance before he desires to commence the works and get the same approved from the Engineer. These drawings shall be submitted only after they have been duly detailed, checked and verified within the Contractor's organization ensuring that the details and data shown/furnished on the drawings are correct and that the requirements of other disciplines have been taken care of. The names and complete signatures of the Contractor's personnel responsible for the drawings shall be contained on each drawing. Any drawing which does not contain the above names and signatures shall be summarily returned to the Contractor and treated as not having been submitted.
 - b) The drawings submitted for approval shall be in any one of the standard sizes - AO, A 1, A2, A3 or A4, in accordance with Indian standards.
 - c) All drawings shall show the following particulars in the lower right-hand corner in addition to the Contractor's name:
 - Project Title
 - Name of the Employer
 - Name of Consultant
 - Contract No.
 - Title of Drawing.
 - Scale
 - Date of Drawing.
 - Contractor's Drawing Number.
 - Space for the Engineer's drawing number.
 - Name of the Engineer.
 - Name of Review Consultant.
 - This drawing is based on Drawing No.(s).
 - Further detail is given on Drawing No.(s)
 - d) Each drawing shall carry a revision number, date of revision and brief details of revisions carried out. Whenever any revision is carried out, the revision number must be updated. The revisions carried out on the drawing shall be clearly marked by clouding and each cloud revision numbered by marking the revision number in triangle.
 - e) All dimensions on drawings shall be metric units, unless otherwise specified. However, all levels shall be in meters.
 - f) A template with the above information shall be got approved from Engineer / Employer before start of the work.
 - g) All shop drawings shall be prepared on CAD using AUTO-CAD Version (latest/as directed by Engineer).
Shop drawings shall be prepared for the following works

- Reinforcing bar bending schedules
 - Working drawings for placing of reinforcement
 - All form works, Shuttering and Scaffoldings
 - Shop/Fabrication drawings for structural steel for PEB
 - •Metalwork (ferrous and non-ferrous) for inserts, structural work in built up sections etc.
 - Seismic joints
 - Expansion joints
 - Construction joints
 - Waterproofing.
 - any other works as per directions of engineer
- h) Drawing Management at Site
- i. The Contractor shall ensure that all drawings meant for further engineering, fabrication, erection and field work are issued to his personnel in a controlled manner. A proper record shall be maintained to show to whom the drawing is issued and to ensure that the latest revisions of the drawing is being followed for further work. All superseded drawings shall be promptly withdrawn from the personnel to whom they are issued and stamped "SUPERSEDED" in RED. The Contractor shall maintain a register of drawings, with their revision/issue number, as received from the Engineer and a record of their distribution to the designated personnel within their organization. A certificate to that effect along with list of drawings withdrawn during the month will be incorporated in the monthly progress report.
 - ii. The Contractor shall maintain at Site a set of the drawings issued by the Engineer on which changes shall be progressively marked and initialed by the Engineer so that "As-Built" drawings can be made correctly and expeditiously at the end of their Work at Site.
 - iii. Revision of Approved Drawings for Temporary/ Ancillary and Shop Drawings If, at any time before the completion of the Work, changes are made necessitating revision of approved Shop drawings/ drawings for Temporary/ Ancillary works, the Contractor shall make such revisions and proceed in the same manner and observe procedure for obtaining approval of the Engineer as for the approval of the original drawings.
- i) Documents by Contractor
- The contractor shall submit to the Engineer, for approval, Quality Assurance plans, design calculations, material specifications for each item and system, samples, as may be called for in the Specifications or as the Engineer may reasonably require. Wherever necessary the Contractor shall provide as built dimensions to facilitate proper Good for Construction drawings being prepared for various construction detailing.
- j) Number of Copies of Drawings for Temporary/ Ancillary works/ Shop drawings and Documents.

All Shop drawings I drawings for Temporary and Ancillary works, Documents, Schedules etc. and revisions thereof shall be submitted by the Contractor to the Engineer in AutoCAD version along with 3 hard copies. Copies required in excess of these shall also be borne by the Contractor at his own cost.

d) Completion Drawings:

On completion of the work in all respects the contractor shall submit the following:

- Two sets of "As Built Drawings" in the standard sizes of AO, A1 each containing complete set of drawings for every component of work on approved scale indicating the work "As Built". Each set shall also contain technical literature.
These drawings shall be prepared on CAD using Auto-Cad version (latest/as directed by Engineer) and shall be recorded on writable CDs and one set of these CDs shall also be submitted.
- Four sets of catalogues of all manufactured materials with the name and addresses of the manufacturers for all equipment provided by him.
- The Contractor shall also submit one set of original "As Built" drawings on polyester film or as directed by Engineer of quality as approved by Engineer/ Engineer's Representative.
The Certificate of Completion of Works as per the provisions in the General Conditions of Contract shall not be issued by the Engineer in the event of Contractor's failure to furnish aforesaid "As Built" drawings for the entire works.

e) Plans and Drawings for Layout of Plant and Equipment

The Contractor shall submit the following information, in triplicate, to the Engineer, for approval, within the time stipulated against each item given below:

- (a) A general layout plan for construction plant and equipment required for execution of work, within thirty days from the date of issue of "Letter of Acceptance".
- (b) drawings or prints showing the locations of major facilities which he proposes to put up at site, at least fourteen days prior to the commencement of the respective work; and
- (c) any other details and drawings as required under the contract, within the time as specified in the contract.

Cost of all the above activities shall be deemed to be included in the quoted rates of various items of the Bill of Quantities and nothing extra shall be paid for on this account.

17.4 DELETED

17.5 3D BIM requirements

17.5.1 BIM Employer's Information Requirements (EIRs) is in line with PAS1192-2:2013.

17.5.2 During the design stage the Contractor shall prepare the project BIM Execution Plan (BEP) which will provide a detailed account of how the deliverables stated in the EIR are to be achieved, each team member's responsibility and allocation of said deliverables according to discipline, for the Engineer's review.

17.5.3 The BEP should include the following sections in line with PAS1192-2:2013:

- Response to the EIRs
- Management processes
- Planning & Documentation processes
- Standard Method and Procedure (SMP)

17.5.4 Information Management

17.5.4.1 Level of Definition

Level of Definition (LOD) is used to determine both the level of geometry detail and Level of associated Information (LOI) for any given model element at the project work stage. Defining LOD and LOI informs the Contractor of the degree of information reliability when using the model.

17.5.4.2 Training Requirements

Training for access and operation of the Employer's CDE shall be provided by the Employer to the Contractor as required. Data security or induction requirements will be highlighted to the contractor on a project specific basis.

17.5.4.3 Planning of work and Data Segregation

This section is to set the management and modelling process requirement for the Contractor. Data segregation

planning and information management responsibilities shall be in accordance with the process described inside PS 1192-2:2013. The following are required as a minimum and shall be documented in the project BEP:

- Naming Conventions
- Model Managements
- Volume, zones and areas
- Publishing Process

The Contractors 3D Model shall be the originating source for drawing productions. The Employer expects all Contractors to work in a collaborative manner utilizing intelligent 3D geometry models.

17.5.4.4 Co-ordination and Clash Deduction

Project quality and de-risking through the model and information co-ordination between various interfaces is a key Employer's objective and requirement.

Coordination meeting shall be conducted at least once in a week or 2-3 times in a month with the specialist/ representatives.

The Contractor shall ensure the availability of space and technical equipment for hosting the meetings, but all the contractor's specialists, sub-contractors and engineers shall be able to work during the meeting using their own portable hardware.

The clash detection and avoidance process shall be detailed in the project BEP. BEP shall include but not be limited to software utilization, responsibility assignment, outputs and clash resolution process. Delivery shall be undertaken through regular sharing of model data as outlined in the BEP in the form of native files and other agreed exchange formats. Prior to sharing, all data shall be checked, approved and validated as 'issued for coordination' in CDE in line with the BS 1192:2007 and PAS 1192-2:2013+A1 Status codes.

Model federation, coordination and reporting responsibilities shall align with the information exchange activities and roles outlined in PAS 1192-2:2013, Table 2.

17.5.4.5 Collaboration Process

The CDE for the project will be provided by the Employer. Details of the project collaboration process shall be fully outlined in the project BEP and should be sufficient to demonstrate competence and capability.

All processes must follow BS 1192:2007 & PAS 1192-2:2013, utilizing the described Common Data Environment (CDE) phases such as Work in Progress, Shared, Published and Archive during all project work stages.

The project CDE setup and management shall align with activities and responsibilities as outlined in PAS 1192-2:2013, Table 2

17.5.4.6 Common Data Environment Security

The project BEP shall set out the process for monitoring, managing and complying with the Employers security mandate, including adhering to any standard or process for data sharing.

All project information is to be treated with confidence and all models shall be exchanged in the CDE using agreed metadata tags. The project BEP shall demonstrate compliance processes and the means by which compliance is monitored and managed.

17.5.4.7 System Performance

The following shall be considered when developing the BEP:

- Model size – no size limitation but practically 200Mb max
- Software Uses – It is essential that the native file formats delivered can be openly shared and software platform systems can export to IFC2x3 format for information extraction, verification,

archive and free model viewing purposes. Inherent model data must be extractable in a format exchangeable with Microsoft Excel for information exchange purposes.

17.5.4.8 Compliance Plan

A methodology for model delivery and data compliance procedures including references to standards and compliance software should be outlined in the BEP as a response. As a minimum reference should be made to

- Quality Assurance/ Control procedures
- Associated software
- Security requirement assurances

The Employer/ Engineer's Information Manager shall be granted access to the Contractor's CDE to enable regular compliance monitoring and audits.

17.5.4.9 Geospatial Coordinates

Models of all disciplines shall be in geospatial coordinate system. General considerations that need to be incorporated are as follows:

- All Models (2D/3D) should be created with the geospatial project origin and orientation using a conventional Cartesian axis and common unit of length.
- Model should be created at 1:1
- Units should be SI unit of measure.
- The accuracy achievable using the chosen units and origins shall be checked by the contractor according with the chosen Authoring tool.

17.5.4.10 Software Platforms

The below table shows the Building Information Model as well as other software Platforms to be used:

Software formats	
Method of Data exchange	Employer CDE
Format of 3D Graphical Data Exchange	IFC2x3, native and NWC, any other required format.
Format of 2D Graphical Data Exchange	PDF, Auto Cad and any other
Non-Graphical Data	IFC2x3, XLSX and any other
Documentation	PDF and any other

The ability of the contractor to use these platforms should be identified in the BEP.

17.5.5 Commercial Management

17.5.5.1 Information Exchange

At a project level, the frequency of required information exchanges shall be defined in further detail within the project Master Information Delivery Plan (MIDP). Whilst information can be shared at any time during a stage, formal published information deliverables should be exchanged prior to the end of a stage to advise the decision gateways, as indicated by the project MIDP.

Information deliverables required at each information exchange shall be as defined by the project MIDP. Those information deliverables range from files that may consist of any of the following:

- Native and PDF documents
- 3D Models – in their native discipline (un-federated) and in open standard IFC (International Foundation Clause) format.
- 2D Drawings – cut from the 3D models.
- Other documents in PDF, any other format required.

17.5.5.2 Roles and Responsibilities

The allocation of roles should be noted within the project BEP (Break Even Points) derived from PAS

1192-2:2013. The roles are not new appointments, rather roles that are applied to named individuals working on the project to assign task ownership. These roles may be transferred and migrated to different individuals as the project progresses.

The following roles in connection with BIM will be taken on directly by the Contractor:

- BIM Manager
- BIM Coordinator
- Technical Lead – BIM (one for each discipline)
- BIM Engineer / Specialist (one for each discipline)

17.5.5.3 Standards and Guidance

The core documents and standards that are mandated to be used on the project are:

- PAS 1192-2:2013
- PAS 1192-3:2014
- BS 1192-4:2014
- PAS1192-5: 2015
- Supported by BS 1192:2007

17.6 Interface and Coordination

- 17.6.1 The Contractor shall to the satisfaction of the Engineer, coordinate, interface and cooperate with all Stakeholders and Project Partners including all external Agencies and Authorities.
- 17.6.2 The Contractor shall fully co-ordinate the design and construction of his Works with Project Partners, but not limited to Viaduct, Track, Solar Panel, Stations, Rolling Stock, Signalling and Telecommunication, Automatic Fare Collection (AFC), Passenger Screen Doors (PSD) and Vertical and Horizontal Transportation Systems (VHTS).
- 17.6.3 The Contractor shall include and cooperate and coordinate by provision for the Project Partners equipment movement and installation by providing suitable access routes, staircases, cut/box outs, sumps, service corridors, cable troughs on the Depot area, raceways, conduits, fixtures, inserts, clearances etc.
- 17.6.4 Earthing and lightning protection shall be provided and fully coordinated with Project Partners.
- 17.6.5 The track supporting structure will support ballast less track (long welded rail) which will be laid later by a separate contractor. Arrangements of inserts/ dowels required for provision of such ballast less track will have to be incorporated in the deck in consultation with the Engineer where the ballast less track concrete is to be laid at the top of the deck slab by Track Contractor.
- 17.6.6 Prior to the Taking-Over Dates, early agreed access shall be provided to other Project Partners appointed by the Employer, to carry out their works. Material and equipment supply delivery routes shall be coordinated and provided to the Project Partners. The security of materials and equipment brought to the site by other Project Partners shall be their responsibility.
- 17.6.7 The Contractor shall conduct and coordinate interface meetings intimated to the Engineer, and adhere to the decisions taken at the meeting approved by the Engineer.
- 17.6.8 Any coordination or interface disagreements with other Project Partners shall be informed to the Engineer. If the Contractor despite having taken all reasonable efforts cannot resolve such disagreements, then the decision of the Engineer shall be final and binding on the Contractor.
- 17.6.9 Access shall be provided to the staff and labour of the other Contractor appointed by the Employer for carrying out their works and bringing materials and equipment at the site. However, the security of materials and Equipment brought at the site will be the responsibility of the respective Contractors.

17.7 Utility Diversions

- 17.7.1 Utility identification at foundation locations shall be carried out by the Contractor in advance. The Contractor shall modify the reference structural design confirmed in the Tender Drawings to save the utilities as directed by the Statutory Authority within the accepted Lump Sum price. The

- relocation/diversion of the utility shall be undertaken by the contractor. The removal/diversion plan shall be approved by the Utility owning agency.
- 17.7.2 The Contractor shall be responsible for design, diversion plan, getting approval, co-ordination and supervision of execution of works pertaining to relocation/shifting/removal of above and below ground utilities, through respective Utility agencies. The payment for these Items will be made under **Schedule 'V'**. The Contractor will be entitled for payment for co-ordination and supervision charges for the executed works as defined in the **Pricing Document (Section-XII of Part-1)**. Any delay in completion of these works shall not relieve the Contractor's obligation and it shall be at Contractor's own risk and cost.
- 17.7.3 Utility services that may require removal/diversion or protection while carrying out the scope of work under this Contract may include, but are not be limited to gas, electricity, telecommunication cables (including fibre optic), military and security, police utilities, medical utilities, sewage and storm water etc.,.
- 17.7.4 The diversion of overhead and underground electric transmission lines above 33kv shall be arranged by the Employer directly through the utility owning Agencies/ statutory authorities and shall be paid directly by the Employer.
- 17.7.5 Tree cutting, relocation, Afforestation and plantation shall be carried out as per **Annexure -3** of Employer's Requirements. However, grass, lawn, herbs, shrubs, plants, and others which are not to be transplanted/removed by the owning agencies shall be removed by Contractor.
- 17.7.6 The Contractor shall ensure that any salvage materials are returned to the utility owning agencies.
- 17.7.7 The demolition, dismantling and disposal of building structures such details will be advised progressively during the progress of the Contract work and the cost towards the same is deemed to be included in the BOQ.
- 17.7.8 Any incidental and unforeseen works under this Contract shall also be deemed to be included in the BOQ.
- 17.7.9 The Contractor shall remain responsible for any works carried out by his Subcontractor, Vendors, Utility owning agencies within the right-of-way and/or the construction site boundaries.
- 17.7.10 Utility Diversions include but are not limited to the following scope of work:
- Verify the correctness of all drawings showing utilities provided by the Employer, Engineer and Statutory Authorities;
 - Relocation/diversion of utilities as deemed necessary, and agreed by the Engineer, to enable the execution of the Works;
 - Construction of temporary traffic diversions where the construction of the works for the utility diversion interrupts existing public or private roads or right of way;
 - Provision and submission to the Engineer and Statutory Authorities of AutoCAD drawings and diversion construction methodology showing details of the utility locations and depth before and after relocation, supported by photographs; and
 - Protection of utilities that are not to be diverted during the execution of the Works as per the Employer's Requirements.
- 17.7.11 In the process of either identifying, relocating or protecting the public utility services located within the right-of-way and/or the construction site the Contractor shall:
- Obtain all necessary approvals (NOC) from the relevant authorities to carry out the investigations to identify the location of all existing public utilities within the right-of-way and/or the construction site boundaries;
 - Provide accurate records of existing public utilities identified to the Engineer, prior to commencement of the Works;
 - Provide accurate records of any additional public utilities encountered and take all necessary steps to prevent damage to and to safeguard such services;
 - Draft any utility diversion design plan in accordance with the applicable standards as approved

- by the relevant Statutory Authorities;
 - e. Cooperate with any other Stakeholders involved so as to avoid interference with other Project Partner Contractor operations e.g. an independently appointed Enabling Works Contractor;
 - f. Cooperate with the public utility authorities to safeguard and minimise the disruption of service;
 - g. Erect suitable barricades around all trenches dug during utility identification or diversion (this is deemed to be part of the Lump Sum Schedule A cost);
 - h. Construct temporary traffic diversions where the construction of the works interrupts existing public or private roads or right of way but only after first obtaining approval from the relevant authorities;
 - i. Prepare shop drawings, approved by the relevant authorities and the Engineer, before commencing any diversion of utilities;
 - j. Construct support and/or protection, as approved by the Utility Authority and Engineer, for those utilities that do not require diversion during construction;
 - k. In the event of a service being interrupted as a result of damage caused by the Contractor or Subcontractor, promptly notify the authority concerned and inform the Engineer of the incident. The Contractor shall be responsible for all costs for damage repairs that are required to restore the services and any consequential damages;
 - l. Ensure that adequate insurance cover is in place at all times, as approved by the Engineer, to cover all liabilities that may result as a consequence of accidental disruption of any utility service;
 - m. Make substitute arrangements, as directed by the concerned Utility Authority, until such time that any damage caused to utility services by the Contractor or Subcontractor has been repaired at the Contractors own expense; and
 - n. Submit a copy of all 'As-Built Drawings' to the relevant authorities and Engineer and obtain a completion certificate from the relevant service authority once of the awarded works related to removal, utility diversion, relocation and protection have been completed.
- 17.7.12 The Employer retains the right to select and appoint the party responsible for carrying out the Utility Diversions scope of work, either in its entirety or to allocate certain parts of the scope of work.
- 17.8 Project Time Requirements**
- 17.8.1 Please refer to **Contract Data of Section-IX for Key Dates** with reference to the Commencement Date (CD).

Annexure – I : Right of Access to the Site**Time for access to, and possession of the Site**

The Right of access shall be handed over progressively, generally taking into account the approved program of works.

The schedule Right of Access of Depot will be given progressively and in line with the requirement of the approved Programme. If any delay in access to, and procession of the site, the extension of time as per relevant clause of contract shall be given for the delay of effected portion of the works.

The Contractor shall bear all costs and charges for special and/or temporary rights-of-way which he may require, including those for access to the Site. The Contractor shall also indicate the, extra railway land or Govt land or private land beyond what is shown in the tentative tender drawing with the view to achieve best fit alignment for improved operational efficiency. On review by Engineer and Employer, the Contractor will be advised with the approved Horizontal/Vertical alignment for permanent works. For additional land if needed by the Contractor beyond the right of way the same shall be arranged by the contractor at his own cost.

In case any operation connected with traffic necessitates diversion, obstruction or closure of any road, railway or any other right of way, the proposal is to be developed by the contractor for review for the approval of the Engineer/Employer and the consents and approval of the concerned authorities shall be obtained well in advance by the Contractor.

Provided that if it is found necessary for the Contractor to move one or more loads of heavy constructional plants and equipment, materials or Pre-constructed units or parts of units of work over roads, highways, bridges on which such oversized and overweight items that are not normally to be moved, the contractor shall obtain prior permission from the concerned authorities.

Payments for complying with the requirements, if any, for protection or strengthening of the roads, highways or bridges shall be made by the contractor and such expenses shall be deemed to be included in his quoted contract price.

Annexure – II : Alignment Plans (GAD)

The proposed tentative alignment plan of the BSRP line is attached, for reference and guidance. This is based on survey conducted by the Authority. The Contractor is required to validate and modify the plan and profile of the alignment so as to get the best fit designed alignment to achieve improved operational efficiency as per SOD within the Right of Access boundaries, with the approval of Engineer/Employer.

In addition, the possibility of reducing BSRP corridors to the extent SOD permits also shall be explored to optimize the land requirement.

Annexure – III : Tree Cutting and Forest Clearances-in Process

The permission for obtaining tree cutting / translocation is in progress with BBMP and Forest Department. The tree numeration list and joint inspection with Forest officers / BBMP / TEC is in progress.

Tree cutting, preservation and disposal (or) Translocation along the alignment for cutting / disposal / translocation / afforestation (as per the norms of Forest Department) in lieu of cutting / translocation to be arranged by Contractor at her / his own cost. The applicable permits / permissions for felling of trees / Translocation shall be arranged by Employer. The tree cutting and disposal is included in the scope of work. The cut trees will be the property of the contractor. However, the contractor shall deposit an amount not less than Reserve Price of the trees (as fixed by Forest Department / BBMP) plus FDT (Forest Development Tax) to KRIDE for onward transmission to Railways / BBMP / Forest Department, as the case may be.

Annexure – V : Applicable Permits**i. Applicable Permits**

- 1.0 The Contractor shall obtain, as required under Applicable Laws, the following Applicable Permits:
- (a) Permission of the State Government for extraction of boulders from quarry;
 - (b) Permission of Village Panchayats and Pollution Control Board for installation of crushers;
 - (c) Licence for use of explosives;
 - (d) Permission of the State Government for drawing water from river/reservoir;
 - (e) Licence from inspector of factories or other competent Authority for setting up batching plant;
 - (f) Clearance of Pollution Control Board for setting up batching plant;
 - (g) Clearance of Village Panchayats and Pollution Control Board for setting up asphalt plant;
 - (h) Permission of Village Panchayats and State Government for borrow earth; and
 - (i) Any other permits or clearances required under Applicable Laws.

Annexure – VI : Provisional Certificate

- 1 I/We, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for construction of the section (km to km) in the State of in- BSRP (the "**BSRP Project**") on Engineering, Procurement and Construction (EPC) basis through (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been undertaken to determine compliance of the BSRP Project with the provisions of the Agreement.
- 2 Certain minor works are incomplete and these are not likely to cause material inconvenience to the Users of the BSRP Project or affect their safety or the movement of rail traffic in any manner. These works have been specified in the Punch List appended hereto, and the Contractor has agreed and accepted that it shall complete all such works in the time and manner set forth in the Agreement.
- 3 In view of the foregoing, I/We am/are satisfied that the BSRP Project from km to km can be safely and reliably placed in service of the Authority for railway freight and passenger traffic, subject to authorisation by the Commissioner of Railway Safety in accordance with Applicable Laws. In terms of the Agreement, the BSRP Project is hereby provisionally declared fit for entry into operation on this the day of 20.....

ACCEPTED, SIGNED, SEALED
AND DELIVERED
For and on behalf of
CONTRACTOR by:
(Signature)

SIGNED, SEALED AND
DELIVERED
For and on behalf of
AUTHORITY's ENGINEER by:
(Signature)

Annexure – VII : Completion Certificate

- ii. I/We, (Name of the Authority's Engineer), acting as the Authority's Engineer, under and in accordance with the Agreement dated (the "**Agreement**"), for construction of thesection (km to km) of in the State of in- BSRP (the "**BSRP Project**") on Engineering, Procurement and Construction (EPC) basis through (Name of Contractor), hereby certify that the Tests in accordance with the Agreement have been successfully undertaken to determine compliance of the BSRP Project with the provisions of the Agreement, and the authorisation by the Commissioner for Railway Safety under Applicable Laws has been obtained.
- iii. It is certified that, in terms of the aforesaid Agreement, all works forming part of Railway Project have been completed, and the BSRP Project is hereby declared fit for entry into operation on this the day of 20.....
- i. The test on completion of civil works shall also include the integrated testing. The objective of the contract is the Design and construction, testing and commissioning of the permanent works, construction and removal of the Temporary Works and the rectification of defects appearing in Permanent Works by the contractor in the manner stipulated by the Contract..
- ii. The completion certificate is as per railway standard format. Please refer CI.30.6 at page 161, para 12 and para 2 . The format can be altered as per the contract conditions. The tender conditions prevails.

SIGNED, SEALED AND DELIVERED
For and on behalf of the Authority's Engineer by:
(Signature)
(Name)
(Designation)
(Address)