



## **Brihanmumbai Municipal Corporation**

### **Design and Build Contract**

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

### **Volume 3**

### **Employer's Requirements**

**Brihanmumbai Municipal Corporation**

**Mumbai, Maharashtra, India**

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**VOLUME 3**  
**APPENDIX-1**  
**DRAWING LIST**

**APPENDIX – 1: DRAWING LIST**

SR.NO.	DRAWING TITLE	DRAWING NO
<b>DP DEMARCATION</b>		
1	DP DEMACATION OF PROJECT ROAD	TUSPL/BMC/DB/DPD/001
2	PROPOSED EXTENSION OF PROJECT ROAD WITH IN BMC (AS PER TP OF GR. MUMBAI) TO MBMC JURISDICTION	TUSPL/BMC/DB/DPD/002
<b>LAYOUT PLAN</b>		
3	LAYOUT PLAN	TUSPL/BMC/DB/SI/101
<b>TOPOGRAPHICAL AND BATHYMETRY SURVEY PLAN</b>		
4	LEGEND	TUSPL/BMC/DB/TS/201
5	TOPOGRAPHICAL SURVEY FROM CH. 0+00 TO CH. 1+350	TUSPL/BMC/DB/TS/202
6	TOPOGRAPHICAL SURVEY FROM CH. 1+350 TO CH. 2+700	TUSPL/BMC/DB/TS/203
7	TOPOGRAPHICAL SURVEY FROM CH. 2+700 TO CH. 4+000	TUSPL/BMC/DB/TS/204
8	TOPOGRAPHICAL SURVEY FROM CH. 4+000 TO CH. 4+580	TUSPL/BMC/DB/TS/205
9	LEGEND	TUSPL/BMC/DB/BS/206
10	BATHYMETRY SURVEY PLAN	TUSPL/BMC/DB/BS/207
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12	TYPICAL CROSS SECTION OF REINFORCED SOIL RAMP WALL	TUSPL/BMC/DB/TCS/302
13	TYPICAL CROSS SECTION OF ROAD ON STILT OVER MANGROVES AND SALT PAN AREAS	TUSPL/BMC/DB/TCS/303
14	TYPICAL CROSS SECTION OF ELEVATED ROAD ACROSS CREEK WITH STEEL ARCH GIRDER	TUSPL/BMC/DB/TCS/304
15	TYPICAL LAND FILLED ROAD - 36M REALIGNMENT OF DAHISAR LINK ROAD	TUSPL/BMC/DB/TCS/305
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<b>PLAN AND PROFILE</b>		
18	PLAN & PROFILE FROM CH. 0+00 TO CH. 0+650	TUSPL/BMC/DB/P&P/401
19	PLAN & PROFILE FROM CH. 0+650 TO CH. 1+350	TUSPL/BMC/DB/P&P/402
20	PLAN & PROFILE FROM CH. 1+350 TO CH. 2+050	TUSPL/BMC/DB/P&P/403
21	PLAN & PROFILE FROM CH. 2+050 TO CH. 2+700	TUSPL/BMC/DB/P&P/404
22	PLAN & PROFILE FROM CH. 2+700 TO CH. 3+330	TUSPL/BMC/DB/P&P/405
23	PLAN & PROFILE FROM CH. 3+330 TO CH. 4+000	TUSPL/BMC/DB/P&P/406
24	PLAN & PROFILE FROM CH. 4+000 TO CH. 4+580	TUSPL/BMC/DB/P&P/407
<b>STRUCTURES GAD DRAWINGS</b>		
25	PIER LOCATIONS FROM CH. 0+00 TO CH. 1+350	TUSPL/BMC/DB/STR/501
26	STRUCTURE PLAN FROM CH. 1+350 TO CH. 2+700	TUSPL/BMC/DB/STR/502
27	STRUCTURE PLAN FROM CH. 2+700 TO CH. 4+000	TUSPL/BMC/DB/STR/503
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42	ROAD MARKING & SIGNAGES PLAN FROM CH. 2+650 TO CH. 3+400	TUSPL/BMC/DB/RM/605
43	ROAD MARKING & SIGNAGES PLAN FROM CH. 3+400 TO CH. 4+050	TUSPL/BMC/DB/RM/606
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59	ELECTRICAL LAYOUT PLAN FROM CH. 2+050 TO CH. 2+700	TUSPL/BMC/DB/EL/1004
60	ELECTRICAL LAYOUT PLAN FROM CH. 2+700 TO CH. 3+400	TUSPL/BMC/DB/EL/1005
61	ELECTRICAL LAYOUT PLAN FROM CH. 3+400 TO CH. 4+000	TUSPL/BMC/DB/EL/1006
62	ELECTRICAL LAYOUT PLAN FROM CH. 4+000 TO CH. 4+580	TUSPL/BMC/DB/EL/1007
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**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 2A WORK AREA**

Refer to Section D3, Volume 03

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 2B**

**CONTRACT KEY DATES AND COMPLETION DATE**



**CONTRACT No. ....****APPENDIX – 2B CONTRACT KEY DATES FOR ROAD, BRIDGES  
INCLUDING ASSOCIATED WORKS**

Key Dates	Description	Number of Days from Commencement
KD-01	Construction Programme, completion of Soil Investigation, Submit Final plans (As required in Appendix 10, Volume 3 Employer's Requirements), Design Basis Report, Alignments, and Preliminary Design Submission and Updated the No objection clearance	90
KD-02	Definitive Design of Land Filled Section Submission and Updated the No objection clearance	110
KD-03	Definitive Design for Bridge Submission and Updated the No objection clearance	120
KD-04	Construction Reference Drawings Submission	150
KD-05	Achieving Substantial completion of Land Filled Work	820
KD-06	Achieving Substantial completion of Bridge Work	900
KD-07	Achieve issuance of Performance and Safety Certificate	950
KD-08	Achieve issuance of Taking Over Certificate	1095

**Notes to Key Dates:**

- The achievement of Key Date shall be subject to the issuing of a Notice of No Objection from the Engineer.

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX - 3**

**PROJECT CALENDAR**

## **APPENDIX – 3 PROJECT CALENDAR**

- 1) The Project Week shall commence on a Monday. A day shall be deemed to commence at 0001 hour on the morning of the day in question. Where reference is made to the completion of an activity or Milestone by a particular week, this shall mean by midnight on the Sunday of that week.
- 2) Requirements for the computation of Key Dates are given in Appendix 2B to the Employer's Requirements, Volume 3.
- 3) A 7 day week calendar shall be adopted for various (Work) programme schedules for scheduling purposes. Any non-work restriction shall be deemed to have been taken into account in the calendar to plan and programme the Works.
- 4) For Project purposes, the presentation shall be in 'Week' units.

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 4**

**PROGRAMME REQUIREMENTS**

## APPENDIX – 4PROGRAMME REQUIREMENTS

### 1. GENERAL

#### i. Purpose of Programme

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

1. Evaluation of Tender (Tender Programme)
2. Progress Status Reports during Construction (Construction Work Programme)

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

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

- ii. The Tenderer/ Contractor shall programme his work at all times to meet the Key Dates and the Works Areas Access Dates stated in Appendices 2A and 2B respectively to the Employer's Requirements, and the specified interface periods for the design and installation of the Works with those of the Interfacing Contractors. The Tenderer/ Contractor shall during the progress of the Works constantly monitor his progress against the programmes described below.
- iii. The Tenderer/ Contractor shall include in all programmes his work obligations towards shared access, shared Site areas and other coincident or adjacent work areas with regard to all interfacing parties.
- iv. The Works Programme, and all more detailed or revised versions, shall be submitted to the Engineer for his Notice in accordance with the provisions of the Conditions of Contract.

### 2. METHODOLOGY

- a. The computerized Critical Path Method (CPM) network using the Precedence Diagramming Method (PDM), has been selected by the Employer as the technique for contract management system and in co-ordinating the multi-contract project. This technique shall also be employed by the Tenderer in preparing their Tender submissions and by the Contractor in their Construction Stage submissions.
- b. Unless otherwise agreed by the Engineer, all programmes submitted by the Contractor shall be produced using computerized Critical Path Method (CPM)

Networks developed implementing the Precedence Diagramming Method (PDM) with Cost Loaded Charts and Tables, using the required software stated in Clause 3 below.

The Contractor shall implement and use throughout the duration of the Contract, a computerized system to plan, execute, maintain and manage the planning, design, pre-construction, construction, and sub-contracts in executing the CPM scheduling by PDM. The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work remaining to be accomplished; shall provide a sound basis for identifying problems, deviations from the planned works, and for making decisions; and shall enable timely preparation of the same for presentation to the Engineer.

**3. PROGRAMME MANAGEMENT SOFTWARE**

CPM programming software used shall be Primavera Project Planning (P6) Program or latest version. Scheduling software and relevant instruction manuals, licensed for use in connection with the contract, shall be provided by the Contractor according to the Employer's specifications. The Contractor shall supply the Engineer with three original licensed copies, including manuals and approved training of the software and any subsequent versions thereof at no extra cost.

**4. (NOT USED)**

**5. POST CONTRACT AWARD**

5.1. The Contractor shall develop his Tender Programme into the Initial Works Programme including an outline Narrative Statement and submit within 4 weeks of the date of commencement and a more detailed version within 7 weeks of receiving the Engineer's Notice to proceed to the proposed Initial Works Programme. Refer Clause 7.0.

5.2. The first Three Month Rolling Programme shall be submitted within 4 weeks of the date of Commencement and all subsequent editions shall accompany the Monthly Progress Report. The Monthly Progress Reports shall also include a Programme Update as described below. These programmes shall subsequently be updated as described below. Refer Clause 9.0.

5.3. Following the Contractor's Initial Works Programme submission but in any case no later than 21 weeks from the date of commencement of the Contract, the Contractor shall submit a detailed **Works Programme** suitably amended to take into account the programmes of Interfacing Contractors, Interfacing Agencies and MEP and TVS Subcontractor. It is the Contractor's responsibility to ensure timely co-ordination with all relevant Parties. The resubmitted Works Programme when given a Notice by the Engineer shall form the **Baseline Programme** which shall solely be used for monitoring and evaluating all facets of the Contractor's performance including, but

not limited to, actual progress and the effects of variations and delays. The Contractor shall monitor his own performance against the Baseline Programme on a weekly basis and shall prepare and submit to the Engineer written and computerised monthly reports including all supporting data. As the work progresses, it may be necessary to update/ revise the Baseline programme, but such updating shall only be carried out with the prior consent of the Engineer or when directed by them.

- 5.4. For the Initial & Detailed Works Programme submission, one (1) original and six (6) colour copies, with a softcopy on a CD, each of the following programmes and reports shall be submitted to the Engineer :
- a) Programme: Baseline CPM Network Recourse & Cost loaded Activity Schedule
  - b) Programme: Baseline Milestone based Cost Activity Schedule
  - c) Baseline Schedule Report
  - d) Narrative Statement
  - e) Baseline Physical Progress 'S' curve
  - f) Baseline Resource Charts
- 5.5. The Engineer shall review and comment on the Contractor's programmes and information submitted under this Clause. The Employer's Representative will issue his notice or otherwise of the submissions within 4 weeks.
- 5.6. The Engineer shall require the Contractor to re-submit within 2 weeks if he is of the opinion that the programmes and information submitted by the Contractor is unlikely to meet the Contract key dates.
- 5.7. If in the opinion of the Engineer, any of the Contractor's revised programmes and information submitted under the Works Programme is not acceptable, it shall be construed as a failure of the Contractor to meet a Milestone.
- 5.8. Notwithstanding the above, the Engineer may at any time during the course of the Contract require the Contractor to reproduce the computer-generated Baseline Schedule Report described above to reflect actual activity dates and generate schedules based upon "what if" statements. The initial computer-generated report after receiving the Engineer's notice will serve as the base against which the contract progress will be measured. Any changes to the Report reflected in subsequent Baseline Schedule Reports shall also require the Engineer's consent.
- 5.9. Failure to include any element of work required for performance of the Contract shall not relieve the Contractor from completing all works required under the Contract to achieve the original or any extended key completion date.

## **6. WORKS PROGRAMME**

- (1) The Works Programme shall detail the full scope of the works taking into account the complex nature and different phases of the contract, and shall be accompanied by detailed supporting information to demonstrate through the sequence and duration of the activities that the plans are achievable and realistic and that the works to be undertaken can meet the requirements of the contract.
- (2) The Works Programme shall be a computerised Critical Path Method (CPM) network developed using the Precedence Diagramming Method (PDM) and shall be present in bar chart and time-scaled network diagram format to a weekly or monthly time scale.
- (3) Tasks in the Works Programme shall be sufficiently detailed to describe activities and events that include, but are not limited to, the following:
  - (a) Key Dates, Works Areas Access Dates, any interface and handover dates
  - (b) All physical work to be undertaken in the performance of the Contract obligations, including Temporary Works
  - (c) the requested date for issue of any drawings or information by the Engineer
  - (d) Incorporation of principal aspects of the Design Programme and Design Submission Programme, including achievement of Preliminary Design, Definitive design and Construction Reference Drawings.
  - (e) Due time allowance for review by the Engineer of the Contractor's submissions, as well as the subsequent amendment and re-submission by the Contractor in the design review and comment process,
  - (e) Due time allowance for complying with requirements of all Government Departments and all others whose consent, permissions, authority or licence is required prior to the execution of any work.
  - (f) Order, procurement, manufacture, delivery, testing and installation of major materials and the delivery and/or partial delivery date on-Site of principal items of Contractor's Equipment.
  - (g) Any off-site work such as production or pre-fabrication of components
  - (h) Installation of temporary construction facilities
  - (i) Interface periods with the Interfacing subcontractors or utility undertakings
  - (j) Design, supply and/or construction activities of sub-contractors
  - (k) Testing, commissioning and integrated testing of the Works.
  - (l) Any outside influence which will or may affect the Project.
  - (m) Mobilization and demobilization
  - (n) Weather allowance



- (o) Completion of core areas / rooms for access by interfacing subcontractor parties.
- (4) The Works Programme shall show achievement of all Key Dates. The programme shall also show Milestones, but the Milestones shall not be taken as imposing any constraints that in any way affect the logic or limit any other dates in the programme.
- (5) Activity descriptions shall be unique, describing discrete elements of work. Any activity creating an imposed time or other constraint shall be fully defined by the Contractor.
- (6) The Works Programme shall be organised in a logical work-breakdown-structure including work stages and phases, and shall clearly indicate the critical path(s). Each activity in the Works Programme shall be coded to indicate:
  - (a) Activity ID and Activity Code which structure should be agreed with the Engineer.
  - (b) The Engineer may request additional activity coding to the extent available without restraint to the Contractor's utilisation of the programme software. When requested, the Contractor shall add the required additional coding to the Programme. The Contractor shall use additional code fields as requested to comply with the requirements and for the use of the Contractor.
- (7) Activity duration shall not exceed two (2) weeks, unless otherwise consented to by the Engineer, except non-construction activities such as submittals, submittal reviews, procurement and delivery of materials or equipment and concrete curing. The Contractor shall submit a Programme/Project Calendar cross reference clearly indicating the allowance for holidays.
- (8) The Works Programme, in each submission, shall be accompanied by an Activity Report and a Narrative Statement as described below in both electronic and hard copy format (time scale logic diagrams in A1 size, reports in A4 size).
- (9) **Activity Report**

Shall list all activities, and events in the Works Programme, sorted by activity identification number.

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

  - (a) Activity identification number and description,
  - (b) Duration expressed in Days,
  - (c) Early and late start & early and late finish dates/-. Planned start and finish dates,
  - (d) Calculated total float and free float,

- (e) Predecessor and successor(s), accompanying relationships and lead/lag duration,
- (f) Imposed time or date constraints,
- (g) Calendar.

(10) **Narrative**

The Narrative shall be a comprehensive statement of the Contractor's plan and approach for the execution of the Works and the achievement of key dates, access to subcontractor dates, submission dates and any intermediate dates. It shall incorporate outline method statements in respect of major items of work including construction sequences and primary items of plant, Construction Equipment, Temporary Works and the like. It shall fully explain the reasons for the main logic links in the Programme and include particulars of how activity durations are established. This shall include estimated quantities, production rates, hours per shift, work days per week and a listing of the major items of Construction Equipment planned for use on the project. Activities, which may be expedited by use of overtime or additional shifts, shall be identified and explained. A listing of holidays, and other special non-work days being used for the computer reports shall be included.

Supporting information and an accompanying narrative for the Programme that details the basis and assumptions upon which the programme has been drawn shall be prepared and submitted as detailed (but not limited to) below:

- i. A narrative description of the sequence of all sections of the Works and in particular a detailed identification and description of the critical path activities. The narrative shall be supported by sketches illustrating the planning sequences of construction phase of works;
- ii. Marked up plans detailing the concreting and concrete pour dates for major section of each part of the structure;
- iii. An overall manpower forecast detailing individual trades and other sub-contract / indirect labour, commissioning teams in terms of the daily number of workers planned to be engaged. The formats for these forecasts shall be in accordance with the Engineer 's requirements;
- iv. Typical cycle time analysis;
- v. Planned production outputs for all major activities and areas of Works;
- vi. List of major items of plant and equipment that are required to be procured identifying the required lead times;
- vii. Accumulative curves and histograms showing the planned weekly figures for each principal quantity, major item of equipment and major power trades;

- viii. Any programme constraints, giving details of the constraints and substantiation thereto;
- ix. Total float listing in order of total float;
- x. Daily and weekly working hours, holidays and shift patterns;
- xi. Other information that the Engineer may request;

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

The Contractor shall also submit at the end of every month, for inclusion in the Monthly Progress Report as stated in Appendix 5, a forecast Cumulative Physical Progress 'S' curve based on the time-phased distribution of cost in the CPM Network Logic Diagram, expressed in percentage terms and plotted with the early and late dates. This 'S' curve shall be generated from the computerised CPM Network Logic Diagram.

**(12) Resources**

The Contractor shall provide on the submission of the Baseline programme full resource details for major activities including but not limited to the substructure, superstructure, architectural and building services fit out stages of the works. These shall include

- Major manpower trades
- Number of items of major plant and equipment
- Principal quantities (i.e, volume of excavation, volume of concrete, tonnage of steel work / reinforcement, area of formwork, length of pipe work etc.)
- Other details as appropriate or required by the Engineer. The Contractor shall also Resource Charts, generated from the Contractor's

CPM Network Diagram, showing the anticipated manpower and main Construction Equipment usage during the execution of the Project.

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

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

## **7. INITIAL WORKS PROGRAMME**

- (1) The Initial Works Programme submitted as under Clause 5.1 need not include the full details given under Clause 6 above. It should be a condensed version with combined activities of longer duration but must show clearly how the requirements of the Contract are to be achieved. The outline Narrative Statement shall be in sufficient detail to clearly show the Contractor's intention.
- (2) Within 7 weeks of the Engineer's consent to the Initial Works Programme, the Contractor shall submit to the Engineer an expanded and more detailed version of the Initial Works Programme containing all of the information and detail required under Clause 6 above.
- (3) Such submission shall make use of the Tender Programme submitted earlier but refined to include the best estimates of dates for the work of Interfacing Contracts which has impact on the Contractor's programme. Such programmes shall be amended subsequently to incorporate the actual dates/ schedule of the affecting contracts. It is the Contractor's responsibility to ensure timely co-ordination with the Interfacing Contractors to finalise the Initial Programme, without affecting progress of the work.

## **8. WORKS PROGRAMME REVISIONS**

- (1) The Contractor shall immediately notify the Engineer in writing of the need for any changes in the Works Programme, whether due to a change of intention or of circumstances or for any other reason. Where such proposed change affects timely completion of the Works or any other Key Date the Contractor shall within fourteen (14) days of the date of notifying the Engineer submit for the Engineer's notice its proposed revised Works Programme and accompanying Narrative Statement. The proposed revised Works Programme shall show the sequence of operations of any and all works related to the change and the impact of changed work or changed conditions.
- (2) If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Programme which together with an accompanying Activity Report and Narrative Statement, shall be submitted by the Contractor within fourteen (14) days after the Engineer's instruction. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions.
  - a) All activities that have negative float must be analysed by the Contractor to identify the impact on the timely completion of the Works or on the achievement of Key

Dates.

#### **9. THREE MONTH ROLLING PROGRAMME**

- (1) The Three Month Rolling Programme shall be an expansion of the current Works Programme showing the activities completed in the last month and the activities that are in progress or will start within the next three (3) months. The Three Month Rolling Programme shall provide more detail of the Contractor's plan, organisation and execution of the work within these periods. The Contractor shall expand each activity planned to occur during the next three (3) month period, if necessary, to a daily level of detail.
- (2) The Three Month Rolling Programme shall be developed as a Critical Path Method (CPM) network, and shall be presented in bar chart and time-scaled network diagram format. Bar charts shall be presented on A4 sheets and time-scaled networks diagrams A3 size. Tasks in the programme shall be derivatives of and directly related to tasks in the Noticed Works Programme. One (1) original and six (6) colour copies, with a softcopy on a CD, of the schedule shall be submitted
- (3) The Contractor shall describe the discrete work elements and work element inter-relationships necessary to complete all works and any separable parts thereof including work assigned to sub-contractors.
- (4) Activity duration shall not exceed two (2) weeks unless otherwise notice given by the Engineer.
- (5) Each activity in the Three Month Rolling Programme shall be coded, or described so as clearly to indicate the corresponding activity in the Works Programme.
- (6) The three months Rolling Programme shall require the Engineer notice for payment purposes.

#### **10. THREE MONTH ROLLING PROGRAMME REVISIONS AND UPDATE**

- (1) The Three Month Rolling Programme shall be a progress update of the accepted Baseline Programme. The Three Month Rolling Programme shall be extended forward each month as described under Clause 9 above. Each submission of the Three Month Rolling Programme shall be accompanied by a Programme Analysis Report, describing actual progress to date, and the forecast for activities occurring over the next three-month period.
- (2) If the Three Month Rolling Programme is at variance with the Works Programme, the Programme Analysis Report shall be accompanied by a supporting Narrative Statement describing the Contractor's plan for the execution of the activities to be undertaken over the three month period, including programme assumptions and methods to be employed in achieving timely completion.

- (3) The Contractor shall revise the Three Month Rolling Programme or propose revisions of the Works Programme in accordance with Clause 8, or both, from time to time as may be appropriate to ensure consistency between them.

**11. PROJECT CALENDAR**

For the Project, the Contractor shall adopt 7 days a week calendar, identical calendar for the purpose of programming and execution of Works. Official documents shall be transacted during 5 days week - Monday through Friday, except for National (Govt. of India) Holidays. For Project purposes, a week begins at 0001 hours on a Monday and ends at 2359 hours on a Sunday. The completion of an activity or the achievement of an event when given a week number shall be taken to mean midnight on the Sunday at the end of the numbered week. An access date or activity start date when given as a week number shall be taken to mean 0001 hours on a Monday of the Numbered week.

**12. PROGRAMMING PERSONNEL**

The Contractor shall submit, as part of its Staff Organisation Plan, the names and experience and any required information for the staff to be employed on Works Programming. The principal Works Programmer shall hold reputable professional qualifications acceptable to the Engineer including at least ten (10) years relevant experience in programming civil Engineering works. Others in the group shall have at least three (3) years experience in such work. The programmers shall be employed by the Contractor full time on the

Contract until the completion or such earlier time the Engineer may give his consent.

**13. PROGRAMME AND REPORT SUBMISSION FORMAT**

The Contractor shall submit one (1) original and six (6) copies in colour, and a softcopy on a CD, of all submissions to the Engineer. All submissions shall be in A0, A1, A3 or A4 size, as appropriate, except as may otherwise be agreed by the Engineer.

**14. FAILURE TO SUBMIT PROGRAMME**

Failure of the Contractor to submit any programme, or any required revisions thereto within the time limits stated for notice of no objection by the Engineer, shall be sufficient reason for not making the relevant milestone on account payment by the Engineer.

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**MONTHLY PROGRESS REPORTS**

## **APPENDIX – 5 MONTHLY PROGRESS REPORTS**

### **1. GENERAL**

The Contractor shall submit to the Engineer six (6) coloured copies and a soft copy on CD of the Monthly Progress Report. This Report shall be submitted by the last day of each calendar month and shall account for all work actually performed from 26<sup>th</sup> day of the last month and up to and including the twenty-fifth (25<sup>th</sup>) day of the month of the submission.

The Report shall be typed, printed and bound. It shall be supported by graphics and photographs as specified in Clause 9 of this Appendix. It shall be submitted in a format to which the Engineer shall have given his consent. Unless the Engineer directs otherwise, the Contractor's Monthly Report shall contain sections/sub-sections for, but not limited to, the topics described in this Appendix.

The Contractor shall include in the Monthly Progress Report a record of monthly progress of various major Works on Site in the form of colour photographs with appropriate annotations and dates stated.

The Contractor shall deliver daily to the Engineer, a report as to the number of workmen, plant and equipment employed on the works in each trade, etc. and a log of delivery notes for all goods and materials delivered to the Site. This information shall be summarised as a monthly return for the monthly progress report

### **2. FINANCIAL STATUS**

A narrative review of all significant financial matters, and actions proposed or taken in respect to any outstanding matters.

A spread sheet summarising each activity, the budget, costs incurred during the period, costs to date, costs to go (including potential variations), cost forecast (total of costs to date and costs to go) and cost variance (difference between cost forecast and budget).

A spread sheet indicating the status of all payments due and made.

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

### **3. PHYSICAL PROGRESS**

The introduction shall briefly summarise the progress that has been made during the past month and how the actual progress relates to the planned progress in accordance with the Works Programme.

- It shall describe the status of work performed, significant accomplishments, including critical items and problem areas, corrective actions taken or planned and other pertinent activities, and shall, in particular, address interface issues, problems and resolutions.



- It shall include a simplified representation of progress measured in percentage terms compared with percentage planned as derived from the Works Programme.
- Physical Progress S-Curve

The Physical Progress S-Curve shall be in the form of a graph which compares the actual progress with the planned progress in terms of percentage to show the project performance.

The value of the physical progress achieved shall be assessed as the aggregate of the values of those activities which are separately identified on the Works Programme and which are:

1. in the opinion of the Engineer, wholly completed;
2. in progress, provided that the value attached to each such activity shall be agreed with the Engineer. Notwithstanding any value agreed with the Engineer shown on the S-Curve, the S- Curve shall not be used for the purpose of Progress Payment Claim.

#### 4. PROGRAMME UPDATE

Programme updating shall include:

- (a) the monthly Programme Update which shall be prepared by recording actual activity completion dates and percentage of activities completed up to the twenty-fifth (25<sup>th</sup>) of the month together with estimates of remaining duration and expected activity completion based on current progress. The Programme Update shall be accompanied by an Activity Report and a Narrative Statement.

The Narrative Statement shall explain the basis of the Contractor's submittal:

- (i) *Early Work and Baseline Submittals – explains determination of activity duration and describes the Contractor's approach for meeting required Key Dates as specified in the Contract.*
- (ii) *Updated Detail Programme Submittals – state in narrative the Works actually completed and reflected along Critical Path in terms of days ahead or behind allowable dates. Specific requirements of narrative are:*

If the Updated Detailed Works Programme indicates an actual or potential delay to Contract Completion date or Key Dates, identify causes of delays and provide explanation of Work affected and proposed corrective action to meet Key Dates or mitigate potential delays. Identify deviation from previous month's critical path.

Identify by activity number and description, activities in progress and activities scheduled to be completed.

Discuss Variation Order Work Items, if any.

- (b) the Programme Status which shall :

- i. *show Works Programme status up to and including the current report period, display Cumulative progress to date and a forecast of remaining work.*
  - ii. be presented as a bar-chart size A4 and as a time-related logic network diagram on an A3 media, including activity listings;
  - iii. schedules of all significant activities tabulated in order of earliest starting date showing the following:
    1. The actual start dates for activities which have commenced together with the scheduled start date for each activity and the time lapse;
    2. The actual completion dates for activities which have finished together with the scheduled finish date for each activity and the time lapse;
    3. The forecast and scheduled start dates for activities scheduled;
    4. The forecast and scheduled completion dates for activities which have commenced;
    5. The percentage completion of each activity started but not completed;
    6. The total float of each activity not completed;
    7. Any known delays to activities.
- (c) The Activity Variance Analysis which shall analyse activities planned to start prior to or during the report period but not started at the end of the report period as well as activities started and/or completed in advance of the Works Programme.
- (d) The Resource Chart to show the actual resources mobilised for the works against the baseline figures in the Baseline Resource Charts.

**5. KEY DATES STATUS**

A report on the status of all Key Dates due to have been achieved during the month and forecasts of achievement of any missed Key dates, and those due in the next month.

**6. THREE MONTH ROLLING PROGRAMME**

Include a copy of the 3-month Rolling Programme for that reporting period.

**7. PLANNING AND CO-ORDINATION**

- (1) Details of co-ordination of interface activities started or completed during the month and shall include for internal co-ordination within the Contractor's own multi-disciplinary team as well as external co-ordination with the Engineer, other Interfacing subcontractors, authorities and the like;
- (2) A schedule of all submissions and consents/approvals obtained/outstanding;
- (3) Details of design and drawing progress, including design interface coordination, started or completed during the month as related to the Temporary Works, Permanent Works and Shop drawings;

- (4) Updated Drawing Register;
- (5) Details of the progress of off-site activities such as design, production and/or fabrication of any components or materials;
- (6) Corrective actions either taken by or to be taken by the Contractor to maintain completion dates, including details of any changes made or to be made to the Works Programme to achieve this objective;
- (7) Contractor's organisation and resources;
- (8) Details of any other items which the Engineer or the Contractor shall consider to be necessary or desirable from time to time.

#### **8. PROCUREMENT REPORT**

- (1) A summary of all significant procurement activities during the month, including action taken to overcome problems, and details of any outstanding actions.
- (2) A report listing major items of plant and materials which will be incorporated into the Works. The items shall be segregated by type as listed in the Specifications and the report should show as a minimum the following activities:
  - (a) Purchase order date - scheduled/actual;
  - (b) Manufacturer/supplier and origin;
  - (c) Letter of credit Issued date;
  - (d) Manufacturer/supplier shipment date - scheduled/actual;
  - (e) Method of shipment;
  - (f) Arrival date in India- scheduled/actual;
  - (g) Analysis of any delay happening/anticipated with proposal for corrective measures.

#### **9. PHOTOGRAPHS**

Two sets of photographs shall be provided with the Monthly Progress Report in colour and shall be submitted in the following manner and format.

Digital colour photographs shall be 10cm x 15cm (4-inch x 6-inch), glossy prints, mounted in protective clear plastic folders and contained in a lever-arch binder. The electronic files shall also be provided in ".jpg" format on CD-ROM. The photographs and electronic files shall be identified by a brief narrative indicating:

- i. Contract number
- ii. A unique sequential number based on an agreed drawing numbering system
- iii. Specific location and subject of photograph

iv. Date and time of photograph

Each month the Contractor shall propose and the Engineer will confirm the number of photographs to be supplied so as to accurately record progress on all parts of the works. The number of photographs shall not be less than 30 per set unless otherwise agreed by the Engineer.

**10. SAFETY**

A review of all safety aspects during the month including reports on all accidents, actions proposed to prevent further occurrence and safety performance to-date, including results of all audits undertaken during the reporting period.

**11. ENVIRONMENTAL**

A review of all the environmental issues during the past month to include all monitoring reports, mitigation measures undertaken and activities to control environmental impacts, including results of all audits undertaken during the reporting period.

**12. QUALITY**

A review of all major quality issues and non-conformances during the month including **the quality control register and** reports on actions proposed to prevent further occurrence **as specified at Appendix 6** and also to include results of all audits undertaken during the reporting period.

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**EMPLOYER'S REQUIREMENTS**

**APPENDIX - 6**

**QUALITY ASSURANCE**

## APPENDIX – 6 QUALITY ASSURANCE

### Quality System Definitions

The following Quality Management System terms are used in these requirements. The definitions given are derived from ISO 9000: 2005, clause 6.

Audit	Systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled Clause under the Conditions of Contract Conformity Fulfilment of a requirement
Design and Development	Set of processes that transforms requirements into specified characteristics or into the specification of a product, process or system. These are prepared to support the Quality Plan for a particular element of the Works
Hold Point (H)	A point in time when a notice of permission, consent or No Objection by the Contractor Quality Assurance Team (or that the Engineer may elect to witness), is required before the Contractor can proceed with an activity
Inspection and Test Plan	Plans specifying the activities required to establish whether conformity is achieved. They identify the responsibilities for executing the activities, the documents controlling them and details requirements for the production of records
Method Statements	Documented procedures, concerning particular aspects of the process, developed to define the manner of production, installation and servicing Nonconformity Non-fulfilment of a requirement
Observation Point (O)	A stage identified on an Inspection and Test Plan where the Engineer or authorised third parties may observe activities and any associated verification
Procedure	Specified way to carry out an activity or a process
Quality	Degree to which a set of inherent characteristics fulfils requirements
Quality Management System	Management system to direct and control an organization with regard to quality as formally expressed by top management
Quality Plan	Document specifying the procedures and

	associated resources shall be applied by whom and when to a specific project, product, process or contract
	Quality Plan shall specify the quality management system of an organization
Requirement	Need or expectation that is stated, generally implied or obligatory
Record	Document stating results achieved or providing evidence of activities performed
Witness Point (W)	A stage in the pre-construction or construction activities in which a party is invited to witness

**1. INTRODUCTION**

- 1.1 The Contractor shall maintain and implement a Quality Management System that shall remain in effect during the execution of the Works. Contractor's organisation is required to operate a Quality Management System based on International Standard ISO 9001: 2008 for its scope of Works and in compliance with the requirements of the Contract. The Contractor shall submit his Quality Management System documentation for review and Notice to proceed by the Engineer as specified in this Section.
- 1.2 ISO 9001: 2008 Certification of the Contractor's organisation is required for this Project. The Engineer may consider the alternative use of ISO 9001: 2000 Certification at his discretion. ISO Certification is a requirement of this Project for the Contractor's subcontractors, consultants, sub-consultants, suppliers and Designers. The Contractor however cannot delegate or subcontract the Employer's Quality Assurance Requirements to subcontractors, consultants, sub-consultants or suppliers without the Engineer written approval.
- 1.3 The Contractor shall implement a Quality Plan that shall incorporate a comprehensive and documented approach to achieve the Project quality requirements that is capable of ensuring that all aspects of the Works, including but not limited to, design, procurement, fabrication, installation, inspection, construction and modifications will comply with the requirements of the Contract.
- 1.4 The Contractor's Quality Plan shall ensure that all goods and materials, whether on-shore in India or off-shore before shipping, workmanship, plant and equipment procured and supplied, inspecting, handling, assembling, testing, storing, fabrication, suppliers and vendors are in compliance with the Contract requirements. Plan(s) and/or Procedures to be prepared by others (suppliers, subcontractors, sub-consultants) and their incorporation in the overall Quality Plan of the Contractor, shall be identified.
- 1.5 The Capitalized terms used and to the extent not defined herein shall have the meaning ascribed to them respectively, in the Conditions of Contract and the Employer's Requirements.
- 1.6 Construction / Installation shall be deemed to include manufacturing, fabrication, assembling,

testing & commissioning, integrated testing and commissioning and trial runs wherever necessary.

- 1.7 The Contractor shall assist in the independent audit review, checking, sampling testing and examination of the Works by the Engineer. The Contractor shall provide full and timely access for such work by the Engineer, including inspection of records and documentation. Such access shall include direct access to the Site, work areas, storage facilities, fabrication sites, Contractor's offices, laboratories, manufacturers/suppliers facilities and similar areas and facilities where any work is being conducted.
- 1.8 For design and/or activities occurring outside of India which require the Engineer to inspect, the Contractor shall provide:
  - (a) Right to inspect;
  - (b) Facilities to carry out their work; and
  - (c) Assistance in travel and accommodation arrangements.

## **2. QUALITY MANAGEMENT SYSTEMS**

- 2.1 Contractor's Quality Management System shall be capable of demonstrating by self-certification that all relevant standards, regulations, testing requirements etc are being met. Self-certification is the process whereby the Contractor can demonstrate that all requirements of the Contract have been fulfilled.
- 2.2 The Contractor shall designate a Quality Assurance Manager (QA Manager) who shall be classified as one of the Key Personnel and shall be responsible for overseeing the implementation of the overall Quality Plan for the Contractor. The Quality Assurance Manager shall not report to the Contractor's Project Manager, but shall be directly responsible to and report to a joint venture board, senior management or similar level of the Contractor's organization that is not directly responsible for design or construction.
  - 2.2.1 Refer to Volume 3 – Section A, Clause A15 Key Staff Requirements.
- 2.3 The Contractor shall be required to provide the Quality Assurance Manager with adequate resources and authority to enable the quality of the work on the Contract to be managed effectively. Those resources shall be required to fulfil the requirements for quality assurance, inspection and testing and self-certification as detailed in these requirements.
- 2.4 The Contractor shall be required to provide appropriate training to all personnel in the operation of the Quality Management System and maintain records to demonstrate competence in its application.
- 2.5 The Contractor shall submit his Quality Management System documentation for review and approval by the Engineer as specified in this Section.
- 2.6 It is anticipated that the Contractor's Quality Management System documentation shall include, but not limited to, the following:
  - a. Quality Plan, identifying its Quality Procedures;
  - b. Manufacturing Quality Plan;
  - c. Design Quality Plan;
  - d. Method Statements;



- e. Inspection and Test Plans; and
- 2.7 The Contractor shall plan, perform and record all quality control activities to ensure that all work is performed in accordance with the requirements of the Contract and of his Quality Management System. Documentation which have been reviewed and Notices by the Engineer, such activities shall include, without limitation, the inspections and/or tests implied or expressly required by the Contract.
- 2.8 The Engineer shall designate, if necessary, Quality 'Hold Points' into the Contractor's Inspection and Test Plans for the Contractor's Quality Department to adhere to, or for the Engineer to attend, on a case-by-case basis at his discretion.
- 2.9 The Contractor shall coordinate the Inspection and Testing necessary to demonstrate that all specified requirements have been met. All non-conformances are to be documented and resolved, before final acceptance of the Works or any section of it.
- 2.10 The Employer, Stake holders, Engineer and third parties including the BMC Road Department and statutory authorities, reserve the right to and shall conduct periodic audits and inspections on the Works and services provided either on its own or through third party, and will sample, test and measure material used within the Works completed by the Contractor or its subcontractors of all tiers and suppliers/vendors and to observe the execution of these activities.
- 2.11 The Contractor, his consultant, subcontractors of all tiers and suppliers thereof shall make available for audit all records necessary to demonstrate that the Works have been executed in accordance with the Contract. They shall also provide the Engineer with documents that demonstrate that the Works are progressing in accordance with the specified requirements. These shall be provided in a timely manner to enable non-conformities to be rectified satisfactorily.

### **3. QUALITY SYSTEM REQUIREMENTS**

- 3.1 The organization of the Contractor's Project Plan shall comply with ISO 10005 (2005): Quality Management-Guidelines for Quality Assurance Plan.
- 3.2 All on-Site and off-Site testing sampling in India is to be carried out by laboratories accredited by NABL (National Accreditation Board of Testing and Calibration Laboratories) or internationally accredited laboratory to ISO 17025: 2005.
- 3.3 A fully equipped concrete laboratory shall be installed at Site along with laboratory technicians and support staff. Testing machines shall be periodically calibrated in accordance with NABL requirements. Details included in clause 14.9.
- 3.4 The Engineer may require the Contractor to stop using a particular laboratory and find an alternative if the Engineer has reasonable grounds to be dissatisfied with its performance.
- 3.5 All testing of systems, software, plant and materials must be carried out by persons accredited to meet the requirements and Standards.
- 3.6 Within thirty (30) days of the Commencement Date, Contractor shall submit to the Engineer for his review, comment and Notice to proceed the following, as appropriate: (a) Quality

Plan;

- (b) Design Quality Plan and Delivery Schedule; and
  - (c) Manufacturing Quality Plan and Delivery Schedule.
- 3.7 The Contractor shall promptly supply the Engineer with six (6) controlled copies of his Quality Plans, Inspection and Test Plan(s), related procedures / instructions / forms upon such documents being reviewed and Noticed by the Engineer. The Contractor shall maintain such controlled documentation throughout the duration of the Contract. For any amendment to the quality system documentation, the Contractor shall as soon as practicable prepare and submit the proposed amendment for review by the Engineer. In addition, the Engineer may request further copies of the quality system documents and these documents shall reach the Engineer's office within fourteen (14) days of notification, at no additional cost to the Contract.
- 3.8 The Contractor shall maintain and make available for inspection by the Engineer at its site, a complete, up-to-date, organized file of all submittals (plans, procedures, Method Statements etc), including an index and locator system which identifies the status of each submittal.
- 3.9 Pursuant to sub-clause 3.8, a 'controlled copy' means a document prepared and issued in accordance with the provisions regarding document control contained in the relevant ISO standard.

#### **4. TYPES OF QUALITY PLANS**

- 4.1 No design, procurement, construction, installation, commissioning or maintenance activity shall commence without a suitable Quality Plan that has been submitted to Engineer for review and comment, consent, approval of Notice to proceed.
- 4.2 The Contractor shall submit to the Engineer the following Quality Plans for his review and approval:
- (a) A Quality Plan for the control of all management related activities;
  - (b) Design Quality Plan(s) for the control of all design related activities for the Permanent Works or Plant and/or Temporary Works;
  - (c) Manufacturing and construction Quality Plan(s), for the control of activities within each category of work or discrete element of construction, manufacture, installation, commissioning, maintenance or servicing of the Permanent Works or Plant and/or Temporary Works or for the control of outstanding work during the Contracts Period, as the same may be required by the Contract and/or directed by the Engineer ; and
  - (d) Method Statements and Inspection and Test Plans, for the control of all inspection and test related activities as per clause 10 and clause 11.

#### **5. FORMAT OF QUALITY PLANS**

- 5.1 The Quality Plan(s) shall define all measures necessary to meet the objectives and

requirements of the Contract at all appropriate phases of the work.

- 5.2 The Quality Plan(s) shall have a standardised format and show clearly on each page:
- (a) The quality plan number or, in the case of attached documents, a reference to the quality plan number;
  - (b) Whether the document is a draft or is Noticed by the authorised representative of the Contractor; and
  - (c) The date of such approval.

## **6. QUALITY PLAN**

- 6.1 The Contractor shall prepare construction Quality Plan(s) for the construction, installation, testing and commissioning activities. Separate construction quality plan(s) shall be prepared for other Contractor's or subcontractor's off Site activities. Each construction quality plan shall identify the scope of work to be controlled.
- 6.2 The Quality Plan shall include a directory and organizational chart showing all of the Contractor's Key Personnel. The directory shall be kept updated throughout the Contract as changes occur and submitted to the Engineer for his approval. The directory shall include the names, titles, areas of responsibility, office address and location, office phone and fax numbers, cellular phone number(s). The Contractor shall provide information sufficient for the Engineer to contact any of the Key Personnel on a twenty-four (24-hour) basis for the duration of the Contract.
- 6.3 The Engineer will also provide a similar directory to the Contractor.
- 6.4 The Quality Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall, without limitation, define:
- (a) The organisation of the Contractor's managerial staff with particular reference to any Joint Venture partners and main subcontractors. An organisation chart is to be produced to illustrate the subdivision of the work into elements for effective technical and managerial control, the reporting structure and the interface relationship between all parties involved;
  - (b) The specific allocations of responsibility and authority given to identified personnel for the day to day management of the work with particular reference to the supervision, inspection and testing of the work;
  - (c) The interfacing or co-ordination required with the Contractor's other related Quality Plans;
  - (d) The specific methods of construction to identify any relevant Method Statements and develop those Method Statements to a degree of detail sufficient to permit the Engineer to understand. Refer to clause 10;
  - (e) The appointment of a Quality Assurance Manager and Quality Control Manager in accordance with clause 12;
  - (f) The audit procedure, audit schedule for each type of quality plans and list of proposed

auditors including details of their authority, qualifications and experience in accordance with clause 9;

- (g) The procedures for the control of receipt and issue of all correspondence, so as to ensure traceability, shall be defined. Correspondence shall include letters, internal memoranda, facsimiles and electronic transmittals (i.e. CompuServe, Internet, SharePoint, Expedition etc);
- (h) The procedures for recording Project related oral communications shall be defined, i.e. records of telephone conversations, notes of informal discussions and minutes of meetings;
- (i) The procedures for the selection, indexing, filing, disposition and maintenance of Project records for storage in the archives shall be defined. A list of items to be archived shall be submitted for review by the Engineer on periods of retention. In addition, the Contractor's and subcontractor's filing systems shall be compatible as far as is necessary;
- (j) The procedures for the identification, production, verification, approval, distribution, implementation and recording of changes to all drawings, reports and specifications shall be defined;
- (k) The procedures for the evaluation, selection, engagement and monitoring of subcontractors / suppliers shall be defined together with the means of application of quality assurance to their work including audit and acceptance;
- (l) The procedure for the regular review and revision of each type of quality plan and its supplemental individual specific quality plans, to ensure their continuing suitability and effectiveness shall be defined. In addition, the method to be used for revision and issue of revised documentation shall be defined;
- (m) The procedures for the control, calibration and maintenance of inspection, testing and measuring equipment shall be defined;
- (n) The procedures for identifying training needs and for the provision of training of all personnel performing activities affecting quality shall be defined; and
- (o) The quality control procedures to be implemented to verify conformance with the Contract specifications. Verification is accomplished by examinations, tests, measurement and inspection and by verifying records including those of his consultant, subcontractors and suppliers by uses of forms to be applied to manage and control the following:
  - (i) The purchasing of materials and ensuring they comply with the requirements of the specification, including purchasing documentation and specific verification arrangements for Contractor/Engineer inspection of material or manufactured product prior to release for use/installation;
  - (ii) The construction process including Temporary Works so as to ensure compliance with drawings and specifications;
  - (iii) The construction and installation process so as to ensure clear identification and

traceability of material and manufactured parts;

- (iv) The inspection and testing activities of incoming materials, in process and final product;
- (v) The identification of the inspection and test status of all material and manufactured products during all stages of the construction and installation process to ensure that only products that have passed the required inspections and tests are dispatched for use and/or installation;
- (vi) Record of non-conformities and the disposition of non-conforming material or product, supported by applicable documentation, agreed remedial action instituted prior to the initiation so as to avoid unintended use/installation. Contractors Non-conformity system provides for the monitoring and tracking of all Non-conformities that occur within his scope of Contract, regardless of who identifies the Non-conformance;
- (vii) The assessment and disposition of nonconforming material(s) and product(s) and approval for reworking or rejection as scrap;
- (viii) The identification of preventive action so as to prevent recurrence of similar non- conformance; and
- (ix) The handling, storage, packaging, preservation and delivery of products.
- (p) The list of Inspection and Test Plans and Method Statements to manage and control any test and inspection activities;
- (q) All particulars of materials submitted for review by the Engineer ;
- (r) Where required by the Contract, the quality control requirements for major components in accordance with clause 16; and
- (s) Lists of forms and formats to be used to record the activities under the construction Quality Plan(s) shall be attached at the end of each section or reference included to existing standard procedures.

6.5 The Quality Plan(s) shall ensure that conditions adverse to quality such as failures, malfunctions, deficiencies and defects in materials and equipment shall be promptly identified and recorded as Non-Conforming Product and specific procedures to rectify non-conformities raised. This includes systems non-conformities raised as a result of both internal audit by the Contractor and external audits by the Engineer.

6.6 The Quality Plan(s) shall address the controls to be applied by its organisation to its subcontractors, suppliers and lower tier contractors thereof, both directly and by identifying the quality system documentation that subcontractors, suppliers and lower tiers thereof are required to produce. The Contractor shall ensure that subcontractors, suppliers and lower tiers thereof agree to and implement the applicable controls specified in the Contractor Quality Plan and the identified Quality Management System documentation.

## **7. DESIGN QUALITY PLAN**

7.1 The Contractor shall be responsible for the management of the design of the Works. While not being responsible to do any design for any Interfacing Party, the Contractor shall use his

- best endeavours to manage and resolve the interface, including those with designers of MEP.
- 7.2 The Contractor shall be responsible for coordinating with and obtaining necessary approvals from cognizant authorities for temporary and permanent road diversions, including overpasses and underpasses. The Contractor shall copy the Engineer on all correspondence with the cognizant authorities and shall note any problems in the Progress Narrative, clause 13, submitted with the Monthly Progress Report.
- 7.3 The Contractor shall ensure that the designs of the Works are properly checked and dealt with by a Design Checker whom shall be identified within the organisation of the Contractor. The Design Checker shall be independent in-house responsible for the detailed Checking of Deliverables prior to submission and ensure that the design can meet all its obligations under the Contract and for the Contractor to do likewise. The Design Checker shall issue a certificate of the same to the Engineer.
- 7.3.1 Refer to Volume 3 - Section 3, Attachment C1.
- 7.4 The Contractor shall identify the Design Checker for each discipline. The Design Checker shall have not less than the competence and experience required of the Contractor's Designer in the same discipline as the discipline of the design to be checked. The Design Checker shall not be associated with or be involved in the actual design, producing design documents or conducting construction site supervision for the Contractor.
- 7.4.1 Refer to Volume 3 - Section 3, Attachment C1.
- 7.5 In the event that the Engineer identifies significant errors or inconsistencies in the Deliverables, then the Engineer shall request for the applicable Design Checker to be immediately removed from the Design Team and be replaced with a competent Checker.
- 7.6 The procedures for the checking of design of Permanent Works shall also apply to design of Temporary Works and construction sequences that affect the Permanent Works or Safety during construction / installation.
- 7.7 The procedures for the control of design changes shall be defined in order that design changes are reviewed, verified, validated and Noticed before implementation.
- 7.8 All design documents (drawings, plans, specifications, calculations and reports) produced by the Contractor's organization shall be checked by the Designer, whom shall issue a certificate of the same to the Engineer.
- 7.8.1 Refer to Volume 3 - Section 3, Attachment C1.
- i. The Contractor shall maintain records showing design calculation and data supporting design review activities.
  - ii. The Engineer reserves the right to inspect and audit these documents at any time to verify the effectiveness of design reviews.
  - iii. The Design Quality Plan(s) shall define the Contractor's policy for the design of the Permanent Works or Plant and/or Temporary Works and shall, without limitation, define:

1. The organisation of the Contractor's design staff;
2. The specific allocations of responsibility and authority given to identified design staff with particular reference to the review and verification of design drawings and calculations by the Contractor;
3. The specific methods of design to identify any relevant Method Statements and develop those Method Statements to a degree of detail sufficient to permit the Engineer to understand;
4. The procedures to be applied to manage and control the quality of the design work, with particular reference to the following:
  - (a) The design and performance requirements which shall be defined in terms of basic data and design assumptions made; relevant codes, standards and regulatory requirements; safety, security and environmental requirements; and commissioning requirements;
  - (b) The design methods. Software applications to be used in the design, both proprietary and public domain, shall be identified and any requirements for physical and mathematical model testing;
  - (c) The preparation, checking, issue, distribution, indexing and filing reports, calculations, drawings and specifications along with the means of their revisions;
  - (d) The formal design review, authorisation and approval of design documentation;
  - (e) The design verification and validation;
- iv. The design checks by the Design Checker; and
- v. List of examples of the forms and formats to be used to record the activities under the Design Quality Plan shall be attached at the end of each section or a reference included to existing standard procedures.

For the following, the Engineer s review and Notice to Proceed is required before proceeding with the next stage of the works or design;

  - (a) The design of temporary traffic arrangements shall be reviewed and Noticed by the Engineer before submitting the same to the relevant authorities;
  - (b) The design of excavation and lateral support systems for underground excavations shall be reviewed by the Engineer before the excavation commences;
  - (c) The design of formwork and false work for cast insitu and precast concrete works shall be reviewed and Noticed by the Engineer before the erection of the same commences;
  - (d) The design of the launching girder shall be reviewed and Noticed by the Engineer before the erection of the same commences; and
- vi. The implementation of temporary traffic arrangements shall be reviewed and Noticed by the Engineer before the associated works proceed.

**(e) MANUFACTURING QUALITY PLAN**

- 8.1 Each Manufacturing Quality Plan shall identify the scope of work to be controlled. In relation to such scope of work, it shall, without limitation, define:
- (a) The organisation of the Contractor's staff directly responsible for the day to day management of the work on or off the Site;
  - (b) The specific allocations of responsibility and authority given to identified personnel for the day-to-day management of the work with particular reference to the supervision, inspection and testing of the work;
  - (c) The interfacing or co-ordination required with the Contractor's other related Quality Plan(s);
  - (d) The specific methods of manufacture to identify any relevant Method Statements and develop those Method Statements to a degree of detail sufficient to permit the Engineer to understand;
  - (e) The procedures, instructions and forms to be applied to manage and control the following:
    - (i) The purchasing of materials and ensuring they comply with the requirements of the specification, including purchasing documentation and specific verification arrangements for Contractor/ Engineer inspection of material or manufactured product prior to release for use/installation;
    - (ii) The manufacturing process so as to ensure compliance with drawings and specifications;
    - (iii) The manufacturing process so as to ensure clear identification and traceability of material and manufactured parts;
    - (iv) The inspection and testing activities of incoming materials, in process and final product;
    - (v) The identification of the inspection and test status of all material and manufactured products during all stages of the manufacturing process to ensure that only products that have passed the required inspections and tests are dispatched for use and/or installation;
    - (vi) The review and disposition of non-conforming material or product so as to avoid unintended use/installation;
    - (vii) The assessment and disposition of nonconforming material and manufactured product and approval for reworking or rejection as scrap;
    - (viii) The identification of preventive action so as to prevent recurrence of similar non- conformance; and
    - (ix) The handling, storage, packaging, preservation and delivery of manufactured product.
  - (f) The Inspection and Test Plans to manage and control any test and inspection activities;
  - (g) All particulars of materials submitted for review by the Engineer ;
  - (h) Where required by the Contract, the quality control requirements for major components



in accordance with clause 14; and

- (i) List of forms and formats to be used to record the activities under the Manufacturing Quality Plans shall be attached at the end of each section or reference included to existing standard procedures.

**(f) QUALITY AUDIT, REVIEWS AND UPDATES**

- Contractor shall submit with his Quality Plan a schedule of internal, consultant, subcontractor and supplier audits that are to be conducted by his personnel at least every six (6) months. The schedule, scope and method of the audits shall be sufficient enough, such that the Contractor can verify that all aspects of the Works are being conducted in accordance with the contractual requirements. The schedule and any amendments are subject to the acceptance by the Engineer. The schedule shall be reviewed every four(4) weeks by the Engineer.
- The Contractor shall ensure that audits of all the activities in each quality plan are carried out to ensure the continuing suitability and effectiveness of the Quality Management System. Reports of each such audit shall be submitted promptly to the Engineer for his information.
- The Contractor shall audit his consultants, subcontractors, sub-consultants and suppliers.
- The Contractor shall allow the Engineer to observe/participate in these audits and to conduct additional independent audits, as they consider appropriate to provide assurance that the Works are being conducted in accordance with contractual requirements. The Contractor shall provide the facilities and access necessary for these audits to be carried out effectively.
  - All audits as described in this section are to be carried out in compliance with established ISO 9001 auditing principles and in accordance with ISO 19011.
  - Plan reviews and updates:
    - The Contractor shall conduct Management Reviews of its quality system, at least annually. As work progresses, the Contractor shall update the Quality Plan to reflect current conditions. The need for revisions to the Quality Plan may be identified by the Contractor and/or the Engineer. The Contractor shall submit any revisions or updates to the Quality Plan to the Engineer for his Notice to proceed within thirty (30) days of the identification of the need for a revision.
- (b) In addition, the Contractor shall submit its Quality Plan for review by the Engineer annually even if no revisions have occurred during the preceding twelve (12) months. The Contractor shall submit a certified copy of the updated Quality Plan with revisions highlighted.

**(g) METHOD STATEMENTS**

- 10.1 Contractor shall prepare Method Statements for each area and/or type of activity conducted, and submitted to the Engineer for his review, comment and Noticeto proceed prior to commencing construction on any Temporary or Permanent Works. Methods Statements shall

be prepared for all Temporary and Permanent Works and shall be specific to the work being constructed and to the location of work.

- 10.2 All Methods Statements shall be consistent with Design Drawings and Works Specifications that have been subjected to checks and reviews as specified.
- 10.3 Any deviations from the requirements of the Design Drawings or Works Specifications shall require written agreement of the Designer, certified by the Design Checker and shall be submitted to the Engineer for his review and Notice to proceed.
- 10.4 Noticed Methods Statements shall be available for examination by the Engineer upon request at site.
- 10.5 Method Statements shall address the following items:
- (a) Scope of work covered by the Method Statement;
  - (b) Relevant drawings and Works Specifications;
  - (c) Hazard analysis and the precautions to be taken to eliminate or mitigate identified hazards;
  - (e) Methods to be used and programme for the work;
  - (f) Resources (plant and labour);
  - (g) Supervision to be provided (by name);
  - (h) Safety provisions;
  - (i) Environmental provisions;
  - (j) Traffic control and temporary diversions to be implemented; and
  - (j) Inspection and Test Plan.
- 10.6 The Contractor shall reference applicable portions of previously prepared plans, such as the Safety Plan or Quality Plan, in its Method Statements.

**(h) INSPECTION AND TEST PLANS**

- 11.1 The Contractor, and through him, his consultants, subcontractors and suppliers engaged in supplying, manufacturing, construction, installation, commissioning and testing or any other service connected with the Works, shall maintain Inspection and Test Plans (ITP) appropriate for the services they provide that are accepted by the Engineer. These accepted ITP's will stipulate the necessary level and frequency of tests and inspections for each aspect of the Works, and also stipulate, without limitation:
- (a) The personnel responsible and/or involvement of various parties for undertaking and certifying the inspection and/or testing;
  - (b) The procedure or instructions for the inspection and/or testing;
  - (c) The test method or a reference to the relevant standard of testing;
  - (d) The inspection and/or testing required prior to commencement of an activity;
  - (e) The inspection and/or testing during an activity and its frequency;
  - (f) The inspection and/or testing required for the completion of an activity;
  - (g) All Quality 'Hold Points' (H), 'Witness Points' (W) and 'Observation Points' (O) shall be identified by the Contractor for his Quality Department to inspect and verify its

acceptance;

(h) The Engineer can place additional Quality 'Hold Points' (H), 'Witness Points' (W) and 'Observation Points' (O) for the Contractor's Quality Department on a case-by-case basis; and

(h) Engineer may designate additional Quality 'Hold Points' for his inspection on a case-by- case basis.

11.2 The Contractor shall conduct inspections and tests in accordance with his detailed plans as stipulated in the ITP. Records shall be kept of the completion of the inspections and tests that identify the record of the results which shall be made available for review during Engineer audit.

**(i) QUALITY PERSONNEL**

12.1 The Contractor shall appoint a suitably qualified and experienced person(s) as the 'Quality Assurance Manager' to be responsible for the task of ensuring that the requirements of the Quality Management System are implemented and maintained. The Contractor shall, at the time of submission of the proposed management Key Personnel, shall submit for review by the Engineer details of the qualifications, experience, authority and responsibility of the proposed Quality Assurance Manager.

12.2 The Contractor shall ensure that the Quality Assurance Manager is able to discharge his duties without hindrance or constraint. In addition, the Contractor shall make available any such resources that are necessary to ensure the effective implementation of the quality system and all quality plans.

12.3 The Contractor shall appoint a suitably qualified and experienced person as the 'Quality Control Manager' to lead teams of Quality Control Engineer s for carrying out, independent from other teams, inspections of the Works as identified as the Quality 'Hold Point', 'Witness Point (W) 'Observation Point (O). The Contractor shall, at the time of submission of the proposed management Key Personnel, submit for review by the Engineer details of the qualifications, experience, authority and responsibility of the proposed Quality Control Manager.

12.3.1 Refer to Clause A15 Section A, of this Volume 3 for the qualification requirements for Key Staff.

12.4 The Contractor shall ensure that the Quality Control Manager is able to discharge his duties without hindrance or constraint, including but not limited to the authority to suspend works as considered necessary. In addition, the Contractor shall make available any such resources that are necessary to ensure the effective implementation of the quality system and all quality plans.

12.5 Quality Control Engineer s:

The Contractor shall assign Quality Control Engineer s for each shift for each location/activities where work is being performed. Each lead inspector shall be qualified by training and experience in all the construction activities being conducted at the Site.

Quality Control Engineer s shall have a minimum of ten (10) years construction / installation

experience with at least five (5) years experience in the inspection, sampling and testing of works of the type being constructed. If required on the request of Engineer additional inspectors shall be appointed, at no additional cost to the Contract.

12.6 Materials Technicians:

The Contractor shall assign qualified materials technicians to conduct the sampling and testing of materials, goods and supplies for the Contract.

12.7 Staffing Levels:

The actual size of the Site staff shall reflect the complexity, needs, shifts and composition of Quality Control activities consistent with work in progress. The staffing levels shall be consistent with the Contractor's Quality Plan and the Project Baseline Programme, the relative locations of work in progress and the nature of the work.

The Quality Plan shall identify administrative/clerical support for the maintenance and management of records/documents pertinent to Quality Control activities.

**(j) MONTHLY PROGRESS REPORT**

13.1 The Contractor shall continuously monitor the performance of his Quality Management System, which shall be included in each Monthly Progress Report (MPR) in accordance with Volume 3 – Section 8, Appendix 5.

**13.2 Quality Certifications:**

The Contractor shall submit a written certification by the Quality Assurance Manager certifying that:

(a) The Quality Plan and all of the measures and procedures provided therein are functioning properly and are being fully complied with, except as specifically noted in the certification.

(b) All work, including that of the Designer, and all other designers, subcontractors at all tiers, suppliers and fabricators, has been checked and/or inspected by the Contractor's Designer Checker, except as specifically noted in the certification, conforms to the requirements of the Contract.

Refer to Volume 3 - Section 3, Attachment C1.

**13.3 Weekly**

Weekly records shall be prepared and maintained that provide factual evidence that required activities and/or tests have been performed, including the following:

(a) Type, number and results of quality assurance and quality control activities, including but not limited to reviews, inspections, tests, audits, monitoring of work performance and materials analysis;

(b) Qualifications of personnel, procedures and equipment used;

(c) The identity of the Quality Control Engineer or data recorder, the type of test or observation employed, the results and the acceptability of the work and action taken in connection with any deficiencies noted;

(d) Nature of nonconforming work causes for rejection, with photographs etc;

- (e) Preventive actions;
- (f) Proposed corrective actions;
- (g) Corrective actions taken and with whose authority; and
- (h) Results of corrective actions.

13.4 The Engineer reserves the right to inspect and audit these documents at any time.

**(k) QUALITY CONTROL REQUIREMENTS**

- 14.1 The Contractor shall, in accordance with the quality control requirements of the Specification and other documents included in the Contract, prepare and maintain quality item lists which establish the criteria for control of each major component or activity during design, construction and/or manufacture and installation, commissioning and servicing in accordance with the need to ensure the desired quality requirements of the Works.
- 14.2 All inspection and testing shall be the responsibility of the Contractor, at Contractor's cost. In all cases, the cost of materials for such tests shall be borne by the Contractor.
- 14.3 The work shall conform to high standards of material, design and workmanship. The Contractor shall conform to the Quality standards prescribed in the Contract document(s).
- 14.4 At Site, the Contractor shall arrange the materials, their stacking/storage in appropriate manner to ensure that the quality of the materials is not compromised. The Contractor shall provide all the necessary equipment and qualified manpower to test the quality of materials, assemblies etc. The tests shall be conducted at specified intervals and the results of tests properly documented.
- 14.5 The Engineer shall be free to carry out such additional tests as may be decided by him at his sole discretion, from time to time, in addition to those specified in this document. The Engineer shall also be free to appoint any third party for inspection and testing of important items like stay cables and steel work including welding etc, at his own cost. The Contractor shall provide the samples and labour for collecting the samples. No extra payment shall be payable to the Contractor for samples or for the collection of the samples. The results of such additional tests and third party inspection shall be binding on the Contractor.
- 14.6 The test(s) shall be conducted at the Contractor's Site laboratory which shall be established by the Contractor or at any other standard external laboratory selected by the Engineer. The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of the Contractor failing to arrange transportation of the samples in proper time, the Engineer shall have them transported and recover two times the actual cost from the Contractor. All sampling and testing shall be performed in the presence of assigned Contractor Quality Personnel. Testing may be witnessed by the Contractor or his authorised representative if permitted by the Standard External Laboratory. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.
- 14.7 The Engineer shall have the right at all times to inspect all operations including the source of materials, procurement, layout and storage of materials, all equipment including the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be

arranged and the Engineer's approval obtained prior to starting of the particular item of work. This shall however, not relieve the Contractor of his responsibilities.

14.8 All materials which do not conform to the Specifications shall be rejected and shall be removed from the Site immediately. The Engineer shall have the power to cause the Contractors to purchase and use materials from any particular source, as may, in the Engineer's opinion, be necessary for the proper execution of Works.

14.9 Field/Site Laboratory

14.9.1 All the materials to be used in the work and tested in the laboratory shall comply with the Employer's Requirements or such recognised specifications as acceptable to Engineer as detailed in clause 3.2 and 3.3 respectively.

14.9.2 The testing machines shall be recalibrated periodically as per Contractor Quality Plan and applicable regulatory Standards. The calibration shall be from an authorized laboratory in accordance with clause 3.2 and Noticed by Engineer.

14.9.3 The Contractor or his authorised representative shall assist in the collection, preparation, forwarding and testing of such samples. The cost of such samples and tests shall be borne by the Contractor. The Contractor shall give not less than seven (7) days' Notice for all tests in order that the Engineer may attend and witness testing at the external laboratory. Two (2) copies of all test certificates shall be supplied by the Contractor to the Engineer for approval immediately after the completion of the tests. Test certificates must be supplied to the Engineer before the materials or components are used in the works, unless the Engineer directs otherwise.

14.10 Frequency of Testing

All materials shall be tested as per the requirements specified in the Contractor's Quality Plan and Annexure I. All test reports shall be documented in hard copy as well as soft copy.

14.11 Unsuitable Materials

If at any stage of execution of work, Engineer finds that the particular material is not suitable to be used in any component of the work, the Engineer may order retesting of the material from any Noticed laboratory at the cost of the Contractor. The rejected material either after the initial test or after re-testing, as the case may be, shall be immediately removed from the Site by the Contractor at his own cost. In case of default on the part of the Contractor in removing rejected materials and any work executed with such unaccepted materials, the Engineer shall be at liberty to have them removed and/or dismantled by other means at the risk and cost of the Contractor.

**(I) NOTIFICATION OF NONCONFORMITES**

15.1 If the Contractor has used or proposes to use or repair any item of the Works which does not conform to the requirements of the Contract, he shall immediately submit for review by the Engineer a proposal for rectification, and supply full particulars of the nonconformity and, if appropriate, of the proposed means of repair.

15.2 If the Engineer issues nonconformity reports, either product based as a Non-Conformance Report (NCR) or procedural through quality audit as a Corrective Action Request (CAR)

or similar documents to notify the Contractor of any item of the Works which does not conform to the requirements of the Contract, the Contractor shall promptly investigate the matter and submit for review within fourteen (14) days of notification by the Engineer of the remedial measures to be taken and stating the reasons for the measures and the corrective and preventive action.

15.3 The Contractor shall maintain a Non Conformity Register to indicate the status of all nonconformities which have been identified by the Engineer and the Contractor.

15.4 The Engineer reserves the right to inspect and audit these documents at any time.

**(m) NOTICE OF PLACE OF MANUFACTURE AND/OR SOURCE OF SUPPLY**

16.1 The Contractor shall notify the Engineer of the places of manufacture and/or the source of supply of all goods and materials to be incorporated into the Works and shall give reasonable notice (which shall not in any event be less than fifty-six (56) days) to the Engineer before the start of any manufacturing and/or the supply of goods and materials.

**(n) NOTICE OF INSPECTION, TEST, TRIALS BY THE CONTRACTOR**

17.1 In relation to all Quality Control points and Quality 'Hold Points' involving inspection and/or witness testing by the Engineer, the Contractor shall give the Engineer notice of when the relevant work will be inspected and/or tested. The period of notice shall be as follows; unless otherwise agreed by the Engineer :

(a) In the case of on-Site work, such notice shall be given not less than forty-eight(48) hours of normal working time before the work is to be inspected and/or tested;

(b) In the case of work carried out off-Site in Mumbai, such notice shall be given not less than fourteen (14) days before the work is to be inspected and/or tested; and

(c) In the case of work carried out offshore outside of India, such notice shall be given not less than twenty-eight (28) days before the work is to be inspected and/or tested.

**(o) WITNESS BY THE ENGINEER**

18.1 In relation to all Quality Control Points involving inspection and/or testing by the Contractor, the Engineer may elect to witness such inspections and/or tests but, on expiration of the period of notice pursuant to clause 17, the Contractor may proceed with the inspections and/or tests notwithstanding the absence of the Engineer or of any response to the said notice. Witness by the Engineer shall not discharge the Contractor of the responsibility to provide acceptable product, nor shall it preclude subsequent rejection by the Engineer.

**(p) CERTIFICATE OF MANUFACTURED GOODS OR MATERIALS**

19.1 The Contractor shall obtain certificates for each batch of manufactured goods and documentary evidence that goods, supplies and materials and Contractor's Equipment conform to the Contract requirements for incorporation in the Works. Each certificate and/or proofing document shall include all reports of inspections and/or tests carried out at the place of manufacture.

19.2 The Contractor shall make available at the Site no less than twenty-four (24) hours prior to installation or use of such goods, supplies or materials and Contractor's Equipment

all certificates and/or proofing document(s).

19.3 The Engineer reserves the right to inspect and audit these documents at any time.

19.4 Materials Certificate of Compliance:

Within seven (7) days of the issue of a Completion Certificate for a Section or for all the Works, the Contractor shall submit a Certificate of Compliance signed by the Project Manager and the Quality Assurance Manager indicating that all materials, goods and supplies incorporated in the Works conform to the requirements of the Contract.

**(q) REPORTS OF INSPECTIONS, TESTS AND TRIALS**

20.1 The Contractor shall compile 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 that the work complies with the requirements of the Contract. Any analysis of the results required to confirm that the work complies with the requirements of the Contract shall be compiled in accordance with clause 21 and reported to the Engineer in accordance with clause 23.

20.2 Each report of inspection and/or test shall be signed by a representative of the Contractor who has been allocated the requisite authority under the relevant Inspection and Test Plan and signed by the Contractor's Quality Assurance Manager.

20.3 The Engineer reserves the right to inspect and audit these documents at any time.

**(r) TIME LIMIT FOR FILING OF REPORTS FOR INSPECTIONS AND/OR TESTS**

21.1 The Contractor shall ensure that a signed copy report of each in-situ and each off-site inspection / test is filed in his Records Office within 3 (three) working days and within seven (7) working days of the date of completion of the test process respectively.

**(s) QUALITY CONTROL REGISTER**

22.1 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. Each register shall:

- (a) List the certificates received for each batch of manufactured goods or materials incorporated in the Works and compares this against the certification required by the Contract and the Contractor's Quality Plan(s);
- (b) List the inspection, sampling and testing activities undertaken by the Contractor on each element of the Works and compare these activities against the amount of inspection, sampling and testing required by the Contract and the Contractor's Quality Plan(s);
- (c) Show 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, including:
  - (i) Standard deviation and coefficient of variation for each grade of concrete;
  - (ii) Summary of trail mix for each grade of concrete;
  - (iii) Summary of sample type and quantity that has been sent for third party testing;
  - (iv) Summary of third party testing reports;
  - (v) Summary of calibration status of monitoring and measurement equipment, batching plant/s; and



- (vi) Summary of in-process testing for routine dynamic pile load test, static pile load test, lateral load test (if required) and pile integrity test etc that have been conducted that month.
- (d) Cumulative quantity of each grade of concrete produced from RMC and/or dedicated batching plant/s;
- (e) Summary of Non Conformance Reports (NCR), raised internally by Contractor in its Quality Management System and as directed by Engineer.

22.2 The Engineer reserves the right to inspect and audit these documents at any time.

**(t) SUMMARIES OF INSPECTION AND/OR TEST**

23.1 The Contractor shall submit to the Engineer for his information summaries based on each quality control register showing the type and amount of certification received and the sampling, inspection, and/or testing undertaken on each element of the Works during the previous week as part of the Weekly Report, in accordance with clause 13.3. 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.

**(u) SAMPLES**

24.1 The Contractor shall ensure those concrete compression test specimens are controlled as followed:

- (a) each sample is identified in accordance with clause 24.3;
- (b) all samples are protected, temporarily stored, handled and transported to the laboratory under the direct supervision of a suitably qualified representative of the Contractor's laboratory;
- (c) no samples are mislaid, damaged, or contaminated, and
- (d) the properties of the sampled material are at no time adversely affected.

24.2 All samples for testing shall be fully prepared for transportation and testing by the Contractor and shall be delivered by the Contractor to the place of testing.

24.3 The Contractor shall ensure that concrete test specimens are identified by a unique reference which, at a minimum, shall contain at least four fields of reference. The sample reference shall be in the form of 'LLNN / LNN / NNNN / LLNN' where:

- (a) 'LLNN' is the alpha-numeric Contract number;
- (b) 'LNN' is the alpha-numeric concrete design mix, for example M25 ('M' refers mix and the number '25' represents the characteristic compressive strength of 15cm cube at 28-days in MPa);
- (c) 'NNNN' represents the date of sample with 'day-month'; and
- (d) 'LLNN' is the alpha-numeric Transit Mixer, for example 'TM01'

24.4 For all test samples, the Contractor shall ensure that all samples are identified by a unique number in accordance with its quality control procedure for inspection and test status of materials and manufactures products and shall contain the required identification

for traceability. At a minimum, the identification reference shall consist of:

- (a) Contract number;
- (b) Test identification code assigned by the Contractor;
- (c) Date of sample with 'day-month'; and
- (d) Unique sequential number of the sample under the particular test identification Code.

24.5 Additional fields may be added by the Contractor with the consent of the Engineer for the control of the laboratory activities and analysis of test results.

**(v) ADDITIONAL SAMPLES**

25.1 The Contractor shall provide additional samples for testing if in the opinion of the Engineer :

- (a) The material previously tested no longer complies with the specified requirements; or
- (b) The material has been handled or stored in such a manner that it is no longer represented by the previously tested samples.

**(w) TRIALS**

26.1 Trials shall be carried out as stated in the Contract to demonstrate that the proposed materials, equipment or methods of construction comply with the Contract.

26.2 Trials shall be carried out before commencement of construction or manufacture of the relevant work in order to ensure that proposed methods and materials comply with the specified requirements.

26.3 Trials shall be carried out using types of materials and methods of manufacture, construction and/or installation which have been reviewed and Noticed by the Engineer.

26.4 Unless permitted by the Engineer, the materials and methods of manufacture, construction and/or installation used in the trial to produce work complying with the requirements of the Contract shall not be changed unless further trials have been carried out to demonstrate that the proposed changes are satisfactory.

26.5 All references to 'tests' and 'testing' in the Contract shall, where the context so permits, include trials and commissioning.

**(x) TIMING FOR INSPECTION BY THE ENGINEER**

27.1 The Contractor shall allow the Engineer a reasonable time to carry out any inspection and/or witness testing and to assess the result of any inspection and/or test before proceeding with the Works.

27.2 Unless the Engineer's prior consent has been obtained, all inspections and/or tests to be witnessed by the Engineer shall be carried out between 0800 and 1800 hours, Monday to Saturday.

**(y) FAILURE OF CONTRACTOR TO INSPECT THE WORKS**

28.1 The Engineer may reject the work in question, or require it to be uncovered, in the event of any failure by the Contractor to inspect and/or test at a Quality 'Hold Point' by Contractor's Quality Department.

**(z) FAILURE OF THE CONTRACT TO TEST THE WORKS**

- 29.1 If the Contractor fails to test, either type test or routine test or qualification test, for each batch of goods or elements of the Works, then the Engineer shall arrange for third party inspection. The Engineer shall recover two times the actual cost associated with testing, including the services of any specialised personnel or independent assessors, and will deduct such cost from the Contractor.

<b>REQUEST FOR INSPECTION(RFI) FOR</b>	
(Detail Area to be inspected)	
Client:	Contractor:
RFI No:	Date:
<p>We request you kindly arrange for the inspection / Checking of the following Works.</p> <p>(Provide brief description about salient details of the Contract No)</p>	
Contract item No: Specification Clause no: ITP/Hold Point details:	Specific area and detail that are requested to be inspected
1.Chainage/Location:	Safety Precaution taken: Yes/No
Brief Description of Works:	Check list to be enclosed: Yes/No
Requested by:	
Name:	Position: Date & Time:
Signature:	
Enclosure: (Attach QA/QC form/checklist etc appropriate to inspection)	
<b><u>Comments / Recommendations of Engineer</u></b>	
Engineer's OBJECTION / NOTICE TO PROCEED	
(Provide details if OBJECTION)	
Received Copy by Contractor's Representative:	
Name:	Position: Date & Time:
Signature:	

Note: R.F.I to be submitted at least 24 hours prior to the inspection.

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX - 7**

**DRAUGHTING AND CAD STANDARDS**

## APPENDIX – 7:DRAUGHTING AND CAD STANDARDS

### 1. INTRODUCTION

- The purpose of this document is to define the minimum Drafting and CAD standard to be achieved by the Contractor for all drawings produced by the Contractor for the purpose of the Works. The Contractor shall produce and obtain the Engineer’s Notice to proceed to a CAD Manual which defines the standards and procedures for producing drawings. This will be co-ordinated with the CAD Manuals produced by the Interfacing Contractors.
- By defining a common format for the presentations of drawings and CAD files, the exchange of drawn information is improved and will maximise the use of CAD in the co-ordination process.
- All submissions shall be made to the Engineer in a format reviewed without objection by the Engineer and in accordance with the Contract requirements.
- Paper and drawing sizes shall be “A” series sheets as specified in BS 3429.
- The latest available versions of the following software, compatible for use with Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

<u>Document Type</u>	<u>Electronic Document Format</u>
Text Documents	MS Word, Ver. 2010
Spread Sheets	MS Excel, Ver. 2010
Data Base Files	MS Access, Ver. 2010
Presentation Files	MS PowerPoint, Ver. 2010
Programmes	Primavera P6 (now Oracle PPM) AutoCAD
Graphics	Corel Draw, Ver. 8.0/ AutoCAD Ver.14
Photographic	Adobe Photoshop, Ver.4.0
Desktop Publishing	Page Maker 6.5,5
CADD Drawings	AutoCAD
ESRI Shape Files	ARC-GIS

(1) Media for Electronic File Submission

Two copies shall be submitted on separate DVDs, unless otherwise stated.

(2) Internet File Formats/Standards

- The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Employer / Engineer.
- All the data formats or standards must be supported by Microsoft Internet Explorer version 2007 or above running on Windows XP, Vista or Windows 7.
- The following lists the file types and the corresponding data formats to be used on Internet.

The Contractor shall comply with them unless prior Notice is obtained from the Engineer for a different Data format:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF or JPEG
Computer Aid Design files (CAD)	Computer Graphics Metafile (CGM)
Video	Window video (.avi) / MP4
Sound	Wave file (.wav)

(3) The following states the standards to be used on the Internet when connecting to database(s). The Contractor shall comply with them unless prior Notice is obtained from the Engineer for a different standard:

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

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

**2. GENERAL REQUIREMENTS**

**2.1 General**

- (1) The Engineer shall provide a title block similar to that used in the Employer’s Drawings.
- (2) Each drawing shall be uniquely referenced by a drawing number that shall define both the current status and revision of the drawing, as described in Section 5 of Volume 7. The current status of each drawing shall be clearly defined by the use of a single letter code as follows:

- P - Preliminary Design Drawing
- D - Definitive Design Drawing
- C - Construction Reference Drawing
- W - Working Drawing
- B - As-Built Drawing
- M - As Manufactured Drawing
- E - Employer's Drawing

**2.2 Types of drawings**

- (1) **"As-Built Drawings"**: means those drawings produced by the Contractor and endorsed by him as true records of construction of the Permanent Works and which have been given a notice from the Engineer..
- (2) **"Construction Reference Drawings"**: means those drawings referred to in Clause C2(8) of the Employer's Requirements - Design in respect of which a Notice has been issued.
- (3) **"Design drawings"** means all drawings except shop drawings and as-built drawings.
- (4) **"Site drawings and sketches"** means the drawings, often in sketch form, prepared on site to describe modifications of the Working drawings where site conditions warrant changes that

do not invalidate the design.

**“Shop drawings”** means special drawings prepared by the manufacturer or fabricator of various items within the Works to facilitate manufacture or fabrication.

**"Working Drawings" means** the Construction Reference Drawings and such other **drawings** and documents, such as bar bending schedules and manufacturing drawings, as are necessary to amplify the Construction Reference Drawings for construction purposes, some of which may be endorsed by the Engineer.

### **3. COMPUTER AIDED DESIGN & DRAFTING (CAD) STANDARDS**

#### **3.1 Introduction**

**Scope of Use;** Data input procedures between the Engineer and Contractors must be co-ordinated, and the key parameters used to form CAD data files must be standardised. The Contractor shall be responsible for coordinating with the Engineer and Interfacing Contractors to prepare, and obtain the Engineer's Notice to proceed to a CAD Manual setting out the production standards and procedures for CAD data files. The production of all CAD data files shall comply with the following requirements.

#### **3.2 Objectives**

The main objectives of the CAD standards are as follows:

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

#### **3.3 General**

1. To facilitate co-ordination between Contractors, it is a requirement that all drawings issued by Contractors for co-ordination or record purposes shall be produced using CAD methods. Drawings shall be issued in digital format in addition to the paper copies.
2. The intent of the issue of digital information is to aid the related design by others. The definitive version of all drawings shall always be the paper or polyester film copies which have been issued by the Contractor or organisation originating the drawing.
3. Drawings and drawing packages issued for co-ordination, record purposes or for acceptance shall be accompanied by a complete set of the corresponding CAD data files.



4. Any Contractor or organisation making use of the CAD data from others shall be responsible for satisfying himself that such data is producing an accurate representation of the information on the corresponding paper drawing which is satisfactory for the purpose for which he is using it. Provided the general principles of this section have been achieved by the originator of the CAD data, Contractors making use of the CAD data from others shall not be entitled to require alterations in the manner in which such CAD data is being presented to them.
5. In particular, automatic determination of physical dimensions from the data file shall always be verified against the actual figured dimensions on the paper or polyester drawings. Figured dimensions shall always be taken as correct where discrepancies occur.

### **3.4 Terminology & Associated Standards / Guidelines**

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

### **3.5 Paper Drawings**

- Hard copies of the drawings, i.e. paper, are considered to be the main vehicle for the receipt and transmittal of design and production information, typically plans, elevations and sections.
- The Project wide accepted media for the receipt and transmittal of "Paper" drawings will be paper and polyester film of various standard ISO "A" sizes. The composition of this information shall be derived from a CAD "Model", as noticed by the Engineer.
- The CAD derived "Paper" drawing composition will reflect a window of information contained within a CAD "Model Space" file together with a selection of information contained within the associated CAD "Paper Space" file.

### **3.6 CAD Data Creation, Content & Presentation**

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

- (1) Model Space Files
  - a) Typically CAD "Model Space" files are required for general arrangement and location plans and will consist of a series of other "Model Space" referenced CAD files covering the total design extents at a defined building level (the number of referenced files should be kept to an absolute minimum). Data contained within a CAD "Model Space" files is drawn at full size (1:1) and located at the correct global position and orientation on the Project Grid / or defined reference points.
  - b) Each CAD "Model Space" file will relate to an individual discipline. Drawing border / text, match / section lines or detailed notation shall NOT be included within a CAD "Model Space" file. Dimensions shall be included within a CAD "Model Space" but located on a dedicated layer. Elevations, Long Sections and Cross Sections shall also be presented in CAD "Model Space" as defined above, but do not

need to be positioned and orientated on the Project Grid.

(2) Paper Space CAD Files

- a) Paper Space” CAD files are utilised to aid the process of plotting “Paper” drawings and are primarily a window of the CAD “Model Space” file. A “Paper Space” CAD file will typically contain drawing borders, text, match or section lines & detailed notation. Once these files are initially set up and positioned the majority of “Paper Drawing” plots at various Noticed scales are efficiently and consistently generated by displaying different combinations of element layers and symbology contained within the “Paper Space” file and the referenced “Model Space” files.
- b) The purpose is to ensure that total co-ordination is achieved between the CAD “Model Space” file and the “Paper Drawing” output during the revision cycle of the design and production process. Duplicated data in “Model and Paper Space” files will not be acceptable unless an automatic update link exists between the two data sets. “Paper Space” files are not typically required as part of the CAD Media Receipt from Contractors, unless specifically requested by the Engineer.

### 3.7 CAD Quality Control Checks

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

### 3.8 CAD Data Transfer Media and Format

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

- a) Data Exchange Format - AutoCAD Release 14 or latest version.DWG
- b) Operating System - Windows NT, Windows Vista or Windows 7
- c) Data Transfer Media shall be submitted on DVD-RW Discs, of at least 4.0 GB.
- d) All DVDs must be labelled with a stick-on circular data sheet with the following details:
  1. Name of Contractor and/or Company
  2. Project Title
  3. Drawing Filenames
  4. DVD Reference No. & Total No. of DVDs
- (e) All media shall be submitted with a completed Transmittal Form, refer to Attachment A2 of Section A of this Volume 3.

- (f) The Contractor must ensure the supplied media is free from all virus's, spam, shareware, etc..
- (g) Sub-directories on DVDs are not permitted. If CAD Data is created using UNIX, archive commands must be unrooted.

### 3.9 CAD Media Receipt & Transmittal

- (1) CAD Media Transmittal forms from the Contractor to the Engineer will consist of the following:
  - (a) CAD Digital Media DVDs shall typically contain CAD "Model Space" and "Paper Space" files.
  - (b) CAD data sheet
  - (c) CAD issue / revision sheet
  - (d) CAD Quality Checklist confirming compliance.

Plot of each "Model Space" file issued on an A1 drawing sheet (to best fit).

- (2) The above CAD media will be collectively known as "CAD Media Transmittal Set". The CAD data file transmittal format required by the Engineer from all contractors shall be AutoCAD Version 14 or latest version.
- (3) All CAD media received from Contractors will be retained by the Engineer, as an audit trail / archive of a specific Contractor's design evolution.
- (4) CAD Media Receipt, issued by the Engineer to the Contractor.
  - (a) CAD media should normally be obtained from the respective Interfacing Contractor(s), but should the Engineer issue CAD media it will consist of the following:
    - (i) CAD Digital Media DVDs typically contain only CAD "Model Space" files.
    - (ii) CAD data sheet.
    - (iii) CAD issue / revision sheet
  - (b) The above CAD media will be collectively known as the "CAD Media Receipt Set".  
  
The CAD data file transmittal format used by the Engineer to all Contractors will be in AutoCAD (version 14)
  - (c) Each CAD transmittal disk / tape will be labelled with proper disk label as Noticed by the Engineer. Any CAD data transmitted without this label is assumed to be provisional information not to have been quality checked and therefore not formally issued.

#### Revisions

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

all levels on.

**Block Libraries, Blocks, & Block Names**

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

**AD Dimensioning**

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

**3.10 CAD Layering**

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

**3.11 Global origin, Location & Orientation on the Alignment Drawing.**

- (1) Location or Plan information in "Model Space" files shall coincide with the correct location and orientation on the Project grid for each specific contract.
- (2) Location plans shall have at least three setting out points shown on each CAD "Model Space" file. Each setting out point shall be indicated by a simple cross-hair together with related Easting's and Northings co-ordinates.

**3.12 Line Thickness and Colour**

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

Colour	Code No	Line Thickness
Red	10	0.18
White	7	0.25
Yellow	2	0.35

Brown	34	0.5
Blue	130	0.7
Orange	30	1
Green	3	1.4
Grey	253	2

### 3.13 CAD Utilisation of 2D & 3D Files

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

### 3.14 CAD File Numbering

- (1) Contractors CAD File Numbering shall be described in 2.2 above.
- (2) The Employer will not be required to produce numerous CAD files, but if they issue any the drawings shall follow the required Contract numbering system, except that the status of the drawing in clause 2.1(3) shall be "E".

### 3.15 CAD File Naming Convention – General

CAD "Model Space" files shall be named in accordance with general drawing conventions.

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**EMPLOYER'S REQUIREMENTS**

**APPENDIX - 8**

**WORKS AREAS & TEMPORARY POWER SUPPLY**

## **APPENDIX – 8:WORKS AREAS & TEMPORARY POWER SUPPLY**

### **1. INTRODUCTION**

- The Contractor shall provide within the designated principal Works Areas, at locations agreed with the Engineer, the compounds and facilities for the Employer, the Engineer, the Contractor and Project Contractors of the Employer as described elsewhere in this Contract and to the engineering conditions defined under Clause 2 of this Appendix 8.
- The standard conditions applying to the use of any Works Area by the Contractor for its site facilities are given under Clause 2 of this Appendix.
- The Conditions for supply of electricity by the Contractor to Interfacing Contractors are given under Clause 3 of this Appendix.
- Other aspects of design, supply and construction within works areas, including structures within works areas shall be covered by the relevant parts of the Specification.

### **2. STANDARD ENGINEERING CONDITIONS**

The following standard engineering conditions apply to all Works Areas:

#### **(1) Formation**

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

#### **(2) Roads & Parking**

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

#### **(3) Drainage & Sewerage**

- a) All storm or rainwater from the Works Areas including any access roads thereto shall be conveyed to the nearest stream course, catch-pit, channel or storm water drain as required by the Engineer. All temporary and permanent works shall be carried out in such a manner that no damage or nuisance are caused by storm water or rain water to the adjacent property.

- b) No drain or watercourse shall be used without a notice issued from the Engineer.
  - c) Damages or obstructions caused to any watercourse, drain, water-main or other installations within or adjoining the Works Areas shall be made good to the satisfaction of the Engineer.
  - d) Treatment and disposal of sewage and wastewater from the Works Areas shall be provided to the satisfaction of the Engineer.
- (4) Buildings
- (a) No permanent structures other than those required for the Permanent Works shall be temporarily permitted on the Works Areas.
  - (b) Electricity, water, telephone and sewerage shall be provided by the Contractor, as required, for all temporary buildings.
  - (c) No public supply potable water shall be used for heating, cooling and humidification purposes, or vehicle washing without a notice from the Engineer.
- (5) Pedestrian Access
- Every existing pedestrian access throughout the Works Areas shall be maintained in a usable condition at all times to the satisfaction of the Engineer including lighting, signing and guarding.
- (6) Fencing
- The Works Areas shall be secured against unauthorised access at all times. In particular fencing or the like shall be maintained, removed and re-erected in the new location wherever and whenever a Works Area is relinquished in stages.

### **3. ELECTRICAL SUPPLY CONDITIONS**

#### **3.1 Work on Site**

- a) The Contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Engineer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring the safety of all temporary electrical equipment on Site. The Contractor shall not install or operate any temporary Site electrical systems until this representative is appointed and has commenced duties.
- b) The name and contact telephone number of the representative having been reviewed with a Notice to proceed by the Engineer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.
- c) Schematic diagrams and the details of the equipment for all temporary electrical installations shall be submitted by the Contractor, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for a notice.



- d) All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorised electricians, who are registered as such under the Electricity Ordinance 1990 / Electricity (Registration) Regulations 1990.

### **3.2 Electrical General**

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

- a) Indian Electricity Rules
- b) The Power Companies' Supply Rules;
- c) Electricity and its subsidiary Regulations;
- d) IEE Wiring Regulations (16<sup>th</sup> Edition);
- e) BS 7375 Distribution of Electricity on Construction and Building Sites;
- f) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites; and
- g) Any other applicable national standards

### **3.3 Materials, Appliances and Components**

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

### **3.4 Design Considerations**

1. Distribution equipment utilised within the temporary electrical distribution system shall incorporate the following features:-
  - a. flexibility in application for repeated use;
  - b. suitability for transport and storage;
  - c. robust construction to resist moisture and damage; and
  - d. safety in use.
2. All cabling shall be run at high level whenever possible and be firmly secured to ensure they do not present a hazard or obstruction to people and equipment.
3. The installation on Site shall allow convenient access to authorised and competent operators to work on the apparatus contained within.

### **3.5. Mains Voltage**

1. The Site mains voltage shall be as per the Electricity Authority, 415V / 3 phase 4 wire system.
  - (a) Single phase voltage shall be as per the Electricity Authority, 230V supply. (b) Reduced voltages shall conform to BS 7375.
2. Types of Distribution Supply  
The following voltages shall be adhered to for typical applications throughout the distribution systems:

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

**3.6. Earthing**

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

**3.7. Plugs, Socket Outlets and Couplers**

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

**3.8. Cables**

- 1. Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346.

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

Flexible cables shall be in accordance with BS 6500 and BS 7375.

### **3.9. Lighting Installation**

- 1 Where Site inspection of the Works is required during the nights, the Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.
- 2 Voltage shall not exceed 55V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.
- 3 Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.
- 4 The Contractor shall upgrade the lighting level to a minimum of 200 lux by localised lighting in all areas where required by the Engineer.
- 5 Mechanical protection of luminaries against damage by impact shall be provided by use of wire guards or other such devices whenever risk of damage occurs.

### **3.10. Electrical Motors**

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

**3.11. Inspection and Testing**

Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16<sup>th</sup> Edition).

**3.12. Identification**

Identification labels of a type reviewed with a notice of no objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.

**3.13. Maintenance:**

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

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**EMPLOYER'S REQUIREMENTS**

**APPENDIX - 9**

**APPROVED MANUFACTURERS / SUPPLIERS**

## **APPENDIX – 9: APPROVED MANUFACTURERS / SUPPLIERS**

All materials and products shall conform to the relevant standard Specifications, IS codes and other relevant codes etc. and shall be of approved make and design.

There are currently no approved manufacturers and suppliers for the Link Road at Dahisar (West) in BMC limit to Bhayander (West) in MBMC limit.

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**EMPLOYER'S REQUIREMENTS**

**APPENDIX - 10**

**HORIZONTAL AND VERTICAL ALIGNMENT**

## **APPENDIX – 10: HORIZONTAL AND VERTICAL ALIGNMENT**

All details with regard to the Horizontal and Vertical Alignment are shown on the plan and profile sheets of the Employer's Drawings provided in Volume 6 of the Contract.

The Contractor has to carry out his own detailed survey based on which the geometric design of horizontal and vertical alignment shall be prepared using industry approved software's like CIVIL 3D or OPENROADS. The geometric design shall be based on the information provided in the tender drawings; deviation from the horizontal alignment given in the tender drawings is generally not permitted. Work shall proceed only after obtaining the Notice to proceed from the Engineer for the Contractor's alignment design.



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**EMPLOYER'S REQUIREMENTS**

**APPENDIX-11**  
**UTILITIES**

## APPENDIX-11:UTILITIES

### DEFINITIONS Utilities-

Utilities are defined as public utilities above or below ground and include all live water mains, water wells, power cables, street lights, transformers, telephone posts, telecommunication cables, sewers, storm water drains shown on the Employer's Drawings OR are uncharted and are therefore not shown on the Employer's Drawings.

### Charted Utilities-

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

### Uncharted Utilities-

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

### Responsibility of the Contractor

- (1) The Contractor shall make his own enquiries and investigations, including excavating trial holes, to ascertain the existence, nature, location and size of utilities. A schedule of utility diversions and utilities to remain but to be supported (the utility diversion plan) shall be prepared by the Contractor and submitted with the Preliminary Design. The schedule will list out utilities that:
  - will be diverted by the Contractor during the course of the Works, and
  - will remain in place and require the use of specific construction protection methods to complete the underground structures around and below the utilities including support of the utilities during construction.
- (2) The Contractor shall take into consideration the time required for utility diversions into the overall Works Programme for the Contract. However, efforts shall be made to avoid diverting/disturbance of any utility and continue the Works by supporting the same but the required services being provided by these utilities shall be maintained at all the times at the cost of the Contractor.
- (3) The diversion work shall be undertaken by the Contractor as per the approval of the Utility owning Agencies and a Notice from the Engineer. Temporary supports and protection by methods proposed by the Contractor and agreed by the Utility Agency shall be provided to the utilities. Permanent supports and protection shall be provided wherever required for the safety and security of the utility service.
- (4) The Contractor shall immediately inform the Engineer and the Utility Agencies of any
  - (a) damage to utilities;
  - (b) leakage of utilities;
  - (c) discovery of utilities not previously identified.
- (5) When diverting and/or protecting sewerage and stormwater lines the Contractor shall ensure that drainage to the site and adjacent areas is maintained at all times and that no times flooding or other nuisance occurs.
- (6) The Contractor shall inform the Engineer of the programme of all works of utility diversion/ protection works and shall take all steps to enable the utility diversions to proceed

in accordance with the programme. The Contractor shall maintain close liaison with the Utility Agencies. The Contractor shall set up and manage a Utility Liaison Group of experienced personnel for the duration of the Contract.

- (7) Records of the existing utilities encountered shall be kept by the Contractor on the Site and a copy provided for the Engineer. The records shall contain the following details :
- location of utility;
  - date on which the utilities were encountered;
  - nature and sizes of the utilities;
  - condition of utility;
  - temporary or permanent supports provided; and
  - diversions made –Temporary or permanent
- (8) The Contractor shall include the details (plan, location, ownership, size and material) of all such utilities on the As Built Drawings.

**Diversion and Protection of Underground/Overhead Utility Lines**

- (9) The work comprises of replacement, relocation, diversion and protection of existing sub- surface, surface and overhead public utilities viz. sewer mains, water lines, water wells, storm water drains, gully pits including connection pipes, house drains, gas pipe lines, electric and telephone cables, optical fibre cables including their appurtenance structure, O.H. electrical transmission line, electric poles, traffic signals, etc... which will be disturbed due to construction of the Road structures, where applicable.
- (10) The Contractor at his own cost shall divert and/or effectively protect all public utilities falling within the vicinity of the Link Road at Dahisar (west) in BMC limit to Bhayander (West) in MBMC limit structures and features and their immediate adjoining areas or which are likely to be exposed, disturbed or damaged during the execution of the work or in consequence thereof, in such a manner and using such materials as required or specified by the concerned Public Utility Agencies and as per instruction of the Engineer, and hold them in proper position without any damage being caused to them during execution of work.
- (11) The Contractor shall have to bear the expenses of providing and laying pipes, water wells, gas mains/gully pit connections/house drains and other electric, telephones, optical fibre cables and other cables or any other underground structures or services falling within the weaving length, ramp, and their immediate adjoining areas which may be found to have been disturbed or damaged due to the Contractor's fault and/or defective and careless workmanship. The decision of the Engineer in this respect shall be binding and final and all costs of rebuilding or repairing of such damaged services or structures as aforesaid shall be deducted from the Contractor, if the same is not taken care of within a reasonable time frame, mutually agreed between the Engineer and the Contractor.
- (12) The Contractor shall enquire of and collect information from all concerned Public and Private Utility Agencies, Owners, Government Departments and local bodies in connection with the sewer lines, water mains, water wells, cables, wires and any other obstruction either overhead or on ground or underground which may be encountered in the course of execution

of the work and which are likely to affect the progress of the work, at his own cost and risk. No idle labour charge will be admissible on account of delay in collecting the above-mentioned information.

- (13) The Contractor shall have to excavate trial trenches of suitable sizes for satisfactorily exploring all the underground utilities as required and as Noticed by the Engineer before commencement of any permanent work below ground level.

The time of completion for the project is inclusive of diverting and/ or protection (temporary as well permanent) of utilities.

**Additional Conditions for Diversion/Protection of Utilities on/under/above the Link Road at Dahisar (west) in BMC limit to Bhayander (West) in MBMC limit BMC's Water Department and Drainage Sewer Department**

- (14) It is the responsibility of the Contractor to get the approval from the relevant BMC's departments for the proposed water/sewer pipeline diversion/shifting. However, the Employer will facilitate the co-ordination work with BMC's departments for getting necessary approvals.
- (15) The shifting/diversion of pipeline work have to be carried out by engaging the BMC registered contractors.
- (16) BMC engineers will supervise the work. The BMC utility contractors have to carry out the work as per the instruction of the BMC engineers during diversion work by the Contractor.
- (17) In case of permanent diversion of water/sewer pipelines, it is the responsibility of the Contractor to carry out such work without affecting water supply/without affecting sewage disposal. If required alternative temporary arrangement have to be made.
- (18) In case of temporary water pipe/sewer pumping mains (without manholes) diversion (which means divert the pipeline temporary away from station box and brought back to the original position after completion of station work), it is the responsibility of the contractor either to use the retrieved diverted pipes or new pipes to restore back the original place without affecting the water supply.
- (19) In case of temporary diversion of gravity sewer pipelines with manholes are required, the contractor, initially before taking up the station work has to ensure that the flow is diverted by laying sewer pipeline and constructing manholes away from the station box and then only divert the flow. After completion of station work, the contractor have to lay again another sewer pipelines and again construct new manholes for restoring back to the original place.
- (20) In case of temporary supporting of water/sewer pipelines, if any damages occurred during construction period it is the responsibility of the contractor to rectify the damages to the satisfaction of BMC Engineers. The cost of the rectification works shall have to be borne by the contractor if not quoted in the Tender document.
- (21) It is the responsibility of the Contractor to obtain completion certificate from the relevant department of BMC for each diversion work. The final bill be paid only after obtaining a completion certificate from BMC.

**Electricity-BEST / TATA**

- (22) The Contractor shall be responsible for diversion of utilities with respect to the BEST/TATA works. However, the Employer will facilitate the co-ordination with the BEST/TATA. The Contractor shall carryout the diversion works complying with the following conditions.
- (23) The Contractor shall submit the utility diversion programme to the Engineer with diversion justification based on trial pit information.
- (24) The Contractor shall submit the diversion plan to the Engineer at least 60 (sixty) days in advance of work commencing to obtain approval from BEST/TATA. For utility diversion proposals of BEST/TATA utilities, the Contractor shall submit diversion justification with trail pit information and drawing(s) with the proposed diversion route(s).
- (25) The Contractor would submit application of diversion works to BEST/TATA with diversion plans. The contractor shall render necessary assistance.
- (26) The Contractor shall coordinate with the BEST/TATA local officials to assess quantities and specifications of materials required for diversion works. Necessary assistance would be provided by the Employer and Engineer.
- (27) The Contractor shall obtain necessary permission from the concerned departments to carryout the diversion/shifting works and get necessary permission from the Traffic Police Department.
- (28) Wherever possible, trenchless technology should be considered at location where utility diversion works crosses roadways and require lane closures for excavation to avoid inconvenience to the traffic.
- (29) The electrical utilities diversion/ shifting should be carried out by Contractors registered with BEST/TATA / CPWD and have C or A grade licence from Chief Electrical Inspector to the Government. The Contractor should be well acquainted with electrical works so as to maintain the BEST/TATA standard. Contractor shall inform the same to the Engineer for getting consent from the BEST/TATA.
- (30) The Contractor shall identify the quantity of materials required for the contract such that the material can be procured in bulk and in advance to the implementation of the utility diversion works. The quality of materials to be procured shall be approved by BEST/TATA. Materials used for diversion / shifting shall be of quality conforming to the applicable BEST/TATA standard and as per relevant ISS.
- (31) The source of materials and the guarantee for the materials to be used shall be submitted to the Engineer for obtaining approval from BEST/TATA. Any failure of the material within the guarantee period shall be replaced and installed free of cost by the Contractor.
- (32) Contractor shall inform the local BEST/TATA officers about the diversion works at least 15 (fifteen) days before the execution of diversion.
- (33) The diversion / shifting utility work shall be carried out under the direct supervision of BEST/TATA officials and BEST/TATA decision is final in this regard.

The Contractor shall provide free access to BEST/TATA officers / workmen for the purpose of inspection / supervision.

- (34) After restoration of regular service completion certificate to be obtained from BEST/TATA.

The regulations for working with BEST/TATA are as follows;

- a. The diversion/shifting utility work should be carried out without causing any inconvenience to the operation and maintenance of Sub-Station and other departmental works of BEST/TATA.
- b. The Contractor shall execute and complete the work strictly in adherence to the time schedule and to the satisfaction of BEST/TATA engineers and adhere strictly the direction of BEST/TATA in any matter.
- c. The Contractor shall be responsible to protect the public and the employees of BEST/TATA against any accident that may arise during the execution of diversion/shifting utility works. The Contractor shall indemnify the Employer for any claims for damages/injuries to the person/property resulting from any such accident. The Contractor shall take steps to properly insure against claims under the Workmen's Compensation Act by the way of obtaining an accident risk type insurance to meet all purpose of relief, failing which or otherwise the Contractor shall be solely responsible for meeting the compensation awarded under the said Act.
- d. The Contractor shall undertake to ensure free flow of traffic during execution of the diversion/shifting works and shall be responsible any accident/loss of lives/property. Damage to the other existing utilities during diversion to be rectified by the Contractor free of cost.
- e. The Contractor shall employ qualified technical personnel to carry out the diversion/shifting of utility works.
- f. The Contractor shall apply well in advance for Line Clearance (LC) for carrying out the joint works/shifting works. Employer would authorise the Contractor to take LC from BEST/TATA. If needed, EMPLOYER would provide assistance to the Contractor to get the LC. The LC will be given by BEST/TATA depending upon exigencies, which have to be strictly adhered to.
- g. The Contractor shall handover all the retrieved / unused material to the stores of BEST/TATA/concerned department. The conveyance shall be at the Contractor's cost.
- h. Contractor should undertake not to revoke the above conditions until the completion of diversion/shifting works.

**All the above shall apply in case of private electric companies as well. BMC's Road Department**

- (35) Diversion of Storm water drain shall be carried out as per the design, standard and general specifications of BMC's Road Department / Highways Department.
- (36) The diversion route for storm water drain shall be approved by BMC's Road Department/ Highways Department.
- (37) The invert level of diverting drain shall be maintained on par with upstream/downstream of connecting drains.

- (38) The Contractor shall make alternate arrangements to divert and ensure smooth flow of water from upstream side during construction.
- (39) The Contractor shall provide 0.9 x 0.9 m and 1.2 x 1.2 m sizes of drain or follow the existing sizes.
- (40) Diversion of storm water drain shall be carried out through the registered contractors of BMC's Road Department/ Highways Department.
- (41) The Contractor shall obtain No objection certificate from BMC's Road Department upon completion of diversion works for making payment
- (42) The Contractor shall make necessary preventive measures to avoid damages to the adjoining building and compound wall.

**Telecom- MTNL and Private Companies**

- (43) The Contractor shall obtain concurrence from the respective Telecom Companies to carry out the utilities diversion. The Contractor shall be responsible for diversion of utilities with respect to the Telecom Companies works. However, the Employer will facilitate the co-ordination with the relevant Telecom Companies. The Contractor shall carryout the diversion works complying with the following conditions.
- (44) The Contractor shall submit the utility diversion programme to the Engineer with diversion justification based on trial pit information.
- (45) The Contractor shall submit the diversion plan to the Engineer at least 60 (sixty) days in advance of work commencing to obtain approval from the respective Telecom Companies. For utility diversion proposals of Telecom utilities, the Contractor shall submit diversion justification with all information and drawing(s) with the proposed diversion route(s).
- (46) The Contractor would submit application of diversion works to the respective Telecom Companies with diversion plans. The Contractor shall render necessary assistance.
- (47) The Contractor shall coordinate with the respective Telecom Companies local officials to assess quantities and specifications of materials required for diversion works. Employer / Engineer would facilitate the coordination work in this regard.
- (48) The Contractor shall obtain necessary permission from the concerned departments to carry out the diversion/shifting works and also get necessary permission from the Traffic Police Department.
- (49) Wherever possible, trenchless technology should be considered at location where utility diversion works crosses roadways and require lane closures for excavation to avoid inconvenience to the traffic.
- (50) The utilities diversion/ shifting should be carried out by Contractors registered with the respective Telecom Companies. The Contractor should be well acquainted with the works so as to maintain the Telecom Companies standard. Contractor shall inform the same to Engineer for getting consent from the respective Telecom Companies.
- (51) The Contractor shall identify the quantity of materials required for the contract such that the material can be procured in bulk and in advance to the implementation of the utility diversion works. The quality of materials to be procured shall be approved by the respective

Telecom Companies. Materials used for diversion / shifting shall be of quality conforming to the applicable the respective Telecom Companies standard and as per relevant ISS.

- (52) The source of materials and the guarantee for the materials to be used shall be submitted to the Engineer for obtaining approval from the respective Telecom Companies. Any failure of the material within the guarantee period shall be replaced and installed free of cost by the Contractor.
- (53) Contractor shall inform the respective local Telecom Companies officers about the diversion works at least 15 (fifteen) days before the execution of diversion.
- (54) The diversion / shifting utility work shall be carried out under the direct supervision of the respective Telecom Companies officials and the respective Telecom Companies decision is final in this regard.

The Contractor shall provide free access to Telecom Companies officers / workman for the purpose of inspection / supervision.

- (55) After restoration of regular service completion certificate to be obtained from the concerned departments. The regulations for working with the respective Telecom Companies are as follows;
  - a. The diversion/shifting utility work should be carried out without causing any inconvenience to the operation and maintenance.
  - b. The Contractor shall execute and complete the work strictly in adherence to the time schedule and to the satisfaction of the respective Telecom Companies engineers and adhere strictly the direction of the respective Telecom Companies in any matter.
  - c. The Contractor shall be responsible to protect the public and the employees of the respective Telecom Companies against any accident that may arise during the execution of diversion/shifting utility works. The Contractor shall indemnify the Employer for any claims for damages/injuries to the person/property resulting from any such accident. The Contractor shall take steps to properly insure against claims under the Workmen's Compensation Act by the way of obtaining an accident risk type insurance to meet all purpose of relief, failing which or otherwise the Contractor shall be solely responsible for meeting the compensation awarded under the said Act.
  - d. Contractor shall undertake to ensure free flow of traffic during execution of the diversion/shifting works and shall be responsible any accident/loss of lives/property. Damage to the other existing utilities during diversion to be rectified by the Contractor free of cost.
  - e. The Contractor shall employ qualified technical personnel to carry out the diversion/shifting of utility works.
  - f. The Contractor shall handover all the retrieved / unused material to the stores of the respective Telecom Companies/concerned department at the Contractors cost.
  - g. Contractor should undertake not to revoke the above conditions until the completion

of diversion/shifting works.



**General**

- (56) The contractor shall provide a 6 months rolling programme every 3 months.
- (57) Supervision Charges, if any levied by the Utilities Departments / Agencies shall be borne by the Contractor.

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**APPENDIX – 12**

**SITE ACCOMMODATION FOR THE ENGINEER**

## APPENDIX – 12: SITE ACCOMMODATION FOR THE ENGINEER

1. The Contractor shall provide Site Accommodation (total area approx. 250m<sup>2</sup> for Dahisar side and 100m<sup>2</sup> on Mira Road side) for the Engineer's. Staff according to the following schedule of offices:

Type	No. of Staff	Area m <sup>2</sup>	Total Area m <sup>2</sup>
Employer / General Consultant Staff	3	10	30
Project Manager Office	1	10	10
Project Manager Staff	8	7.5	60
Project Manager Staff	8	5.0	40
Senior Resident Engineer Office	1	10	10
Resident Engineer Office	2	7.5	15
Site Engineer Office	4	5	20
Site Inspectors	8	2.5	20
General Office / Reception Area	-	15	15
Rest Rooms (washroom/toilet)	-	5	10
Kitchen	-	10	10
Meeting Room	-	15	15
<b>Total</b>			250

2. Offices shall be accessible only from a corridor within the building. The corridor and reception area entrances shall be provided with an external double door.
3. Materials for the construction shall be new, robust and durable. The building shall be weatherproof, vermin proof, well insulated thermally and acoustically. Internal walls shall be soundproofed. Electrical power and lighting, including all fixtures and fittings, power, telecoms and internet sockets, shall be provided to each room, including air conditioning and heating to maintain the internal temperature within the range of 20 to 24 degrees Celsius at all times. A standby generator shall also be provided and installed with an automatic switchover.
4. Internal doors shall be flush, fitted with door closers, mortise locks with keys and lever handles.
- External doors shall be a pair of solid core doors, external quality, hung on heavy duty hinges, one leaf fitted with barrel bolts top and bottom and the other leaf fitted with a Yale or similar lock.
  - Windows, of area not less than 10% of the floor area, shall be provided to all rooms, securely barred, fitted with blinds and having opening sections fitted with locks and mosquito screens.

- The building shall be provided with a continuous water supply and drainage to Kitchen, Washroom and Toilets. The Toilets shall be equipped with low level suites and be adequately ventilated through the ceiling.
- The Kitchen shall be fitted out with a 2 drainer stainless steel double sink unit, hot water heater, worktop with cupboards under, tiling above the sink and worktop and wall mounted cupboards.
- Fire and Safety regulations shall be complied with and fire fighting equipment shall be provided in accordance with the recommendations of the Maharashtra State Fire Service.
- The Contractor shall provide, erect and maintain appropriate name boards as specified, for each of the offices. The wording shall be agreed with the Engineer.
- The Contractor shall provide protective clothing and safety equipment for 25 persons, comprising, as a minimum – Safety Helmets, Safety Harness, Steel-toed construction shoes/boots (sizes to be notified), Day-Glo waistcoat, Industrial safety goggles, Industrial gloves, Breathing Masks and Filters, Ear protectors, Heavy weight suits (sizes to be notified), Lamps (with batteries), etc. as required by the Engineer
- The Contractor shall provide an adjacent shaded hard standing parking area for 20 cars.
- The Contractor shall arrange for upkeep, service and security of the offices and compound. These to be thoroughly cleaned and rubbish and waste to be removed at least once per day.
- The Contractor shall submit a detailed office layout plan showing all relevant details of these site offices, not limited to that described above, which will require a Notice from the Engineer.
- Furniture and equipment for the Engineer's office shall be provided by the Contractor.

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**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 13**

**CONTRACTOR'S SITE LABORATORY**

## **APPENDIX – 13 :CONTRACTOR’S SITE LABORATORY**

### **1. SITE LABORATORY**

- The Site Laboratory shall be approximately 250m<sup>2</sup> in area. It shall consist of the following accommodation:
 

1 concrete laboratory	60m <sup>2</sup> floor area
1 Soil laboratory	30m <sup>2</sup> floor area
2 office	each 15m <sup>2</sup> floor area
1 store room 10m <sup>2</sup> floor area	
1 kitchen 10m <sup>2</sup> floor area	
male toilets, changing room & shower	sufficient for 6 persons
  
- The remainder of the 250m<sup>2</sup> shall consist of storage area for concrete cube curing tanks. The laboratory, office, etc., shall be in one building; the curing tank and storage building may be in a separate building, but if so it shall be adjacent to the laboratory building and connected to it by a level, weatherproof passageway. In addition, an area of covered hard standing of 50m<sup>2</sup> for motor vehicles shall be provided adjacent to the laboratory.

### **2. STANDARD OF CONSTRUCTION**

- The laboratory shall be constructed to the best Employer’s engineering practice and the Engineer shall issue a Notice to Proceed. Two independent telephone lines with two extensions each shall be provided for the laboratory. Telephones shall be located in areas as agreed with the Engineer.
- A covered water tank with minimum capacity of 2000 litres shall be installed, as a source of constant water pressure (15 kPa minimum) for each laboratory.
- In the case of sinks used separating devices shall be facility for washing samples, adequate trapping and/or provided to ensure the proper functioning of the facility

### **3. FURNISHINGS AND FIXTURES**

The Contractor’s site laboratory shall be provided with required furnishings and fixtures.

### **4. LABORATORY EQUIPMENT**

- The laboratory equipment, as listed below, shall be issued a Notice from the Engineer. The Contractor shall submit for the Engineer’s Notice within 2 weeks of the order to commence work the name of the supplier he intends to use for each piece of apparatus together with the relevant catalogue and catalogue number.
- The layout of the equipment in the testing laboratory shall require a Notice to Proceed from the Engineer. The equipment shall be maintained to an accuracy appropriate to the required testing methods with routine calibration by an accredited organisation as recommended by the appropriate Authority. The Equipment shall also be calibrated after maintenance or relocation.

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

**Determining Liquid Limit (1 complete set)**

Liquid limit device (Casagrande type)	1 Set Grooving
tools	1 No. Evaporating dish
1 No. Spatula 100mm blade	1 No.
Laboratory balance, capacity 500 gm, 0.01 gms.)	1 No. (sensitivity
Wash bottle, capacity 500 ml.	1 No.
Moisture cans, capacity 50 ml.	24 Nos.

**Determining Plastic Limit (1 complete set)**

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

**Determining Moisture Content (1 complete set)**

Micro Oven, capacity 35 litres, control temperature up to 200 °c	1 No.
Balance, capacity 200 gm., sensitivity 0.01 gm.	1 set Lab.
Tongs	1 No.
Moisture cans 75ml. with lid	36 Nos.

**Compaction Characteristics (1 complete set)**

Standard compaction mould 100mm dia.	1 No. Modified
compaction mould 150mm dia.	1 No. Standard
compaction Rammer, 2.5 kg.	1 No. Modified compaction
Rammer, 4.5kg.	1 No. Straight edge 300mm long
1 No. Sample ejector for 100mm and 150mm mould	1 No.
Sample tray 60 x 60 x 8 cm	3 Nos.
Wash bottle, 500 ml.	2 Nos. Moisture
cans 250 ml.	24 Nos.

**Density of soil in-place by sand cone method (2 complete set)**

Sand density cone apparatus, 150mm	2 Nos. Plate,
300mm x 300mm with centre hold 150mm	2 Nos.
Glass jug for sand cone	2 Nos.

Chisel 25mm x 150mm	2 Nos.
Hammer	2 Nos.
One-gallon field cans	24 Nos.
Sampling spoon	2 Nos. Soft
hair brush	2 Nos.
Moisture cans 250 ml.	48 Nos.

**Sieve Analysis**

Sieve shaker (portable)	1 unit	
Coarse sieves	In Sizes from 100mm to 10mm	1 set
Fine Sieves	#4, #8, #16, #30, #40, #50, #100, #200 each)	1 set
Pans & Covers		As required

**Specific Gravity and Absorption of Coarse Aggregate**

Wire basket, 200mm dia.	5 No
Heavy duty suspension balance, 20 kg x 1 gm. with accessories for weight in water	1 set
Suitable water container	1 No

**Unit Weight of Aggregate**

Balance, 100 kg. Capacity with 10 gm precision	1 No. Tamping
rod 16mm diameter x 600mm long	1 No. Measuring
containers (3, 10, 15, 30 litres)	1 each

**Flakiness and Elongation**

Flakiness gauge, elongation index	1 set
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**Soundness Test**

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

**Concrete**

Buckets for concrete sampling	12 Nos.
Slump cone	12 Nos.
Tamping rod	12 Nos
Base plate	12 Nos.
Mixing pan for concrete	2 Nos.
Scoop for general purpose	2 Nos.
Concrete thermometer	1 No.
Concrete cylinder mould, 150mm * 300mm;	



100mm * 300mm	10 each
Concrete cube mould, 100mm cube & 150mm cube	10 each
Adjustable spanners for dismantling cube moulds	6 No.
Capping set	2 Nos.
Capping compound	As required
Concrete curing tank with capacity for 270 cubes, temperature controlled, with circulation system drain and lockable cover	5 Nos.
Schmidt test hammer	1 No.
Compression testing machine (simple hand operated)	1 No.
Mould oil	As required
Temperature chart recorder	1 No.

### Miscellaneous

Vernier callipers to measure up to 200mm, with elongated jaws	5 Nos.
Steel rule, 300mm long graduated	2 Nos.
Rubber gloves	10 pr.
Cotton working gloves	20 pr.
First aid kit	1 set
Wire brush	6 No.
Steel tape, 3m, 5m, 30m	3 each
Ballpein hammer, 1 kg	2 Nos.
Paint scraper. Approx. 100mm wide	8 Nos.
Float, steel Approx. 280mm x 120mm	8 Nos.
Sack barrow	1 No.
Shovel: Square Mouthed	2 Nos.
: Round Mouthed	2 Nos.
24-wheel trolley, heavy duty, approx. 0.7m x 1.0m with long pneumatic tyred type	1 No.
Wheelbarrow, rubber tyred	1 No.
Comprehensive tool kit. To include screwdrivers, pliers, claw hammer, multi-grips, spanners (adjustable)	1 No.
Type NR Schmidt Hammer and tester with recording device	1 No.
Testing Anvil for Schmidt Hammer test (SHT)	1 No.
Chart recording paper for SHT	10 Pkts
Cover meter for detecting metal objects to depth of 100mm below the surface of non-magnetic objects	3 No.
Noise meter	1 No.

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**APPENDIX – 14**  
**EARTHING AND GRID**

## **APPENDIX – 14: EARTHING AND GRID**

### **1 INTRODUCTION**

#### **1.1 Introduction Scope**

- (1) The purpose of this Earthing, Bonding, Lightning Protection and Corrosion Protection Policy is to define the requirements for the earthing and bonding of the electrical power supply systems and other parts of the roads and bridges sections to ensure, as far as possible:
  - the safety of operating personnel and other persons from electrical shock.
  - the minimum of electrical interference between the electrical power supply and other electrical and electronic systems and the protection of electrical equipment.
- (2) This document is divided into several sections. Sections 2 and 3 are of a general nature whilst Sections 4 to 7 deal with specific items under system and equipment-specific general headings.
- (3) It should be noted that no Single section can be taken alone as being complete in itself in covering all aspects of earthing under the general heading of that section. In the implementation of the earthing policy account has to be taken of the interrelationship, interface and integration of all systems.
- (4) The Contractor shall develop his own designs as required for Earthing, Bonding and Lightning Protection, using this document as a basis for doing so, which shall require a notice of no objection from the Engineer, prior to commencing any such works.
- (5) The Contractor shall coordinate his designs for earthing, Bonding, Lightning Protection as required with all Interfacing Contractors.
- (6) Reference in other documents to "Grounding" shall be taken to be synonymous with "Earthing".

### **2.CATEGORIES OF EARTHING**

#### **2.1 General Requirement**

The earthing system provided at any location may be common to two or more categories of earthing, in which case all the earthing points on the individual items of equipment will be bonded together to discharge any earth fault currents: In general, earthing and bonding is required under one or more of the following categories.

#### **2.2 Neutral Earthing**

- (1) Connection to earth at one or more nominally equipotential points of the current-carrying conductors of each section of the power supply system shall be arranged to ensure that the voltage at any point in the system relative to the general mass of earth will be within defined limits and will provide a low impedance path for earth fault return currents.
- (2) For low impedance earth paths to be established the ground conditions must first be measured (earth resistivity Ohms / m ) and the system designed according to the results. Allowance shall be made for the fact that conditions may vary throughout the year due to seasonal weather.

#### **2.3 Protective Earthing**

Connection to earth at one or more points of the non-current-carrying parts of electrical equipment

shall be arranged to ensure that, in the event of a failure of insulation or other inadvertent connection between current and non-current-carrying parts, no dangerous potential difference occurs between the non-current-carrying parts of the equipment and the general mass of earth or adjacent equipment, and to provide a low impedance path for earth fault currents.

#### **2.4 Adjacent Metallic Structures**

This relates to connection to earth of metallic structures, which are not part of the electrical equipment but are in close proximity to the electrical system.

#### **2.5 Mitigation of Interference Effects**

This relates to the connection to earth of the screening of light current signal and control cables. The connection to earth of the screening conductors of any light current cables will, in general, be confined to one end in order to avoid circulating currents in the screen causing interference on the signal chores.

There may be exceptions to this and EMC considerations will determine the solution to be adopted

in individual cases.

#### **2.6 Treatment of unearthed systems**

This relates to unearthed systems where the current carrying conductors are fully insulated from earth at all points. No part of such a system need to be automatically disconnected immediately on the occurrence of a single earth fault in that part. However special care needs to be taken during design and installation when considering this type of earth system.

#### **2.7 Earthing for Lightning Protection**

This relates to the protection of buildings and structures from lightning by the provision of lightning arrester and hence connection to the earth electrode system. Account shall be taken of the locality and lightning incidence rate and applied to the protection of the Systems as a whole from "Far" and "Near" strikes, individual structures and personnel protection.

### **3. GENERAL REQUIREMENTS**

#### **3.1 Legislation and Standards**

Earthing, bonding, lightning and corrosion protection has to be in accordance with applicable requirements related to the Subsea roads and bridgessystem for the purposes of this Earthing Policy, which shall be assumed to be no less onerous than the relevant requirements of the following standards:

- (a) British Standard 7361, Part 1 - Cathodic Protection - Code of Practice for Land and Marine Applications.
- (b) BS 7671 - Requirements for Electrical Installations
- (c) IEC 60364 - Electrical Installations of Buildings
- (d) IEC 61312 - Protection Against Lightning
- (e) IEC 61024-1; Protection of Structures against Lightning, Part 1: General Principles.
- (f) IEC 61024-4; Series protection against lightning electromagnetic impulses for structure with electrical and electronic systems.
- (g) IEC 61000-5 Edition1, Electromagnetic Compatibility (EMC) Part 5
- (h) BS 7430 - Code of Practice for Earthing.

- (i) ANSI/IEEE 80 - Earthing of Substations
- (j) IS—3043--EARTHING
- (k) BS-1013---SUBSTATION EARTHING
- (l) NFPA-- 780-- LIGHTNING PROTECTION
- (m) IEEE- 1100—EARTHING OF ELECTRONIC EQUIPMENT EN- 50122-2 Insulation from Earth
- (n) RDSO/SPN/144/2004 Safety and reliability requirement of electronic signalling

equipment, Local Codes. These may however conflict with International Codes/Standards in which case discussion and agreement with the employer representative will be required.

### 3.2 Treatment of AC Power Supplies

The general policy followed in this document is to provide an earth farm for each of the auxiliary substations and at other locations as required for purposes of earthing AC power supply systems under the category of Clause 2.2 and metallic enclosures and structures under Clauses 2.3 and 2.4.

- (1) The earth farms at each substation and other locations shall be multiple-interconnected by provision of bonding connections cable sheaths, cable armouring, to adjacent earth farms to form an incidental earth mat embracing the whole of the roads and bridges section..
- (2) The armouring of HV power supply cables will not be connected to the incoming supply to the bulk substation earthing system (this must be agreed with the local authority) or other mitigation measures taken. However, there shall be provision to do so conveniently on a temporary basis whilst work and testing requiring this is carried out.
- (3) Two other difficulties could arise with segregation as follows:
  - Transferred potentials will appear across insulated joints used to segregate the systems where there are interconnecting cables etc. and between adjacent structures bonded to different earthing systems
  - Provision of earthing for the screening of telecommunications cables to reduce interference (Clause 2.5 above).
- (4) For the reasons described above, the effects of the segregation will need to be monitored closely.

### 3.3 Treatment of Unearthed Auxiliary Supplies

- (1) Certain low voltage auxiliary, signalling, control or indication systems come under the category of Clause 2.6, where the ability to temporarily continue in operation with a single earth fault gives increased security of supply. The control circuit can be isolated from Earth to avoid mal operation or Nuisance Tripping of the control circuit which will therefore need its own Alarm to draw attention to this fact and hence start the fault rectification process (normally by manual investigation and maintenance operations).
- (2) The incoming power supplies to the control system however may have their own Earth Fault detection.

### 3.4 Lightning Protection

The protection of above ground structures from lightning under the category of Clause 2.7 is included within this policy document..

#### **4 OVERALL EARTHING STRATEGY FOR THE PROJECT**

##### **4.1 Earthing, Bonding, Lightning Protection and Corrosion Protection Principles**

- (1) Taking into account the previous general requirements in section 3:
  - A "Structure Earthing" strategy shall be applied throughout the project to ensure electrical safety and provide the basis of lightning protection;
- (2) All buildings I structures shall be connected to mass earth via earth farms which form part of the building I structure foundations and this earth shall be continuous through all building structures by the appropriate interconnection and bonding of all metalwork.

##### **4.2 Service Building**

- (1) The reinforcement in the building I structure shall be bonded together throughout by the use of welded flat steel bars. The bonding of reinforcement with the civil works shall be provided by the relevant civil contractor to a design provided by the Electrical contractor.
- (2) The flat steel bars shall be brought out into every auxiliary service substation to main earth bars located on a wall.
- (3) Further flat steel bars shall be brought out to earthing terminals in:
  - (a) Every Control Room
  - (b) Every plant and equipment room
  - (c) Other locations where required as an earthing point for metal work and lightning protection.  
(It should be noted that general earthing of typical electrical equipment should be through the reticulated earth of the low voltage power supply system or back to the nearest earthing terminal.)
- (4) The flat steel bars shall be provided by the civil contractor to a design provided by the electrical contractor.
- (5) Any distribution of earthing required beyond the above nominated locations shall be provided by the respective contractor responsible for the provision of the particular equipment.
- (6) Lightning interception facilities shall be provided on the roofs of buildings I structures which shall be securely bonded to the structure earth of the building I structure. These shall be provided by the civil contractor to a design provided by the electrical contractor.

#### **5. EARTHING OF ELECTRICAL POWER SUPPLY SYSTEMS**

##### **5.1 Supplies**

The electrical power supply systems comprise 110/33 kV and 415V, 3 phase, 3/4 wire ac supplies, 240V and 110V, 1 phase, 2 wire ac supplies, at 50Hz and 110V dc equipment control supplies.

##### **5.2 Earth Electrodes and Earth Systems**

- (1) Earth Systems for Bulk In-feed Substations
  - (a) Each bulk In-feed substation will be provided with earthing farms for utility supplier.
  - (b) Connections to the earth farms will be through two 'Principal Connections' links by means of stranded insulated copper cables with a cross- section area calculated for the worst case

conditions of earth current through marshalling earth bars in the area of the farms

(2) Earth Systems for Substations

- (a) Each services Substation will be provided with an earth farm, of resistance less than 1 ohm, and connected to the substation earthing system through two 'Principal Connection' links by means of stranded insulated copper cables with a cross- section area calculated for the worst case conditions of earth current.
- (b) The substation earthing system is to be compliant with IEC 60364 and IEC 61312 or BS 1013

(3) Earthing for Distribution Systems

- (a) Supplies at 415/240 V, or 110 V are made available for Plant/building equipment, and, where applicable, roads and bridge side equipment. These supplies are derived from the Secondary winding of the power source (Transformer/Generator etc) 415 V star-connected 3-phase supplies, the star point of which is to be bonded to the auxiliary Substation earthing system.
- (b) Continuity of this earth connection to the point of supply shall be provided by the cable sheath / armouring and/or additional bonding cables.
- (c) All locations receiving such supplies, which are remote from the earth system of any distribution substation, are to be earthed by one of the following methods:
  - (i) by low impedance connection to the trunk earth system such that the minimum earth fault current is adequate to operate the over current protection in accordance with IEC 60364;
  - (ii) where the requirement in (a) cannot be met, approved earth leakage protection is to be provided;
  - (iii) by connection of the earth terminal to the earth electrodes at any adjacent location via cable sheaths and armouring and/or additional bonding cables such that the earthing impedance meets the requirement in (a) above;
  - (iv) by connection of the earth terminal via sheaths and armouring of the supply cables or other bonding conductor to the earth system of the auxiliary substation, such that the earth fault loop is entirely metallic and of sufficiently low impedance to meet the requirement of (a) above.
- (4) The earthing of all distribution and sub-distribution systems is to be in accordance with IEC 60364.

**5.3 System Earthing**

General

This section describes the connection to earth of the neutral or negative, nominally equi-potential points of the current carrying conductors in each section of the power supply system.

- (a) 110 kV Supplies
  - The method of earthing of 110kV, 3 phase supplies from utility supplier must be coordinated with utility supplier.

(b) 415V Supplies

- The star point of the 415V secondary winding of the auxiliary transformer will be connected to the earth bar of the 415V switchboard.
- The earth bar will be connected to the neutral bar via a neutral link in the switchboard
- The neutral bar of the transformer is to be solidly earthed, via a bolted link to the earth system.

(c) 240V Supplies

- The 240 volt supplies are taken from one phase and the neutral of the above 415V supplies. The neutral shall be earthed in accordance with Clause 4.3.5. (d) 110V AC Supplies
- The 110V supplies are obtained from 240/110V transformers. Each 110V winding of these transformers is to be fitted with a centre tap which is to be solidly earthed.
- Approved earth fault detection equipment is to be provided. (e) 110V DC Supplies
- Both poles of the 110V battery supplies used in distribution substations and elsewhere in connection with the power supply system are to be insulated from earth.
- Approved positive pole and negative pole earth fault detection equipment is to be provided.

**5.4 Equipment Earthing**

- 1) This section refers to the treatment of metal enclosures or supporting metalwork for the equipment associated with the power supply systems covered in Section 4.3 above.
- 2) Earthing and bonding of electrical equipment is required to reduce the effects of interference, and to ensure the personal safety of the public, operational and maintenance staff by limiting the step and touch voltages to within acceptable limits. Where there is a conflict between these requirements, personal safety is always to take precedence.
- 3) 33kV Cables
  - The earthing of screens and armouring of all 33kV cables is to be earthed at both ends.
  - Exception may be made at the extreme ends of the system to avoid any circulating currents detected in service.
  - Means are to be provided for disconnecting the screen ends, individually, from earth for testing purposes.
- 4) Other Power Supply Cable
- 5) This section covers the cables for the distribution of 415/240Vac supplies and 110Vdc Supplies
- 6) The armouring of multicore cables (e.g. 3 phase or twin and earth etc.) is to be earthed at both ends via an earth terminal provided with the gland, or via the metalwork of the cable box and structure to the earth bar or terminal of the equipment at which the cable is terminated.
- 7) Exceptions will be where the equipment at each end does not share the same earth



system as, for example, the dc switchgear for which the enclosures are insulated from the substation earth and connected to it via a leakage current measuring shunt. In this case the armouring will be earthed only at the distribution board end.

- 8) Single core cables are to be earthed in a similar manner but at one end only and must avoid circulating eddy currents where the metallic cable sheath is connected to a metallic cabinet
- 9) 110 kV/ 33 kV Switchgear
- 10) All ac switchgear will be earthed directly to the substation earthing system.
- 11) 415V, 240v and 110 V Switchgear
- 12) All metallic components of the cubicles are to be bonded to an earth bar or terminal which is to be connected to the substation earth system.
- 13) Battery Equipment
- 14) All metallic components of metal stands and cubicles for batteries, battery chargers and DC distribution switchboards are to be bonded to an earth bar or terminal which is to be connected to the earth system.
- 15) Transformer
- 16) All electrically separate parts of each transformer core are to be bonded together and the core as a whole is to be insulated from the enclosure/tank. An accessible removable link is to be provided between the core and the enclosure/tank for earthing the core for core testing.
- 17) All metallic components of control compartments are to be bonded to an earth terminal or bar, which is to be connected to the enclosure. The enclosure is to be connected to the substation earth system with a suitable fault rated earth connection
- 18) 415/110VTransformers
- 19) Each transformer is to be provided with a screen between the primary and secondary windings so that in the event of a fault the primary winding or its connections cannot be connected to the secondary winding or its connections
- 20) The centre point of the secondary 110 V winding is to be connected to the substation earth system.
- 21) This screen, the core and framework of each transformer is to be connected to the earth bar or terminal of the enclosure in which the transformer is located.
- 22) The earth bar or terminal of the enclosure is to be connected to the substation earth system.
- 23) Marshalling Panels
- 24) All metallic components of each cubicle are to be bonded to an earth terminal or bar, which is to be connected to the earth system.
- 25) Instruments, Relays, Control Switches and other Electrical Components
- 26) All metallic cases and/or frames of instruments, relays, control switches and other electrical components mounted on control panels or in cubicles are to be connected to the earth bar or terminals of the cubicle in which the component is mounted

- 27) Ancillary Equipment
- 28) Cubicles, cabinets, racks and panels are to be provided with a copper earth bar having a suitable cross-sectional area for the possible fault current, placed at a convenient position within the equipment. All metal parts, other than those forming part of an electrical circuit, are to be earthed by connection to the earth bar.
- 29) When apparatus or instruments are accommodated on panel cubicle doors or
- 30) swinging frames, flexible cable or braid is to be used for earthing these items; the door hinges are not acceptable as means of earthing this part of the equipment.
- 31) Except where otherwise approved, a stud type terminal of diameter not less than 12 mm, or a tapped boss of equivalent size, is to be provided on the outside of each cubicle or structure for the purpose of making the connection to earth. This terminal is to be connected to the substation earthing system.

## **6 EARTHING OF COMMUNICATION AND CONTROL SYSTEMS**

### **6.1 General**

- (1) There are several separate sub-systems which collectively form the control and communications system. Equipment, enclosures and mountings associated with these sub-systems are distributed throughout the system at wayside and service buildings locations.
- (2) Separate clean earths of value not exceeding 0.5 Ohms required at each service Building for BMS/SCADA, to be terminated in BMS/SCADA, communication system rooms and other related rooms.

## **7 EARTHING OF OTHER METALLIC STRUCTURES**

### **7.1 General**

- (1) Other metallic structures comprise those structures which do not form part of the Power Supply or Communication and Control Systems covered in Section 4 and 5 above. They include the reinforcing in concrete construction, pipes for other services and fixtures and fittings in buildings and roads and bridges sections..
- (2) Lightning protection of structures and buildings is also included in this Section.
- (3) The ac systems are generally arranged to operate with their neutrals earthed, and with associated metallic enclosures also connected to earth, by conventional methods.
- (4) The Buried Earth Cable shall be regularly earthed and connected to earth pits.
- (5) Earth pits shall be provided at each stations and their spacing should not exceed 300m on viaducts and in depot. Earth pits earthing value shall not exceed 1 Ohm.
- (6) Earth pit shall be provided with disconnecting bars so that their earthing value can easily be checked.
- (7) Any exposed metallic structure, concerned by 7.1.1, which is closer than 10m from the Over Head Line shall be earthed to the Buried Earth Cable as per clause 5.5.2.1.
- (8) The self-restoring properties of high voltage limiting devices avoid a permanent leakage path for limited faults whereas a latched contactor needs to be manually reset or a device

needs to be physically replaced.

- (9) 7.2 Over ground Structures
- (10) The frames of all buildings and other structural steelwork are to be bonded to the local earth system unless all parts of the frame or structure are completely encased in concrete, masonry or other non-metallic cladding.
- (11) Where a local earth system is not provided under the provisions of Clauses 4.2.1 such a system is to be provided for the purposes of this Clause in those locations where accidental contact with the power system is possible. Such an earth system is to have an overall resistance not exceeding 10 ohms between any point of the earthed frame or structure and the general body of the earth. In addition a self-restoring spark gap device is to be connected between each separate structure and the power return system
- (12) In general the reinforcing bars in concrete structures or foundations are not to be earthed in those cases where the reinforcing bars are completely encased in concrete. This applies to substation foundation slabs.
- (13) Where external connections are made to the reinforcing, for the purpose of providing studs for securing metallic structures or components which are earthed, insulating sleeves and washers are to be fitted to the studs if there is a possibility of power return currents passing into the reinforcing via the studs.

#### **7.4 Services To Service Building premises.**

- (1) Metallic service (I.e. water, gas, waste water etc) pipes entering the Service Building premises, both over and underground, are to be provided with an insulated insert at the point of entry, and the pipe work within the Service building is to be bonded to the local earth system.
- (2) Where both plastic and metal pipes are used, all lengths of exposed metal pipes, or those connected to taps or apparatus, are to be bonded to the local earth system. A separate bond is not required for the pipe if it is electrically continuous with earthed apparatus.

#### **7.5 Small Metallic Components**

- (1) Small metallic and isolated structural parts which are effectively segregated from any electrical apparatus or cables etc. or earthed metallic enclosures and structures do not require to be bonded to the local earth system.
- (2) For the purposes of this Clause the metal angle supports for trench covers and similar metalwork in electrical and distribution substations are not effectively segregated and are to be bonded to the substation earth system.

#### **7.6 Service building Fencing**

- (1) The Service Building will also derive their earthing from the Service building slab structural earth system
- (2) Metallic fencing associated with the service building within 10.0 metres of the overhead contact line, is to be earthed to the Buried Earth Cable.
- (3) Each separate section of fencing is to be separately earthed in the appropriate manner as above.

- (4) All gate posts are to be bonded to each other across the gate opening by an underground conductor, and the gates themselves bonded across the hinges.

### **7.7 Lightning Protection**

- (1) The need for lightning protection for individual mass transit system buildings is to be assessed in accordance with IEC 61024-1 or the local building code. Where lightning protection is found to be necessary, it shall be provided in accordance with this Standard.
- (2) All building structures will be of steel or steel reinforced concrete with every pillar of the structures bonded into the structure earth.
- (3) Metal roofing will be multiple bonded into the metal of the building structure. Lightning conductors will be provided to bridge any non-metallic roofing and conduct into the steel structure in the most efficient manner.
- (4) Cables with metal sheaths and other metallic services entering the building are to be bonded to the structure at the point of entry and to any electrodes provided for lightning protection, if not already adequately bonded via the local earth system.

## **Volume 3**

# **APPENDIX – 15 ADJACENT WORKS CONTRACTS**

## **APPENDIX 15:ADJACENT WORKS CONTRACTS**

The Contractor shall be fully responsible for identifying and interfacing with all adjacent construction works projects.

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 16**

**DESIGN AND CONSTRUCTION INTERFACE MANAGEMENT**

## APPENDIX – 16 : DESIGN AND CONSTRUCTION INTERFACE MANAGEMENT.

### 1. DEFINITIONS AND ABBREVIATIONS

- 1.1. **Chief Interface Coordinator** means a suitably qualified person, assigned by the Contractor, who is the Team Leader responsible for administrating, monitoring, managing, supervising and resolving all interface issues between the Contractor and (1) Interfacing Contractors, (2) Interfacing Agencies, and (3) MEP Subcontractor.
- 1.2. **Combined Services Drawings (CSD)** means those drawings produced by the Contractor, showing the locations, sizes and details of all of the Contractor's equipment, cable containment, pipes etc. These drawings are to be used to enable all equipment, pipes, cables etc. to be installed without conflict and to enable future changes or modifications to be performed without impacting the existing installation.
- 1.3. **Interface** means the region of interaction across the common boundary between two adjacent but separately managed and controlled. The coordination and management of the interaction regions is necessary to ensure that the overall scope and definition of the Project works is complete and seamless across all such boundaries.
- 1.4. **Interfacing Contractors** means Project Contractors and design or specialist consultants engaged on the Project from time to time by the Employer, whose activities or the works they are engaged to carry out in any way or at any time affect or are affected by the Works:
- 1.4.1 **Interfacing Agencies** means any of the activities, works or approvals required to be carried out in any way or at any time effect are effected by the Works :
- a) The Government of India Departments with whom the Contractor need to liaise, coordinate or carry out works, including but not limited to the following:
    - Ministry of Environment and Forest and Climate Change (MoEFCC).
    - Mahangar Telephone Nigam Ltd. ( MTNL)
  - b) The Government of Maharashtra Departments with whom the Contractor need to liaise, coordinate or carry out works, including but not limited to the following:
    - Maharashtra Heritage Conservation Committee
    - Bombay National History Society (BNHS)
    - Public Works Department (PWD)
    - Mumbai Metropolitan Regional Development Authority (MMRDA)
    - Mumbai Maritime Board



- Maharashtra Pollution Control Board
- Maharashtra Coastal Zone Management Authority (MCZMA)
- Water Department of BMC
- Storm Water Department of BMC
- Solid Waste Department of BMC
- Sewage Department of BMC
- Disaster Management Department of BMC
- Maharashtra State Electricity Supply Co. Ltd.( BEST/TATA)
- Brihanmumbai Electric Supply and Transport Co.( BEST)
- Traffic Police Department
- Forest Department
- Maharashtra State Road Development Corporation ( MSRDC)
- Fisheries Department, Govt. of Maharashtra
- Mumbai Port Trust
- Indian Navy
- Coast Guard
- Mumbai Heritage Conservation Committee
- Tree Authority

c) The private sector utility providers with whom the Contractor need to liaise, coordinate or carry out works, including but not limited to the following:

- Tata Power
- Reliance Energy
- Reliance Communications
- Tata DOCOMO
- AIRTEL
- VODAFONE
- IDEA

1.4.2 **MEP Subcontractor** means a specialist subcontractor for carrying out all mechanical and electrical related works, nominated by the Contractor and Noticed by the Engineer. Interfacing with all MEP works shall be carried out by the Contractor.

1.4.3 Developers or franchisees appointed on the Project from time to time by the Employer;

1.4.4 Subcontractors of any tier of the contractors within category 1.4 above, and contractors and subcontractors of any tier of utility providers, developers and franchisees within categories 1.4.1 (a),(b) and (c) above;

Provided that the definition shall exclude the Contractor and his subcontractors

of any tier in relation to the Works and in any other capacity which would otherwise fall within categories as mentioned above in relation to other works.

- 1.5. **Interface Coordination Sheet (ICS)** means a document produced by the Contractor which defines the integration and interfaces between his contract and the Interfacing Contractors and their own MEP Subcontractor employed on the Project.
- 1.6. **Interface Management Programme (IMPG)** means the programme produced by the Contractor, developed and updated on a quarterly basis, which describes the sequence and timing of each of the Interfacing Contractors scope of work and his MEP Subcontractor's work to be carried out by the Contractor in coordination with the Interfacing Agencies.
- 1.7. **Interface Management Plan (IMP)** means the Report prepared by the Contractor, developed and updated on a quarterly basis that provides a clear description of his interfaces both sequentially and technically as specified in the Contract. The report will be reviewed in accordance with this procedure and is a pre-requisite to the Engineer's Notice to proceed.
- 1.8. **Interface Specification (IS)** means the specification document developed by the Contractor for the interfacing part of his project on the basis of, and by integrating into his design, the information provided by the Interfacing Contractor/s and MEP Subcontractor, in accordance with the interface agreements as contained in the ICS. The Interface specification needs to be agreed upon by both the Contractor and the Interfacing Contractor/s and MEP Subcontractor, before it is submitted to the Engineer for Notice to proceed.
- 1.9. **Structural, Electrical and Mechanical Drawings (SEM)** means those drawings produced by the Contractor in coordination with his own MEP subcontractor, showing the locations, sizes and details for all structural openings, plinths, embedment, sumps, floor chases, etc. required for the installation of all equipment, cable trays, pipes, etc.
- 1.10. **Zone of Interface** means where two or more components of the roadway provided by two or more Interfacing Contractors combine to provide a single element.
- 1.11. **Interfacing Party** means Interfacing Contractor and / or Interfacing Agency and / or MEP Subcontractor as appropriate.

## 2. INTRODUCTION

- 2.1 Interface and co-ordination of the Works will include the co-ordination of all design, technical and programming matters with the various Interfacing Contractors, Interfacing Agencies and MEP sub contractor to achieve fully co-ordinated construction and installation of the facilities.
- 2.2 This Appendix 19 describes the Contractor's responsibilities with regard to interface management and coordination with those Interfacing Contractors / Agencies

and MEP subcontractor who are responsible for undertaking work, which interfaces with the Contract. The Contractor's responsibility for interface coordination shall include currently defined Interfacing Contractors / Agencies / MEP subcontractor and those who may be identified in the future. This responsibility is not limited to a particular number of Interfacing Contractors / Agencies / MEP subcontractor.

- 2.3 The Contractor's responsibility for interface co-ordination shall include identification of Interfacing Contractors / Agencies and those who may be subsequently identified during the course of the Contract for whom the Contractor will need to interface and coordinate the Works. This in no way detracts from the fact that the Contractor remains solely responsible for identifying, liaising, and co-ordinating with all Interfacing Contractors / Agencies in relation to the Works.
- 2.4 The Engineer will monitor and oversee the interface Management activities by the contractor and will specifically provide direction or information in the following circumstances.
- a) When the interfacing contract has not yet been awarded
  - b) When common agreement cannot be reached between the interfacing parties
  - c) When it is in the interest of the project programme, quality or safety to issue direction.

Direction or information provided by the Engineer where ever necessary, shall not in any way relieve the contractor of his full responsibility to ensure the correctness, accuracy and suitability of the interface implementation and required specification.

- 2.5 The Contractor shall at all times use his best endeavours to resolve all interfaces applicable to the Contract and shall be proactive in seeking out interface issues and their solutions.
- 2.6 The Contractor shall ensure that all of the above Interface requirements are included in his Interface Management Plan, refer to Clause 6 of this Appendix 16. Flow charts illustrating the process of entering into an Interface agreement and Monitoring its progress with the help of the Interface Coordination Sheet are provided as Attachments A&B of this Appendix. Figure 1 gives a schematic presentation of the Interface Communication and Coordination processes between the various role-players in the Project.
- 2.7 The Contractor's internal sub-contractors and suppliers interfaces are the sole responsibility of the Contractor and are not covered in this Appendix, except the MEP Subcontractor. Notwithstanding the requirements in this section the coordination and interface with his MEP subcontractor is the sole responsibility of the Contractor. However, the Contractor shall co-ordinate and manage these interfaces in such a way as to identify and cater for the requirements of domestic interfaces, including but not limited to, the avoidance of clashes and sequencing of Works. The Contractor shall compile an internal IMP for his own use, a copy of which shall be furnished to the Engineer on request at any time.

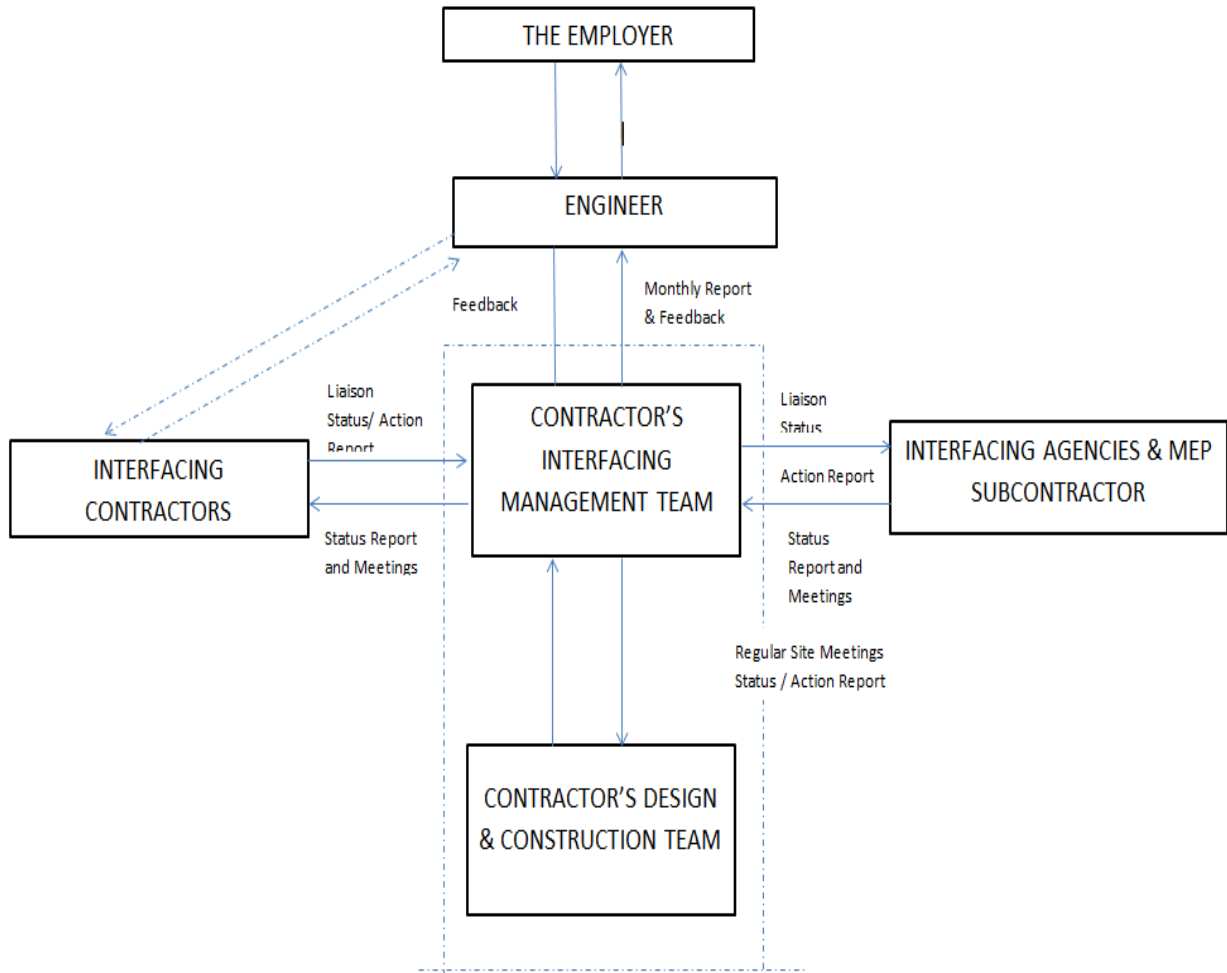


Figure 1- Contractor's Interface Communication and Coordination Model

**3. CO-ORDINATION**

**3.1. Contractor's Coordination Responsibilities**

The Contractor shall coordinate with the Engineer and may be required to attend meetings on issues appertaining to Government authorities and utility agencies regarding the services/facilities to be provided by them for the project. The Contractor shall ensure that the work of all Interfacing Contractors/ Agencies and the MEP subcontractor can be carried out in accordance with the Interface Management Plan prepared by the Contractor.

**3.2 Site Co-Ordination & Attendance**

3.2.1 The Contractor shall, at his own cost, provide all attendance on and co- ordination with Interfacing Contractors / Agencies and MEP subcontractor. The following items are not a comprehensive or exhaustive list of the co-ordination or interface attendance items to be provided for the Interfacing Contractors use, but are intended to provide an outline of the content of amenities, services and facilities for which the Contractor is

responsible:

- a) Single point of contact for meetings, actions, planning, scheduling and co-ordinating.
- b) Site access  
The Contractor shall co-ordinate with the Interfacing Contractors / Agencies/ MEP subcontractor and provide access and use of temporary access roads to and from and within the Site. The Contractor shall co-ordinate all vehicle movements, deliveries and other activities with the Interfacing Contractors / Agencies/ MEP subcontractor so as to ensure conflicts of use will be controlled on and around the Site.
- c) Storage and Accommodation area  
The Interfacing parties will require limited temporary site accommodation and storage areas. The Contractor shall agree with the Interfacing parties access and areas for storage and temporary site accommodation prior to their commencing work on Site.
- d) Work space requirement and sequence of Works
- e) Shared use of Contractor's scaffold  
The Contractor shall co-ordinate with the Interfacing parties and provide free use and shared access of his erected scaffolding, ladders and hoists should they be available at the time the Interfacing Contractor requires to use them. Notwithstanding this requirement, the Contractor shall at all times remain responsible for the management of safety and the maintenance of such scaffolding, ladders and landings. The Contractor will not be required to adapt or erect access scaffolds specifically for the use of Interfacing parties.  
  
If the Interfacing parties erect and use his own scaffold they will be required to adhere to the Contractor's safety rules and access routing for equipment and materials. The Contractor shall ensure that all scaffolds of Interfacing Contractors/ Agencies and MEP subcontractor are erected in a safe manner and are subject to permits for use issued by the Contractor.
- f) Setting out control points
- g) Access Openings  
The Contractor will form all penetrations and delivery openings and subsequently close them ( either temporary or permanent) for access to rooms or areas for the delivery of equipment and materials.
- h) The Contractor will be required to install all temporary and permanent lifting hooks and beams shown Temporary lighting requirements 100 lux minimum.
- i) Temporary power and water supplies have to be provided at agreed locations around the Site for the Interfacing Contractors use.
- j) Water tightness. All rooms and areas handed over to Interfacing

Contractors / Agencies shall be in a watertight condition and maintained as such.

- k) Ensure all electrical supplies both temporary and permanent have the correct testing and commissioning certification.
- l) Waste management and disposal
- m) Appropriate protection to finishes, walls, floors, ceilings and equipment using polythene, hardboard, steel plates etc.
- n) Programme agreement for mobilizing and demobilizing
- o) Fire fighting and supply and maintenance of fire extinguishing equipment and devices pursuant to the Contractor's obligations .
- p) Construction interface co-ordination management of penetrations in structures, embedded and cast-in items, etc.
- q) Temporary Drainage  
The Contractor shall provide, operate and maintain all necessary temporary drainage, sumps, silt traps and sump pumps to collect and dispose of wastewater from Interfacing Contractors / Agencies construction processes including installation, testing and commissioning activities.
- r) Sanitation facilities  
The Contractor shall provide all sanitation facilities and the disposal of waste. No unauthorised sanitation facility will be allowed on the Site.
- s) Making good and fire stopping of penetrations
- t) Lifting apparatus and hoists  
The Contractor will be required to install all temporary and permanent lifting hooks and beams shown on the drawings and the Specification required for installation and/or maintenance purposes. The Contractor will be responsible for the testing and labeling of all apparatus. The Contractor will be required to make available any lifting or hoist apparatus on Site as required by the Interfacing Contractor / Agencies and the MEP subcontractor at agreed times and duration for their use. The Contractor shall be responsible for the maintenance testing and operational management of hoists. The Contractor shall make available his cranes for lifting equipment or materials for Interfacing Contractors / Agencies and MEP subcontractor.
- u) Health and Welfare Facilities

The Contractor shall allow Interfacing parties use of his health, welfare and mess facilities, and temporary background lighting. The Contractor shall liaise with the Interfacing parties to determine their planned and actual manning levels and ensure that sufficient facilities are provided prior to them commencing work on Site. The facilities shall be maintained on Site until the Interfacing Parties have completed their Works and demobilised or such

earlier time as the Engineer may direct.

**3.2.2** The Contractor is deemed to have ascertained for himself the full scope of his responsibilities and obligations under the Contract in terms of attendance on and co-ordination with Interfacing Parties and shall not be entitled to any additional payment, Cost or extension of time for completion should he have failed to do so.

**3.2.3** The Contractor shall make due allowance for providing Attendance, including power and other utilities supplies, throughout all phases of the Interfacing Parties work including testing and commissioning and where supplies to various Interfacing Contractors need special consideration during testing and performance trials under peak load conditions.

#### **4. INTERFACE**

##### **4.1 Coordination of Contractor's Scope of Work**

In accordance with the requirements of the Conditions of Contract and other specified requirements, the Contractor shall co-ordinate his own work with that of all Interfacing Contractors/ Agencies / MEP subcontractor and ensure that the design, construction, installation and testing requirements of the Interfacing Contractors are incorporated into the Contractor's co-ordinated plans, programmes and Works. The Contractor shall proactively seek out interface issues and solutions.

In addition to the Contractor's obligations to the Interfacing Contractors and MEP Subcontractor contained elsewhere in the Contract, the Contractor shall provide / handover occupation or access as required, to the Interfacing Contractors to those parts of the Works which are subject to Key Dates by the required Key Dates.

The Contractor shall complete those parts of the Works, which are subject to Key Dates, by the required Key Dates that may be specified in the Appendix to Tender and/or Appendix 2B of Volume 3 – Employer's Requirements of this Contract. Those parts of the Works subject to Key Dates shall be completed to a state whereby any Interfacing Contractor/ Agencies and MEP subcontractor can immediately commence his works without the need to make any change, addition or modification to the Contractor's Works.

##### **4.2 Interfacing Contractors**

**4.2.1** The Interfacing Contractors will require interface and co-ordination for information, programming, drawings acceptance, handover etc. as shown on the Interface Coordination Sheet enclosed in Attachment F of this Appendix.

The Contractor should fill in Interface Coordination Sheet involving Interfacing Contractors / Agencies and MEP Subcontractor.

The Contractor shall take overall responsibility for the Interface Coordination Sheets, which must be submitted to the Engineer for a Notice to proceed.

**4.2.2** Where an interfacing contract has yet to be awarded, the Contractor shall proceed with the coordination activities (including preparation of ICS and Interface specification) as instructed by the Engineer until such time when the Interfacing Contractor is available.

### 4.3. Interfacing Contractors - Communications and Information Exchange

#### 4.3.1 General

- a) The Contractor shall communicate, co-ordinate and exchange information directly with the Interfacing Contractors / Agencies and MEP Subcontractor and the Contractor shall keep the Engineer advised at all times. 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.
- b) All requests for information, acknowledgement of receipt of information, and any official communication between the Contractor and the Interfacing parties shall be made in writing, with a copy to the Engineer for his information. The Engineer shall be invited to attend all interface meetings between the Contractor and the Interfacing parties. Irrespective of whether these meetings were attended by the Engineer or not, the Contractor's monthly progress report to Engineer shall invariably include the details of all interface meetings held and decisions arrived.
- c) The Contractor's programme shall allow time for the availability of necessary interface information from the Interfacing Contractors and in this regard the Contractor shall, where required, proceed on a late start basis to allow adequate time for others to provide required information and thereby achieve design process compatibility.
- d) The Contractor shall allow for the fact that many of the design and construction activities for the different contracts will be proceeding concurrently. In the event that certain interface information is not forthcoming at the time targeted, the Contractor shall be responsible to resolve the matter with the relevant Interfacing party without recourse to the Engineer, and where necessary develop alternative interim arrangements such that the interface information may be accommodated at a later date.
- e) Definitive dates for transfer of information and particular interface actions shall be confirmed between the Contractor and the Interfacing Contractors.

#### 4.3.2 Interfacing Functions

The Contractor is responsible for, but not limited to, the following;

- the management of Contract to Contract Interfaces as required;
- preparing the Interface Management Plan and subsequent procedures;
- preparing their Interface Management Programmes in accordance with this procedure and submitting these to the Interfacing parties for concurrence;
- preparing the Interface Management Programmes and submitting these to the Engineer for a Notice to proceed;
- preparing their Interface Coordination Sheets and Interface Specifications



and issuing same to the relevant Interface parties and the Engineer;

- coordinating with the relevant Interfacing parties to establish coordinated CSD & SEM Drawings;
- maintaining their ICS updated continuously and attaching it to their Monthly Progress Report submitted to the Engineer in accordance with the requirements of the Contract and this Appendix.

#### **4.3.3 Documentation Review**

The Contractor shall, as a minimum:

- review those portions of the Specification and Drawings relevant to the interface and transmit such information to the Interfacing parties;
- co-ordinate and co-operate with Interfacing Contractors/ Agencies and MEP subcontractor on all Site related matters including, but not limited to, Site access and occupation, attendance, safety, verification of work compatibility, survey control, etc.;
- review the interface information received and agree in writing with the Interfacing parties that the interface information is adequate for that stage of that activity.

#### **4.3.4 Design Stage**

The design interface is an iterative process, thus throughout the design process, the Contractor shall be responsible for coordinating his own design with Interfacing Contractors/ Agencies and MEP Subcontractor to develop interface designs in conjunction and co-operation with the designers of Interfacing Contractors. These interface designs will be monitored and have to be given Notice to proceed by the Engineer, but the Contractor shall work directly with the Interfacing Contractors/ Agencies and MEP subcontractor to develop designs which are mutually acceptable to all parties.

The Contractor shall, immediately upon Contract Award, gather all necessary information and develop his design to a level where meaningful interaction can take place as soon as the Interfacing Contractors/ Agencies and MEP subcontractor are available.

#### **4.3.5 CONSTRUCTION PHASE**

During construction the Contractor shall, when a construction item is ready for field inspection, advise the Interfacing Contractor/ Agencies and MEP subcontractor in advance to verify compatibility with the needs.

The Contractor shall:

- advise the Interfacing Contractors/Agencies and the MEP subcontractor in writing when the as-constructed interface-related work can be inspected, and provide the necessary Site access and occupation;
- request in writing and obtain from the Interfacing Contractors / Agencies and MEP subcontractor, interface information required for that stage of the Contract;

- agree in writing with the Interfacing Contractors/ Agencies and MEP subcontractor on the adoption of any applicable comments on the constructed work;
- agree that any testing and commissioning for works can be carried out in accordance with the Interface Management Plan;
- conduct on-Site inspections of the work elements, and give comments in writing to the Interfacing Contractors and MEP subcontractor;
- agree in writing with the Interfacing Contractors / Agencies and MEP subcontractor that the as-constructed work meets the interface requirements.
- Where the execution of work by Interfacing Contractors/ agencies and MEP subcontractor depends upon the Contractor's site management or upon information to be given by the Contractor, the Contractor shall provide the Interfacing Contractors/ Agencies and MEP subcontractor with the required services or the correct and accurate information required to enable the Interfacing Contractors to meet their programme for the construction or installation of their works.

#### **4.3.6 INTERFACE COMMISSIONING**

The Contractor shall co-ordinate all of his testing and commissioning activities with the Interfacing Contractors / Agencies and MEP subcontractor. Interface commissioning shall demonstrate that the delivered interface, part A of the interface, is ready and meets the interface requirements of the interface part B, and vice versa.

Successful completion of all interface commissioning shall prove its readiness for commissioning of the overall contract scope and completion of the overall Road Project, prior to handover to the Employer for their operation.

#### **4.4 Resolution of Co-Ordination Difficulties**

When the Contractor identifies interface co-ordination difficulties, the Contractor shall review the pertinent points of each Interfacing Contractor/ agencies and MEP subcontractor to determine possible compatible solutions in terms of sequence, timing and technical details. The Contractor shall then meet with the relevant Interfacing Contractor(s)/ agencies/ MEP subcontractor to determine solutions, which are mutually acceptable to each Interfacing Contractor and advise the Engineer.

Where an acceptable solution has not been identified, the Contractor shall advise the Engineer in writing of the problems encountered. If, in the opinion of the Engineer, an interface is not proceeding satisfactorily, then the Engineer will review the matter, and establish a co-ordinated plan directing the Contractor and the Interfacing Contractor(s) on the required action. In the event that no agreement can be made between the Contractor and the Interfacing Contractor(s), the Engineer shall determine the requirements to the best of his knowledge, and his determination shall be final and binding on the Contractor and the Interfacing Contractor(s).

#### **4.5 Interface Performance**

The Contractor's performance in relation to his compliance with the interface requirements under the Contract shall be assessed by the Engineer 3 months after the Commencement Date and thereafter at three monthly intervals.

The assessment will be in the form of an audit of the Contractor's interface management system. This audit will assess the Contractor's compliance with the responsibilities delineated in this Appendix and elsewhere as related to interface management and the preparation of the Interface Management Plan and Programme and other documentation and procedures associated with Interface Management and Coordination.

The Contractor will be notified of non-conformances from the audit, which will require rectification. Where, in the opinion of the Engineer, the Contractor has failed to rectify a non-conformance within a reasonable period from the date of notification, this may lead to non-payment of any lump sums, until such time as the non-conformance has been rectified to the satisfaction of the Engineer, refer sub-clause below.

The Contract allows for continuous audits of the Contractor's compliance with his Interface Management Plan and the requirements of this Appendix 16 of Volume 3 Employer's Requirements and any extreme or continuing failures shall result in a negative audit report, which may lead to non-payment of the relevant payment item in the Preliminaries section of the Pricing Document. The decision of the Engineer in this regard shall be final.

## **5. CONTRACTOR'S INTERFACE MANAGEMENT SYSTEM**

### **5.1 Interface Management System**

The Contractor shall establish and maintain an Interface Management System to identify, control and monitor the interfaces of the Contract, which shall include, but not be restricted to, the following:

- a. Establishment and maintenance of an Interface Management Team suitably qualified and experienced in co-ordination and interface management.
- b. Provision, as one of his Key Personnel, of a Chief Interface Co-ordinator, to head the Interface Management Team, suitably qualified and experienced as noted in Section A of this Volume 3 Employer's Requirements, with the responsibility, experience and authority to resolve interface matters in accordance with the Contract. The Chief Interface Co-ordinator will develop a monitoring and reporting procedure to be implemented by his team for the duration of the Contract.
- c. Implement and maintain a strict monitored control of information transfer to the Interfacing Contractors, the Employer and the Engineer utilising the official channels of communication.
- d. Provide a comprehensive interface schedule of Interfacing Contractors/ agencies and MEP subcontractor identifying all interfacing activities and timetables of events.
- e. Arrange all internal and external interface meetings. The Engineer may arrange regular meetings to monitor the status of interfaces, and may require special

meetings as may be necessary to resolve specific issues. The Contractor's Interface Management Team will be required to attend such meetings. The Contractor may request assistance from the Engineer to arrange meetings on particular subjects.

- f. Providing the Engineer with all information and/or details of interfaces, including copies of all correspondence and material.
- g. Providing the Engineer with access to information for the purpose of conducting audits on the interface system and for confirming that interface co-ordination is proceeding consistently with the Project requirements.
- h. Establish interface dates for information, documentation, access or works completion requirements.

## **5.2. Interface Management Team**

The Contractor's Interface Management Team will undertake and fulfil the following tasks:

- Provide timely interface information when requested, anticipating the information needs of the Interfacing Contractors/ agencies / MEP subcontractor and transmitting such information as soon as it is available.
- Pro-actively keep the Interfacing Contractors / agencies / MEP subcontractor informed of any development of the Works related to the interfaces. Communicating and co-operating with the Interfacing Contractors / agencies / MEP subcontractor to identify and resolve potential interface problems.
- Advise the Interfacing Contractors / agencies / MEP subcontractor on potential problems related to the interfaces, together with proposed solutions likely to be acceptable to Interfacing Contractors / agencies / MEP subcontractor and which meet the needs of the Project.
- Arrange and/or attend meetings with the Interfacing Contractors / agencies / MEP subcontractor as necessary to resolve interface issues.
  
- During each stage of the Contract, the Contractor shall directly communicate and co-ordinate with Interfacing Contractors / agencies / MEP subcontractor as necessary to achieve a fully co-ordinated construction / installation.
- Contractor shall issue true records of all interface meetings, with appropriate actions and attendance lists, to all Interfacing Contractors / agencies / MEP subcontractor, whether in attendance or not, and to the Engineer, within 3 days of the meeting. Minutes of meetings shall be signed by all parties in attendance, signifying their agreement to the contents thereof, before being formally issued by the Contractor.

The authority and responsibilities of all personnel involved in the Interface Management

Team must be clearly defined in the IMP.

## **6. INTERFACE MANAGEMENT PLAN & INTERFACE MANAGEMENT PROGRAMME**

## 6.1 General

The Contractor shall prepare the proposed Interface Management Plan and proposed Interface Management Programme, in accordance with CPA Clause 6, this clause 6 and based on the formats noted in Attachments H and I, to which the Engineer issues a Notice to proceed. The Interface Management Plan and Interface Management Programme shall completely define the Contractor's programme and methodology for interface co-ordination and management, whilst complying with all Key Dates stated in the Appendix to Tender and/or Appendix 2 of this Volume 3 Employer's Requirements. Subsequently they shall be kept up to date and submitted on a quarterly basis to the Engineer for scrutiny and Notice to proceed, and a summary of the principal issues shall be included in each Monthly Progress Report. The Contractor shall note that each submission of these documents is subject to regular audits and the issue of a Notice to proceed by the Engineer.

## 6.2 Interface Management Programme (IMPG)

The Interface Management Programme describes 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 works and that of the Interfacing Contractors / agencies / MEP subcontractor and complementing the Interface Management Plan, whilst complying with all Key Dates stated in the Appendix to Tender and/or Appendix 2 of this Volume 3 Employer's Requirements.

The programme 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 Interface Management Programme 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.

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 exchange 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 and also identified on the ICS, refer Clause 7 below.

Refer to Attachment H - Guidance Notes for the Preparation of IMPG

## 6.3 Interface Management Plan (IMP)

The Interface Management Plan is that document which describes the Contractor's interface management in terms of providing a clear description of each of the interfaces, both technically and sequentially, and represents an account of how the Contractor proposes to achieve co-ordination of the Works. The description shall completely detail the Contractor's work scope and interface with each of the Interfacing

Contractors / agencies / MEP subcontractor in terms of technical description, sequence and timing for each of the elements required to achieve a coordinated design. The Contractor shall demonstrate how potential interface conflicts can be eliminated by design simplification. This document is also required to demonstrate that the co-ordinated design and construction details described therein fully comply with the needs of others, and agreement in writing of these details by the Interfacing Contractors/ MEP subcontractor will be a pre-requisite to the Engineer issuing a Notice to proceed.

Refer to Attachment I – Guidance Notes for the Preparation of IMP.

#### **6.4 Requirements for the Interface Management Programme & Interface Management**

**Plan** The Interface Management Programme (IMPG) shall be a process-driven programme in a format to be agreed with the Engineer. The IMPG shall incorporate the key activities from both the Interfacing Contractors", Contractor's and MEP subcontractor's Works programmes that will enable the Contractor to demonstrate that any Interface is being correctly managed and will result in fully co-ordinated construction / installation of works.

The Interface Management Plan and Interface Management Programme shall:

- Follow the outline structure, numbering system, and related procedures in a format to be agreed with the Engineer.
- Be co-ordinated with the Interfacing Contractors to ensure compatibility of interface identification and definition.
- Comply with the Key Dates stated in the Appendix to Tender and/or Appendix 2B of this Volume 3 Employer's Requirements.
- Be transmitted to the Interfacing Contractors concurrently with submittals to the Engineer.
- Support the Works Programme to which the Engineer has given a Notice to proceed.
- Address each zone of interface related to each design submission and stage of design or construction / installation.
- List all relevant interfaces in detail, their status, and the corresponding source(s) of information.
- Include interface information transfer dates which have been agreed by the Interfacing Contractors.
- Accommodate comments and input required by the Engineer.
- Include an account of how the interfaces are being managed.
- Identify the latest information regarding agreements with the Interfacing Contractors / Agencies / MEP subcontractor and transfers of information.
- Review and address the design, supply, installation, testing & commissioning programme of the Interfacing Contractors and MEP subcontractor to ensure that

the Key Dates of each contract can be achieved, and highlight any programme risks requiring management attention.

- Identify any problems related to co-ordination with Interfacing Contractors / Agencies / MEP subcontractor.

## **6.5 Interface Specification.**

6.5.1 The Interface Specification, proforma enclosed in Attachment C, and associated drawings shall specify the proposed method and schedule for verifying the interface integrity, the individual equipment/system performance and the combined system performance.

The Interface Specification shall include a programme of tests to demonstrate the performance and integrity of the integrated system. The interface sheets developed by the Engineer are enclosed in attachment D . The attached interface sheets are not final and do not relieve the Contractor's obligation to identify any new interface to meet contract requirements. The interface sheets, which the Contractor shall develop, shall be used as a basis to establish the Interface Specification. Any revision to the Interface Specification shall be mutually agreed between the Contractor and Interfacing Contractors / agencies / MEP subcontractor, with submission to the Engineer, and shall specifically -

- a. Understand the design requirements of each party and associated constraints;
- b. Determine the detailed interface works to be performed during the various stages and
- c. Agree on the interface works in reference to respective scope, with any agreements reached to be formally documented in Interface Meeting Minutes, including an actions item list.

6.5.2 The Interface Contractors / MEP subcontractor shall mutually identify and agree the Interfaces that will exist between them using the Interface Coordination Sheets, the format of which is contained in Attachment F. These interfaces may be expanded to include all, and any other, interfaces that develop during the execution of the Project.

6.5.3 The Interfacing Contractors / MEP subcontractor shall mutually agree upon the information to be exchanged and shall develop a unique Interface Specification for each interface identified. A sample Interface Specification proforma is provided in Attachment C.

The ICSs will be tracked and monitored using an ICS Register to be compiled by the Contractor. This register will track the progress of the ICS from inception through to closure and final processing by the Contractor, prior to transmittal to the Engineer as a complete Integrated Design.

Each interface shall have a unique reference number to enable the Interface to be readily identified and tracked and monitored.

## **7. INTERFACE COORDINATION SHEET (ICS)**

- 7.1 The Contractor's Interface Coordination sheet, the format of which is shown in Attachment F – Part 1, is required to be used by each of the Interfacing Contractors to record all of the Contract Interfaces. The Contractor shall ensure that each Interfacing Contractor / MEP Subcontractor provides input and maintains the ICS continually updated as required in this Appendix.
- 7.2 The Contractor shall ensure that the Interfacing Contractors demonstrate their co-ordination efforts as required by the Contract. To achieve this, the Contractor and the Interfacing Contractor / MEP Subcontractor shall identify their interface requirements which shall be input into the interface documents, i.e. IMP, IMPG, ICS, etc., by the Contractor.
- 7.3 The Contractor shall monitor the ICS to ensure that, as the Interface progresses, the records show the appropriate Status ( refer status codes indicated in Part 3 of Attachment F) as agreed with the Interfacing Contractors. The Contractor will be responsible for confirming the "Closing Out" of each ICS record, whilst ensuring that throughout the interface process all Interfacing Contractors and MEP subcontractor have agreed to the following:
- a) The receiving Interfacing Contractor / MEP subcontractor has received and accepted the Interface being recorded.
  - b) All Interfacing Contractors / MEP subcontractor have recorded the interface record as "Proposed Close Out".
  - c) The Confirmation of Co-ordination form in Attachment G has been updated and signed by the relevant Interfacing Contractors and MEP subcontractor, refer clause 7.4 below.
- 7.4 When documents are exchanged for review/comment with Interfacing Contractors / MEP subcontractor, the originator preparing these documents should ensure that they are accompanied by the Confirmation of Coordination form in Attachment G. When the Interfacing Contractor / Agencies / MEP subcontractor returns these documents with comments to the originator, they should be returned with the Confirmation of Coordination form duly completed, confirming coordination and agreement or comment as appropriate, as a record of them having coordinated the interface item. This Confirmation of Co-ordination is to be transmitted to the Engineer upon signing by the Interfacing Contractor(s).

## **8. COORDINATION DRAWINGS**

### **8.1 General**

For the purpose of achieving a Project which is fully co-ordinated with respect to civil, structural, electrical, mechanical works and interface elements, and to ensure compatibility between different facilities and services, and adequate space requirements, all drawings are to be reviewed and co-ordinated by the Contractor.

The Contractor will provide and issue detailed Interface Working Drawings in terms



of items such as; special arrangements, space allocation, cast in items, primary and secondary fixings, grouting of equipment/plinths, drill and fix brackets, embedded and cast-in items and the like.

The drawings shall be prepared by the Contractor and shall also include composite cross-sections and layouts, which show the spatial requirements of all Interfacing Contractors and identify items to be finalised, defined, or resolved.

## **8.2. Combined Services Drawing (CSDs) And Structural E&M Drawings (SEMs)**

The Contractor's CSDs and SEMs must be clear and sufficiently detailed to unambiguously show the intent of the subject services and the corresponding structure / facility allowances. While these drawings do not have to duplicate all of the details of the Drawings, they must include plans sections and elevations as required to clearly illustrate the compatible relationship between the different disciplines. Specifically, the drawings will include wall elevation drawings at 1:50 scale (or larger where required) indicating all openings, access panels, reinforcement zones, embedded and cast-in items and the like, and shall be submitted to the Engineer for a Notice to proceed.

The CSDs shall show the intended locations, routes and spatial relationships of the individual services, systems and installations with each other and the civil structural work. The CSDs shall also clearly indicate that effective cable co-ordination has been achieved in terms of cable location or cable trays and the trunking and cable routing.

The SEMs shall show all civil and structural requirements for the E&M services and installations, Builder's works and the Core Systems and other installations.

Where Builder's works are required by the Interfacing Contractors / Agencies / MEP subcontractor, the drawings, details, specification notes and catalogue information and the like shall be obtained by the Contractor from these Interfacing Contractors / Agencies/ MEP subcontractor indicating the Builder's work to be incorporated into the Works. The Contractor shall include details of such Builder's works in the SEMs and Method Statements as appropriate.

Builder's work comprises, but is not limited to, the following:

- construction of plinths, bases, builders bund walls and the like.
- placing and fixing of holding down bolts, lifting beams and hooks and other supporting items;
- Supply, fabrication installation, protection, fixing and finishing of supporting steel work, for equipment and associated accessories;
- casting in of edgings, angles in recesses, ducts, conduit, pipes etc;
- fixing equipment and associated, brackets, cable containment and fixtures;
- forming of penetrations, sleeves, access panels, holes, chases, recesses, openings;

all in accordance with the Contract.

The CSD/SEMs shall also be used for the purpose of co-ordinating with the Interfacing Contractors / Agencies / MEP subcontractor and shall be continuously updated to reflect the latest interface co-ordination. Copies of the CSD/SEM drawings shall be included in submittals to the Engineer.

Where the CSDs or SEMs do not fully co-ordinate with the Site conditions the Contractor shall co-ordinate and propose a solution to the problem. All proposed solutions shall be issued to the Engineer.

### **8.3 Interface Drawings**

For the Interface Drawings, the Contractor shall prepare in diagrammatic format for each interface the demarcation of scope of responsibilities between the Contractor and each of the Interfacing Contractors / Agencies / MEP subcontractor. The Contractor shall submit all Drawings with interface requirements for a Notice to proceed from the Engineer. Any proposed deviation to the Construction Specification or Drawings shall be identified and justified with design documentation, details and drawings. The submission shall also identify all interface requirements. The contractor should develop interface drawings with detailed design and dimensions and submit the same to all interfacing parties.

### **8.4 As Constructed Drawings**

Upon completion of the Works the Contractor shall submit all Combined Services Drawings, Structural E&M Drawings, and Interface Demarcation Drawings showing the final "As Constructed" status of the Works related to these drawings.

## **9. ATTACHMENTS.**

Attachment A - Flow Chart for creation / elaboration of Interface Coordination Sheet

Attachment B – Flow Chart for Progress Monitoring of Interface Agreements

Attachment C – Interface Specification Form.

Attachment D – Preliminary Interface sheets

Attachment E - Master Interface Matrix

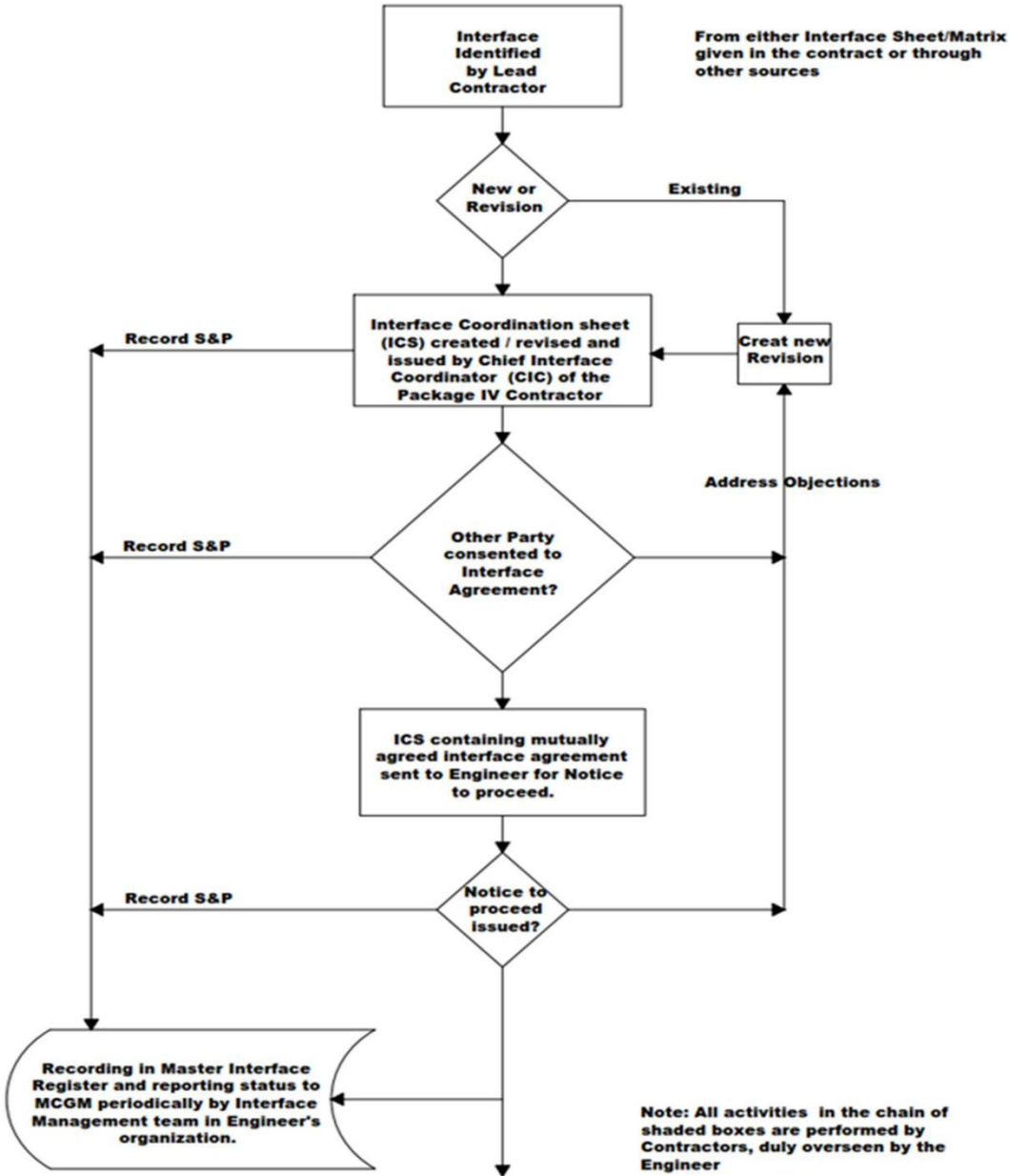
Attachment F – Interface Coordination Sheet

Attachment G – Confirmation of Co-ordination

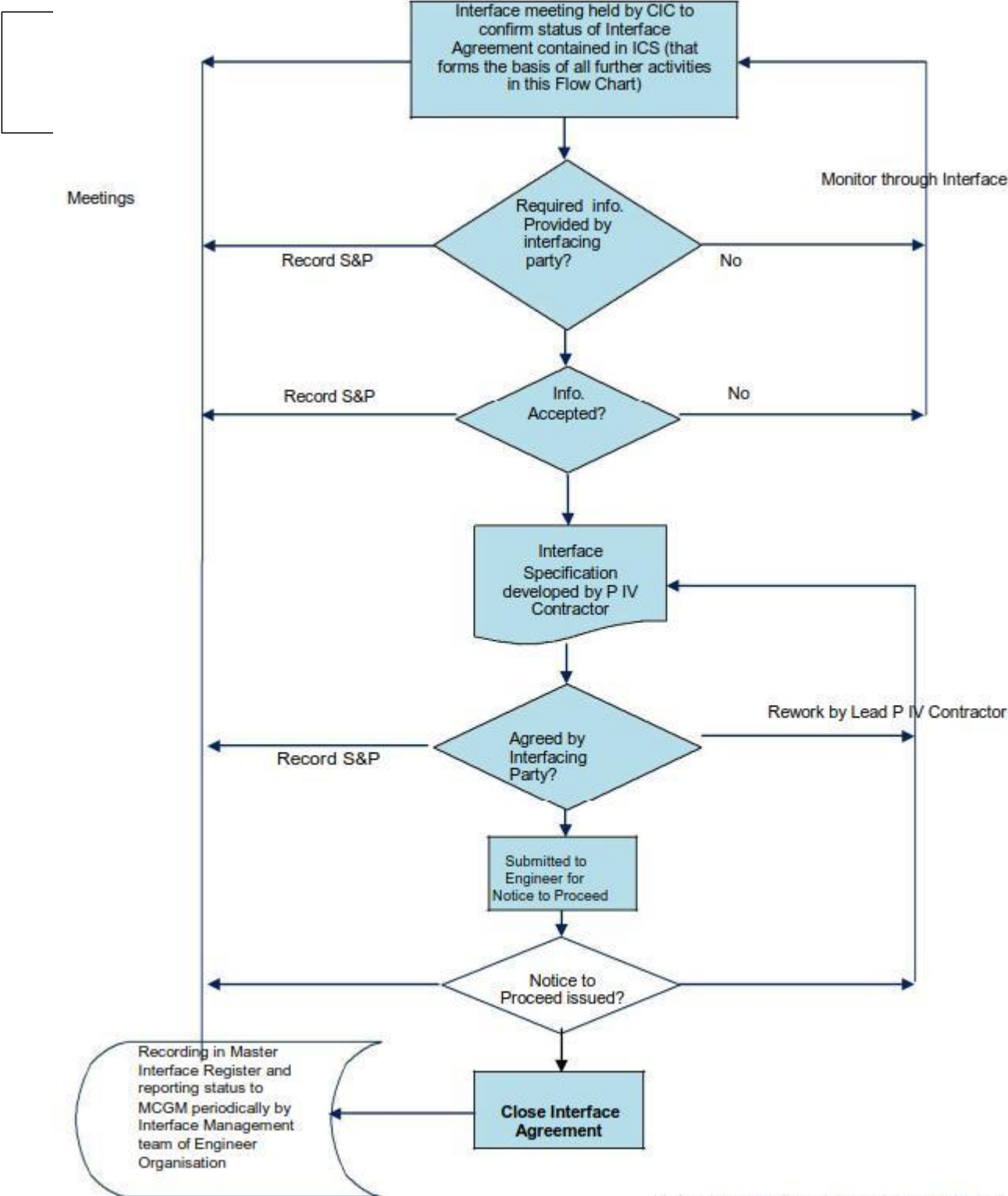
Attachment H - Guidance Notes for the Preparation of IMPG

Attachment I – Guidance Notes for the Preparation of IMP

### **Attachment A : Flow Chart for creation / elaboration of Interface Coordination Sheet**



Attachment B : Flow Chart for Progress Monitoring of Interface Agreements



Note: All activities in the chain of shaded boxes are performed by Contractors, duly overseen by the Engineer

INTERFACE SPECIFICATION

Ref : XXX-00001-A-01

	<b>Contract Designation</b>	<b>Contractors Sequence Number</b>	<b>Date of Issue</b>	<b>15/09/2008</b>
<b>Initiating Contractor</b>			<b>Interface Manager Signature</b>	
<b>Responding Contractor</b>			<b>Interface Manager Signature</b>	
<b>Interface Specification Required for;</b>			<b>Response Required by;</b>	
<b>Reviewed by;</b>  <b>Design Sections</b>				
<b><u>Description of the Interface</u></b>				
<b><u>Specific Details of the Interface</u></b>				<b><u>Location</u></b>
<b>Drawings / Specifications Attached</b>				
<b>Title</b>	<b>Drawing / Specification Ref.</b>		<b>Drg. Issue</b>	
<b>Document</b>	<b>Name</b>	<b>Date</b>	<b>Document References (if any)</b>	
Prepared by:				

Attachment D - Preliminary Interface Sheet				
Interface Sheet	Contract	Contract	Sheet # 1	
Approved by:	Contractor	Interfacing Contractor/Agency/MEP Sub-contractor	Last changes : First issue	
Issue by:				
Checked by:				
Interface description brief/ Key elements (time schedule, physical, functional,...)				
Contract		DESIGN STAGE	Contract	
Reference document:			Reference document:	
Contract		CONSTRUCTION/INSTALLATION STAGE	Contract	



**Attachment F Part 3 - Interface Coordination Sheet Format**

The following table describes the Interface Status with codes to be used in preparing / updating the

Interface Coordination sheet.		
Interface Status Codes & Meanings		
Interface Status	Code for log	Description of Status
To be coordinated	TBC	Both Contractors have not agreed the conditions for this interface
Coordinated	COR	Both Contractors have agreed that the interface is Valid
Not coordinated	NCOR	One Contractor does not agree the conditions for this Interface
Received	REC	The contractor responsible for the design/construction element has received the information/documents required
Provided	PRO	The Contractor responsible for providing the information /documents to progress the design / construction element has provided the documents to the interfacing Party
Accepted	ACP	The contractor has accepted the proposed Interface Design or Construction element
Not Accepted	NACP	Either of the Contractors have not accepted the proposed Design /Construction element
Propose closeout	PCO	Both Contractor's have accepted the proposed Interface Design or Construction element and no other requirements are outstanding. Both Parties can agreed to sign the Confirmation of Coordination Form
Closed out	CO	The final Interface Documentation together with confirmation of Coordination Form has been sent to the Interface Coordination Manager for closing the Interface
Superseded	SUP	The Interface design or construction element has been superseded



**Attachment G – Confirmation of Coordination Form**

<b>Road</b>					
					<b>Ref No.</b>
<b>CONFIRMATION OF COORDINATION</b>					
<b>CONTRACT:</b>				<b>TRANSMITTAL No.:</b>	
<b>TITLE:</b>					
<b>ACTIVITY NO.:</b>					
<b>GENERAL DESCRIPTION:</b>					
<b>SIGNATURE OF INTERFACING CONTRACTORS / MEP SUBCONTRACTOR:</b>					
	<b>Interfacing Contractor/ MEP subcontractor</b>	<b>Authorized Name</b>	<b>Signature</b>	<b>Date Reviewed</b>	<b>Comment</b>
1					
2					
3					
4					
5					

Signatures above confirm that this design document has been reviewed as part of the coordination process.

**NOTE:** Where Contractors are not in agreement with the details on this submission, they are to comment above and advise the interfacing party in question requesting accommodation of the requirement and advise the Engineer under separate cover and report progress in Monthly Report / Coordination Meetings.

**Attachment H - Guidance Notes for the Preparation of Interface Management Programme.**

1. The programme shall be prepared and submitted in bar chart format.
2. The bar chart shall be formed by activities grouped by major Zones of Interface.
3. The detail of each bar chart activity shall demonstrate the Contractor's understanding of the scope of work of any Interfacing Contractor / Agencies / MEP subcontractor who is to supply input to the Contractor, in order for him to achieve an integrated coordinated design.
4. The bars shown on the bar chart shall be annotated with details of the information expected from the Interfacing Contractors / Agencies / MEP subcontractor, and highlight any target dates to receive or produce information.
5. Information relating to contractual milestone dates shall be shown on both the Contractor's and Interfacing Contractors / MEP subcontractor's schedules.
6. The prime purpose of the document is to assist with ensuring that a coordinated design, construction, testing and commissioning is achieved. This document shall be forwarded to Interfacing Contractors / Agencies / MEP subcontractor for comment and agreement on a regular basis.
7. A complementary table of activities and dates should be prepared for ease of reference.

**Attachment I - Guidance Notes for the Preparation of Interface Management Plan.**

The purpose of this Plan is to demonstrate how the Contractor proposes to achieve a fully coordinated design, which is compatible with that design carried out by Interfacing Contractors / Agencies / MEP subcontractor.

This document shall describe each of the component parts, within Zones of Interface, of the design, which require input from Interfacing Contractors / agencies / MEP subcontractor. The descriptions should include details relating to the inputs required from both the Contractor and Interfacing Contractor / Agencies / MEP subcontractor, to achieve a fully coordinated design. The document should also be complementary to the IMPG, which details the proposed schedule and timings of each of the interfacing activities.

This document shall also detail the proposed interfacing requirements to be met by all Interfacing Contractors / Agencies / MEP subcontractor. The Contractor shall ensure that this document is acceptable to the Interfacing Contractors / Agencies / MEP subcontractor and that they are able to comply with all of its requirements. This is to be achieved by document exchanges and discussions to achieve agreement of documents.

The Plan shall therefore:

- i) Detail each of the component parts of the Project, which require the input of Interfacing Contractors / Agencies / MEP subcontractor to achieve a coordinated design. It shall describe the various disciplines and detail the technical input from others that will be required to achieve a coordinated design.
- ii) Cover the whole duration of the Works and be complementary to the IMPG, which details the proposed/agreed schedule and timings.
- iii) Be given by the Contractor to other Interfacing Contractors / Agencies / MEP subcontractor

for their information and agreement.

- iv) Be developed in association with the process of increasing knowledge of the design and shall reflect the agreements reached by the Contractor and the Interfacing Contractors / Agencies / MEP subcontractor as the Project progresses. The Plan shall be updated on a quarterly basis to reflect this developing status.

The Status of any interface at any point in time shall be identified by one of the following conditions;

- to be coordinated
- coordinated
- not coordinated
- received
- provided
- accepted
- not accepted
- propose close-out
- superseded
- closed out

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 17**

**OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENTAL**

## **APPENDIX – 17 :OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENTAL**

### **1. SCOPE**

1.1.1 The Employer's Requirements Volume 3, Appendix 17 titled "Occupational, Health, Safety and Environmental Manual (OHS&E) details the requirements of the Employer for Safety, Health and Environmental control measures associated with the Contractor and any other agency, to be practiced in sites and associated premises. This document should be treated as OHS&E.

### **1.2 Application of this document**

1.2.1 This OHS&E applies to all aspects of the Contractor's scope of work including that conducted by their appointed Subcontractor's and other Agencies on their behalf. There shall be no activity associated with the Road project which is exempted from the purview of this document. The Employer's Requirements OHS&E is further supplemented with a further 3 OHS&E Volumes for ease of reference. Their individual scope and applicability is as follows;

1.2.2. This OHS&E document (Appendix 17 of Volume 3) is the controlling document for all Contracts and is fixed throughout the term of the project. Compliance with this OHS&E (Appendix 17 of Volume 3) is mandatory.

1.2.2 OHS&E Section 1, Volume 7 provides Safety & Health guidance that the Contractor may choose to use unless stated as mandatory within this appendix 17. The contents of OHS&E Section 1, Volume 7 remains subject to revision by the Engineer in the event of new Legislation or changing circumstances. The information contained within the Section 1, Volume 7 shall be used by the Engineer in assessing the sufficiency and suitability of the Contractor's management systems and performance.

1.2.3 OHS&E Section 2, Volume 7 provides Environmental guidance and procedural requirements for the project the Section 2, Volume 7 remains subject to periodic revision and updating.

1.2.4 OHS&E Section 3, Volume 7 is specifically for projects and its use is mandatory. The Section 3, Volume 7 4 *remains* subject to revision and updating during the project period in light of legislative or methodology changes.

**1.2.5** OHS&E Section 1, 2 & 3 are appended under Volume 7 Reference Documents.

### **1.3. Purpose of this document**

The purpose of this document, the Employer's Requirements, OHS&E Volume 1 is to provide Contractors and other interested parties with the mandatory requirements relating to Health, Safety and the Environment practices and performance expectations.

This document:

- a) Describes the OHS&E interfaces between the Employer, Engineer and the Contractor;
- b) Details the processes by which the Contractor shall manage OHS&E issues while carrying out the works under the contract; and
  - a. Describes by reference, the practices, procedures and requirements

#### 1.4.

Project has identified five principle objectives for attainment during the project. These long term objectives shall be supported with quarterly, short and medium term objectives to enable structured advancement in overall performance. The short and medium term objectives also aims to facilitate effective monitoring and measurement to identify where a directional change may be necessary. The long term objectives are:

- a. To eliminate or minimize the unwanted effects of hazards and risks to personnel, members of the public and other stakeholders who may be exposed to the undertakings associated with the construction
- b. Establish an effective and robust OHS&E management system that will enable Contractors to achieve international recognition and registration to the BS EN 18001:2007 Series.
- c. Actively contribute to Contractors development through support, encouragement, determination in control and transfer of knowledge and skills in order to make the move from traditional compliance driven management through to risk managed processes.
- d. To simplify the risk concept, to ensure a sensible approach to risk management and simplify hazard awareness training through adoption of the ALARP (As low as reasonably practicable) principles.
- e. To practice \_Best Practice 'within the construction industry - Establishing a work environment that conforms to international health & safety standards and make recommendation to improve effectiveness of regulations both nationally and locally.

## 2. REFERENCE PUBLICATIONS

- o BS EN ISO 9000:2005, Quality management systems — Fundamentals and vocabulary
- o BS EN ISO 9001:2008, Quality management systems — Requirements
- o BSENISO 14001:2004, Environmental management systems — Requirements with guidance
- o BS EN ISO 19011:2002, Guidelines for quality and/or environmental management systems auditing
- o ISO 45001 added with BS OHSAS 18001:2007, Occupational health and safety management systems Requirements.
- o BS OHSAS 18002, Occupational health and safety management systems – Guidelines for the implementation of BS OHSAS 18001
- o PAS 99, Specification of common management system requirements as a framework for integration
- o International Labour Organization: 2001, Guidelines on occupational health and safety management systems — ILO-OSH 2001

- Health & Safety Guidance (HSG) Health and Safety Executive publications United Kingdom

### 3. TERMS AND DEFINITIONS

- 3.1. **Acceptable risk.** Risk that has been reduced to a level that can be tolerated by the organization having regard to its legal obligations and its own OHS&E policy
- 3.2. **Accident.** Incident giving rise to injury, ill health or fatality
- 3.3. **ALARP** (As low as reasonably practicable) principles.
- 3.4. **Audit.** Systematic, independent and documented process for obtaining —audit evidencell and evaluating it objectively to determine the extent to which —audit criteriall are fulfilled
- 3.5. **BOCWA. Building and Other Construction Workers (Regular Employment and Conditions of Service) Act, 1996**
- 3.6. **BOCWR. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998**
- 3.7. **Chief Safety Expert. An officer nominated by BMC who is the overall responsible for monitoring all OHS&E functions prescribed in this document.**
- 3.8. **BMC. Brihanmumbai Municipal Corporation**
- 3.9. **Competent person.** Person with the appropriate combination of skill, knowledge, qualifications and experience
- 3.10. **Continual improvement.** Recurring process of enhancing the OHS&E management system in order to achieve improvements in overall OHS&E performance consistent with the organization's OHS&E policy
- 3.11. **Corrective action.** Action to eliminate the cause of a detected nonconformity or other undesirable situation
- 3.12. **Design Risk Assessments.** Used to record the actions of designers when reducing risks in construction and for future repairs and maintenance issues.
- 3.13. **Employer.** BMC
- 3.14. **Hazard.** Source, situation, or act with a potential for harm in terms of human injury or ill health, or a combination of these
- 3.15. **Hazard identification.** Process of recognizing that a hazard exists and defining its characteristics
- 3.16. **Health surveillance.** Monitoring health of employees to detect signs or symptoms of work - related ill health so that steps can be taken to eliminate, or reduce the probability of, further harm
- 3.17. **ILL health.** Identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/or work-related situation

- 3.18. Incident. Work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred. An accident is an incident which has given rise to injury, ill health or fatality. An incident where no injury, ill health, or fatality occurs may also be referred to as a —near-missll, or —dangerous occurrenceell.
- 3.19. Interested party. Person or group, inside or outside the workplace, concerned with or affected by the OHS&EOHS&E performance of an organization
- 3.20. Nonconformity. Non-fulfilment of a requirement; A nonconformity can be any deviation from: relevant work standards, practices, procedures, legal requirements, etc. or OHS&E management system requirements. A nonconformity can be any deviation from: — relevant work standards, practices, procedures, legal requirements, etc. — OHS&E management system criteria.
- 3.21. OHS&E management system. Part of an organization's management system used to develop and implement its OHS&E policy and manage its OHS&E risks. A management system is a set of interrelated elements used to establish policy and objectives and to achieve those objectives. A management system includes organizational structure, planning activities (including for example, risk assessment and the setting of objectives), responsibilities, practices, procedures, processes and resources.
- 3.22. OHS&E objective. OHS&E goal, in terms of OHS&E performance that an organization sets itself to achieve.
- 3.23. OHS&E performance. Measurable results of an organization's management of its OHS&E risks
- 3.24. OHS&E policy. Overall intentions and direction of an organization related to its OHS&E performance as formally expressed by top management
- 3.25. Preventive action. Action to eliminate the cause of a potential nonconformity (3.19) or other undesirable potential situation
- 3.26. Procedure. Specified way to carry out an activity or a process
- 3.27. Record. Document stating results achieved or providing evidence of activities performed
- 3.28. Risk. Combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s)
- 3.29. Risk assessment. Process of evaluating the risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk(s) is



- 3.30. Risk control. Selection and application of suitable measures to reduce risk
- 3.31. Shall. Indicates a mandatory requirement within this document
- 3.32. Stakeholders. Those with a interest in an organization's achievements that includes, but is not limited to, internal and —outsourcedll employees, customers, suppliers, partners, employees, distributors, investors, insurers, shareholders, owners, government and regulators.
- 3.33. Status review. Formal evaluation of the OHS&E management system
- 3.34. Top management. Person or group of people who direct and control an organization at the highest level
- 3.35. Worker representative. Representative of employee occupational health and safety

#### **4. SHE MANAGEMENT SYSTEM REQUIREMENTS**

##### **4.1 General requirement**

- 4.1.1 The Contractor shall define and document the scope of its Occupational Safety Health and Environmental (OHS&E) management system to meet legal requirements within this document.
- 4.1.2 The Contractor's OHS&E management system shall determine how the organisation shall document, implement, maintain and continually improve upon performance in accordance with the requirements of the International OHSAS Standard to which the Employer is committed.

##### **4.2 BMC OHS&E Policy Statement of Intent**

BMC consider that health, safety and environmental is of equal importance in comparison to any other aspect of business management and as such is committed to promoting high standards of safety, health, environment and welfare on all of their sites and premises. To achieve this Link Road at Dahisar (West) in BMC limit to Bhayander (West) in MBMC limit shall:

- Constantly work towards improving the safety culture at all levels.
- Ensure compliance with all relevant legal duties in respect of health and safety at work legislation.
- Provide adequate resources for planning and controlling working conditions and safe systems of work.
- Work with our Contractors and suppliers to improve their safety performance, by measuring and monitoring their performance. Responsibilities and performance requirements for Safety, Health and the Environment are summarised as follows:
- All Contractors, employees, sub-contractors, consultants, suppliers and visitors have a duty to play an active role in achieving our objectives through compliance with their legal obligations and this Safety Policy.
- Participation and consultation are vital aspects of this Policy and to the achievement of our objectives. Contractors and Staff are encouraged and expected to:
- Discuss safety, health and welfare matters with their managers, and company Safety, Health & Environmental Representatives who will offer or obtain further

expert advice, where necessary.

- Co-operate at all times; contribute good ideas and improvements; report defects and short falls.

The correction of any breach of statutory provision or Link Road at Dahisar (West) in BMC limit to Bhayander (West) in MBMC limit requirements on health and safety shall take priority. Should appropriate action not be taken to meet the required standards, this will be taken seriously and may lead to disciplinary action being taken.

This Policy Statement shall be displayed prominently on all Link Road at Dahisar (West) in BMC limit to Bhayander (West) in MBMC limit sites and offices and will be kept under review to ensure its relevance.

### **4.3. Planning**

#### **4.3.1. Hazard identification, risk assessment and determining controls**

4.3.1.1 The Contractor shall submit a procedure detailing the process in place for the identification of Hazards and Risks and the determination of control measures including the relevant standards as per clause 4.4.4.1.2. The Procedure shall incorporate the Employer's Requirements within this and other applicable OHS&E Volumes.

4.3.1.2 Management of Change

4.3.1.2.1 All temporary and permanent changes to organisational, personnel, systems, procedures, equipment, products, materials or substances shall be evaluated by the Contractor and managed to ensure that health, safety and environmental risks arising from these changes remain at an acceptable level. Changes made by the Contractor are subject to submittal and notice of no objection by the Engineer prior to adopting change.

4.3.1.3 Risk Register & Hazard Log

4.3.1.3.1 The Contractor's Construction Health and safety Plan shall contain a detailed Risk Register and Hazard Log specific to the project. The register and log shall be assessed against the BMC OHS&E requirements Volume 2.

4.3.1.3.2 The Hazard Log shall identify future method statement, risk assessment and operational procedures pertaining to specific equipment and operations in relation risk and local environmental constraints. Construction phase OHS&E Plans shall not be accepted without a fully completed Hazard Log and Risk Register.

4.3.1.4 Method Statements

4.3.1.4.1 Method statements are to be submitted to the Engineer a minimum of 21 days prior to task commencement to ensure sufficient time is available for review and notice of no objection.

4.3.1.4.2 Method statements shall contain the information requirements as prescript within the BMC OHS&E Volume 2.

- 4.3.1.4.3 Method statements shall incorporate the control measures within the process methodology as identified within the risk assessment.
- 4.3.1.4.4 A copy of the relevant method statement for the activity being undertaken shall be available on site for reference by all site management and supervisors.
- 4.3.1.4 Risk Assessment production & submittal
- 4.3.1.5.1. Risk assessments shall contain as a minimum, the information as specified within the BMC OHS&E Volume 2. The Contractor may choose to use their own format however the risk tolerances, probability and consequences must be included.
- 4.3.1.5.2 Risk assessments shall be produced and submitted to the **(TA4)** Engineer a minimum of 21 days prior to task commencement for notice of no objection. Risk assessments may be submitted independently or as part of a Method Statement.
- 4.3.1.5.3 Generic risk assessments other than routine activities of low risk shall not be accepted by the Employer.
- 4.3.1.5.4 Risk assessments shall be regularly reviewed to ensure they remain suitable and sufficient. Risk assessment reviews shall be undertaken where an incident has occurred and when a change in location may introduce additional risks from construction activities.
- 4.3.1.5.5 Substances hazardous to health shall be subject to assessment by the Contractor. Where Hazardous substances are identified for use within a process the assessment and determining controls shall be included within the relative method statement.
- 4.3.1.6 Design Risk Assessment
- 4.3.1.6.1 Design Risk Assessments shall be submitted to the Engineer for granting of no objection. Design risk assessments shall accompany all drawing submittals for operations involving;
- Temporary works,
  - Formwork & false-work
  - Heavy lifting equipment.
- 4.3.1.6.2 Drawings shall not be accepted by the Employers Representative without an accompanying design risk assessment.
- 4.3.2 **Legal and other requirements**
- 4.3.2.1 Contractor shall comply with all legal obligations and the requirements of Road as contained herein.
- 4.3.2.2 Indian statutory requirements
- The Contractor shall abide by all national, state and local bye-laws. It is the duty of the Contractor to ensure that all sub-Contractors appointed also comply with their legal obligations as listed below but not limited to:
- i. Indian Electricity Act 2003 and Rules 1956
  - ii. National Building Code, 2005
  - iii. Factories Act, 1948,
  - vii. Motor Vehicles Act as amended in 1994, The Central Motor Vehicles Rules, 1989.
  - viii. Indian Road Congress Code IRC: SP: 55-2001 \_Guidelines on Safety In Road Construction Zones.

- ix. The Petroleum Act, 1934 and Rules 1976 x. Gas Cylinder Rules, 2003
- xi. Indian Explosives Act. 1884, along with the Explosives substance Act 1908 and the explosives Rules 1983
- xii. The (Indian) Boilers Act, 1923
- xiii. The Public Liability Insurance Act 1991 and Rules 1991
- xiv. Minimum Wages Act, 1948 and Rules 1950
- xv. Contract Labour Act, 1970 and Rules 1971
- xvi. Child Labour (Prohibitions & Regulations) Act, 1986 and Rules 1950
- xvii. Environment Protection Act, 1986 and Rules 1986
- xviii. Air (Prevention and control of Pollution) Act, 1981
- xix. Water (Prevention and Control of Pollution) Act, 1974
- xx. The Noise Pollution (Regulation & Control) Rules, 2000
- xxi. Notification on Control of Noise from Diesel Generator (DG) sets, 2002
- xxii. Recycled Plastic Usage Rules, 1998
- xxiii. Notification, Central Ground Water Board, Act January 1997
- xxiv. Manufacture, Storage & Import of Hazardous Chemicals Rules, 1989
- xxv. The Hazardous Waste (Management & Handling) Rules, 1989
- xxvi. Hazardous Waste Management Rules 1989 (as amended in 1999)
- xxvii. Batteries (Management and Handling) Rules
- xxviii. Fly ash utilization notification, Sept 1999 as amended in August 2003
- xxix. Workman Compensation Act, 1923 along with allied Rules

4.3.2.3 International Standards, Guidelines & ISO Certifications

4..2.3.1 If the requirements stated in this document are in conflict or inconsistent with the requirements of applicable laws , the more stringent requirements shall apply.

4..2.3.2 The works shall be undertaken in accordance with the applicable international guidelines, standards and specifications on OHS&E and every Contractor shall actively pursue the achievement of:

- BS EN OHSAS 18001:2007 - OHS Management Systems
- ISO 14001-2004: Environmental Management Systems

4.3.2.3. The process of international certification to BS EN 18001:2007 and ISO 14001-2004 standard shall commence immediately after the award of Contract through appointment of ISO accrediting body for obtaining the certification. Should this not be undertaken by the Contractor within 3 months of the Contract award, the Engineer shall appoint at the Contractor's cost.

4.3.2.3.4 Should the Contractor already possess such certification, the scope of the CMR project must be included on the Contractor's certification within 1 year of Contract commencement and proof of such attainment demonstrated to Link Road at Dahisar (west) in BMC limit to Bhayander (West) in MBMC limit.

4.3.3 **Objectives and programme(s)**

4.3.3.1 The Contractor shall maintain procedures to establish detailed OHS&E objectives

and performance criteria. Such objectives and performance criteria shall be developed to incorporate the Road policy and strategic OHS&E objectives. The Contractor's objectives shall be quantified, wherever practicable, and identified with defined timescales. The Contractor is required to submit for notice of no objection their procedure and objectives as per clause 4.4.4.1 of this control document.

**4.4 Implementation and operation**

**4.4.1 Resources, roles, responsibility, accountability and authority**

4.4.1.1 The Contractor shall detail within the Construction Health, Safety and Environmental Plan the planned roles and resources allocated for the CMR project. In addition to the staffing arrangements the Contractor shall prescribe the responsibilities specific to role, accountability and the authority under which they operate.

4.4.1.2 Safety, health & environmental resources shall be provided by the Contractor as per the Contract value in table 1.

	1	2	3	4	5	6
Contract Value in (Cr.)	Chief OHS&E Manager	Senior OHS&E Manager	Junior OHS&E Manager	Safety Steward	Senior Electrical Engineer	Junior Electrical Engineer
Up to 2			1	Refer to note 1		1
Up to 10		1	Refer to note 1		1	Refer to note 2
Up to 25	1	Refer to note 1			1	
Up to 100	1				1	
Up to 250	1		1			
250 or More	1				1	

	7	8	9	10	11
Contract Value In (Cr.)	Occupational Health Officer with necessary nursing Assistants (Refer Note 3)	Environmental Manager	Senior OHS&E Traffic Engineer (Refer to Note 4)	Housekeeping and Barricade maintenance	Labour Welfare Officer
Up to 2				Refer to Note 5	
Up to 10	1 (PT)	1	1		1
Up to 25	1 (PT)	1	1		1
Up to 100	1 (PT)	1	1		1
Up to 250	2 (FT)	1	1		1 with Support staff
250 and More	2 (FT)	1 with support staff	1		1 with Support staff

Note 1	Qualified and trained OHS&E Professionals as per Table 2 with required support staff to be deployed at each worksite at each shift. Qualifications of appointed OHS&E personnel shall be in accordance with section 4.4.2 Competence, Awareness and Training, within this document.
Note 2	Qualified and trained Electrical Engineers / supervisors to be deployed at each worksite for each shift.
Note 3	(PT) means Part-Time and (FT) means Full-time.
Note 4	Senior OHS&E(Traffic) Engineer Post and Barricade Manager posts are applicable to contracts where the work has to be executed either below or way such as Viaduct, Station Contracts.
Note 5	One Housekeeping Manager/ Barricade Manager supported by required supervisors and workmen necessary to maintain a clean and tidy site or yard

4.4.1.3 Responsibility

4.4.1.4 The General Manager of the Contractor is responsible and accountable for compliance with the conditions and clauses within this document.

4.4.1.5 The General Manager is responsible to ensure that the necessary resources are allocated and made available to meet the requirements as laid out within this document and other referenced materials to include Legal Requirements (4.3.2).

4.4.1.6 For all works carried out by the Contractor and appointed sub-Contractor's, the responsibility for ensuring OHS&E resources remains with the main Contractor. Activities undertaken by the Contractor's Sub-Contractors shall be monitored by the Contractor at all times to ensure compliance with agreed safe systems of working.

4.4.1.7 All Contractor's OHS&E personnel shall report to the Chief OHS&E Manager who shall report directly to the General Manager or Corporate Safety Director of the Contractor's organisation. This shall be reflected in the Contractor's organisation charts within the OHS&E plan and Quality Management Plan.

4.4.1.8 The Employer shall monitor adherence to the provisions of Table 1. Where deviation is evident this shall be recorded as a non-conformance.

4.4.1.9 The Contractor shall provide all OHS&E personnel with such facilities, equipment and information that are necessary to enable them to dispatch their duties effectively.

4.4.1.10 The Contractor's Safety Managers, Safety Advisors and Officers are responsible for ensuring that reports on the performance of the OHS&E management system are presented to top management for review and used as a basis for improvement of the OHS&E management system.

4.4.1.11 The Contractor's Safety Managers, Safety Advisors and Officers are responsible for independently monitoring the operations of the Contractor, where deficiencies are identified they are responsible to report their findings immediately to the Site

Engineer in charge who then must take action as directed.

4.4.1.12 Accountability

4.4.1.13 In cases where the Contractor fails to provide the minimum required manpower as illustrated in Table 1, or fails to fill vacancies created within 30 days, the same may be provided by the Engineer at the Contractor's cost. Any administrative expenses involved in providing the same for example, vacancy advertisements or recruitment consultant charges, shall also be at the cost of Contractor.

4.4.1.14 No OHS&E personnel shall be permitted to do any work which is unconnected to, inconsistent with or detrimental to the performance of the OHS&E duties.

4.4.1.15 Supervisors must ensure that the employees under their direct supervision are working in compliance with the approved safe systems of working.

4.4.1.16 Authority

4.4.1.17 The Contractor's Safety Managers, Safety Advisors and Officers authority shall be stated within the Construction Health and Safety Plan and the authority level must be communicated to all Contractor's Staff including sub-Contractors.

4.4.1.18 The Contractor's Safety Managers, Safety Advisors and Officers shall have the authority as assigned by the General Manager to suspend works where deviation from an approved method of working occurs that presents a risk of injury, equipment or property damage.

4.4.1.19 The Engineer shall have the right to stop the work, if in his opinion the work is being carried out in such a way that a risk of injury, property and or equipment damage may exist. The Contractor shall not proceed with the work until remedial works have been completed with under the direction and satisfaction of the Employer. Should the Contractor continue to work without implementing the Engineer's instruction, clause 4.4.2.2 shall be applied to the individual responsible for the decision to proceed.

4.4.1.20 The Contractor shall not be entitled to any damages or compensation for stoppage of work, due to safety reasons. The period of such stoppages of work shall not be taken as an extension of time for completion of the facilities and will not be the ground for waiver of levy of liquidated damages.

**4.4.2 Competence, training and awareness**

4.4.2.1 The Contractor shall ensure that the recruitment, selection and placement processes shall be in place to ensure that personnel are qualified, competent, and physically fit for assigned tasks. The Contractor shall produce a procedure that shall be made available to the Engineer for notice of no objection as per Clause 4.4.4.1.2 of this document. The procedure shall define the processes in place to ensure competence.

4.4.2.2 The Contractor's attention is drawn to Part I General Conditions Clause 6.9 (d), whereby any person employed thereon, who in the opinion of the Engineer, misconducts himself or is incompetent or negligent or fails to conform with any particular provisions with regard

to safety, health or environment which is set out in the Contractor’s OHS&E Plan or a requirement of the Contract, or persists in any conduct which is prejudicial to safety or health, shall be removed from site immediately, and such persons shall not be employed again upon the Works. The decision of the Engineer in this regard shall be final.

4.4.2.3 Notice of No Objection from the Engineer

4.4.2.3.1 The name, educational qualifications and work experience for all persons intended for a Contractor’s OHS&E role shall be submitted to the Engineer for notice prior to employment. Only upon notice of no objection by the Engineer shall OHS&E personnel be authorised to work on a BMC site.

4.4.2.3.2 The Contractor shall appoint the required OHS&E personnel in accordance with the qualifications and experience as listed in Table 2.

Table 2 OHS&E Personnel Qualifications & Experience			
Item	Designation	Qualification	Experience (Years)
1	Chief Safety Manager	The Chief OHS&E Manager shall be qualified in any of the following degrees/diplomas:	15
		Post Graduate Diploma in Industrial Safety & Environmental Management (PGDISEM)	
		M.E. in Industrial Safety from NIT,	
		B.E. in Fire and Safety Engineering.	
		B.E. with advanced Safety Management Diploma	
		B.E / B.Arch., with one year <u>Full Time</u> advanced Safety Diploma	
		B.E/B.Tech full time Degree / Diploma in Safety.	
		International qualifications, CSP (Certified Safety Professional), NEBOSH, MIOSH, MSISO etc	
		Aslo refer to item 10, Clause A15(9), Volume 3	
2	Senior OHS&E Manager	As stated in Sl. No:1 and in addition the following categories:	2 years for category (i) (ii) and (iii)
		i) B.Sc.(Physics/Chemistry/Maths) with one year Full Time advanced Safety diploma	
		ii) B.Sc. / Diploma in Engg. with advanced safety Management Diploma	
		iii) B.Sc. (Physics/Chemistry/Maths) with One year Full Time diploma in Safety Engineering	
iv) Any Graduate or diploma holder with 7 years of work experience in a OHS&E department upon approval of Engineer.			
		i) Degree in Science / Diploma in Engineering with Govt. recognized safety diplomas	i) 2 Years



	Junior OHS&E Manager	ii)Any Graduate or diploma holder with <u>5 years</u> of work experience in a OHS&E department with prior approval of Engineer? on a case to case basis	
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Item	Designation	Qualification	Experience (Years)
4	Safety Steward	Any basic qualification with any OHS&E related certificate	2 Years
5	Senior Electrical Manager	Degree in Electrical Engineering + Govt. Recognized Electrical Licence holder	2 Years
6	Electrical Manager	Diploma in Electrical Engineering + Govt. Recognized Electrical Licence holder	1 Year
7	Occupational Health Officer	MBBS with Govt. recognized degree/diploma in Industrial/occupational health	1 Year
8	Environmental Manager	Govt. recognized PG Degree / PG Diploma / Degree in Environmental Engineering / Science	2 Years
9	Senior Traffic Engineer	Govt. recognized PG Degree / Degree / Diploma in Traffic/Transportation Engineering or Planning	1 Year
10	Housekeeping & Barrier Manager	Any Diploma in Engineering	1 Year

4.4.2.3.3 Where a potential candidate has previously worked in a Metro Rail construction environment and does not possess the qualifications and or the necessary experience as listed in Table 2 for the particular role, the Engineer may upon a successful interview of the candidate grant a waiver subject to successful completion of a probation period of 3 months.

4.4.2.3.4 In order to effectively interact on labour welfare matters with the Engineer and the statutory authorities enforcing the labour welfare legislations every Contractor shall employ a full time Labour Welfare Officer duly qualified and experienced as per clause

4.4.2.3.5 OHS&E Induction Training

4.4.2.3.6 The Contractor shall ensure that all personnel working at the site receive an induction OHS&E training explaining the nature of the work, reporting & communication routes the hazards that may be encountered during the site work and the particular hazards attached to their own function within the operation. The training shall cover as a minimum the contents as directed within OHS&E Volume 2.

4.4.2.3.7 Records of all inductions shall be maintained by the Contractor and be made available for inspection by the Employer upon request.

4.4.2.3.8 The Contractor shall provide their workforce and management staff with an

OHS&E induction Handbook containing the information as per the induction training.

- 4.4.2.3.9 A condensed induction shall be given by the Contractor to all visitors. The induction briefing shall include the risk and hazards associated with the particular site and the operations being conducted.
  - 4.4.2.3.10 All personnel shall be issued a temporary ID upon the completion of the Contractor's induction. The temporary ID shall be signed by the Human Resource Manager or appointed representative and limited to a 2 week validity period at which time the temporary ID shall be replaced with a permanent ID including photograph.
  - 4.4.2.3.11 Individuals found on site by the Engineer without-dated temporary ID cards shall be removed from site
- 4.4.2.4 OHS&E Training
- 4.4.2.4.1 The Contractor shall assess the training requirements for all the employees, plan and initiate a training program to fulfil the training needs assessment. The assessment of training needs shall incorporate all levels of staff including Sub-Contractor's against an individual's role, responsibility, ability, language skill and risk.
  - 4.4.2.4.2 The Contractor shall produce a 'Training Implementation Plan' to incorporate the findings of the needs assessment.
  - 4.4.2.4.3 The training needs assessment together with Implementation Plan shall be submitted to the Engineer for notice of no objection within 4 weeks of commencement. The Engineer shall evaluate the assessment and plan against the base line training matrix contained within OHS&E Volume 2.
  - 4.4.2.4.4 Records of all training conducted shall be maintained and made available for inspection by the Engineer upon request.
  - 4.4.2.4.5 Should the Contractor fail to provide the training identified within the Contractor's assessment, implementation plan and the Engineer's Training matrix within the agreed timescales, this shall be reflected in the potential scores awarded within the monthly audit report.
  - 4.4.2.4.6 Specific training with regard to the provisions of the Construction Safety Plan, and associated operational and system procedures shall be conducted by the Contractor for all persons with supervision responsibilities. Records of training including duration shall be maintained.

#### **4.4.3 Communication, participation and consultation**

##### 4.4.3.1 Communication

- 4.4.3.1.1 The Contractor shall produce a 'High Quality' quarterly newsletter on a rotational basis with other Contractors. Rotation shall be announced within the Engineer's OHS&E Committee meetings.
- 4.4.3.1.2 All Contractors including the Engineer shall provide input into the rotational Contractor for the newsletter content such as details of accidents, incidents and near misses together with any lessons learned; specific safety initiatives; internal

competitions and workforce awards etc.

- 4.4.3.1.3 The Engineer shall be issued the draft newsletter for review prior to the Contractor's publishing.
- 4.4.3.1.4 The OHS&E Newsletters shall publicise all Contractors OHS&E performances over the previous 3 months in relation to OHS&E Audits and shall form the basis for the Engineer's Awards programme. Results of audits shall be provided by the Engineer for inclusion.
- 4.4.3.1.5 The quarterly newsletters shall be issued to all interested parties and be promulgated at site level. Where language barriers exist the contents of the newsletters shall be communicated by the Workforce Representative to ensure understanding.
- 4.4.3.1.6 At site level the Contractor shall erect pertinent awareness signage and posters. Posters shall be changed on a monthly basis to maintain impact.
- 4.4.3.1.7 Poster campaigns shall be discussed and agreed at the Engineer Committee Meeting to maintain a consistent improvement programme across all BMC Sites.
- 4.4.3.1.8 Informational posters, banners etc shall be provided in Marathi, Hindi and English.
- 4.4.3.1.9 Toolbox talks or team briefings shall be carried out daily by the Contractor and correspond to the works activities being undertaken or to communicate a specific awareness initiative. Toolbox talks shall not replace professional training.
- 4.4.3.1.10 Records of all toolbox talks undertaken together with the date, topic, participant's names and signatures shall be maintained and made available for inspection by the Engineer.
- 4.4.3.1.11 Method statement and risk assessment briefings shall be carried out prior to the commencement of a new task and or when a change to the method of working arises. Records of all such briefings shall be maintained by the Contractor.
- 4.4.3.1.12 Visitor information signage shall be posted at site entrances detailing where to report and contact information. Note: visitors shall be accompanied at all times by site security where office locations require walking through operational areas.
- 4.4.3.1.13 Public Liaison
- 4.4.3.1.14 Public informational signage and Contractor contact information shall be posted externally to the site.
- 4.4.3.1.15 The Contractor shall appoint an individual as a Public liaison Officer to communicate directly with members of the public regarding forthcoming operations, what to expect, noise expectancy, duration of operations etc.

#### 4.4.3.2 Participation and consultation

The Contractor shall establish a Safety Committee within 4 weeks of commencement that shall be chaired by the Contractor's Project Director.

- 4.4.3.2.2 The Contractor shall notify the Engineer of the establishment of the Committee together with the committee members' names and designation. The Contractor's Chief Safety Manager, Senior Safety Manager, Plant & procurement Manager and

Human Resources Manager shall form the minimum committee members. Site based personal shall be represented within the Committee by the attendance of Site Manager(s) and the Workforce OHS&E Representative.

- 4.4.3.2.3 The Engineer shall be invited to attend the Contractor's Safety Committee meetings.
- 4.4.3.2.4 The Contractor's OHS&E Committee shall meet on a monthly basis throughout the duration of the Contract.
- 4.4.3.2.5 The Committee shall review the previous month's performance, to include, inspections and audits undertaken, accidents and incidents and any concerns or complaints that have been raised. Short term objectives and targets for improvement shall be set for completion by the next scheduled Committee meeting.
- 4.4.3.2.6 The Safety committee shall undertake a formal site inspection to be scheduled on a 2 monthly basis. The inspection shall review progress regarding the achievement of short term targets. The Committee shall produce a report stating progress made together with any corrective actions required and issue to the Engineer within 7 days following the Inspection.
- 4.4.3.2.7 Minutes of the Committee meeting shall be issued within 2 days and promulgated to all members including the Engineer. The minutes of meeting shall also be posted on all sites within the workforce area. The minutes intended for site communication shall be in both Tamil and English.
- 4.4.3.3 Engineer OHS&E Committee
  - 4.4.3.3.1 A Safety Health and Environmental Committee shall be established by the Engineer and shall sit every 3 months throughout the project period. All Contractors shall be required to attend the quarterly meetings who shall be represented by their General Manager and Chief Safety Manager.
  - 4.4.3.3.2 The Committee shall review previous performances project wide and set short and medium term objectives and targets for achievement within the next reporting period.
  - 4.4.3.3.3 The Engineer reserves the right to call an Emergency Meeting of the Committee members in the event of a serious incident that requires immediate change to the operational methods of working.
  - 4.4.3.3.4 Minutes of the Engineers OHS&E Committee shall be promulgated to all Contractor's within 3 days.
- 4.4.3.4 Workforce Representation
  - 4.4.3.4.1 All workers shall have access to a Workforce OHS&E Representative who is responsible to communicate directly with the labour force with regard to safety and health. The representative's name and contact number shall be posted on all sites externally to the site office.
  - 4.4.3.4.2 The Workforce OHS&E Representative shall be made a member of the OHS&E Committee and attend all meetings.

- 4.4.3.4.3 The OHS&E Representative shall meet the labour force on a monthly basis to discuss health, welfare, safety initiatives and or concerns the workforce may have. Minutes are to be produced by the OHS&E Representative and issued formally within 2 days after the meeting date to the Contractor's Project Manager and General Manager and the Engineer.
- 4.4.3.4.4 A lockable site suggestion box to which only the workforce OHS&E Representative shall have access shall be installed on all sites and within any labour accommodation camps. The suggestion box shall be located independent from any offices, in a public area and protected from bad weather. The OHS&E Representative shall inform the workforce that the purpose of the suggestion box is to provide a means of participation, communicating ideas and initiatives and also for raising concerns without fear of reprisal.
- 4.4.3.4.5 The contents of all suggestion boxes shall be collected and collated on a weekly basis. Where concerns or complaints regarding the standards of health, safety or welfare have been reported these shall be immediately reported to the Chief OHS&E Manager and Project Manager who shall investigate the concern(s). Records of such investigations and resultant outcomes shall be maintained.
- 4.4.3.4.6 Ideas, suggestions and concerns raised by the workforce during the OHS&E representative's on site monthly meetings shall form an agenda item within the Contractor's OHS&E Committee meeting.
- 4.4.3.4.7 Where an idea or specific suggestion is subsequently adopted for use by the Contractor's OHS&E Committee, the individual shall receive an OHS&E award as determined by the Contractor.
- 4.4.3.4.8 Where Employee awards are issued this shall be notified to the Engineer to ensure inclusion within the Quarterly Newsletter.
- 4.4.3.5 Contractor Awards

The Employer shall recognize the effort, participation and commitment demonstrated by the Contractor by nominating awards. The award type shall be at the discretion of the Employer.

#### 4.4.3 Documentation

- 4.4.4.1 Management System procedures
- 4.4.4.1.2 The Contractor is required to submit for notice of no objection, the organisation's top tier Management System Procedures as listed in Table 3 that shall be adopted for use on the CMR project.
- 4.4.4.1.3 System procedures shall be submitted to the Engineer within 4 weeks of commencement.
- 4.4.4.1.4 Construction works shall not commence until such time as a Notice of no objection has been received; applicable to all management system procedures as listed in Table 3. Should the Contractor commence operations on site without

notice, the Engineer shall award a Zero audit score for every month of non-compliance with this clause.

4.4.4.1.5 The Engineer shall evaluate the suitability of the Contractor’s system procedures against the BS EN 18001:2007 and ISO 14001:2004 standards.

4.4.4.1.6 The submitted procedures shall be individually identified with a unique reference and detail in sequence the scope, purpose, referenced material and procedure processes.

4.4.4.1.7 Where such procedures as listed in Table 3 exist within other areas of the Contractor’s organisational management systems such as quality management, these shall not be subject to replication if the procedure makes specific reference to Health, Safety and Environmental control.

4.4.4.1.8 Compliance standards against the Contractor’s management system procedures shall be subject to audit by the Engineer.

**Table 3 OHS&E Management System Procedures**

Hazard identification, risk assessment and determining controls	Communication, participation & Consultation	Environmental Impact Aspect Assessment	Objectives and programme(s)
Training, awareness and competence	Implementation and Operation	Accident & Incident Investigation	Legal requirements
Documentation	Monitoring & Measurement	Emergency Preparedness	Change control
Procurement	Record keeping	Audit	Management

**4.5 Control of documents**

4.4.5.1 All plans, procedures and method statements shall be controlled and subject to review and formal approval by the Contractor’s Project Director prior to issue to the Engineer.

All documents subject to review by the Engineer shall be signed by the Contractor’s Project Director and issued formally.

4.4.5.2 Documents shall be issued as per the Engineer’s requirements regarding Quality Management.

4.4.5.3 OHS&E Documents shall be issued, maintained, traceable and available for retrieval pursuant to the Contractor’s ISO accredited Quality Management System.

**4.4.6 Operational control**

4.4.6.1 Operational control shall be maintained through the implementation of the provisions stated within the Contractor’s site specific Construction Health Safety and

Environmental Plans, the contents of which are outlined in Safety, Health and Environmental Volumes 2 and 3 and Volume 4 to which the Contractor shall comply.

4.4.6.2 Construction Phase Health & Safety Plan

4.4.6.2.1 The Contractor shall produce a Contract specific Construction Health & Safety Plan (CHSP) and submit to the Engineer within 28 days of commencement.

4.4.6.2.2 The Construction Health and Safety Plan shall contain the informational requirements as per the CHSP contents as prescript within the BMC OHS&E Volume 2, Safety Plan contents.

4.4.6.2.3 The CHSP shall be assessed by the Engineer against the provisions as stated within OHS&E Volume 2. Where deficiencies exist to an extent where an objection is raised, construction activities shall be suspended until such time as the deficiencies are subject to corrective action, re-submittal and notice of no objection by the Employer.

4.4.6.2.4 Delays incurred as a result of the Contractor failing to achieve a No objection status from failing to submit within the specified timescale or non compliance with OHS&E Volume 2 shall be entirely at the Contractor's risk and cost.

4.4.6.2.5 The Contractor shall undertake a monthly review of the CHSP. The review shall be recorded and the Engineer notified of any updates.

4.4.6.3 Construction Phase Site Environmental Plan

4.4.6.3.1 The Contractor shall produce a Contract specific Site Environmental Plan (SEP) and submit to the Engineer within 28 days of commencement.

4.4.6.3.2 The Site Environmental Plan (SEP) shall contain the informational requirements as per the contents as prescript within the BMC Environmental Management Arrangements Volume 3, Environmental Plan contents.

4.4.6.3.3 The SEP shall be assessed by the Engineer against the provisions as stated within the Environmental Management Arrangements Volume 3. Where deficiencies exist to an extent where an objection is raised, construction activities shall be suspended until such time as the deficiencies are subject to corrective action, re-submittal and notice of no objection by the Engineer.

4.4.6.3.4 Delays incurred as a result of the Contractor failing to achieve a No objection status from failing to submit within the specified timescale or non-compliance with Environmental Management Arrangements Volume 3 shall be entirely at the Contractor's risk and cost.

4.4.6.3.5 The Contractor shall undertake a monthly review of the SEP. The review shall be recorded and the Engineer notified of any updates.

4.4.6.4 Operational procedures

4.4.6.4.1 The Contractor shall identify within the Hazard Log and Risk Register the operational control procedures that shall be applicable for the CMR project under their individual scope of works.

4.4.6.4.2 Operational procedures shall be submitted for review to the Engineer for notice of no objection together with the Construction Site Safety Plan within 4 weeks of

commencement.

- 4.4.6.4.3 The operational procedures shall be evaluated by the Engineer against the requirements stated within OHS&E Volume 2, international safety standards such as the International Labour Organisation, European Norms and British Standards where an equivalent Indian Standard does not exist.
- 4.4.6.4.4 Construction works shall not commence until such time as a notice of no objection has been received; applicable to all operational procedures as identified within Table 4 and the Contractor's Hazard Log & Risk Register. Should the Contractor commence operations on site without notice, the Engineer shall award a Zero'audit score for every month of non-compliance with this clause.
- 4.4.6.4.5 The submitted procedures shall be individually identified with a unique reference and detail in sequence the scope, purpose, referenced material and procedure processes.
- 4.4.6.4.6 In the event that the Contractor is unable to comply with the 28 day timeframe for submittal of the minimum operational procedures as detailed within Table 4, the Contractor shall assign an individual identification reference for the outstanding procedure within the Construction Health, Safety & Environmental Plan together with the statement under process. The Under Process'procedure shall be required to be submitted for notice of no objection a minimum of 28 days prior to commencement of any activity that involves the application of the procedure.

**Table 4 Operational Procedures**

Lifting Operations & Lifting Equipment	Plant & Equipment	Occupational Health provisions	Emergency Medical Facilities & First Aid
Personal Protective Equipment	Permit to Work Systems	Site Electricity & Distribution	Welding & Cutting operations
Incident Investigation	Traffic Management	Working at Height	Hazardous Substances
Site Security	Fire Safety	Manual Handling	Site Set-up
Abrasive Wheels	Public Interface	Noise and Vibration	Welfare Arrangements

- 4.4.6.4.8 The Contractor shall adopt the following colour code scheme across all BMC Sites



to ensure efficient recognition of relevant personnel.

Safety Helmet Colour with Logo	Designation
White	BMC Staff and Engineer
Violet	Contractor's Engineers & Supervisors
Blue	Sub-Contractor's Engineers & Supervisors
Red	All Electricians
Green	Safety personnel
Orange	Security Guards & Traffic Marshals
Yellow	General Workforce
White (With VISITOR Sticker)	Visitors

**4.4.7 Emergency preparedness and response**

4.4.7.1 Emergency Response Plan

4.4.7.1.1 The Contractor shall prepare a project specific Emergency Plan and submit to the Engineer for notice of no objection. The Emergency Plan shall be submitted within 4 weeks of contract Commencement.

4.4.7.1.2 The plan must identify the potential for emergencies and the provisions for responding to such emergencies, particular to their environment and location. The Emergency planning arrangements shall be assessed as per the provisions in OHS&E Volume 2 for suitability.

4.4.7.1.3 The Contractor shall ensure that all persons including sub-Contractors on site are aware of the emergency procedure to follow in the event of an emergency. Awareness training shall commence at induction and thereafter through refresher training such as toolbox talks and monthly emergency drills. Records of refresher training and emergency drills shall be maintained.

4.4.7.1.4 Site signage shall be erected and detail the emergency process to follow and include emergency telephone numbers, fire, ambulance, police, nearest hospital etc.

4.4.7.1.5 Arrangements shall be made by the Contractor for casualty evacuation and emergency medical treatment. The Contractor shall enter into an agreement with a hospital to provide ambulance services. Alternatively the Contractor shall provide a fully equipped ambulance on-site that shall be manned by a paramedic. This provision shall be subject to the Engineer audit.

**4.5 Checking**

4.5.1 Performance measurement and monitoring

4.5.1.1 The Contractor shall submit a Monthly OHS&E Progress Report no later than 7<sup>th</sup> of each month to the Engineer. The Report shall contain the minimum information specified within OHS&E Volume 2. The report shall contain text, tables

and colour photographs.

- 4.5.1.2 Site Inspection
- 4.5.1.3 Independent of the plant and equipment inspection, testing and maintenance regimes that shall be stated within the Contractor's Plant and Equipment Procedures, the Contractor shall carry out site monitoring exercises on a daily and weekly basis.
- 4.5.1.4 The Contractor shall ensure that all monitoring equipment is calibrated as per the manufactures requirements. The Engineer shall be provided with test certificates for such equipment
- 4.5.1.5 Site Engineers shall be required to participate in daily internal OHS&E inspections to facilitate prompt communication and rectification of minor deviations. Records of such inspections and rectification needs shall be maintained at site level and made available for review by the Engineer other interested parties.
- 4.5.1.6 Formal site inspection reports shall be produced on a weekly basis by the Contractor's OHS&E personnel for each site and submitted to the Project Director and copied to the Contractor's General Manager.
- 4.5.1.7 The Contractor may choose inspection format of his/her choice, however format shall contain the minimum information as provided within OHS&E Volume 2 regarding weekly inspection form.
- 4.5.1.8 The Contractor's OHS&E Personnel shall be accompanied during a formal site inspection by the Site Manager responsible for the particular site. The resulting inspection report shall be signed by both the Site Manager and the OHS&E officer.
- 4.5.1.9 The Engineer shall formally inspect and report the Contractor's site conditions against the compliance criteria set within the Contractor's operational procedures and the Engineer's requirements on a weekly basis. These inspections shall include batching plant and associated yards.
- 4.5.1.10 The Contractor shall undertake specific inspections at the Engineer's request where concerns have been raised regarding the suitability of control measures and or plant or equipment condition. Such inspections shall be carried out with immediate effect.

#### **4.5.2 Evaluation of compliance**

- 4.5.2.1 The information submitted by the Contractor within the OHS&E Monthly Progress Report together with the Engineers Reports shall be evaluated against the Employer's compliance requirements and OHS&E objectives.
- 4.5.2.2.1 Inspection reports shall be evaluated against the Legal Requirements (4.3.2) to which the Contractor is bound to comply.
- 4.5.2.2 The Contractor's OHS&E Committee shall formally evaluate reports and results of accidents and or injury on a monthly basis. The results of this evaluation such as

identified changes to safe systems of working' shall be included with the Committee minutes

- 4.5.2.3 The Engineer shall evaluate Accident Injury Rates' and Frequency Rates' per individual Contractor and as a project to determine performance against the international rates. The international rates used to benchmark performance shall be promulgated to all Contractor's and other interested parties.
- 4.5.2.4 A Project Monthly Progress Report shall be produced by the Engineer. Evaluation results shall be included within the relevant sections for Health Safety & the Environment.
- 4.5.2.5 The Contractor's External OHS&E Audits (4.5.5) shall be evaluated by the Engineer against the internal Standards BS EN 18001:2007 AND ISO 14001:2004.

**4.5.3 Incident investigation, nonconformity, corrective action and preventive action**

4.5.3.1 Incident investigation

- 4.5.3.1.1 The Contractor shall undertake accident investigation for all fatal accidents, major injuries and dangerous occurrences as defined within the Employer's Project OHS&E VOL 2.
- 4.5.3.1.2 In the event of a fatality, major injury or dangerous occurrence, the Contractor shall not disturb the accident scene or remove equipment beyond that required to make the area safe and/or for the treatment and/or removal of casualty(s) to hospital.
- 4.5.3.1.3 Should the Engineer find an accident scene disturbed beyond that reasonably expected with making an area safe, this shall be subject to thorough investigation by the Engineer.
- 4.5.3.1.4 The Engineer shall be informed immediately of all fatalities, major injuries or dangerous occurrences. Any delay in reporting to the Engineer may be subject to disciplinary action.
- 4.5.3.1.5 The Contractor is responsible to report accidents, incidents and dangerous occurrences to the relevant governing bodies as per their statutory obligations. The Contractor shall maintain responsibility for ensuring sub-Contractor's under their direct control also comply with this requirement.
- 4.5.3.1.6 A preliminary accident notification report shall be issued to the Engineer for all fatal and major injuries and or dangerous occurrences within 12 hours as per OHS&E Volume 2. This shall be followed by the detailed accident report as per OHS&E Volume 2 within 48 hours of the investigation completion.
- 4.5.3.1.7 Near misses and minor accidents should also be investigated by the Contractor as soon as possible as they are signals that there are inadequacies in the safety management system.
- 4.5.3.1.8 In case of fatal accidents, major injuries or dangerous occurrences the Engineer shall conduct an independent investigation. The Contractor and his staff shall extend the necessary co-operation.

4.5.3.2 Nonconformity, corrective action and preventive action

- 4.5.3.2.1 The Contractor shall conform to their internal procedures regarding nonconformity,

corrective action and preventive action. The Contractor shall be audited by the Engineer for compliance with internal procedures.

- 4.5.3.2.2 Major and Minor non-conformances shall be raised by the Engineer as per the Employer's Quality Management requirements and the OHS&E Audit criteria as defined within OHS&E Section 1 of Volume 7.
- 4.5.3.2.3 Open non-conformances shall be reflected in the Contractor's Monthly Audit Report and are subject to verification by the Engineer as detailed in OHS&E Section 1 of Volume 7. Failure to successfully take corrective action and close out non-conformances will impact negatively on the Contractor's total quarterly audit score 4.5.5.
- 4.5.3.2.4 Where non-conformances have been raised by an External Auditor against the BS EN 18001:2007 or ISO 14001 Standard, the Contractor shall produce and submit for review within 2 weeks, an action plan of how and within what timescale shall the non-conformance(s) be closed-out.
- 4.5.3.2.5 Where the corrective action and preventive action identifies new or changed hazards or the need for new or changed controls, the proposed actions shall be taken through the risk assessment process. The associated method statement and risk assessment shall be amended and re-submitted to the Engineer for notice of no objection.
- 4.5.3.2.6 A change in work methodology shall be communicated to the workforce. Evidence of such communications shall be made available for inspection by the Engineer. The Engineer shall also make random enquiries at site level to establish workforce awareness.

#### 4.5.4 **Control of records**

- 4.5.4.1 The Contractor shall maintain all OHS&E records in accordance with the Contractors ISO 9001 Quality Management System.
- 4.5.4.2 Records shall be made available to the Engineer upon request for the purpose of incident investigation and management review.

#### 4.5.5 **Audit**

- 4.5.5.1 Monthly Audit Report (MAR)
  - 4.5.5.1.1 The Contractor shall undertake an internal monthly audit using the process and audit report form (MAR) as prescribed within OHS&E Volume 2.
  - 4.5.5.1.2 The Contractor shall submit the completed audit report no later than the 7<sup>th</sup> of each month within the Contractor's monthly OHS&E Report. Failure to submit the monthly audit report within the stipulated timescale shall result in the Engineer awarding a Zero score for the month.

- 4.5.5.1.3 The audit scores awarded internally by the Contractor shall be subject to review and verification by the Engineer. The Engineer shall substantiate the awarded scores through making comparison with the results of a physical site inspection against the model audit scores criteria as provided within OHS&E Section 1 of Volume 7.
- 4.5.5.1.4 The Engineer shall formally verify that the Contractor's self awarded scores comply with the audit scoring system and scoring criteria as defined within OHS&E Section 1 of Volume 7.
- Where discrepancy exists the Engineer shall provide supporting evidence (Photographic) and instruct the Contractor to amend the initial awarded score. Following adjustment, the monthly audit report shall be re-submitted to the Engineer within 3 days.
- 4.5.5.1.5 The Contractor shall be required to achieve a minimum 65% overall audit score on a monthly basis.
- 4.5.5.1.6 Monthly audit scores shall be totalled over a 3 month (3 audit results) period. Where the average score for three (3) months of audits is below 65%, then the OHS&E lump sum item in the preliminaries section of Volume 8 pricing shall be withheld.
- 4.5.5.1.7 If non-payment of the lump sum item in preliminaries occurs as a result of failing to achieve the required 65% over a single quarterly reporting period, the Engineer may reinstate the lump sum item at his discretion should the Contractor achieve above 65% for the following six (6) consecutive monthly OHS&E audits equating to two (2) quarterly reporting periods. This repayment of the lump sum item shall not occur if the quarterly aggregate is less than 50%.
- 4.5.5.1.8 In the event the Contractor fails to achieve a minimum of 65% on a monthly audit, an action plan shall be submitted together with the audit results detailing the actions that shall be taken within timescales.
- 4.5.5.1.9 Monthly audits shall be conducted prior to the sitting of the Contractor's Safety Committee and shall form part of the agenda.
- 4.5.5.2 External OHS&E Audit
- 4.5.5.2.1 Contractor is required to conduct external audits as per the BS EN 18001:2007 & ISO 14001:2004 international standards on a quarterly basis throughout the Contract period or until the Contractor achieves accreditation to the standard whereby monitoring timescales shall be instructed by the ISO accrediting body.
- 4.5.2.2. External audit and follow up audit reports shall be submitted to the Engineer for review within 7 days of audit completion.
- 4.5.2.3 Should the Contractor fail to undertake external audits within the 3 month period the Engineer shall appoint an ISO accredited 3<sup>rd</sup> party agency to conduct the audit at the Contractor's cost.
- 4.5.5.2.4 Where Major non-conformances with international standards are identified, a follow-up external audit shall be carried out within 28 days for closing out of the non-conformance(s). Follow-up audits shall continue on a 28 day rotation until such time as

Major non- conformances are closed to the satisfaction of the 3<sup>rd</sup> Party ISO accredited auditor.

**4.6 Management review**

- 4.6.1 Management Reviews shall be undertaken annually by the Engineer in compliance with ISO 9001:2008.
- 4.6.2 The Management Review Report shall make recommendations for improvement.
- 4.6.3 The Contractor shall carry out a formal Management Review on an annual basis as a minimum. The Management Review may form part of the review under the organisations Quality Management System.
- 4.6.4 The Contractor shall submit Management Review Report to the Engineer within 7 days after meeting completion together with the organisations new objectives.

**VOLUME 3**  
**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 18**  
**DOCUMENT IDENTIFICATION AND NUMBERING**

## APPENDIX – 18:DOCUMENT IDENTIFICATION AND NUMBERING

### 1. INTRODUCTION

Documentation identification is mandatory to achieve the Project in terms of Quality Assurance. It will be made through a **coding system**, which principles are set in this document.

The procedure shall ensure that all entities establish codes in a uniform and constant manner. The aim is that a **unified number, built on a one structure of reference**, shall be used **for one document**. This is applicable **for all document of the project**, issued or received, so that they can be easily traceable. This way, communication between all project parties shall be facilitated. Revisable and non-revisable documents are all concerned.

### 2. PRINCIPLE OF THE IDENTIFICATION Revisable documents

The codification of documents will be made through numbers and letters, concerning 5

separated fields:

SL NO	Designation	explanation	format
1			MCR"N"
2	Issuing entity	To be completed	LLL
3	Discipline	A part of an activity or period / phase of the project	NNN
4	Document Type	Tender Drawing(TR)Design Drawing(DD),Design Report(DR) etc	LL
5	Document Nb	Continuous number given by the CHRONO	"N"NNNNNN

Where:

- **L** is a letter,
- **N** a digit number,
- **"N"** a Chainage number

Format of Code include in document:

	Issuing entity	Discipline	Document Type	Document Number
MCR"N"	LLL	NNN	LL	"N"NNNNNN

### "Name Shape"



Each field of the coding name has to be separated by a dash “-“.

The electronic file name has to be the coding name, which will appear on the document itself as well.

**3. DEFINITION OF FIELDS**

Code	Designation
DBCR	General

**Issuing entity**

Code	Designation
MCG	BMC
PMC	Can be 3 letter short form of Company name
GCC	
LLL	3 letter short form of Contractor

The list will have to be completed when contracts will be awarded.

**3.3 Discipline**

The “discipline” concerns a part of an activity in a period / phase of the project, in coherence with the classification scheme.

Code	Work stage on level 1	Discipline / work on level 2	Level 3
000	<i>All (to avoid or to limit)</i>		
1XX	<i>Contract management</i>		
100		GC Proposal	
110		GC and BMC contract	
120		GC internal contract	
2XX	<i>Project management</i>		
200		Project organization	
210		Minutes of Meeting	
211			ER- BMC meeting
212			ER Viaduct related meeting
213			ER Road related Meeting

214			ER MEP Related Meeting
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Code	Work stage on level 1	Discipline / work on level 2	Level 3
215			GC Marine/related meeting
216			
220		Quality Management & QC	
230		Documents control	
240		Risk management	
Code	Work stage on level 1	Discipline / work on level 2	Level 3
250		Program cost control	
260		Program schedule	
270		Health and Safety management	
280		Correspondence	
281			Incoming correspondence
282			Outgoing correspondence
290		Procurement and tender	

Code	Work stage on level 1	Discipline / work on level 2	Level 3
<b>3XX</b>	<b><i>Project system management</i></b>		
300		General System	
320		RAM and Safety	
330		Fire Engineering	
340		Space proofing	
350		Interface control	
<b>4XX</b>	<b><i>Design and call for tenders</i></b>		
401		Alignment	
410		Survey	
411			Topographic
412			Utilities
413			Traffic Diversion
414			Geo-Technical
415			Building Survey
420		Civil-Obligatory Span	
421			Structural
422			Architectural
423			Civil

430		<b>Civil-Viaduct</b>	
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<b>Code</b>	<b>Work stage on level 1</b>	<b>Discipline / work on level 2</b>	<b>Level 3</b>
431			Structural
432			Architectural
433			Civil
440		<b>Roads</b>	
441			Road Cross Sections
442			Signals and Road Furniture
443			

<b>Code</b>	<b>Work stage on level 1</b>	<b>Discipline / work on level 2</b>	<b>Level 3</b>
450		<b>Culverts and Underpasses</b>	
451			
452			
453			
460			
461			
462			
463			
<b>470</b>			
471			
472			
473			
480		<b>Geotechnical</b>	
481			
482			
483			
490		<b>Land Filled</b>	
481			
<b>Code</b>	<b>Work stage on level 1</b>	<b>Discipline / work on level 2</b>	<b>Level 3</b>
482			
<b>5XX</b>	<b>Work supervision</b>		
<b>500</b>		<b>Contracts and administrative</b>	
<b>6XX</b>	<b>Operation and maintenance preparation</b>		
<b>710</b>		Operation	
711			Definition of performances and objectives/targets
<b>712</b>			Operation organization

Code	Work stage on level 1	Discipline / work on level 2	Level 3
720		Maintenance	
721			System maintenance
722			Maintenance of fixed installations
723			Maintenance of structures

**Document Type**

The “Document Type” concerns a phase of the project, in coherence with the classification scheme.

Generic codes

Code	Document Designation
TD	Tender Drawings
PD	Preliminary Design Drawings
DD	Detailed Design Drawings
CD	Construction Reference Drawings
PR	Preliminary Design Report
DR	Detailed Design Report
LL	Letter

**3.4 Document Number**

3.4.1 All documents except drawings

The number of the document is only a sequence number. To ensure that one unique number is given for only one document, this number is given by the CHRONO file, which can be found on SharePoint.

**4.1 Revision Index**

The format allows for a combination of two items

- 1 a **sequence number** for **internal revision** within the issuing entity
- 2 a revision letter for each new release or submission outside the entity.

A change of the revision letter index is only possible after a control by the delegated

representative of the Engineer

L	Revision letter Index, when issued to client / ...
(N)	Internal revision number prior official submission

When the creation of the document is going on, after each modification the number is incremented: A1, A2, A3... Once it is final, it becomes only A.

If some modifications are made after issuing, it becomes B1, B2, B3,... until second issue : it becomes B.

**Comments**

This coding system is to be completed by few words, taken from the title or the subject of the document, in order to better identify the document.

For instance for this document, the name of the soft copy is: *MCR0-GCC-230-000-0900015 -doc\_identification\_numbering* The document should bear the following identification:

	Issuing entity	Discipline	Area	Document Nb.
<b>DBCR</b>	<b>GCC</b>	<b>230</b>	<b>000</b>	000015

**VOLUME 3**

**EMPLOYER'S REQUIREMENTS**

**APPENDIX – 19**

**NO OBJECTION CERTIFICATES**

## **APPENDIX – 19 :NO OBJECTION CERTIFICATES**

### **1. INTRODUCTION**

It is the responsibility of the Contractor to obtain No Objection Certificates (NOC) and prior approvals from the concerned Statutory Authorities before start of relevant construction work. NOCs from autonomous bodies may also be required.